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RESEARCH ARTICLE

EFFECTIVENESS OF LEARNING MATERIALS PACKAGE OF HUMAN BEING REPRODUCTION SYSTEM BASED ON PROCESS IMAGES ON STUDENTS' ACHIEVEMENT AND CRITICAL THINKING SKILLS.

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Abstract

Biology learning contains of many abstract concepts, therefore teachers need media that can support a good learning process. Good learning media refer to a medium that can interpret complex concepts into simply concepts. Producing of process-image base learning material package need critical thinking skills. This study aimed to examine the effectiveness of the use of learning material packages of human being reproduction systems based on process images on students' achievement and critical thinking skills. This study is a quasi-experimental by one group pretest-posttest design. This study is conducted in three high schools (A, B, C). The data of the study are score of students' achievement and critical thinking skills, where analyzed quantitative descriptive. Findings of research shows that students' achievement and critical thinking skills in schools A and B in the medium category, and in school C in the high category.

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Introduction:-

The demands of the times have influenced education in Indonesia. This can be optimized by increasing human resource skills through learning resources in schools. One source of learning that is able to play a role is a learning materials package. In the research results of 6 high schools in Jember (3 schools in Jember Regency and 3 schools in Banyuwangi Regency), learning materials packages in the form of textbooks with many sentences do not train and develop students' critical thinking skills. This is in accordance to support the statement of Tania et al., (2015), that the learning materials package in the form of textbooks is not yet in accordance with the educational needs of students today. Lack of thinking skills is shown by low scores on students' achievement. This can be seen from the average score of Jember Regency (3 schools from Jember Regency and 3 schools from Banyuwangi Regency) in the subject of the human being reproductive system of the 2017/2018 academic year with the value of 66.5 or below the minimum score of 80. The lack of optimal thinking skills is caused by students and teachers who put too much emphasis on the subject presentation (Bannert, et al., 2015). Therefore, optimal learning resources greatly affect the learning process of Biology.

Biology learning is an embodiment of students' interaction with objects consisting of objects and events, processes and products. Interaction with objects can occur directly or indirectly when direct interaction with objects is not possible. Not all biological symptoms and phenomena can be observed directly with the naked eye. Good learning activities are activities that are able to train students how to hone their cognitive abilities, so that students' critical

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thinking skills become more optimal (Inan, 2010). Critical thinking is a directed and clear process used in mental activities such as analyzing assumptions, making decisions, solving problems, and conducting scientific research (Johnson, 2011). This is in accordance with Ennis (2011) which states that, critical thinking skills can be used by students in analyzing, evaluating information, thinking logically, and deciding on certain actions. In addition, practicing critical thinking skills can train and help students to think deeper about a concept (Choy and Chech, 2009). Critical thinking skills can be honed depending on the use of instructional media.

Good learning media are learning media that can interpret abstract concepts into concepts that are easily understood by visualizing the physiological processes in them (Bus et al, 2018). Visualization in the form of images can make optimal illustrations in the brain (Howe et al, 2016). Based on the survey results of researchers, it is known that 16 out of 18 students feel more comfortable in learning to use printed teaching materials and 15 out of 18 students feel more interested in learning by using printed teaching materials that are equipped with many images. This shows that pictures can increase students' interest in Biology subjects, including the material of the reproductive system. Based on the results of a survey from researchers, 17 of 18 students said that they had difficulty in understanding the physiological concepts of the reproductive system. One of them is the process of sperm formation, ovum formation, Menstruation, and fertilization in the reproductive system. Processes that occur in the body are biologically characterized by organization, interaction, complex components, and dynamic processes (Assaraf et al., 2011).

Concepts in Biology learning cannot be separated from images and interrelated processes. Therefore, the form of innovation that can be done is to unite the linkages between images and processes. Image process as a series of images from initial to final conditions in the form of objects, events, or phenomena, where the one image with the next picture has a difference, but the difference in the picture is seen as a sequence or sequence of conditions (Sutarto et al., 2018). Characteristics of process images, which consist of several different images (size, shape, color, position), images arranged sequentially, interconnected, and describe a particular process (Harianto et al., 2017). The union of the characteristics of process images is closely related to the characteristics of critical thinking abilities.

Characteristics of critical thinking skills are training to think that involves analysis, evaluation, and creation (Gultepe, 2016). The ability to think critically includes the ability of logic and reasoning, analysis, evaluation, creation, problem solving, and decision making (Brookhart, 2010). The ability of analysis is the ability of individuals to determine the parts of a problem and can show the relationship between these parts, able to identify the cause and effect of an event and provide arguments from a statement (Larsson, 2017). These characteristics of critical thinking skills are needed by students to analyze the flow of biological processes that are visualized through process images in the form of learning materials packages.

Sutarto (2000) states that the process-based learning materials package is presented through various illustrations of images, icons, symbols, shapes and diagrams in such a way. Learning Resource Package (PSB) is a form of textbook that is defined as a special textbook that has a picture of the process in it (Rahmah et al., 2017). Images used to visualize a process will be processed in the brain so that it exercises the ability of illustration power, especially the right hemisphere brain. The right hemisphere brain emphasizes matters relating to imagination, intuition, rhythm, music, images, creativity and emotions (Corballis et al., 2014: 48). This is closely related to the characteristics of process-based teaching material.

The selection of the right media (easy to implement, communicative and informative) is a solution to overcome problems that occur in the learning process (Biggs, 2016), such as the ability to think critically. One of the media that can be used is an image-based learning resource package process to practice the ability to think critically, about the reproductive system. Therefore, this study aimed to analyze the effectiveness of learning packages of human reproductive systems based on process images for students' critical thinking skills.

Research Methodology:-

This type of research is a quasi experimental design research. The subjects of this study were students of class XI IPA of SMA Negeri 1 Gambiran (School A), SMA Muhammadiyah 3 Genteng (School B), and MAN 2 Banyuwangi (School C), Banyuwangi, Indonesia, in the 2018/2019 academic year. The number of students in each school are 30 students. The research design used Pretest-Posttest design only. Learning outcomes were measured by Pretest-Posttest, critical thinking skills were measured from test score results. Questions of critical thinking ability were given at each meeting and then the scores were analyzed using test scores. Then the scores of learning outcomes

with N-gain (formula 1) and critical thinking skills were added up and calculated in the form of values (formula 2), after that it was explained by category. The assessment of each aspect used a Likert scale of 1 to 5. The categories of each N-Gain learning outcomes (Table 1), critical thinking skills can be seen in (Table 2).

$$g = \frac{\text{skor posttest} - \text{skor pretest}}{100 - \text{skor pretest}} \dots\dots\dots(1)$$

(Hake, 2002).

Table 1:- Categories of N-gain performance levels

No	N-Gain Average Interval	Categories
1	$g < 0.3$	Low
2	$0.3 \leq g < 0.7$	Medium
3	$g \geq 0.7$	High

$$V = \frac{\sum \text{achieved score}}{\text{maximum score}} \times 100 \dots\dots\dots(2)$$

(Hake, 2002).

Table 2:-Value categories of Critical Thinking skills

No	Values	Categories
1	$20 \leq x < 36$	Very bad
2	$36 \leq x < 52$	Bad
3	$52 \leq x < 68$	Good enough
4	$68 \leq x < 84$	Good
5	$84 \leq x \leq 100$	Very good

Result:-

This study aimed to determine the effectiveness of teaching materials that need to be further developed, especially the process-based learning resource package on the reproductive system material for students’ achievement and critical thinking skills. Students’ achievement and critical thinking skills can be seen in (Table 3 and Figure 1).

Table 3:-Average results of students’achievement and Critical Thinking

Schools	Cognitive learning outcomes	Average Scores	N-gain	Categories
A (N=30)	Pre test	52.34	0.60	Medium
	Post test	81.25		
	Critical Thinking	81.41		
B (N=30)	Pre test	59.33	0.64	Medium
	Post test	85.45		
	Critical Thinking	82.42		
C (N=30)	Pre test	59.87	0.71	High
	Post test	88.64		
	Critical Thinking	85.70		

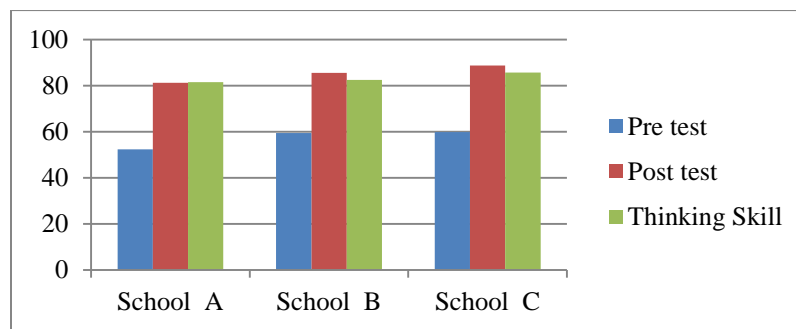


Figure 1:-The value of students’ achievement and critical thinking skills

Table 3 and Figure 1 show the average value of learning outcomes and critical thinking skills. N-Gain scores were included in the medium school category A 0.60; school B 0.64; and school C 0.71 which is in the High category. Critical thinking skills that were categorized medium in school A 81.41; school B 82.42; and school C 85.70 belonged into the excellent category. Furthermore, the frequency category of students' critical thinking skills can be seen in Figure 1.

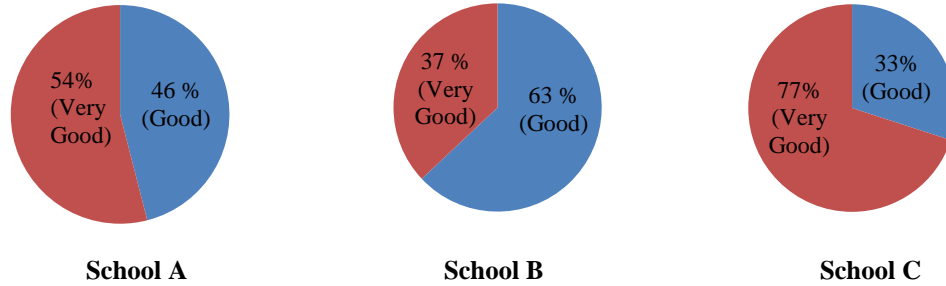


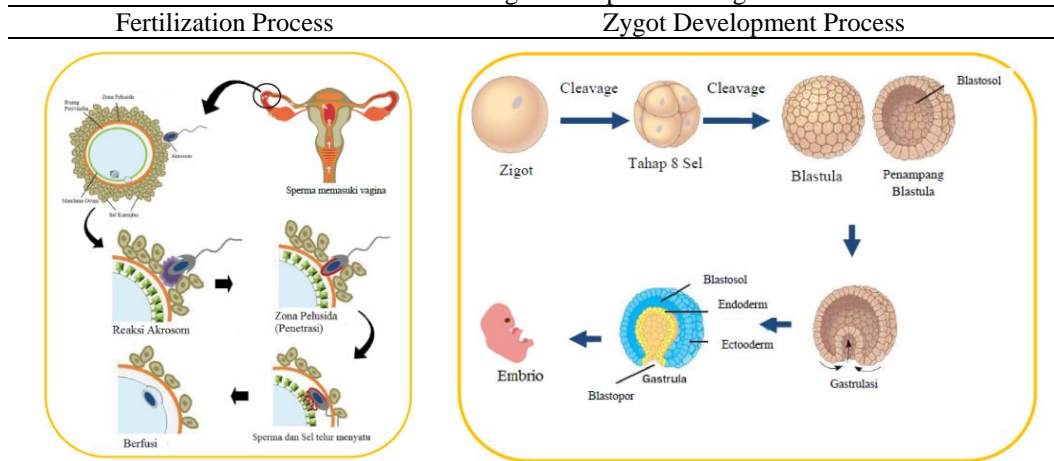
Figure 2:- The calculation results of the students' critical thinking skills value

Based on Figure 2, it can be seen about this category. Critical assessment of students about the grading system. A very good percentage is 54% (A); 37% (B) and 77% (C). These results indicate that a package of learning resources are effective in processing images for students' critical thinking skills referred to good categories.

Discussion:-

Based on Table 3, it can be seen that the students' achievement and critical thinking skills in categories A, B and C are good. This means that image-based learning resource packages are effective processes for students' achievement and critical thinking skills. That happens because of the availability of illustrative images with process images that train students' analytical skills. The process of visualizing concepts related to reproduction is the main advantage of the image-based learning resource package. The illustrated material based on process images can help students to understand concepts more deeply. Information presented through image visualization can last longer than words (Bransford et al., 2005; Rinne et al., 2011; Hardiman et al., 2014). Process images make students analyze the processes that occur in a series of images (Widita et al., 2018), so that the value of critical thinking skills becomes good. The example of the design of the image based learning resource package process can be seen in (Table 4).

Table 4:-Design of the process image



Good quality students can be created by the teacher by choosing the right media, namely by using visual media in the form of a process based learning resource package. Using different components of images, diagrams, writing, and colors can train the brain to think critically (Craig, 2007). Learning to use process media images can improve students' critical thinking skills. The images displayed in the lesson must be communicative and informative as a means of visualizing what you want explained in the material. This makes students easier to understand than just

using verbal sentences. In accordance with Roetz & Maritz (2016) that a person needs good creativity to think critically, but the power of analysis can bring a different perspective.

Conclusion:-

Based on the results and discussion, there is an increase in the value of students' learning outcomes and critical thinking skills when using resource-based learning process packages of human reproductive processes in the learning process. So it can be concluded that the source package of learning human reproductive systems based on images is an effective process for students' achievement and critical thinking skills. This can be seen from the average value of students' achievement and critical thinking skills in trials (A, B, and C) that meet both categories.

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