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Development of Basic Tissue Histology Atlas to Improve Student Motivation and Learning Outcomes on Animal Tissue Structure Materials in High School

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Abstract

This study aims to describe characteristics, validity, applicability and effectiveness of Basic Tissue Histology Atlas to improve student motivation and learning outcomes. This research design is Research and Development (R&D). The research subject was students of grade XI SMA Negeri Gondangrejo, with 30 students in the small-scale trial and 35 students in the large-scale trial. Methods of data collection in the form of media and material validation questionnaires, teacher and student response questionnaires, learning motivation questionnaires, and 20 items of multiple choice test. The results showed that the Basic Tissue Histology Atlas that was developed obtained an average percentage of 92.2% with very valid criteria, 95% teacher responses and 100% student responses with applicable categories, 82.8% learning motivation with motivated categories. and highly motivated, as well as an increase in learning outcomes of 0.67 in the medium category. This research can be concluded that the characteristics of Basic Tissue Histology Atlas are composed of simple to complex tissue and full color display. The Basic Tissue Histology Atlas valid and can be applied as a learning medium, effectively used to improve student motivation and learning outcomes.

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INTRODUCTION

Learning media is a tool that facilitates teachers and students in the teaching and learning process. Learning media can also be an intermediary for teachers in conveying information or learning materials. The existence of learning media today, especially biology learning media, is needed by both teachers and students. If you look at the characteristics of biological material, you can find many materials that are on average verbalistic in nature and very few presentations of images that can support the explanation of the material.

Based on the results of the interviews, the teacher found it difficult to carry out observations in the laboratory because of the lack of facilities such as microscopes and the absence of preserved preparations provided by the school, as well as the lack of time to make observations due to the large number of materials that students had to learn, especially biology material in class XI. This situation not only makes it difficult for teachers, but students who cannot understand properly how the actual shape of animal tissue that composes the organs of the animal and human bodies.

Based on the curriculum mandate in KD (Kompetensi Dasar/Basic Competences) 3.4, previous students were able to observe the structure of animal cells using a microscope and observation materials that can be easily found and presented, such as the epithelium on the human cheek and in plant cells by using observation material in the form of a thin membrane on red onions. Meanwhile, in observing animal tissue, the teacher can only facilitate students with pictures of animal tissue which are actually less representative according to the teacher from Google or the results of the workshop that are displayed through power points to be shown to students.

The results of filling out the questionnaire on the aspect of the level of learning motivation, the average number of students answered was still low. This is supported by the results of observations made by researchers, there are some students who are still lazy and busy themselves when the teacher is giving the material. The attitude of these students due to low motivation to learn finally has an impact on the results of student test scores which on average are still lacking and some students do not reach the KKM (Kriteria Ketuntasan Minimum/Minimum Criteria of Mastery Learning). The existence of motivation in learning certainly affects student learning outcomes.

The Basic Tissue Histology Atlas deserves to be developed as a learning media because it can overcome the limited time for teachers to make observations or identify. The use of Histology Atlas in learning biology is able to overcome the problems caused by the lack of learning facilities such as microscopes and preserved preparations. Based on the facts and existing problems, it is necessary to develop a Basic Tissue Histology Atlas that can be used as a learning medium so that it can overcome the limitations of teachers in learning material on animal tissue structures in high school.

RESEARCH METHODS

This research was conducted at SMA Negeri Gondangrejo in the even semester of the 2020/2021 school year. The design of this research is Research and Development (R&D) using the Sugiyono development model. The research subject was students of grade XI SMA Negeri Gondangrejo which included 30 students as subjects of small-scale trials and 35 students as subjects of large-scale trials. The method of data collection was carried out by questionnaires and tests. The research instrument used was a teacher and student response questionnaire and a learning motivation questionnaire, with 20 multiple choice questions to measure the improvement in student learning outcomes before and after using the atlas. Data analysis includes analysis of atlas validity,

teacher and student responses, learning motivation using the percentage descriptive method and improving student learning outcomes with the N-gain test.

RESULTS AND DISCUSSION

The purpose of this study was to analyze the characteristics, validity, applicability, and effectiveness of the Basic Tissue Histology Atlas to improve students' motivation and learning outcomes on the material of animal tissue structure. Atlas characteristics can be seen from each component in the atlas which includes atlas cover design, foreword, Table of contents, atlas content design, bibliography, and atlas index. The success of measuring validity, applicability, and effectiveness can be seen from the achievement based on predetermined indicators, namely, valid if obtaining a total percentage of at least 71% with valid criteria, can be applied if obtaining a minimum percentage of teachers and students 81% criteria can be applied, effectively increasing motivation study with a minimum percentage of 75% classically with motivated and highly motivated criteria, and student learning outcomes obtained classical completeness, namely 75% of students reached KKM (Kriteria Ketuntasan Minimum/Minimum Criteria of Mastery Learning) 75 and learning outcomes increased with moderate criteria.

Characteristics of Basic Tissue Histology Atlas

Characteristics of the Basic Tissue Histology Atlas developed can be seen from several components contained in this atlas including the atlas title located on the cover page, foreword, Table of contents, atlas contents section, bibliography, and index. Atlas cover design is an important part of the atlas, because it contains an overview of the contents of the atlas. Therefore, the illustrations used must also reflect the contents of the atlas. The illustration used on the cover of the atlas by taking one of the pictures of the preparations, namely skin preparations as an illustration.

The foreword in this atlas is structured like the foreword in general in a written work. Presentation of the foreword is based on the aspect of the purpose of writing the atlas, for whom the atlas was prepared or written, and expressions of gratitude. The Table of contents is a section that contains a collection of titles for chapters written in a work, so that it can be used as a guide or map to make it easier for readers to find information based on the title and the intended page number.

The design of the content of the atlas displays presentations that are able to attract learning motivation for students. This can be seen from the images that are displayed in full color, neatly and systematically arranged, the presentation of sequential material from the basic epithelial tissue, then connective tissue, muscle tissue and nervous tissue. This systematic presentation can help students process information in a coherent manner so that they can make connections between networks with one another.

The bibliography is important to include in the writing because it contains reference sources used by the author, so that if the reader wants to know more, they can cite the sources listed and look for them on online search sites or google. There is no special design in the index, it is written and compiled using the Aristotelian style with a modern format. The writing of the index in this atlas contains scientific words or terms and important terms that characterize the material of animal tissue structure.

Validity of Basic Tissue Histology Atlas

Product validation was carried out by filling out a Basic Tissue Histology Atlas validation questionnaire by media and material experts. The result of the final validity of the product that has been developed is the average percentage value of the validation value by media experts and material experts. The following presents the results of the atlas validity assessment by media experts in Table 1.

Table 1. Recapitulation of Validation Results by Media Experts

No.	Items of Assessment	Total Score	Score Obtained	Percentage
1.	Graphical Aspect	88	83	94,3%
2.	Presentation Aspect	20	18	90%
	Total score obtained		101	
	Total overall score	108		
	Percentage of media validity			93,5%
	Criteria	Very valid		
	Test decisions	Can be used with revision		

Based on Table 1, it is known that media experts assess the validity of Basic Tissue Histology Atlas based on two aspects, obtaining a score of 83 on the graphic aspect and a score of 18 on the presentation aspect. Each aspect gets a percentage of 94.3% on the graphic aspect and 90% on the presentation aspect. The percentage of total media validity obtained from the validator is 93.5% with very valid criteria.

The graphic aspect is divided into several indicators, namely atlas size, atlas cover design and atlas content design. A high percentage of validity indicates that the atlas made in accordance with the ISO standard size (*The International Organization for Standardization*) is B5 with a size of 176 x 250 mm. Atlas cover design pays attention to the appearance of layout elements with harmonious colors that can clarify the material. The use of illustrations on the cover is able to reflect the content and characteristics of the atlas material. In addition, the atlas cover design also pays attention to the balance or proportionality of the shape, font size, illustration size, and the color of the letters used.

The design of the content of the atlas includes the title of the chapter, the title of the picture of the preparation, the description of the picture of the preparation, and the complete page number. The description of the images presented is able to clarify the presentation of the material supported by a color composition that attracts reading interest. Placement of image captions adjacent to the image so that it is easier for students to understand. The addition and placement of illustrations in the atlas does not interfere with important information in the material such as titles, image descriptions, and page numbers. The ease of use of the developed atlas is also seen in the consistent use of symbols or icons and the variety of letters used is not excessive, so that it does not interfere with students' reading focus. Based on the presentation aspect, the atlas displays the right center of view for the title so that it can become the initial attraction for the reader. The presentation of the index on the atlas received a positive response from the validator, because the index included was very helpful for students in finding a list of words or terms that had been completed with page numbers and arranged alphabetically.

Table 2. Recapitulation of Validation Results by Material Expert

No.	Assessment Items	Total Score	Score Obtained	Percentage
1.	Material Feasibility Aspect	48	44	91,7%
2.	Language Feasibility Aspect	36	33	91,7%
3.	Contextualization Aspect	4	3	75%
Total score obtained			80	
Total score		88		
Material validity percentage				90,9%
Criteria		Very valid		
Test decisions		Can be used with revision		

Based on Table 2, it is known that the material validity assessment by material experts is based on three aspects, obtaining a score of 44 on the aspect of material feasibility, a score of 33 on the language feasibility aspect, and a score of 3 on the contextualization aspect. Each percentage in sequence on the three aspects above are 91.7%, 91.7% and 75%. The percentage of the total validity of the material obtained from the validator is 90.9% with very valid criteria. A high percentage indicates that the atlas developed has met the aspects of material feasibility, language, and contextualization.

The first aspect that is assessed is the feasibility of the material. The aspect of material feasibility obtained a percentage value of 91.7%. This shows that the material presented is in accordance with the KD (Kompetensi Dasar/Basic Competences) achievement determined by the curriculum. The presentation of the atlas material is adjusted to the level of needs of high school students. The material presented does not cause many interpretations and is in accordance with the concepts that apply in the biological sciences. The accuracy of the images in the atlas can be seen in the presentation of images that can visualize the structure of the tissue making up the organs of the animal and human organs in a concrete way according to the concept of biological science. This is in accordance with the opinion of Mustika (2015), image or photo-based media has advantages because it is visually concrete so that it can display objects according to their original form and not verbalistic. The presentation of the material in the atlas is able to stimulate curiosity and encourage students to study and seek information thoroughly.

The second aspect in assessing the validity of the material is linguistic feasibility. The linguistic aspect obtained a percentage of 91.7%. The indicators of linguistic feasibility assessed are straightforward, communicative, dialogical and interactive, conformity to the level of student development, and the use of terms or symbols. The use of sentences in the atlas is able to represent the content of information in accordance with good and correct Indonesian rules. The language used in explaining the concept is in accordance with the level of cognitive development of high school students, using simple sentences, easy to understand and not convoluted so that it can evoke a sense of pleasure when students read it. The term language does not only refer to written or spoken forms, but also in the form of symbols (Wicaksono, 2016). Therefore, the use of symbols in this atlas can also facilitate learning communication between teachers and students.

The third or last aspect is the aspect of contextuality. The percentage on the aspect of contextuality gets a score of 75%. This shows that the use of atlas is able to encourage students to make connections between the knowledge they have and their application in everyday life related to the material structure of animal tissues. The contextuality of the material in learning can help students combine knowledge with action and application in life (Parhan, 2018).

After the assessment, the experts also provided suggestions for improvement of the Basic Tissue Histology Atlas that had been developed. After the basic tissue-based histological atlas media were repaired and assessed by media experts and material experts, the results of the two experts' assessments were then averaged. The following presents the average results of the assessment of the validity of the Basic Tissue Histology Atlas by

the two experts in Table 3.

Table 3. Recapitulation of the Average Assessment Results by Media and Material Experts

No.	Assessor	Percentage of validity values
1.	Media experts	93,5%
2.	Material experts	90,9%
	Average percentage	92,2%
	Criteria	Very valid

Based on Table 3 it is known that the percentage of validity values by media experts and material experts get different values. The percentage value of validity by media experts is 93.5% and by material experts is 90.9%. After being averaged, the percentage of the final validity value of the Basic Tissue Histology Atlas learning media was 92.2% with very valid criteria.

Applicability of Basic Tissue Histology Atlas

Assessment of the applicability of the Basic Tissue Histology Atlas as a learning medium was obtained through filling out questionnaire responses by biology subject teachers and students. Data on teacher and student responses were obtained during small-scale trials. The teacher response questionnaire was filled out by one biology subject teacher and the student response questionnaire was filled out by students in one class consisting of 30 students.

1) Teacher's Response

The teacher's response questionnaire sheet contains several questions related to the teacher's response to the basic network-based histology atlas media which consists of three aspects, namely, material aspects, aspects of applicability and ease of use, and language aspects. Following are the results of the assessment of the applicability of the Basic Tissue Histology Atlas through the teacher's response questionnaire in Table 4.

Table 4. Recapitulation of Teacher Response Assessment Results

No.	Assessment Items	Total Score	Score Obtained	Percentage
1.	Material Aspects	52	49	94,2%
2.	Applicability and Ease of Use Aspects	24	23	95,8%
3.	Language Aspects	24	23	95,8%
	Total score obtained		95	
	Total score	100		
	Percentage of teacher responses			95%
	Response Criteria	Applicable		

Based on the results in Table 4, it is obtained a score of 49 on the material aspect, a score of 23 on the aspect of applicability and ease of use, and a score of 23 on the language aspect. The percentages obtained sequentially in each aspect are 94.2%, 95.8%, and 95.8%. The total percentage obtained from the teacher's response assessment is 95% with the criteria that can be applied.

The first aspect is that the material gets a percentage value of 94.2%. The high score percentage shows that in terms of material, Basic Tissue Histology Atlas can be applied in learning. The material component that received a positive response from the teacher was the suitability of the material with the standard of achievement of KD (Kompetensi Dasar/Basic Competences) and the level of needs of high school students. The presentation of images in the atlas is able to support students' understanding of the material structure of

animal tissues. This is supported by the results of Karyati's research (2017), concluding that image-based print media as an alternative learning media that is effective in increasing students' understanding so that they can improve their learning outcomes. Pictures and compositions of writing with attractive color arrangements are able to foster students' reading interest in Basic Tissue Histology Atlas.

The second assessment aspect is applicability and ease of use. The percentage value obtained in the second aspect is 95.8%. Applicability and ease of use are shown by the positive response of teachers to the atlas which is easy and practical to use in learning biology. The use of Basic Tissue Histology Atlas is able to overcome the limitations of time and senses in learning, especially material on animal tissue structures. Maulida (2013) states that atlases have advantages, namely they are visual, can overcome the limitations of space, time, and senses, and provide easy access for both teachers and students. In addition, the use of the atlas is also able to overcome the limitations of facilities such as microscopes and preserved preparations so that if it is not possible to conduct observations, then as an alternative, teachers can do learning with this atlas.

The third aspect is language. The teacher's response to the aspects of the language used in this atlas is very important. This is because later teachers and students will use this atlas as a learning medium, so that the ease of communication used in writing on the language aspect can streamline the learning process. The assessment of the language aspect by the teacher obtained a percentage value of 95.8%. The high percentage is indicated by the positive response of the teacher with the use of simple, uncomplicated, and easy to understand language, and the use of language in the atlas able to explain the delivery of concepts according to the level of students' cognitive development.

2) Student's Responses

Besides being obtained from the teacher's responses, the applicability value of the Basic Tissue Histology Atlas was also obtained from the results of student responses. The student response questionnaire sheet contains several questions with four aspects of assessment, namely aspects of interest, aspects of applicability and ease of use, aspects of material, and aspects of language. Following are the results of the assessment of the applicability of the Basic Tissue Histology Atlas through student response questionnaires in Table 5.

Table 5. Recapitulation of Student Response Assessment Results

No	Criteria	Number of Students
1.	Very good	7
2.	Good	23
3.	Fairly good	0
4.	Not good	0
5.	No good	0
Total number of students		30
Percentage of classical student responses (%)		100%
Response criteria		Applicable

Completing student responses through questionnaires obtained a classical percentage of 100%. The percentage of grades is classically obtained from the number of students who provide responses with good and very good criteria.

Overall, the Basic Tissue Histology Atlas that has been developed has several advantages, including being easily accessible by teachers and students because it is a print media so it does not require energy in its use such as electricity and internet networks. Easy to learn anytime and anywhere and under any circumstances because it does not require other means. This is in accordance with the theory stated by Indriana (2011), that print media has advantages in terms of ease of access and without the help of other means so as not to worry as

online media if there is a power outage or internet network.

Effectiveness of Basic Tissue Histology Atlas

1) Learning Motivation

Assessment of students' learning motivation is done by filling out questionnaires by students. The assessment questionnaire used is based on indicators of learning motivation adapted from Uno (2016) and Sardiman (2012). The frequency distribution of student learning motivation is presented in Table 6.

Table 6. Frequency distribution of student learning motivation

No.	Category Score	Criteria Motivation	Number of Students	P (%)
1.	85% - 100%	Very motivated	4	11,4
2.	70% - 84%	Motivated	25	71,4
3.	60% - 69%	Moderately motivated	6	17,2
4.	50% - 59%	Not motivated	0	0
5.	<50%	Very unmotivated	0	0
Total number of students			35	100
Classical motivation (%)				82,8

Based on the results of Table 6, it is known that classical student learning motivation is 82.8% with motivated and highly motivated criteria. The percentage of classical learning motivation has met the indicators achieved in this study, namely 75% in the learning process with motivated and highly motivated criteria. Total of 4 students out of 35 students were in the highly motivated category, 25 students out of 35 students were in the motivated category, and 6 students out of 35 students were in the moderately motivated category. The learning motivation that is expected in this study is the student's interest in the Basic Tissue Histology Atlas that has been developed, so that it can increase student enthusiasm in learning and linearly improve student learning outcomes.

Interest in the learning process is the initial mover of students in learning to achieve the desired learning objectives. This is in accordance with the results of Fauziah's research (2017) which states that an interest in learning is a picture of a student who wants to achieve his goals. Students' interest in learning is needed because when students have an interest in the material, they will try to learn it thoroughly. Motivation is one of the important factors to foster enthusiasm for learning in students. The existence of motivation will be followed by the desire or ideals, so that students who have high learning motivation will understand what will be the goal in learning.

Learning motivation is influenced by intrinsic and extrinsic factors. Intrinsic factors can be in the form of desire and desire to achieve success, encouragement of learning needs, and desired hopes or ideals. While external factors are in the form of awards, a conducive environment, and interesting learning (Uno, 2016). Interesting learning can be created and facilitated by teachers, one of which is by using learning media. The use of learning media is able to create a pleasant learning climate so that it can affect learning motivation.

Motivation and learning are two words that are integrated with each other, both influence each other and cannot be separated. Learning with a strong motivation will certainly have a positive impact on learning outcomes, and vice versa (Maryam, 2016). Motivation arises because of the desire to fulfill needs. The needs of students in learning is a strong motivation for students to achieve maximum achievement. The need for clear and directed learning has an effect in the form of a strong urge to study each material seriously so that the learning process becomes more active and effective.

2) Learning Outcomes

Student learning outcomes were obtained by giving a written test in the form of 20 multiple choice questions. The data obtained are in the form of pretest and posttest scores which are done individually by students, to measure students' cognitive abilities before and after using Basic Tissue Histology Atlas as a medium for learning biology on animal tissue structure material. Data on student learning outcomes are presented in Table 7.

Table 7. Students Learning Outcomes

No.	Data Information	Trial Class	
		Pretest	Posttest
1.	Highest score	90	100
2.	Lowest score	30	75
3.	Average score	57,85	86,42
4.	Number of students	35	35
5.	Number of students completed (reaching KKM 75)	7	35
6.	Number of students who did not complete	28	0
7.	Average classical completeness of KKM students ≥ 75	20%	100%

Based on Table 7, it is known that student learning outcomes before and after using Basic Tissue Histology Atlas media have increased. The average percentage of students' classical completeness increased from 20% before using the atlas to 100% after using the atlas. How much increase in student learning outcomes is further analyzed by the Normalized Gain (N-gain) formula. Data on improving learning outcomes is presented in Table 8 below.

Table 8. Improved Learning Outcomes with N-gain test

Average Pretest Score	Average Posttest Score	Ideal Score/Maximum	N-Gain
57, 85	86,42	100	0, 67
Learning outcome criteria			Medium

The use of Basic Tissue Histology Atlas as a learning medium is not only able to increase learning motivation, but also to improve student learning outcomes. This can be seen in Table 7, classically the average percentage of student learning completeness increased from 20% before using the atlas to 100% after using the atlas. Total of 7 students from 35 students completed the initial assessment (*pretest*) and the remaining 28 students did not complete. After learning using a Basic Tissue Histology Atlas, as many as 35 students or all students completed the final assessment (*posttest*). The increase in student learning outcomes after the N-gain test obtained a value of 0.67 was in the medium category. Based on these results, the Basic Tissue Histology Atlas is effectively used as a learning medium because it has reached the feasibility indicator specified in this study, namely the student classical posttest results ($\geq 75\%$ of the total number of students achieved a Minimum Criteria of Mastery Learning score of 75) and student learning outcomes increased at least are in the moderate criteria.

The use of learning media is able to facilitate the process of delivering material from the teacher to students, because it can clarify abstract and verbalistic material to be more real and not verbalistic. The use of media in learning is one way for teachers to increase student motivation and learning outcomes. Based on Wahyu's research (2014) stated that learning using media will significantly improve learning outcomes when compared to learning that does not use learning media. The teaching and learning process using the media really attracts students' attention, because learning is done not only monotonously by listening to lectures from

the teacher. The use of media greatly helps the effectiveness of the learning process and the delivery of lesson information at that time.

The increase in student learning outcomes as a result of using learning media is shown in the increase in student learning motivation which can indirectly have a positive effect on increasing student learning outcomes. This is because an attractive visualization on a Basic Tissue Histology Atlas with colored images will increase the attractiveness or motivation of students towards learning and the complete arrangement of network images will enrich the histology reference sources so as to make it easier for students to understand and have a positive impact on improving student learning outcomes. The role of motivation in learning is a psychic driving force that is able to encourage students to learn, provide enthusiasm and a sense of pleasure that creates energy for learning. The energy generated by the motivation can influence students to be active in their studies so that it has a positive impact on high learning outcomes and vice versa (Palittin, 2019).

CONCLUSION

Based on the analysis of the results and discussion, it can be concluded that the characteristics of Basic Tissue Histology Atlas are composed of simple to complex tissue and full color display. The Basic Tissue Histology Atlas valid and can be applied as a learning medium, effectively used to improve student motivation and learning outcomes.

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