

DEVELOPMENT OF FLASHCARD AND INTERACTIVE MIND MAPPING MEDIA IN THE WEBSITE ON PLANT TISSUE MATERIAL TO IMPROVE STUDENT'S COMPREHENSION AND MOTIVATION

Pengembangan Media Flashcard dan Mind Mapping Interaktif dalam Website pada Materi Jaringan Tumbuhan untuk Meningkatkan Pemahaman dan Motivasi Siswa

Faradiba Widiasti

Undergraduate Program in Biology Education, Faculty of Mathematics and Natural Sciences
State University of Surabaya C3 Building 2nd Floor Ketintang Street, Surabaya 60231
e-mail: faradiba.18016@mhs.unesa.ac.id

Isnawati

Undergraduate Program in Biology Education, Faculty of Mathematics and Natural Sciences
State University of Surabaya C3 Building 2nd Floor Ketintang Street, Surabaya 60231
e-mail: isnawati@unesa.ac.id

Abstract

Pandemic conditions cause students to do most of their activities, including learning, at home. As a consequence of the monotonous online learning activities, student learning results decrease, and learning motivation suffers. Plant tissue material is one of the materials that is difficult to learn and require special attention because when the object of observation is difficult to sense, complicated, and it is not enough to simply study theoretically, but to learn in an applied and interactive way. The aim of the research is to develop plant tissue flashcard media and interactive website-based mind mapping as practical learning media to improve students' understanding and motivation. The ADDIE development model is used in this research (Analysis, Design, Implementation, and Evaluation). Validation methods, pretest and posttests, student response questionnaires, and student motivation questionnaires were used to collect data from 20 students in class 11, 8th Public High School of Surabaya. The information gathered was analyzed using descriptive-quantitative methods. The findings showed that flashcard and mind mapping media were highly valid, with a validity score of 3.97, could improve students' comprehension with a medium score, and received a 95.9% positive reaction from students. As an outcome, the website's interactive flashcard and mind mapping media on the plant tissue material provided are valid, practical, and useful in increasing comprehension.

Keywords: flashcard, interactive mind mapping, website, plant tissue, learning comprehension, motivation.

Abstrak

Kondisi pandemi yang terjadi mengharuskan siswa untuk melakukan sebagian besar kegiatan didalam rumah termasuk juga dengan kegiatan pembelajaran. Hal ini menimbulkan penurunan hasil belajar siswa karena kegiatan pembelajaran daring yang monoton sehingga motivasi belajar menurun. Salah satu materi yang sulit dan memerlukan perhatian khusus dalam pembelajaran dimana materi objek pengamatan sulit untuk diindera, kompleks, dan tidak cukup dengan hanya mempelajari secara teoritis melainkan pembelajaran secara aplikatif dan interaktif adalah materi jaringan tumbuhan. Penelitian ini bertujuan untuk mengembangkan media flashcard dan mind mapping interaktif berbasis website pada materi jaringan tumbuhan sebagai media pembelajaran praktis untuk meningkatkan pemahaman dan motivasi siswa. Penelitian ini menggunakan model pengembangan ADDIE (Analysis, Design, Implementation, and Evaluation). Metode pengumpulan data melalui metode validasi, tes pretest dan posttest, angket respon siswa serta angket motivasi siswa yang diberikan kepada 20 siswa kelas XI MIPA SMA negeri 8 Surabaya. Data yang diperoleh dianalisis melalui teknik deskriptif-kuantitatif. Hasil penelitian menemukan bahwa media flashcard dan mind mapping sangat valid dengan skor validitas sebesar 3.97, dapat meningkatkan pemahaman siswa dengan skor medium dan mendapatkan respon positif dari siswa sebesar 95.9%. Dengan demikian media flashcard dan mind mapping interaktif dalam website pada materi jaringan tumbuhan yang dihasilkan valid, praktis dan efektif dalam peningkatan hasil belajar.

Kata kunci: motivasi belajar, jaringan tumbuhan, hasil belajar, flashcard, mind mapping interaktif, websit

INTRODUCTION

Learning motivation is the driving force contained in students to raise intentions in carrying out learning activities so that the objectives of the learning subject can be achieved (Cahyani et al., 2020). Learning motivation has several aspects. The aspects developed by John Keller consist of 4 types, namely Attention, Relevance, Self-Confidence (Confidance), and Satisfaction (Satisfaction) (Simsek, 2020). To create a better learning atmosphere, these four elements must be developed in learning. Students need to develop the four aspects of motivation, especially considering the situation.

Nowadays, the Indonesian state is even almost all over the earth facing the conditions of the COVID-19 pandemic where the government requires to carry out most of the activities at home / *Work from Home* (WFH) so that learning activities are carried out online. In online learning activities, student learning motivation decreases due to monotonous activities carried out during online learning so that students quickly feel bored. (Cahyani et al., 2020). In learning activities, there are several factors that affect student learning motivation, one of which is external factors such as the condition of the learning environment in students. The condition of the online learning environment that requires students to study at home causes teachers to be unable to give appreciation to students directly so student motivation is weakened (Cahyani et al., 2020). Therefore, teachers are expected to improve their students' motivation for learning by using a variety of learning techniques and making use of online learning materials in order to create a learning environment that might attract their interest in the study.

The material on the structure and function of plant tissues is material given to high school students in class XI in the first semester. The basic competencies given contain analyzing the relationship between cell structures in plant tissues and the function of organs in plants and presenting data on the results of observations of tissue and organ structures in plants where the concepts given are about cells, structures, tissues, and organs in plants and their functions for plants. Based on the percentage in the 2019 National Examination, it can be seen that the material on the structure and function of living beings received a score of 49.50 on a national scale, which is the second-lowest score in biology lessons mate. The activity of determining organs and organ systems that are arranged by certain tissues and explaining the characteristics and functions of tissues in plants received

quite low values, namely 29.85 and 49.47 on a national scale (Kemendikbud, 2019). Based on the research questionnaire, it has been found that 51.6% of students of class 11, 8th Public High School of Surabaya have difficulty in understanding the structure and function of plant tissues, especially in plant tissue sub-materials during distance or online learning. This proves that the structure and function of plant tissues is one of the difficult materials and require special attention in learning. The material cannot be given only by the lecture method because the material of the structure and function of plant tissues is a material where the object of observation is difficult to sense, complex, and not enough to study theoretically but must using an applicational learning (Rohmawati, 2018).

In applicative learning, appropriate learning media are needed to attract students' interest in learning and help students understand the material. Learning media is a tool that serves to convey the message of learning (Triana, 2018). One of the learning media that can help students in generating motivation in teaching and learning activities and can bring influence to students is interactive multimedia. The advantage of using interactive multimedia is that it can present information with abstract objects to be concrete and provide direct experience to students because students can interact with the concepts they learn (Noviar, 2016). One of the interactive multimedia that can be used today is to use web media or web-based learning. web-based learning is distance learning based on information technology and web interface communication (Munir, 2009). Web-based learning can be done by accessing the website, where students can carry out learning activities such as studying material, doing assignments, and interacting with friends or teachers. All these activities can be carried out through the website independently or with the help of teachers as facilitators.

This website is an interactive multimedia that can be used. This interactive multimedia function can be supported by adding interactive learning media such as Flashcard learning media and Interactive Mind Mapping. Flashcard is one of the learning resources in the form of a card that contains an image accompanied by a symbol or writing caption that brings students to things related to the content of the card (Setyawan, 2019). Flashcards have several benefits that can support learning activities such as being able to develop a vocabulary in Language lessons and also talking points will be easy to remember, besides that teachers and students are also involved in presentation

(Setiawati et al., 2015). Based on the research questionnaire on class XI students of SMA Negeri 8 Surabaya, it was revealed that 74.2% of class XI students of SMA Negeri 8 Surabaya had never heard / knew learning using flashcards so that 87.1% of these students were interested in learning using flashcards.

Besides, Mind Mapping is one of the learning strategies that can be applied so that the reception of information becomes easier (Amalia, et al., 2013). This learning strategy involves the work of both brains, namely the right and left brains, so that it will make it easier for students to organize and remember all forms of information. Based on research conducted by Rohmah in 2016, it was found that the use of flashcards is effective in increasing students' completeness and interest in learning by 100% and 97.7%.

Based on existing problems, this research aims to develop flashcard media and web-based mind mapping on plant tissue materials, validate media, and describe the practicality and effectiveness of flashcard media and website-based mind mapping on plant tissues to increase students' understanding and motivation.

METHODS

This research uses a quantitative description method with the ADDIE research model which consists of 5 stages, namely Analysis, Design, Development, Implementation and Evaluation.

The target of the study was flashcard media and Website-based Mind Mapping on plant tissue material with a trial carried out by 20 students of class XI MIPA2 SMA Negeri 8 Surabaya. The study was conducted from January to June 2022. Data collection techniques are used through validation, pretest and post-test tests, response questionnaires and student motivation.

The media validation developed is an analysis of the value of the accuracy of the format and content of the media based on the validation sheet scores obtained from two expert lecturers and one biology teacher of SMA Negeri 8 Surabaya. The validation sheet uses a likert scale assessment with a maximum score of 4 and a minimum of 1. The validation results are then interpreted with criteria if 1.00-1.75= not feasible, 1.76-2.50= less feasible, 2.51-3.25= feasible, and 3.26-4.00=very feasible. The media can be said to be feasible if it obtains a result of ≥ 2.51

Pretest and Post-Test tests are used to assess a student's level of understanding. Student learning outcomes using a normalized gain test using the following formula

$$n - gain(g) = \frac{posttest\ score - pretest\ score}{maximum\ score\ (100) - pretest\ score}$$

The gain value is expressed as high when obtaining the value of $n > 0.70$ with interpretation criteria of $0.00 < g \leq 0.30$ = low, $0.30 < g \leq 0.70$ = medium, and $0.70 < g \leq 1.00$ = high.

The response questionnaire is compiled in the form of a statement to find out opinions and input about the media. The results of the questionnaire are calculated on the Guttman scale where the Yes answer has a score of 1 and the answer Does not have a score of 0. The percentage of students against the media is calculated using the following formula.

$$Positive\ Response\ (\%) = \frac{Yes\ score}{All\ students} \times 100\%$$

Student response criteria are declared effective if they get a percentage of $\geq 61\%$ with an interpretation of 20%-40%= less effective, 41%-60%= quite effective, 61%-80%=effective, 81%-100%= very effective.

Meanwhile, the motivational questionnaire is calculated using the form of positive and negative statements. Statements with positive criteria: 1:strongly disagree, 2: disagree, 3: doubt, 4: agree, 5: strongly agree and also vice versa. The average score is then interpreted according to its categories of 1.00-1.49=not good, 1.50-2.49=less good, 2.50-3.49=quite good, 3.50-4.49=good, 4.45-5.00= very good. The combined average score result of positive and negative criteria will be calculated using the n-gain formula.

$$n - gain(g) = \frac{score\ after - score\ before}{maximum\ score\ (100) - score\ before}$$

The gain value is expressed as high when obtaining the value of $n > 0.70$ with interpretation criteria of $0.00 < g \leq 0.30$ = low, $0.30 < g \leq 0.70$ = medium, and $0.70 < g \leq 1.00$ = high.

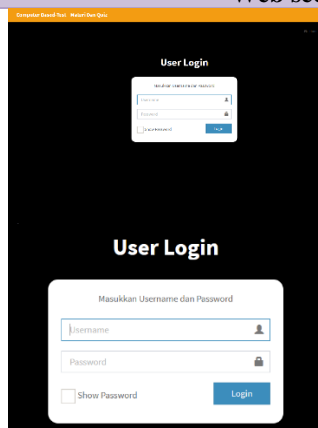
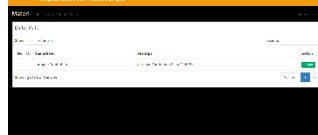
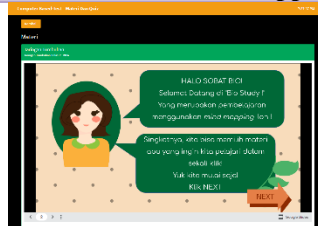


RESULT AND DISCUSSION



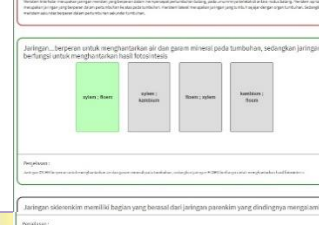

Website Media Profile

This research and development resulted in flashcard media and interactive mind mapping on plant tissue meters applied to websites for class XI high school. There is a material section, quizzes, and exam section on the website that contains this flashcard and mind mapping media. Flashcards and mind maps with material on plant tissue are included in the material and quiz sections. To make it easier for students and teachers to access the material, mind mapping in the form of a powerpoint presentation that is connected to Google Slides. While the flashcard contains questions and answers that are divided into answer boxes with various options. Whether the student's response was correct or incorrect will be

evaluated when the box is opened. Here are the views and features developed in Table 1 below.



Tabel 1. Flashcard and Intreactive Mind Mapping Apparence

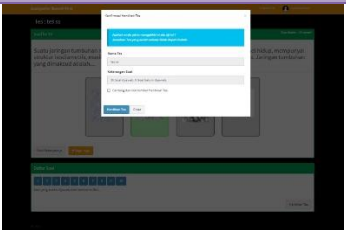
Display and features	Description
Web section	
	This is a general display when opening the website, students can immediately see the mind mapping and flashcard material on the "materi and quiz" menu. If students have registered, they can directly login by entering their username and password.
	The "material and quiz" section contains a list of materials that can be filled in by other materials so that they can be used for other types of material or subjects
Mind Mapping Section	
	The initial part when opening the material, there is an introduction, also mentioned basic competencies and indicators of the material to be studied.
	Interactive mind mapping display that can be clicked according to the sub-chapters that students want to learn.
	The image features in this mind mapping aim to provide visuals to students about plant tissue material, so they can add to their understanding of plant tissue material.

Display and features	Description
	The video feature can be found in the "NONTON YUK!" feature which contains videos to improve students understanding the concepts
	The "FUN FACT" feature contains interesting facts about plant tissue material so that students are more interested in learning.
Flashcard section	
	Flashcard display when students answer questions correctly
	Flashcard display when students answer questions incorrectly

The website can also be used as a medium to conduct tests. Here's what it looks like when used for tests in table 2

Table 2. Exam Section Apparence

Display	Description
Exam Section	
	The website display after students log in using the registered username and password, students will choose the test to be selected or see the results of past tests.
	The website display when students take the test

Display	Description
Exam Section	
	The website display after students take the test

Website Media Validity

Flashcard media and interactive mind mapping have been validated by three validators consisting of two validators and a high school biology teacher. Validators judge based on aspects of content, language, presentation, use, and assistance. The following is a recapitulation of the validity of flashcard media and interactive mindmapping in the website on plant tissue materials to increase student understanding and motivation (Table 3)

Table 3. Recapitulation of Validation Recap Score

Assessment aspects		Score			Average
		V1	V2	V3	
Component Contents					
1.	The existence of material content with <i>FlashCard</i> Media and <i>Mind Mapping</i>	3,67	4	4	3.89
Average of the components of the contents		3.89			
Interpretation of the content component score		Very Valid			
Linguistic Components					
2.	The use of good and correct Indonesian rules	4	4	4	4
3.	Sentences used are clear and operational	4	4	4	4
Average of the linguistic components		4.00			
Interpretation of the linguistic component score		Very Valid			
Serving Components					
4.	Serving technique	4	4	4	4
5.	Presentation View	4	4	4	4
Average serving components		4.00			

Assessment aspects		Score			Average
		V1	V2	V3	
Interpretation of the presenting component score		Very Valid			
Components of use					
6.	Ease of use of the website	4	4	4	4
Average usage components		4.00			
Interpretation of the usage component score		Very Valid			
Components of assistability					
7.	Flashcards, Mind Mapping, and Websites can improve understanding	4	4	4	4
8.	Flashcards, Mind Mapping, and Websites meet the motivational enhancement aspects	4	4	4	4
Average of the assistability components		4.00			
Interpretation of the assist ability component score		Very Valid			
Average overall score		3.97			
Interpretation of the overall score		Very Valid			

Based on the recapitulation of the validation data in Table 3, flashcard learning media and interactive mind mapping have been included in the very valid category with an average overall score of 3.97. these results prove that flashcard media and interactive mind mapping are worthy of use in learning.

The content component is an important part in the validation process, where the content of plant tissue material is on flashcard media and interactive mind mapping. the average score of the content component validation is 3.89 with a very valid interpretation. the score shows the content on the media is valid and feasible to use.

The linguistic component said to be very valid with an average score of 4. the linguistic component in flashcard media and mind mapping uses good and correct

Indonesian grammar rules, in accordance with PUEBI, represents the content of the message to be conveyed, does not cause double meaning or contains elements of sara and have the correct writing of foreign/scientific terms. The sentences used in the flashcard and mind mapping media are clear and operational, which means they are not complicated, commonly used, and use consistent terms.

This is in accordance with the Ministry of National Education, 2004, namely good teaching materials have clear and understandable sentence structures, use language that is appropriate to the level of student development, and do not lead to multiple interpretations.

Learning media is anything that can be used to convey messages (learning) so that it can stimulate students' attention, interest, and role in learning activities in order to achieve learning goals (Hidayati and Susanti, 2013)

Based on the recapitulation in Table 3, the presentation component and the use component of flashcard media and mind mapping get an average value of 4 which is a valid media in presentation and presentation techniques and also easy-to-use media.

Based on the assistability component of flashcard and mind mapping media, this media is classified as very valid with a score of 4 to improve comprehension, and fulfill aspects of enhancing motivation, such as attention, relevance, confidence, and satisfaction.

Increasing Student's Understanding of Using The Website Media

The increase in students comprehension of plant tissue material was measured using pre-and post-tests. The test was done twice a week in two sessions, showing data such as that shown in Table 4.

Table 4. Recapitulation of Pretest-Posttest Recap Score

Aspect	Pretest	Post test
Number of student	20	20
Number of questions	10	10
Highest score	60	100
Lowest score	10	60
Total score	770	1630
Average	38.5	81.5
N-gain	0.69	
Interpretation on N-gain score	Medium	

During the pretest, it was discovered that students still did not comprehend the material of plant tissue. Table 4 shows that the pretest has a maximum score of 60 and a minimum score of 10. There are ten multiple-choice questions on the test. Students can only answer a

maximum of 6 correct questions on the pretest, whereas the standard value of the indicator / KKM is 75. To improve students' comprehension, students are then asked to explore the that's in flashcard media and mind mapping on the website.

The average post-test score of 20 students was 81.5, which is a complete score higher than the standard indicator. The greatest post-test implementation score is 100, which is a perfect score, while the lowest post-test implementation score is 60. Although the lowest post-test score was not included in the complete category and is still below the indicator level, this value represents a significant improvement over the pretest score. The internal aspect of the student is one of the uncompleted factors that impact comprehension. Because all students pay attention to the explanations and materials provided during the learning process, internal factors can be the cause of poor learning outcomes. As factors that influence student motivation, incompleteness can be caused from both external and internal factors (Yusuf, 2009)

The n-gain calculation is being used to measure the increase in student comprehension. The difference between the pretest and posttest scores is being used to calculate n-gain, or normalized gain. The n-gain computation provided a result of 0.69, which is classified as a medium increase.

Student's Responses of Using The Website Media

The students were asked to fill out a questionnaire after taking the pretest and posttest and learning the flashcard and mind mapping media. The aim of the questionnaire was to find out how they considered about flashcard and mind mapping media that had been used. The questionnaire asked about systematics, attractiveness, convenience, and assistance of the flashcard and mind mapping media. The results obtained are shown in Table 5 below.

Table 5. Recapitulation of Students Responses

No	Indicators	Positive Responses	Persentase
Systematics of presentation			
1	Materials and drawings are presented in a coherent and systematic manner	20	100
2	Systematic <i>website presentation</i> facilitates the use of media and understanding of plant tissue material	19	95

No	Indicators	Positive Responses	Persentase
Average systematics			97,5
Presentation			
3	The appearance of <i>the website</i> design is attractive to look at.	19	95
4	<i>The website</i> is equipped with pictures, photos, and illustrations that match the content of plant tissue material.	20	100
5	The selection of the type and size of the letters is appropriate and easy to read.	19	95
6	The image and the content of the material are neatly arranged and balanced.	20	100
7	The color combinations used in the <i>Website</i> are proportional and harmonious	20	100
8	The website is interactive.	18	90
Average presentation			96.6
Ease of presentation			
9	<i>The website</i> is easy to use anytime and anywhere	18	90
10	<i>The website</i> can be used repeatedly.	19	95
11	Instructions for using <i>the Website</i> can simplify the learning process.	19	95
12	The problems presented in are easy to use for self-study as well as classically	20	100
13	<i>Websites</i> can be connected with everyday phenomena	16	80
14	Images on the <i>Website</i> facilitate the process of understanding plant tissue material.	20	100
15	The order in which the images and illustrations presented are easy to follow.	20	100
16	The use of language on the <i>Website</i> is easy to understand.	20	100

No	Indicators	Positive Responses	Persentase
17	The description of the material is clear and simple.	19	95
18	<i>Websites</i> can simplify the process of understanding and increase learning motivation	18	90
Average ease			94.5
Helpfulness of presentation			
19	The material on the <i>Website</i> may provide new insights.	20	100
20	Problems presented on the <i>Website</i> can help increase understanding of plant tissue material.	18	90
21	The order of the presented images and illustrations helps to improve understanding of plant tissue material.	20	100
22	This website can help students be active in thinking.	20	100
23	This website can attract students' attention in learning.	20	100
24	This website can help students in associating learning materials with daily life.	17	85
25	This website can help students to increase their confidence in thinking.	18	90
26	This website can help students search for information from several sources.	19	95
27	This website can help students to get maximum results in learning.	19	95
Average helpfulness			95
Average total			95.9

According to table 5, the flash card and mind mapping media received a 95.9% positive response from students, placing it in the very practical category. The questionnaire does include a statement about media presentation's

systematics, attractiveness, convenience, and assistance provided by flashcard media and mind mapping.

The systematic presentation of flashcard and mind mapping media includes a clear and systematic presentation of material in order to facilitate media use, which receives a 97.5% positive response. 96.6 percent of students considered the presentation of flashcard and mind mapping media was interesting, especially the illustration images that match the plant tissue material and were neatly organized, as well as proportional and balanced colors.

The ease in which students can use flashcard media and mind mapping is one aspect of presenting ease. Flashcard and mind mapping media can be used independently and classically to help students understand plant tissue material (Setiawati et al., 2015). Students had a positive answer in terms of convenience, with 94.5 percent giving feedback on problems connected to everyday phenomena that could be improved. While students thought that using flashcard and mind mapping media helped them improve their comprehension and motivation, they received a good response of up to 95%.

Increasing Student's Motivation of Using The Website Media

A motivation response questionnaire was used to measure the effectiveness of flashcard and mind mapping media. Students were given motivation response surveys after using flashcards and mind mapping media, as well as completing a pretest and posttest. The outcomes are shown in Table 6 below.

Table 6. Recapitulation of Students Motivation

No	Before Average	After Average
1	3.13	3.08
2	3.42	3.02
3	3.10	2.95
4	3.14	3.38
5	3.43	3.48
6	2.95	3.05
7	3.22	2.92
8	3.02	3.09
9	3.28	3.11
10	3.23	3.63
11	3.39	3.45
12	3.30	3.61
13	3.09	2.97
14	3.45	3.24
15	3.13	3.20
16	3.12	3.65

17	3.04	4.92
18	3.13	3.46
19	3.51	3.31
20	3.02	2.85
Average	3.20	66.38
N-gain	0.06	

According to the results in Table 6, the average value of students' motivation before using media was 3.20, indicating that they were moderately motivated. The average student motivation was 3.31 after using flashcard and mind mapping media, and they were still classified as moderately motivated. The number of normality, or n-gain, was used to measure the improvement in motivation. The difference between the scores before and after the use of the media is used to calculate the n-gain. According to the data, there was a 0.06 increase in motivation, indicating an increase in students' lack of motivation.

Aspects of student attentiveness, relevance of the subject to students' daily lives, student self-confidence, and student satisfaction were measured in this study. The effectiveness of increasing student motivation was very low in this study since students were still unable to enhance self-confidence. Whereas motivation of students has importance effects on their success.

The students surveyed in this study did not show a significant increase in motivation. This is due to the fact that both internal and external factors can influence student motivation. Internal elements include interest, attention, persistence, attitude, and study habits, and also physical and health conditions, which all affect students' learning ability (Setyawan, 2019). While external factors, such as family, school, and community, affect student learning outcomes, external factors are elements that come from outside of students (Kılıç et al., 2021). In the teaching and learning process, all factors which influence student motivation must be considered (Ditta et al., 2020).

Based on the validation of the data obtained with very valid results, it was discovered that the flashcard media and interactive mind mapping on the website on plant tissue material were valid for usage based on the research and development that had been done. According to student responses, flashcard media and interactive mind mapping are also very practical and can be used to considerably improve the understanding based on pretest and posttest data. However, the function of flashcard and mind mapping media needs to be improved in order to increase student motivation, especially in terms of student interest and satisfaction.

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CLOSING

Conclusion

Research and development of flashcard media and interactive mind mapping on the website on plant tissue material was considered very valid to be applied to students by 3 validators with a value of 3.97. The students gave this flashcard and mind mapping media a 95.9% good reaction, and they thought that it helped them in using the media. In the medium category, flashcard and mind mapping media were able to improve students' understanding, but with only a 0.06 improvement in student motivation, flashcard and mind mapping media were still lacking.

Suggestion

The researcher recommends that the next research emphasis on the impact on student motivation and learning effects on plant tissue material by utilizing flashcard media and interactive mind mapping. To improve learning results on a variety of biology subjects, researchers have increased the usage of flashcards and interactive mind mapping for high school biology teachers.

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