The critical thinking skills on animal tissue learning: Inquiry based student activity sheets development

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The critical thinking skills on animal tissue learning: Inquiry based student activity sheets development

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ABSTRACT

Students' critical thinking skills in Indonesia are still categorized as low, so it is necessary to facilitate learning tools that support critical thinking activities. One of the learning tools is the inquiry-based Student Activity Sheet (LKS) which can train students' critical thinking skills. The purpose of this study was to develop inquiry-based worksheets on animal tissue learning material for class XI SMA Negeri 3 Mojokerto. The model used in this research is the 4-D model namely define, design, develop and disseminate. The research subjects were 12 students of class XI MIPA 1 as many as 12 students of SMA Negeri 3 Mojokerto. The results of the precentage agreement validation of the LKS were 96% categorized as reliable. The effectiveness of the student worksheet is based on a gain score of 0.89 with high criteria, so that the device is said to be effective. Student responses to the developed worksheets obtained results of 99.08% with a very good response. Thus, inquiry-based student worksheets on animal tissue learning material can train students' critical thinking skills.

Citation:

INTRODUCTION

Education is an effort to educate the nation's life as stated in Law no. 20 of 2003 concerning the National Education System article 3. Education is the main factor that determines the quality of a nation (Ceisar, 2011). Through education there is a process of interaction that occurs between students and learning resources in an environment, to foster and develop basic human abilities as optimally as possible according to their capacities (Prasiwi & Suliyanah, 2018). Utilization of all learning resources (competencies) is one of the characteristics of the 2013 curriculum.The curriculum used in Indonesian education today is the 2013 curriculum, based on the Indonesian National Qualifications Framework (KKNI) which emphasizes active student learning (student center) and refers to century skills. -21 (Setiawan, 2017). 21st century education focuses on preparing human resources who have the ability to think (creative, critical, learners and decision makers), the ability to communicate and collaborate, mastery of science and technology through the learning process (Badan Standar Nasional Pendidikan, 2010). To achieve 21st century skills, thinking skills are recognized as essential skills, one of which is critical thinking skills (S. Prayogi et al., 2018).

The ability to think is a cognitive process or a mental activity to acquire knowledge that can be developed and can be taught (Khairiyah & Faizah, 2019). So that critical thinking skills are important to be trained in the learning process, because critical thinking is an important intellectual capital for everyone and is a fundamental part of human maturity, so it is important to be taught at all levels of education (Fitriani et al., 2018). Several studies have shown that critical thinking skills have a

significant impact on learning, academic ability and achievement. Critical thinking skills can improve students' abilities in relating learning material and daily life (Astuti & Yulianto, 2015).

Biology education is inseparable from the ability to think critically, because it is related to daily life activities and is based on discoveries. As stated by (Susilo, 2011) that Biology learning must cover all elements of learning and 21st century skills, including criti2 thinking. In fact, Biology learning is still understood textually which 1hould require experimental-based learning activities that can train students' critical thinking skills. Based on the results of interviews with students, it was found that students experienced boredom and were less motivated to participate in biology learning because students only listened to explanations from the teacher and only did assignments. The delivery of theories and concepts will be well conveyed to 1tudents if there is two-way communication and interaction between 1tudents and teachers, so that students do not only listen to material explanations but students must be able to build their own knowledge through experimental activities to practice their thinking skills.

Based on research (Kurniahtunnisa et al., 2016) that low critical thinking skills result in low learning outcomes. This is in line with research (Sudarmini et al., 2015) that learning activities are more emphasized on the cognitive aspects only in the form of memorization. Therefore, the teacher must facilitate students to practice and develop critical thinking skills. Current learning tends to rote learning, so that students easily forget the material they have learned, this is what causes students in Indonesia to have low thinking skills. According to (Dewi et al., 2018) that classroom learning activities, the learning tools used to train critical thinking skills have not been implemented properly, while the learning process in Indonesia should be developed requiring students to be more active so that their critical thinking skills develop in solving problems. In research (Sutama et al., 2014) pembelajaran biologi lebih cendrung mengasah aspek mengingat serta memahami, hal ini merupakan biology learning tends to hone aspects of remembering and understanding, this is low-level thinking, students tend to only memorize, are not active in learning and only record material delivered by the teacher. One of the Biology materials, Animal Tissue class XI in SMA cannot be limited to memorization, but direct and scientific observation (experimentation) must be carried out to understand the material. As stated (Kesuma, 2013) that in Biology learning, experimentation is an important model because students conduct experiments by experiencing and proving themselves what they are learning. In line with research (Ratunguri, 2016) that critical thinking skills can be trained with experimental activities, because it emphasizes students to conduct experiments systematically through the workings of science. Therefore, Biology learning should not just remember and understand because learning with this system will lead to the ability to memorize material (Yustyan et al., 2015).

Increasing critical thinking skills in the learning process must be supported by the right models, materials and media. (Saiful Prayogi & Asy'ari, 2013)) conducted research and it was found that students' critical thinking activities could be developed and enhanced by learning experiments or experiments in the laboratory in solving problems. Accord2g to Piaget, learning that facilitates learning to carry out experimental activities is inquiry activity. The inquiry learning model can improve students' critical thinking skills (Fuad et al., 2017). The inquiry model is a model that directs students to conduct investigations based on curiosity (Hunaepi et al., 2018) and emphasizes the learning process of critical and analytical thinking to seek and find their own answ1s to the problems in question (Sanjaya, 2011). Scientific learning with experimental activities requires teaching materials in the form of student worksheets (LKS) which contain guides or activity instructions and summaries that lead to direct learning processes such as experimental activities that refer to the competencies that must be achieved (Prastowo, 2014). LKS developed by the teacher can encourage student independence, besides that worksheets make learning more fun and help students to construct their knowledge (Ulaş et al., 2012), thereby increasing problem-solving abilities (Helmi et al., 2017), and increasing understanding of concepts and students' critical thinking skills (Pangesti et al., 2017). LKS can guide students to improve learning outcomes if it is in accordance with their thinking stage (Choo et al., 2011). LKS can help students to find answers to problems or facts through direct observation or scientific work with

LKS guides. Quality worksheets can make the learning process more effective, efficient, and can improve the quality of learning (Ningtyas, E et al., 2014).

Based on this, it is necessary to carry out research related to the development of learning tools in the form of worksheets that can help students in the learning process and improve critical thinking skills as a demand for 21st century education as well as intellectual capital for students in the future. The purpose of this research is to produce a feasible and effective LKS learning tool to train students' critical thinking skills on Animal Tissue material in SMA.

RESEARCH METHOD

Research design

The type of research used is research and development (Research and Development). The research model used in this research is the development of a 4-D model (Four D Models) according to (Thiagarajan & Sivasailam, 1974). The 4-D development model consists of four stages, namely the stage of defining, designing, developing and disseminating. Based on the research model used, namely to produce products in the form of LKS learning tools and test the effectiveness of these products. The product developed is tested for its feasibility by validating and testing the product to determine the feasibility and effectiveness of learning.

Population and Research Sample

The trial subjects for the development of LKS learning tools in this study consisted of small group subjects, namely 12 students of class XI MIPA 1 SMA Negeri 3 Mojokerto, East Java Province in the academic year 2020/2021 odd semester selected heterogeneously.

Instrument

The instruments used when collecting data in the research on the development of learning tools in the form of Student Worksheets (LKS) for animal tissue material are the validation sheet for learning devices, the validation sheet for the evaluation instrument, the student response questionnaire sheet, and the critical thinking ability test sheet in the form of essays which each consisting of 6 questions both pretest and posttest, with the measured indicators consisting of analysis, interpretation and inference. The determination of the validator is based on the results of 2 experts, namely in the field of biology and evaluation of biology learning, and the observation sheet is used to assess the learning tools used during learning activities according to students 'opinions, while the description test is used to determine the increase in students' critical thinking skills after using learning tools.

Research Procedure

In this study the learning device development procedure consisted of: (1) The defining stage (Define) is a stage that analyzes the beginning and the end consisting of analysis of the curriculum used, student analysis to determine student characteristics as an illustration in product development, task analysis in the form of topic analysis, namely focuses on studying KI and KD and analysis of task completion (procedural), concept analysis to determine the content of the material developed in the form of concept maps and analysis of learning objectives based on KI and KD and Curriculum 2013 (2) the design stage is a stage that aims to determine format in the form of choosing strategies, approaches, learning methods, learning resources, media that are attractive and make it easier for students to learn to make initial designs of learning tools; (3) the development stage is the stage that produces a final script in the form of learning tools which are validated first consisting of worksheets and critical thinking instruments; (4) the dissemination stage is a trial phase to obtain input in the form of responses, reactions, student comments as targets for using learning tools with designs in the form of giving initial exams (Pretest), learning activities and final tests (Posttest) and at the end of learning students are given questionnaire response to learning to be filled in then the results are analyzed.

Data Analysis Technique

The data analysis techniques used to determine the quality of the learning tools in the form of the developed worksheets consist of:

a. The validation sheet data analysis was carried out by 2 validators who are biologists and educational evaluators. The validation results obtained from the assessment of the two experts were then compared with the validity criteria adapted from (Ratumanan & Laurens, 2011) which are presented in Table I.

Table I. Validation Results Criteria

No.	Interval	Rating Category	Information
1	$1{,}00 \leq SV \leq 1{,}59$	Not Valid	Not yet usable and still requires consultation
2	$1{,}60 \leq SV \leq 2{,}59$	Less Valid	Can be used with multiple revisions
3	$2{,}60 \leq SV \leq 3{,}59$	Valid	Can be used with minor revisions
4	$3{,}60 \leq SV \leq 4{,}00$	Very Valid	Can be used without revision

Data in the form of suggestions and comments from the validator will be considered in making revisions to the learning device. Furthermore, to measure the validator's understanding or reliability using the analysis of the percentage of agreement with the formula:

$$R = \left[1 - \frac{A-B}{A+B}\right] \times 100\%$$

Information:

R : Instrument reliability

A : The frequency of aspects of the behavior observed by the observer which gives the high frequency

B : The frequency of aspects of the behavior observed by the observer who gives the low frequency

The instrument is said to be reliable if the reliability is obtained ≥ 0,75 (75%) (Borich, 1994).

b Analysis of student responses using descriptive analysis calculating the percentage of the questions given in the questionnaire. The percentage is calculated using the formula:

$$P = \frac{\sum K}{\sum N} \times 100\%$$

Information:

P : The percentage of student scores

∑K : The number of students who chose the answer "Yes" or "No"

∑N : The total number of students who answered "Yes" or "No"

Then compared with the criteria for the percentage of student responses according to (Riduwan, 2012) which is presented in Table 2.

Table 2. Student Response Percentage Criteria

No.	Persentage (%)	Criteria
1	0 – 20	Very less
2	21 – 40	Less
3	41 – 60	Average
4	61 – 80	Good
5	81 – 100	Very Good

c. Individual completeness analysis by analyzing the results obtained by students with the completeness criteria set by the Ministry of Education and Culture. Students are said to have achieved individual completeness if they meet the completeness criteria ≥75 (Ratumanan & Laurens, 2011). The individual student scores obtained from the cognitive test instrument are calculated by the following formula:

$$T_{individual} = \left(\frac{\sum Ss}{\sum Smaks}\right) x\ 100\%$$

Information:

$T_{individual}$: Individual Completeness
$\sum Ss$: Total acquisition score
$\sum Smaks$: Maximum number of scores

d. The improvement of students' critical thinking skills after the learning process using inquiry-based animal Tissue student worksheets was analyzed using a gain score. N-gain formula:

$$(g) = \frac{Spost - Spre}{Smax - Spre}$$

Information:

(g) : Gain Score
Spost : *Posttets* Score
Spre : *Pretests* Score
Smax : Maksimum Score

he results of the N-gain calculation are then converted to the criteria according to (Hake, 1999) which are presented in Table 3.

Table 3. Normalized Gain Criteria

No.	Score N-Gain	Criteria
1	0,70 - < N-Gain	High
2	0,30 ≤ N-Gain ≤ 0,70	Medium
3	N-Gain < 0,30	Low

RESULT

The results of research on the development of learning tools in the form of worksheets starting from the defining stage are the stages to define, collect appropriate information for the product being developed consisting of (1) initial and final analysis to determine the basic problems of animal tissue material by analyzing the curriculum. The basic problem that occurs is still using the lecture learning method so that the delivery of the material is not well conveyed and the curriculum used by SMA Negeri 3 Mojokerto is the 2013 Curriculum; (2) analysis of student characteristics to suit the design of learning device development. Student analysis is the stage of thinking of students who will carry out experimental or research learning activities; (3) task analysis to identify key skills which consists of two procedures, namely topic analysis and procedural analysis to meet the graduation standard criteria; (4) concept analysis to determine the content of the material in the developed worksheets and (5) analysis of learning objectives to summarize the results of concept analysis and task analysis to determine the behavior of the research object. Based on the results of the define stage analysis, it shows that the learning tools used have been provided before, so that they are not suitable for student characteristics, assignments, curriculum, and learning objectives.

Furthermore, the second stage, namely the design, carried out in four stages, namely the preparation of test standards, the selection of media, this was adjusted to the characteristics of the material and learning objectives, as well as the selection of an attractive format, facilitating and helping

students and making the initial design according to the established format. Product design in the form of worksheets and evaluation instruments. LKS cover design is made as attractive as possible by using Microsoft Word to attract students' attention. The features of the LKS consist of: (1) title, time allocation, class / semester adjusted to the LKS sub-theme; (2) learning objectives that are adjusted to the basic competencies in the syllabus; (3) LKS instructions, to facilitate students in using LKS; (4) presentation of animal tissue material according to the sub-theme adapted to the curriculum used; (5) contains the syntax the inquiry learning model and indicators of critical thinking consisting of problem orientation, formulating problems, proposing hypotheses, collecting data, analyzing data and drawing conclusions. The LKS writing format uses century fonts and the size of the letters is adjusted to the quality of the SMA LKS. Arranging the right format for student worksheets makes it easier for students to learn. Inquiry-based learning tools designed to practice critical thinking skills. The prototype results of the initial design of the learning device are used as drfaf I.

The third stage is development which is divided into two activities, namely: expert appraisal and development testing. At the development stage, the LKS validation and evaluation instruments were carried out by two experts in the field of biology and biological evaluation which was carried out by filling out the validation sheet to provide an assessment and provide suggestions and comments on the learning tools developed. Validity is a measure that shows the level of validity of a test or instrument. An instrument is said to be valid if the instrument measures what it wants to measure.

The fourth stage is dissemination in which the learning tools in the form of worksheets and critical thinking skills tests that have been validated by experts are tried out in class, in this study 12 students were tested in class XI MIPA 1. There were 4 worksheets that were tested consisting of epithelium tissue, connective tissue, muscle tissue and neural tissue. Meanwhile, the evaluation of critical thinking skills consisted of 6 questions both pretest and posttest. Student response sheets will be given at the end of the lesson.

The results of the assessment of the two validators related to student worksheets and critical thinking evaluation questions are presented respectively in Table 4 and Table 5. Based on the results of the LKS validation, the mean value was 3.85 and categorized as very valid with the reliability of the LKS (Percentage of agreement) of 96% which was categorized as reliable. While the results of the validation of critical thinking evaluation questions obtained a pretest mean of 3.96 and categorized as very valid with the results of a reliability score (Percentage of agreement) of 98.81% categorized as reliable, for posttest questions obtained a validation average of 4.00 categorized as very valid and a reliability score of 100% so that it is categorized reliable.

Table 4. Recapitulation of LKS Validation Results by 2 Validators

No	Assessment Aspects	Average	Category	Reliability Score (%)	Category
A.	**Content Criteria**				
	LKS Instructions	3.75	SV	93%	Reliable
	Material on LKS	3.81	SV	95%	Reliable
	Critical Thinking Components	3.92	SV	98%	Reliable
B.	**Serving Criteria**				
	LKS Cover	4.00	SV	100%	Reliable
	LKS Serving	3.75	SV	93%	Reliable
	Language	3.75	SV	93%	Reliable
	Sentences	4.00	SV	100%	Reliable
	Average of All Aspects	**3.85**	**SV**	**96%**	**Reliable**

Information:
SV : Very Valid

Table 5. Recapitulation of the Results of the Validation of Critical Thinking Evaluation Questions by 2 Validators

Question	Critical Thinking Aspects	Assessment Aspects					
		Content validation			Validation Language & writing		
		Average	K	Reliability Score (%)	Average	K	Reliability Score (%)
Pretest	Formulating the problem (Interpretation)	4.00	SV	100	4.00	SV	100
	Making Hypotheses (Inference)	4.00	SV	100	4.00	SV	100
	Determining the Variable (Inference)	4.00	SV	100	4.00	SV	100
	Compiling Experiment Design (Inference)	4.00	SV	100	4.00	SV	100
	Analyzing Data (Analysis)	3.50	V	85.7	4.00	SV	100
	Draw Conclusions (Analysis)	4.00	SV	100	4.00	SV	100
	Average	**3.92**	**SV**	**97.62**	**4.00**	**SV**	**100**
	Overal average of *Pretest*	**3.96 (SV)**			**98.81%**		
Posttest	Formulating the problem (Interpretation)	4.00	SV	100	4.00	SV	100
	Making Hypotheses (Inference)	4.00	SV	100	4.00	SV	100
	Determining the Variable (Inference)	4.00	SV	100	4.00	SV	100
	Compiling Experiment Design (Inference)	4.00	SV	100	4.00	SV	100
	Analyzing Data (Analysis)	4.00	SV	100	4.00	SV	100
	Draw Conclusions (Analysis)	4.00	SV	100	4.00	SV	100
	Rerata	**4.00**	**SV**	**100**	**4.00**	**SV**	**100**
	Overal average of *Posttest*	**4.00 (SV)**			**100%**		

Information:
K : Category
SV : VeryValid
V : Valid

The effectiveness criteria of the developed worksheets were shown by the achievement of the critical thinking test results in students or individual completeness and the results of student responses. The results of the achievement of critical thinking skills were obtained from the pretest and posttest scores conducted by 12 students of XI MIPA 1. The test results after learning were carried out to determine the progress of student learning outcomes and increased critical thinking skills. Based on Table 6, it shows that the mean pretest and postets on inquiry-based animal tissue material has increased. The result of the gain index calculation shows a value of 0.89 which is categorized as high.

Table 6. Individual completeness data and N-Gain of Critical Thinking Skills Aspects

Student Initials	Completeness				N-Gain	Catagory
	Pretests		*Postetst*			
	Score	Information	Score	Infromation		
S 1	29	TT	96	T	0.94	High
S 2	25	TT	92	T	0.89	High

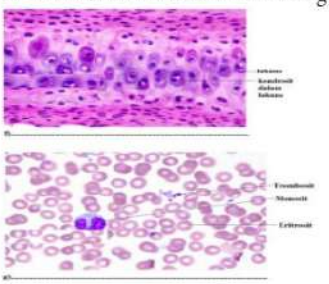
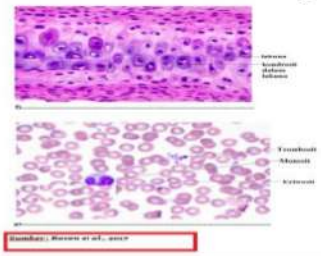
S 3	29	TT	83	T	0.76	High
S 4	29	TT	87.5	T	0.82	High
S 5	29	TT	87.5	T	0.82	High
S 6	29	TT	87.5	T	0.82	High
S 7	33	TT	87.5	T	0.81	High
S 8	29	TT	83	T	0.76	High
S 9	25	TT	87.5	T	0.82	High
S 10	25	TT	83	T	0.77	High
S 11	29	TT	92	T	0.89	High
S 12	25	TT	83	T	0.77	High
Average	**26**		**87.5**		**0.82**	**High**
Enhancement	**61.5**					

Infromation:

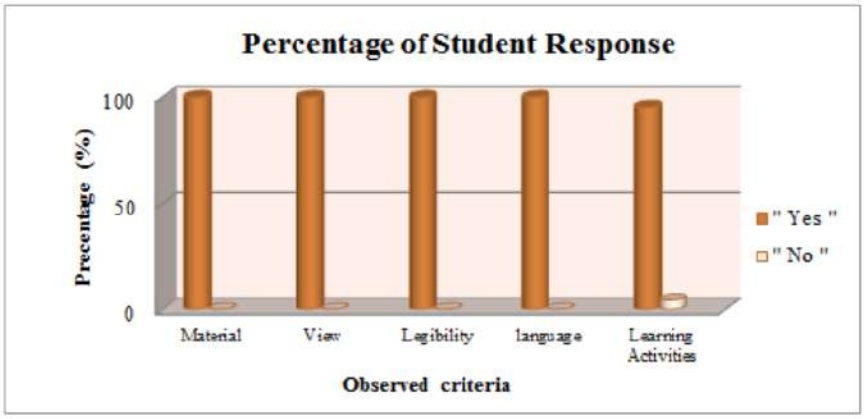
S : Student
TT : Not complete
T : Complete

Revision activities based on suggestions and comments from the two validators will be carried out after validation or at the expert appraisal stage, while at the development testing stage validation will be carried out based on deficiencies during the learning process. Based on the results of the validation analysis, there are also suggestions from the validator which are presented in Table 7.

Table 7. Results of suggestions and revision of worksheets

Media	Revised Source	Validator's Advice	Revised Results
Student Activity Sheet (LKS)	Validator	1. The image size should be smaller 2. Changing the use of Indonesian in the word Fat cell 3. Include the source of the image 	Based on the validator's suggestions, it has been fixed: 1. Image size is adjusted to be smaller. 2. Change the language usage to Indonesian 3. Attach the source on each image 

Student responses obtained from the response questionnaire sheet given after learning with inquiry-based worksheets on animal tissue material filled by class XI MIPA I students totaled 12 students. Following are the responses from students which can be seen in Picture 1.



Picture I. Graph of the results of student response analysis to the developed worksheets

DISSCUSSION

Products in the form of inquiry-based worksheets on animal tissue material to practice critical thinking skills are assessed based on the results of validation by 2 expert validators and the effectiveness of the product as seen from individual completeness or increase in student learning outcomes through pretest and posttest in the form of essay tests and based on student responses at the end of learning with the product.

LKS is one of the tools that can facilitate learning activities, in the LKS presents short material, problem orientation, as well as experimental activities and some discussion questions that will help train students' critical thinking skills. Based on the results of the analysis of the LKS validation carried out by 2 validators presented in Table 4 LKS is one of the tools that can facilitate learning activities, in the LKS presents short material, problem orientation, as well as experimental activities and some discussion questions that will help train students' critical thinking skills. Based on the results of the analysis of the LKS validation carried out by 2 validators presented in. LKS assessment consists of content and presentation criteria. LKS is a good teaching material if it meets several requirements such as didactic, construction and technical requirements (Darmojo & Kaligis., 1993). Didactic requirements relate to the fulfillment of the principles of effective learning in the LKS. The construction requirements relate to the use of language, sentence structure, vocabulary, level of difficulty and agility so that the student worksheet can be understood easily. Technical requirements related to the presentation of the worksheets such as fonts, illustrations / pictures and appearance. In this study, the linguistic aspects which are technical requirements are categorized under the presentation criteria.

The worksheets developed are based on inquiry, where the teacher acts as a facilitator in providing material and problems while students play an active role in problem solving, besides that the teacher facilitates investigations and encourages expressing ideas or questions that guide for further investigation and requires students to participate more actively in carrying out scientific investigations. LKS contains experimental or investigative activities which are models using constructivist learning principles, which explain that knowledge is constructed by students themselves (Khanafiyah, 2010). Experimental activities can build students' own concept of knowledge (Hapsari et al., 2012) this is related to research (Qing et al., 2010) that experimental activities can improve critical thinking skills. In line with research (Triwiyono, 2011) that students' critical thinking skills can be developed using experimental methods. Experimental method learning involves students directly and conducting scientific experiments so that students understand the symptoms and events of the experiment (Anggreani, 2015). This is in accordance with the opinion (Triwiyono, 2011) that learning with the experimental method is more effective in improving students' critical thinking skills compared to conventional learning. Critical thinking skills are not acquired naturally, but must be trained in students (Suamiati et al., 2018). Critical thinking is a reflective way of thinking based on logic, which focuses

on determining what to believe and do (Ulger, 2018). Critical thinking is very important because it is able to prepare students to be smarter at explaining reasons, able to make informed judgments and be able to solve problems (Thomas, 2011), besides enabling students to handle social, scientific and practical problems effectively in the future, which is in demand 21st century learning (Lai, 2011). With critical thinking skills, it can equip students to deal with the problems they face in everyday life (Facione, 2013). This is in accordance with the opinion (Arends, 2012) that the inquiry learning model is a model developed with the aim of how students think, in this case including critical thinking. Inquiry-based learning models and tools can develop critical thinking skills. So that the inquiry model has a good and appropriate effect for critical thinking analysis.

Learning with the inquiry model makes it easier to remember material, so that students are not limited to memorizing but can apply it directly to everyday life, and train students' confidence to find the essence of the concept, as well as learning material obtained by students is more durable and raises learning motivation to follow learning process well (Anam, 2015). Through inquiry activities, students actively construct knowledge, so that the desired learning outcomes are achieved, because inquiry leads learners to conduct investigations based on curiosity (Hunaepi et al., 2018) In accordance with research (Dahlia et al., 2018) that learning tools inquiry-based can improve critical thinking skills with implementation of 91.25% with good category.

Validation LKS has suggestions and input from the validator including changing the image size, adding image sources and captions to the image. Suggestions from the validators have been revised and presented in Table 7. In addition to the LKS, there are learning tools in the form of critical thinking evaluation instruments consisting of a pretest and posttest that have been validated by 2 experts presented in Table 5 with a mean score on the pretest question of 3.96 which is categorized as very valid with the percentage of agreement (Percentage of Agreement) of 98.81% which is categorized as reliable. In the posttest questions obtained a validation mean of 4.00 which was categorized as very valid and the percentage of conformity (Percentage of Agreement) was 100% and categorized as reliable. The evaluation of the validation of the evaluation instrument consisted of content criteria and the language of writing the questions. These results present that learning tools in the form of inquiry-based evaluation instruments can be implemented in learning activities to practice critical thinking skills. The pretest and posttest questions have also been adjusted to KI and KD in the Animal Tissue material in SMA. Follow the bloom taxonomy rules. Pretest questions are carried out at the beginning before the application of the device in order to find out students' prior knowledge. While the posttest questions were implemented at the end of the lesson after learning tools were applied to determine the development of students' critical thinking skills the impact of the learning tools used.

The effectiveness of worksheets is obtained from the results of individual completeness and the increase in students' critical thinking test scores to practice critical thinking skills (pretest and posttest). Based on Table 6 individual completeness and N-Gain aspects of critical thinking skills obtained an N-Gain value of 0.82. According to (Hake, 1999) if 0.70 - <N-Gain is included in the high criteria and is said to be effective. From the calculation of N-Gain, it can be seen that the criteria for the achievement of students' critical thinking skills before and after being treated with the application of LKS. So it can be said that the developed worksheets are effective for practicing critical thinking skills on animal tissue material in high school students. Student responses to the developed student worksheets obtained a percentage of 99.08% with a very good category so that it can be stated that the student worksheets received a very good response which is presented in Figure 1. This is in accordance with the opinion (Sukmadinata & Syaodih, 2012) that individual learning by students can adjust the speed of learning with individual abilities that students have.

The development of inquiry-based tools to train students' critical thinking skills in high school is also proven by the research from (Fadilah et al., 2017) with the results of data analysis showing that the completeness of critical thinking indicators is 94.6%.

CONCLUSION

Based on the development study from the research results, it is concluded that the learning devi in the form of inquiry-based worksheets to practice critical thinking skills of animal Tissue material in high school developed is valid and effective. This LKS obtained an N-gain value of 0.82 with high criteria, so that it was declared effective. Student responses to the LKS obtained a percentage of 99.08% in the very good category. Thus, inquiry-based worksheets can practice critical thinking skills on animal Tissue learning material at SMA Negeri 3 Mojokerto.

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ORIGINALITY REPORT

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1	moam.info Internet	264 words — 5%
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