



The Development of E-Handout Teaching Materials for the Sub-Concept of Structure and Function of Tissues in Plants

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ABSTRACT

Learning in the 21st century is supported by mastery of technology. The utilization of technology in education can be implemented in the use of electronic teaching materials, one of which is E-Handout. The purpose of this study was to describe the needs analysis, validity and practicality of the results of the Development of E-Handout Teaching Materials for the Sub-Concept of Structure and Function of Tissues In Plants. This research is categorized as research and development (R&D) based on the 4D model. Data collection used teacher and students needs instruments, validity and practicality questionnaires. The research subjects were 3 experts and 12 students of class XI MIPA at SMA Negeri 1 Alalak. The results showed that first, the results of the needs analysis were "good" (77.83), meaning that E-Handout teaching materials need to be developed on the Sub-Concept of Structure and Function of Tissues in Plants. Second, E-Handout have a validity of "very valid" (88.45), meaning that E-Handout is very valid and in accordance with learning objectives, language, format and media. Third, the practicality results are "very good" (91.88), meaning that the E-Handout is very practical and easy to read by students. This shows that the E-Handout developed is valid and practical so that it can be used as teaching material as needed. The implication of the research results is that students can learn independently anytime and anywhere using E-Handout via laptop or smartphone.

Keywords: Teaching materials, E-handout, Development, Structure and function, Tissue in plant

INTRODUCTION

Learning activities will always follow and adjust to the times. In the 21st century, learning is required to be able to prepare the younger generation to face technological advances in life (Asrizal, et al., 2017). 21st century learning is the impact of information development marked by the development of digitalization (Syahputra, 2018). The development of digitalization demands that 21st century education can combine knowledge, attitudes and skills with mastery of technology. These skills can be developed through 21st century competencies called the 6C. The 6C skills consist of character, citizenship, creativity, communication, critical thinking, and collaboration (Noorhapizah, et al., 2022; Rodiya, et al., 2022). The 6C skills can be applied to the 2013 curriculum learning activities. The 2013 curriculum aims to develop interests, potential, and talents so that students are competent and have character. These results can be achieved with a variety of learning experiences. Therefore, educators are required to be able to carry out learning and assessment according

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to the characteristics of 21st century learning that applies 6C skills in the 2013 curriculum.

Teachers have a very big role in the applying of curriculum implementation. The implementation is carried out through the learning and assessment process in order to improve the competence of students so that graduates are ready to face global challenges (Marlina, 2013). The implementation of the 2013 curriculum shifts conventional learning to learning that prioritizes the active role of students (Sani, 2014). Banawi (2019) explained that in the 2013 curriculum, a scientific approach is applied, where students are expected to fulfill the 5 activities, namely observing, questioning, collecting data, associating or reasoning, and communicating in learning. That is why learning should be well designed so that the process and results are appropriate.

Biology learning that is carried out using the right method is an effort to develop students' thinking skills. This can trigger learning to be carried out optimally. Good planning in the learning process will be able to realize the achievement of educational goals (Fadilah, et al., 2015). Besides planning a thorough learning process, educators must also prepare teaching materials that will be used (Amin, 2016). Teaching materials are an important component of education. With the help of teaching materials, teachers will easily implement learning and also make it easier for students to learn. The development of teaching materials is designed in various formats and forms according to the characteristics of the material and needs (Magdalena, et al., 2020). The effectiveness of teaching material management by educators is one of the main factors that influence the learning process and outcomes of students. So, in learning teachers should be able to creatively develop teaching materials to create interesting and meaningful learning. The development of teaching materials that are appropriate and relevant to the characteristics of the material, curriculum demands and the needs of students will certainly be able to produce effective, active, innovative, and enjoyable learning so that learning objectives can be achieved optimally (Ma'rifah, 2018; Murod, et al., 2021). Therefore, efforts are needed to develop new teaching materials that are innovative and interesting in the hope of fostering interest and enthusiasm for learning, one of the alternative teaching materials is Handout.

Research on the development of teaching materials in the form of handouts has been carried out by previous researchers. Among these studies are Rahmi, et al. (2020) concluded in their research entitled "Development of Handout on the Concept of Human Blood Circulatory System Class XI IPA SMAN 6 Banjarmasin", overall, the Handout is very valid and very practical to be implemented in the learning process. Khotimah, et al. (2022) concluded in their research entitled "Development of Teaching Materials for the Concept of the Human Respiratory System in High School in the Form of HTML5 Flip-Based E-Handout", it was found that E-Handout was very suitable, very feasible, very good readability and responded very well by students so that it could be used as Biology teaching material. While research on the development of teaching materials E-Handout of Structure and Function of Tissues in Plants has not been reported.

Based on the needs questionnaire analysis of Biology teachers of SMA Negeri 1 Alalak, it is known that in learning biology in class XI odd semester the use of teaching materials that are usually used are textbooks, student worksheets and sources from the internet. Teachers argue that the sub-concept of the Structure and Function of Tissues in Plants is included in the category of material that is difficult to teach to students. Therefore, it requires the development of other interesting teaching materials. This is reinforced by Susilawati, et al. (2020), which states that the obstacles for Biology teachers who teach the sub-concept of the Structure and Function of Tissues in Plants include the utilization of little media, the availability of books and inadequate supporting facilities, very short training time, and difficult assessments that require a lot of time.

In the results of the questionnaire analysis of the needs of students in class XII MIA SMA Negeri 1 Alalak, it was found that biology teaching materials that are often used are textbooks. The teaching materials use language that is easy to understand, but there are still few pictures or illustrations. Most students need other teaching materials to support the learning process. Students argue that in the odd semester of class XI the most difficult biology subject matter to learn is the Structure and Function of Tissues in Plants because the presentation of the explanation is incomplete and contains few images or illustrations.

To overcome the obstacles that occur in learning Biology sub-concept of Structure and Function of Tissues in Plants at SMA Negeri 1 Alalak, E-Handout teaching materials are developed. E-Handout is one of the many innovations in the scope of education along with technological developments. E-Handout is in electronic form so it is easy to access through various devices such as laptops or smartphones. E-Handout can also be studied anywhere and anytime. E-Handouts can be used in online and face to face learning to increase students' understanding of the subject matter. The selection of E-Handout is also supported by the statement of Gusteti, et al. (2023), that handouts can help educators deliver material and enrich students' understanding. In addition, according to Haryanti & Fatisa (2020), E-Handout is an ideal teaching material for students to learn independently because it contains components that are useful in understanding the material. The display in electronic format is expected to increase the motivation and interest of students because it contains images, audio, and video. Based on this background, the researcher is interested in conducting a study entitled "The Development of E-Handout Teaching Materials for the Sub-Concept of Structure and Function of Tissues in Plants". The purpose of this study was to describe the needs analysis, validity and practicality of the results of the development of E-Handout Teaching Materials for the Sub-Concept of Structure and Function of Tissues in Plants.

METHODS

The method used in this research is a type of research and development (R&D). The development model refers to the 4D model by Thiagarajan, et al. (1974). In the 4D model there are 4 stages, namely define, design, development, and dissemination. In this study, the development model was carried out only up to the limited dissemination stage to adjust to the needs.

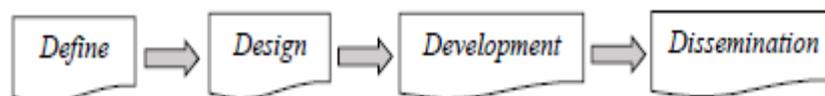


Figure 1. Stages of Research and Development of the 4D Model

At the define stage, direct observation and observation of the subject and object of research were carried out. The observation used a questionnaire instrument of teacher needs and student's needs. This stage aims to determine, define and collect information related to the needs in the learning process and the product to be developed. The define stage is divided into several steps, namely initial and final analysis, learner analysis, task analysis, concept analysis, and formulation of learning objectives. The initial analysis was carried out by analyzing the needs of Biology teachers, learner analysis was carried out by analyzing the needs of students, task analysis was carried out by analyzing and reviewing the 2013 revised curriculum syllabus and semester program, concept analysis was carried out by analyzing the main materials contained in the 2013 revised curriculum syllabus, formulation of learning objectives was carried out by formulating competency achievement indicators in accordance with the curriculum and subject matter. The formulated competency achievement indicators is then further elaborated into several learning objectives.

The activity at the design stage is to carry out the design and design of E-Handout teaching materials. The design stage consists of preparing criteria reference tests, media selection, format selection, and initial design. In the step of preparing the criteria reference test, 2 types of assessment instruments were prepared consisting of validity tests and practicality tests. Media selection is carried out to identify teaching materials that are relevant to the information that has been collected, format selection is done by selecting a structure format that is suitable for teaching materials, the initial design stage is carried out by making teaching materials in the form of E-Handout using several software applications, namely Microsoft Word, Canva, and FLIP HTML5. This stage will produce Draft I.

For the develop stage will produce E-Handout teaching materials which are further revised based on assessment and input by experts and students. There are two steps in this stage, namely expert assessment and development trials. Expert assessment is carried out by testing the validity of the product from Draft I which will be revised based on the comments and suggestions obtained. After that, it was tested again until the assessment results were consistent and then produced Draft II. In the development trial, the product was tested directly to students as users to get input from the product that had been made. The development trial was carried out by testing the practicality of students from Draft II which was revised based on the comments and suggestions obtained so that Draft III or the final product would be produced.

The disseminate stage is the final step in the development of the 4D model. This stage is carried out when expert assessments and development trials obtain consistent results and good comments. At this stage, the dissemination of Draft III or the final product of the revised research is carried out. Dissemination aims to get responses and feedback on the products that have been developed. The distribution of this product was only limited to teachers and students of SMA Negeri 1 Alalak.

Data collection used teacher and students needs instruments as well as questionnaires and validity rubrics by expert subjects (validators) and practicality by development trial subjects (students). Validators by 3 experts, namely 2 lecturers of the Biology Education Study Program University of Lambung Mangkurat Banjarmasin and 1 partner teacher. The development trial took 12 students of Class XI MIA who had taken the Sub-Concept of Structure and Function of Tissues in Plants and reached the minimum completion criteria score. The object of research is E-Handout teaching materials. The research took place at SMA Negeri 1 Alalak and at University of Lambung Mangkurat. The research time took place in the odd semester 2022/2023 from July 2022 to December 2022.

The data analysis technique was carried out by calculating the score of validity and practicality by applying the Purwanto formula (2020) as follows.

$$M = \frac{\sum X}{N}$$

Description:

M = Average score (*mean*)

$\sum X$ = Total scores

N = Number of aspects

To determine the validity and practicality of this E-Handout, the initial data in the form of scores is converted into qualitative data (interval data) with a Likert scale. For Likert scale, the highest score of each item is 5 and the lowest is 1. In order to describe the results of the validity and practicality of E-Handout teaching materials, the average validity and practicality scores can be interpreted with the validity and practicality criteria of E-Handout. Based on the adaptation of Widoyoko (2012), for the average score $X < 1.80$ (very less valid or very less good), $1.80 < X < 2.60$ (less valid or less good), $2.60 < X < 3.40$ (quite valid or quite good), $3.40 < X < 4.20$ (valid or good), and $X > 4.20$ (very valid or very good). Furthermore, according to

Riduwan (2009), the value of validation and practicality analysis can be obtained by dividing the score obtained by the maximum score then multiplied by 100. In addition, the validity and practicality value categories are converted into several categories, namely the range 0-20 (invalid or not good), 21-40 (less valid or less good), 41-60 (quite valid or quite good), 61-80 (valid or good), and 80-100 (very valid or very good).

RESULTS AND DISCUSSION

Results

Needs Analysis Results

Based on the data that has been collected through the stages of the 4D model, 3 research results are obtained, namely needs analysis, validity and practicality. In the needs analysis using a questionnaire instrument for the needs of teachers and students, the data was analyzed. The first analysis was in the form of analyzing the needs of teachers at SMA Negeri 1 Alalak obtained from 2 Biology teachers. The results obtained from the teacher needs questionnaire are as follows. Analysis of aspect 1 of the teacher's needs for teaching materials used has 5 components, namely textbooks (TB), E-books (EB), student worksheets (SW), handouts (HO), booklets (BL) and sources from the internet (IN). The analysis of aspect 1 teacher needs can be seen in Figure 2.

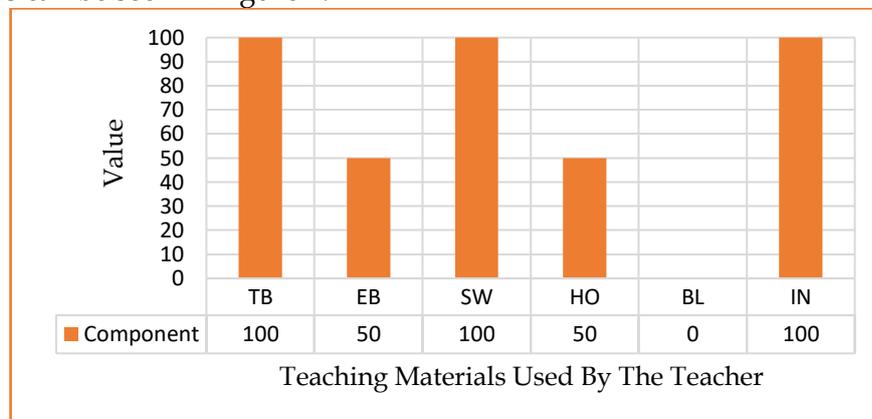


Figure 2. Aspect 1 Teacher Needs

In Figure 2, it is known that teaching materials that are often used in learning biology, especially class XI odd semester are textbooks, student worksheets and sources from the internet. The value of the most frequently used teaching materials is 100. For other forms of teaching materials are still rarely used. Among these teaching materials are E-books, handouts and booklets. This shows that teaching materials in biology class XI odd semester are dominated by the use of textbooks, student worksheets and internet sources so that there is no variety of interesting teaching materials in the learning process.

Based on the analysis of the level of difficulty of the Sub-Concept of Structure and Function of Tissues in Plants, the teacher believes that the Sub-Concept of Structure and Function of Tissues in Plants is included in the category of material that is difficult to teach to students. Referring to the need for the development of E-Handout teaching materials, it is known that the development of teaching materials is classified as very necessary. Therefore, teachers need the development of teaching materials that suit their needs. The alternative teaching material chosen is in the form of E-Handout. In addition, teachers also agreed to the development of E-Handout teaching materials.

The second needs analysis conducted was an analysis of the needs of SMA Negeri 1 Alalak students. The students' needs questionnaire was filled in by 62 students. In the analysis

of teaching materials used in learning biology class XI odd semester, several components were analyzed, namely textbooks (TB), E-books (EB), student worksheets (SW), handouts (HO), booklets (BL), sources from the internet (IN), files (FL), and powerpoint (PPT). Below are the results of aspect 1 learners' needs in Figure 3.

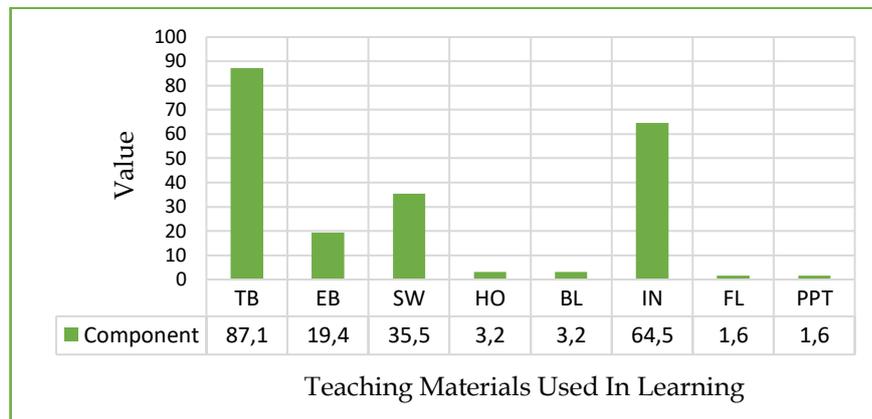


Figure 3. Aspect 1 Students Needs

Based on the students' needs questionnaire in Figure 3, the results show that the teaching materials that are often used when learning biology in class XI odd semester are textbooks (87.1), sources from the internet (64.5) and student worksheets (35.5). For other teaching materials, namely E-books, handouts, booklets, files, and PowerPoints are still little used. Learners expressed the need for other teaching materials. This shows that students think that other teaching materials are needed to support the learning process. These teaching materials are expected to help make it easier to understand the learning material.

Aspect 2 of the needs of students analyzed next is about the concept of Biology class XI odd semester which requires additional teaching materials. The concept consists of 6 components. These components include Cells (C), Structure and Function of Tissues in Plants (SFTP), Structure and Function of Tissues in Animals (SFTA), Structure and Function of Bones, Muscles, and Joints (SFBM), Structure and Function of the Circulatory System (SFCS), and Structure and Function of Cells in the Digestive System (SFCD). The results of the analysis of aspect 2 of the learners' needs can be seen in Figure 4 below.

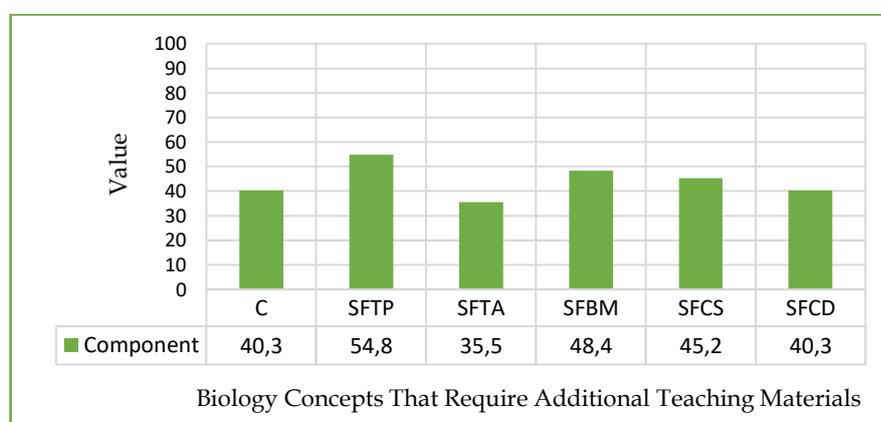


Figure 4. Aspect 2 Students Needs

In Figure 4, it is known that for the concept of Biology class XI odd semester which is most chosen by students and requires other additional teaching materials is the Structure and Function of Tissues in Plants (54.8). For other concepts have values, namely Structure and Function of Bones, Muscles, and Joints (48.4), Structure and Function of the Circulatory System (45.2), Cells (40.3), Structure and Function of Cells in the Digestive System (40.3) and Structure

and Function of Tissues in Animals (35.5). Learners sometimes find it difficult to understand the Sub-Concept of Structure and Function of Tissues in Plants taught through teaching materials used by the teacher. Learners also consider that the Structure and Function of Tissues in Plants is difficult to understand. So, students think that other additional teaching materials are needed on the Structure and Function of Tissues in Plants because the material presented is sometimes difficult to understand.

Analysis on aspect 3 of the needs of students is about the needs of students for E-Handout. The need for the development of teaching materials in the form of E-Handout on the Sub-Concept of Structure and Function of Tissues in Plants is divided into several categories. The category consists of very necessary (VN), necessary (N), less necessary (LN) and not necessary (UN). The results obtained in aspect 3 can be seen in Figure 5 below.

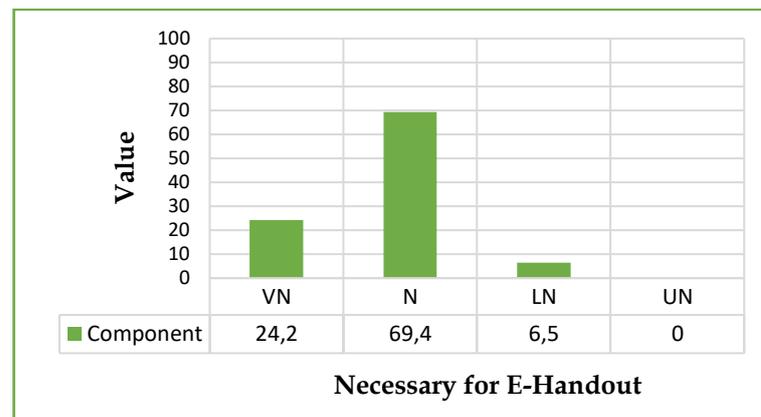


Figure 5. Aspect 3 Students Needs

Based on Figure 5, students with a score of 69.4 stated that it is necessary to develop additional teaching materials on the Sub-Concept of Structure and Function of Tissues in Plants in the form of E-Handout. 24.2 of them revealed that it was very necessary to develop E-Handout teaching materials on the sub-concept. In addition, students agree if E-Handout teaching materials are developed for the Sub-Concept of Structure and Function of Tissues in Plants. These teaching materials are expected to support learning. Therefore, it is necessary to develop E-Handout teaching materials on the Sub-Concept of Structure and Function of Tissues in Plants for class XI odd semester. So, in the E-Handout needs analysis, an average total score of 77.83 was obtained. This value indicates that the results of the needs analysis of E-Handout teaching materials for the Sub-Concept of Structure and Function of Tissues in Plants are in the good category.

Validity Test Results

The validity of the results of the development of E-Handout teaching materials was assessed through a validity test using a validity questionnaire. Validity was assessed by 3 experts. In this validity test there are 4 components, namely learning objectives (LB), language (L), format (F) and media (M). The recapitulation of the E-Handout validity results is presented in Figure 6 below.

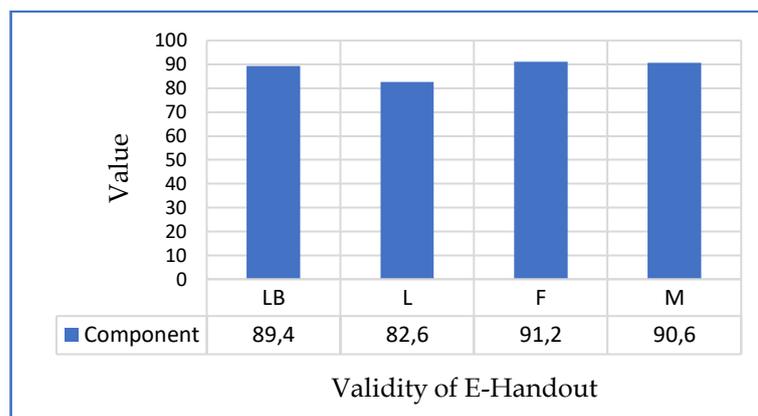


Figure 6. Recapitulation of the validity of E-Handout

In the recapitulation of the validity of E-Handout in Figure 6 above, the results show that the format component gets the highest score of 91.2. Furthermore, the media component with a value of 90.6, the learning objectives component 89.4 and the language component 82.6. These four components consist of a total of 25 aspects (A1-A25). The learning objectives component is divided into several aspects including A1-A12, namely the relevance of learning objectives is appropriate (A1), the meaning of learning objectives for teachers (A2), the meaning of learning objectives for students (A3), the source of learning objectives is clear (A4), learning objectives from various sources (A5), relevance of learning objectives with content (A6), completeness of theoretical content (A7), completeness of definitions and explanations (A8), complete use of terms, symbols, and formulas (A9), examples presented (A10), examples according to life (A11), and developer competence (A12). The language component is divided into A13-A17, including sentence structure (A13), sentence effectiveness (A14), use of standard language (A15), language according to students' cognitive (A16), and sentences according to PUEBI (A17). The format component consists of A18-A20, namely presentation of material (A18), section format (A19), and completeness of instructions for use, concept maps, evaluation questions, and developer profiles (A20). In the media component, there are A21-A25, namely layout elements (A21), illustrations, images, and videos (A22), appropriate and harmonious appearance (A23), accuracy of color selection (A24) and accuracy of typesetting elements (A25).

Aspects learning objectives from various sources, developer competence, sentence structure, sentence effectiveness, language according to students' cognitive, section format, and accuracy of typesetting elements received the lowest score of 80. Furthermore, the aspects of the meaning of learning objectives for teachers, the source of learning objectives is clear, completeness of theoretical content, the use of terms, symbols, and formulas is complete, examples are presented, use of standard language, sentences according to PUEBI, layout elements, accuracy of color selection received a score of 86.6. For the aspects of relevance of learning objectives with content, completeness of definitions and explanations, examples according to life, and presentation of material received a score of 93.4. Aspects that get the highest score of 100 include aspects of relevance of appropriate learning objectives, meaning of learning objectives for students, completeness of instructions for use, concept maps, evaluation questions, and developer profiles, illustrations, images, and videos, and appropriate and harmonious appearance. So, overall in the validity test, E-Handout has an average total score of 88.45. This value indicates that the results of the validity test of E-Handout teaching materials for the Sub-Concept of Structure and Function of Tissues in Plants are included in the very valid category.

Practicality Test Results

The results of practicality in the development of E-Handout teaching materials were assessed through a practicality test. The practicality test was carried out using a practicality questionnaire. The practicality test consists of several components, namely useful (U), clear (C), easy to use (EU), attractiveness (A), and low cost (LC). A recapitulation of the practicality results by 12 students is included in Figure 7 below.

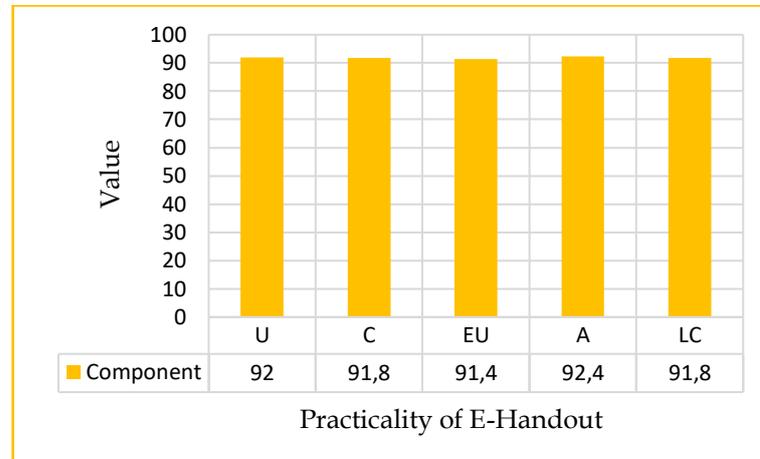


Figure 7. Recapitulation of the practicality of E-Handout

Based on Figure 7 on the results of the practicality test, it is known that the component that gets the highest average score is attractiveness, which is 92.4. The average value of the useful component is 92, clear 91.8, low cost 91.8 and easy to use 91.4. There are a total of 25 aspects (A1-A25) in the five components. The useful components are A1-A6, including fun to use (A1), become independent teaching materials (A2), stimulate students' cognitive abilities (A3), students' reading interest increases (A4), more effective use time (A5), and fulfill the demands of learning objectives (A6). The clear component consists of the following A7-A12, includes instructions for use (A7), contains multimedia (A8), the use of language is clear (A9), the content section is related to the curriculum (A10), the material is related to the Basic Competencies (A11), and additional information is relevant (A12). The easy-to-use component is composed of A13-A17, namely easy to access anytime and anywhere (A13), practical use (A14), helps students' concept understanding (A15), helps increase students' interest (A16), and compilation according to systematics (A17). The attractiveness aspect contains A18-A23, including illustrations and pictures according to the text (A18), useful material in everyday life (A19), up to date and current material (A20), important as an alternative teaching material (A21), attractive appearance (A22), and more efficient learning (A23). The low-cost aspect consists of A24-A25, namely relatively low cost (A24) and valuable for students (A25).

The aspect that received the lowest score was become independent teaching materials with a score of 86.6. Other aspects scored 88.4, namely contains multimedia, material related to basic competencies, helps students' understanding of concepts, and compilation according to systematics. In the aspect of including instructions for use, illustrations and pictures according to the text, material is useful in everyday life, important as an alternative teaching material, relatively low cost obtained a score of 90. The aspects with a score of 91.6 are fun to use, and fulfilling the demands of learning objectives. For the aspects of students' reading interest increases, time of use is more effective, language use is clear, the content part is related to the curriculum, easy to access anytime and anywhere, practical use, helps increase students' interest, attractive appearance, learning is more efficient and valuable for students have a score of 93.4. The aspect of stimulation of learners' cognitive abilities received a score of 95. Finally, the aspects that received the highest score, namely additional information is relevant and the

material is up to date and current with a score of 96.6. So, in the practicality test, E-Handout has an average total score of 91.88. This value means that the results of the practicality test of E-Handout teaching materials for the Sub-Concept of Structure and Function of Tissues in Plants are in the very good category.

E-Handout Description

The product developed in this study is the E-Handout of the Structure and Function of Tissues in Plants. The E-Handout was created and designed based on the structure of the E-Handout drafting format by Batubara (2022). The format has then been modified as needed. The following are the results of the front and back covers of the E-Handout that have been designed which can be seen in Figure 8.



Gambar 8. (a) Front Cover of E-Handout, (b) Back Cover of E-Handout

This E-Handout consists of 3 main parts. First, the introduction section which contains the front cover, preface, table of contents, list of images, instructions for use, E-Handout identity, scheduling and material mapping, core competencies, basic competencies, competency achievement indicators, and learning objectives identities and concept maps. Second, the content section contains the introduction and the content of the material. The content of the material is divided into 3, namely the types of tissues in plants, the tissues that make up organs in plants and the nature of totipotency and tissue culture. Third, the closing section contains a summary, evaluation questions, bibliography, glossary, developer profile, and back cover.

The front cover displays the title, class, image, and developer name. The title is written based on the material contained in it, namely the Structure and Function of Tissues in Plants. This teaching material was developed for class XI SMA/MA. The cover is made attractive and adjusts to the content by paying attention to the composition of colors, fonts, font sizes, and images displayed. On the front and back covers there are chili plants that represent the content material of the Structure and Function of Tissues in Plants that are easily found around us so that it is hoped that students can more easily understand the material to be studied.

E-Handout of the Structure and Function of Tissues in Plants was developed with various improvements based on input, suggestions and criticisms given by validators and students. The goal is to produce a good product. Some suggestions from validators are to replace and adjust the colors on the front and back covers, add scientific names to each plant, correct word usage errors, replace images of chili plants of the same species between those used on the cover and the introduction of the material, replace the example image with the original and replace the appropriate example image to make it clearer. Feedback and

suggestions from students that were used as revision materials included improving the design by adding color variations in some parts, multiplying sample images and adding appropriate illustrations. All input, suggestions and criticisms that have been given are used as material for improvement so that the E-Handout obtains valid results and good practicality as teaching materials.

The difference between this E-Handout and handouts by other previous researchers is that the material has been divided into 3 meetings according to the time allocation and learning objectives of each meeting, making it easier for students to focus more on understanding the material. Teachers are also easier to manage time. In addition, there are also practice questions that are divided based on the 3 meetings. This can help students to evaluate their understanding based on the division of material. In the E-Handout, there are many pictures and illustrations that come from the latest sources so that it attracts interest in learning and can provide more understanding to students.

Discussion

Based on the results of the needs analysis conducted on teachers and students, an average total score of 77.83 was obtained which was included in the good category. This value indicates that the development of E-Handout teaching materials is needed. It is known that the teaching materials used in learning Biology class XI odd semester are still dominated by textbooks. There is no variety of other teaching materials that are interesting and innovative for students. In addition, the Structure and Function of Tissues in Plants is material that is difficult for teachers to teach and difficult for students to understand. For this reason, it is necessary to develop teaching materials in the form of E-Handouts on the Structure and Function of Tissues in Plants. These results are in accordance with previous research by Rahmi, et al. (2020) which states that the lack of variety of teaching materials because it is still dominated by textbooks causes students to have difficulty in understanding the subject matter so that the development of other teaching materials is needed.

Validity is the degree of accuracy between the data on the research object and the actual data (Dewi, et al., 2020). In the results obtained through the validity test, the E-Handout that has been developed has an average total score of 88.45 and is included in the very valid category. So, the validity test of this study shows that E-Handout is very valid and in accordance with the components of learning objectives, language, format and media. In addition, the E-Handout was also prepared referring to the basic competencies, learning objectives and indicators of competency achievement based on the demands of the curriculum in the 2013 revised curriculum syllabus. In line with that, Jailani & Hamid (2016) stated that the suitability of materials that refer to basic competencies, learning objectives and indicators of competency achievement is a guarantee of optimal learning outcomes.

The aspect of learning objectives from various sources received the lowest score because the sources presented in the E-Handout are still lacking. Therefore, other sources should be added. This is supported by Suryanda, et al. (2020) which states that the use of learning resources is intended to achieve learning objectives. In order to accelerate this achievement, it can be complemented with various other learning resources according to the material. The next lowest score is on the aspect of developer competence. This is because the E-Handout developed still has shortcomings so that improvements need to be made through input, suggestions and criticism in the E-Handout development process in order to produce a good product. Furthermore, the aspects of sentence structure, sentence effectiveness, language according to the cognitive of students include language aspects. This is because there are still sentences or words and the use of punctuation that are not in accordance with grammatical rules. Nurwicaksono & Amelia (2018) revealed that many language errors occur due to

improper use of punctuation marks, the use of redundant spaces and the use of the strip sign (-), improper writing of affixes, rephrases, and prepositions. The aspects of format of parts and accuracy of typesetting elements also have the lowest scores. This can be caused by the existence of parts that are not in accordance with the E-Handout development format. In addition, there are still letters that are not appropriate. Dewi (2017) explains that the format aspect is tested to measure the suitability and completeness of the components in the teaching materials.

There are several aspects that get the highest score relevance of learning objectives is appropriate and the meaning of learning objectives for students which are included in the learning objectives. This shows that the development of E-Handout is in accordance with the learning objectives. Qodriyah (2019) added that in choosing teaching materials, it must have the principle of relevance, namely having basic competencies relationship with indicators of competency achievement so that it is in accordance with the learning objectives. The aspects of completeness of instructions for use, concept maps, evaluation questions, and developer profiles, illustrations, images, and videos, and appropriate and harmonious appearance also received the highest scores. These three aspects represent format and media. This means that the E-Handout developed is very much in accordance with the format and media aspects assessed so that students easily understand the concepts learned. Based on Dewi (2017), the media aspect is tested to measure the suitability of illustrations (pictures, tables, etc.) in order to clarify and facilitate understanding of the material.

The practicality test aims to analyze the level of practicality of teaching materials when used in the learning process (Lestari, et al., 2018). Based on the results of the practicality test, E-Handout has an average total score of 91.88 so that it is classified as a very good category. This means that the E-Handout that has been developed in this study is very good, practical and easy to read and understand by students. This is supported by Saroni et al. (2016) which explains that readability with a good level can maximize learning interest and memory, maintain reading habits and increase reading speed and efficiency. In the practicality test results, it was found that the aspect that received the lowest score was become independent teaching materials. This is influenced by students who are less interested in using E-Handouts as independent teaching materials. Therefore, the E-Handout was improved based on the suggestions and criticisms that had been obtained in order to attract students to use it. In line with this, Priscylio & Zuhdi (2019) revealed that good teaching materials not only contain material according to the curriculum, but also must have a high level of readability.

The aspect of practicality that gets the highest score, namely additional information is relevant. This is because the E-Handout contains additional information or reading material that will enrich students' knowledge related to the material and can attract students to use E-Handout. This is reinforced by Hidayati (2020) who states that additional information includes facts and some additional information about the material being studied. The purpose of additional info is to provide learners with a clearer understanding of the material presented. Another aspect that received the highest score was up to date and current material. This is because the material compiled in the E-Handout is equipped with the latest information and images. So that students get relevant information in accordance with the latest developments. Masrikin (2021) revealed that teaching materials that are always updated play a role in the success of learning.

The results of this study indicate that the E-Handout of the Sub-Concept of Structure and Function of Tissues in Plants is declared very valid and very good practicality. This means that the E-Handout teaching materials that have been developed based on needs can be used. Therefore, E-Handout teaching materials for the Sub-Concept of Structure and Function of Tissues in Plants can be implemented in learning. These results are in accordance with research conducted by Rahmi et al. (2020) that overall very valid and very practical handouts can be

implemented in the learning process. The implication of this research is that E-Handout teaching materials can be used by students in a directed manner with the teacher in classroom learning or independently through laptop or smartphone access anywhere and anytime.

CONCLUSION

Based on the results of research and discussion, it can be concluded that *First*, the results of the needs analysis obtained as the basis for the development of E-Handout teaching materials are stated to be good, this shows that there is a need for the development of E-Handout teaching materials on the Sub-Concept of Structure and Function of Tissues in Plants. *Second*, the validity of E-Handout is declared very valid and in accordance with learning objectives, language, format and media. *Third*, the E-Handout practicality test was declared very good, meaning very practical and easy for students to read. This shows that the E-Handout that has been developed can be a teaching material used in the Sub-Concept of Structure and Function of Tissues in Plants in learning. The implication of the research results is that students can learn independently anytime and anywhere using E-Handout via laptop or smartphone.

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