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Effectiveness Interactive Multimedia of Digestive System Based on Guided Inquiry to Improve Science Literacy

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Abstract. This research was purposed to describe the effectiveness of learning by using guided inquiry-based on interactive multimedia to improve students' literacy skills on digestive system material. The research method used quasi experiment by using pretest-posttes design. The population of this research was eight grade students of SMP N 2 Banjit and taken two classes to be sampled through purposive sampling technique, obtained class VIII A and VIII B. The instrument of this research used questionnaires and tests. The data was analysed by using paired sample t-test to see the effectiveness of learning in both groups of samples. The results showed that there was a significant difference between the mean posttes score with the average pretest science literacy value of students and the effect size of the large category that was 0.95 in the class VIII A and 0.94 in class VIII B. The highest increase in the indicator " draw conclusions "and the lowest on the indicator of" interpreting scientific evidence ". The result of questionnaire of teacher and student response to learning using guided inquiry based on interactive multimedia was 93% and 95% with very high category, it showed that interactive multimedia based on guided inquiry effectively improve students literacy science ability.

INTRODUCTION

Much research focuses on the literature of science, especially biology. The study provides information that the literacy ability of Indonesian students is still low. Several studies have been conducted regarding the ability of students' science literacy on biological materials, among others, entitled “analysis of the early ability of science literacy students on the concept of natural sciences” states that the initial ability of science literacy students only be in two levels of categories of four categories of science literacy namely the nominal category on the percentage range of 54% -95%, functional in the percentage range of 4% -9%, whereas in the conceptual and multidimensional categories are at 0% percentage (Odja & Payu, 2014), the research entitled “analysis of early science literacy ability of Malang city high school students” stated that the initial literacy students 'sciences are still low, especially in students' ability to understand and interpret data (Rizkita, Suwono, & Susilo, 2016).

This indicates that science learning in Indonesia is still not able to train students to science literacy. The results are reinforced by the 2015 Program for International Student Assessment (PISA) report on science literacy, Indonesia ranked 66th out of 72 countries with an average score of 403 below the PISA average score of 500 (OECD, 2016). The low achievement of Indonesian students in the PISA study is a reflection of the unsuccessful learning of science and the low level of student science literacy. It shows that the lack of students' understanding of the basic concepts of science that actually has been taught, so they were not able to apply it to interpret the data, explain casual relationships, draw conclusions and solve simple problems though and the limited ability of students to express thoughts in writing (Retmana, 2010).

The low ability of science literacy can be influenced by the selection of models, facilities and learning facilities and learning media used less precise. One solution to overcome the low literacy of science is to use guided inquiry learning model (Islami & Zaky, 2013). Learning using inquiry consists of a series of activities that involve students 'ability to search and investigate systematically, critically, logically and analytically so that they can formulate their own knowledge with confidence in order to improve students' literacy skills (Qing, Jing, Yazhuan, Ting & Junping, 2010).

In addition to the learning model, other aspects related to overcoming the low literacy of science students are the means and facilities of learning and the media used by teachers in the learning process. Developments in the field of IT is very fast, so its use in education can support the learning process, one of them the use of interactive multimedia. According to Leow and Neo (2014) " The use of multimedia elements in creating the learning contents makes the learning experiences more meaningful. It becomes an important component in learning as it provides the students with an alternative means to have more choices when learning in the student centred learning environment".

Several studies have been conducted regarding inquiry-based multimedia learning, among others, the study of Abdullah and Shariff (2008) entitled "The effects of inquiry-based computer simulation with cooperative learning on scientific thinking and conceptual understanding of gas laws" states that computer technology has evolved now at a point where it greatly facilitates the inquiry process at various levels, and provides new tools to represent the nature of science in the classroom. Joolingen, Jong and Dimitrakopoulout (2007) research entitled "Issues in computer supported inquiry, learning in science" states that computers can create learning process using inquiry-based interactive multimedia, where students can engage in inquiry process by studying domain along with scientific investigation process effectively improving learning outcomes, further research entitled "Inquiry-based learning, the nature of science, and computer technology: New possibilities in science education" states that inquiry-based computer simulations with cooperative learning methods are effective in improving scientific reasoning and conceptual understanding for students (Kubieck , 2005).

Based on some of the research results concerning interactive multimedia learning no one examines how the guided inquiry learning process using interactive multimedia can improve scientific literacy in the digestive system materials. This is also supported from the results of structured interviews of 10 science teachers in Lampung Province showed that the media used to explain abstract concepts in the learning process of science, especially in learning material digestive system 80% of teachers have not used interactive multimedia based on guided inquiry, which there are schools that are ordinary interactive multimedia without any syntax of learning process and have not trained students' science literacy skills. So it is necessary to do research on interactive multimedia using guided inquiry learning, so that learning is not only oriented to understanding the concept but also trained the students' science literacy skills through a series of activities contained in interactive multimedia.

The material of food digestion system is chosen as the learning theme in this research, because the food digestive system is a theme that is closely related to daily life, but the process in the body can not be observed directly so it is appropriate when in the learning process using interactive multimedia.

RESEARCH METHODS

Research Design

This research was conducted in SMP N 2 Banjit in the first semester in the academic year of 2017/2018. The research method used is quasi experiment with pretest-posttest design as presented in Table 1 bellow.

Table 1. Pretest posttest design

Class	Pretest	Treatment	Posttest
VIII A	O_1	X	O_2
VIII D	O_1	X	O_2

Sugiyono (2009)

Description: O_1 is pretes, X is learning using interactive multimedia, and O_2 is posttest.

Population and Sample of Research

The population in this research is taken from all students of eight grade students of SMP N 2 Banjit period 2017/2018. The amounts of them are 140 students. The samples of this research were two classes of the eight grade students of SMP N 2 Banjit, class VIII A was as the first experimental class and VIII D was taken from as second experimental class. Samples of this research obtained by purposive sampling technique.

Instrument

Instrument of the research is uses interview, questioner and test. Structured interviews were given to science teachers in 10 schools in Lampung Province to find out the media used in learning the material of the digestive system. Questionnaires were given to find out teacher and student responses to learning using interactive multimedia. The tests were performed to determine the students' literacy skills, given at the beginning of the lesson (pretes) of the first meeting and the end of the lesson (postes) at the second meeting. Prior to the use of test instruments in the measurement of validity and reliability first.

Data Analyzing

Technique of data analyzing after getting the data, researcher did was computing the average score each points of pretest and posttest in form of normality test. If the data is normally distributed then t test (paired sample t-test), looking for the difference gain ratio or n-Gain in the first and second experimental class using the formula:

$$g = \frac{Spost - Spre}{Smax - Spre} \quad \text{(Hake, 1999)}$$

Description: g = average n-gain, Spos = average postes score,
Spre = average pretest score, Smax = maximum score
The n-Gain criterion is high if g> 0.7, medium if 0.7> g> 0.3, and low if g <0.3.

To know the magnitude of the difference between the value of pretest and posttest in the first and second experimental class need to be calculated effect size. According to Sullivan and Feinn (2012) the effect size is important to find because it can inform the size of the impact. To find the effect size (UE) using the formula:

$$\eta^2 = \frac{T^2}{T^2 + df} \quad \text{(Jahjouh, 2014)}$$

Description: η^2 = Effect size, T^2 = t of the t-test
df = degrees of freedom

The effect size criteria use the standard Cohen criteria as follows:

Table 2. Effect size category

Cohen's Standard	*Effect Size*	*Percentile Standing*	*Percent of Nonoverlap*
Large	0,6-2,0	73-97,7	47,4-81,1
Medium	0,3-0,5	62-69	21,3-33,0
Small	0,0-0,2	50-58	0-14,7

Cohen (1988)

Student and teacher response data obtained from questionnaire responses to learning using guided inquiry based on interactive multimedia analyzed descriptively.

RESULTS AND DISCUSSION

Based on the analysis of data and hypothesis testing, it shows that guided inquiry based on interactive multimedia is effective increasing students' literacy ability of science, it can be seen from the significant difference between the mean of pretest and posttest of science literacy of students in first and second experimental class (Figure 1).

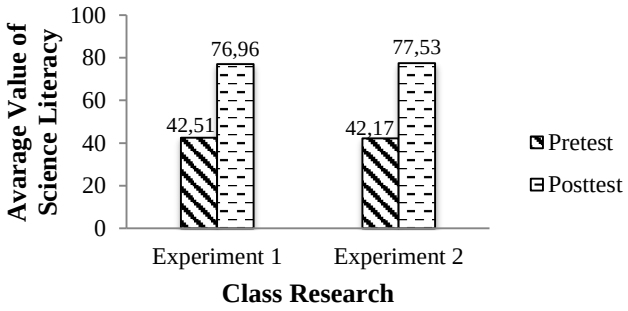

Figure 1. Average pretest and posttest values in the first and second experimental class

The competence of science literacy ability that focuses on this research covers aspects of explaining scientific phenomena, interpreting data and drawing conclusions. In interactive multimedia, the ability of science literacy on the aspects of explaining scientific phenomena is trained in the activities of "formulating problems" and "data analysis". Examples of problem formulas and explain the scientific phenomenon written by students can be seen in Figures 2 and 3. Examples of student responses (Figures 2 and 3) illustrate the ability of students in explaining scientific phenomena is good and in accordance with the phenomenon presented in interactive multimedia.

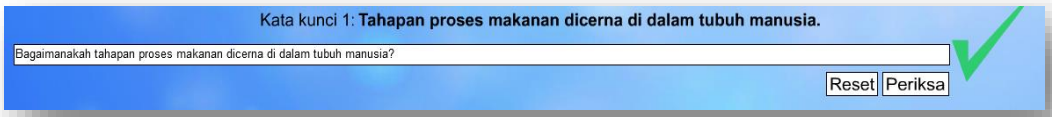

Figure 2. Example of problem formulation written by students on sub-material 1.

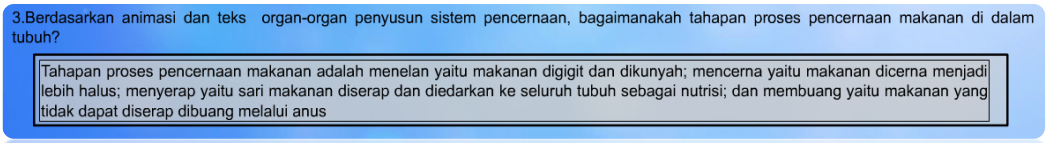

Figure 3. Examples explain scientific phenomena written by students in the data analysis phase of sub-material 1.

The ability to interpret data and scientific evidence is trained in the "collecting and analyzing data" stage, the competence of drawing conclusions is trained at the "conclusion" stage. Examples of data interpretation and scientific evidence written by students can be seen in Figure 4 and Figure 5 examples of conclusions made by students.

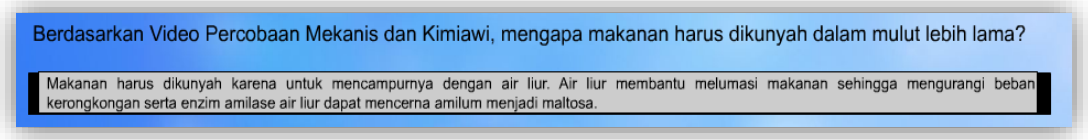

Figure 4. Examples of data interpretation and scientific evidence on sub-material 2

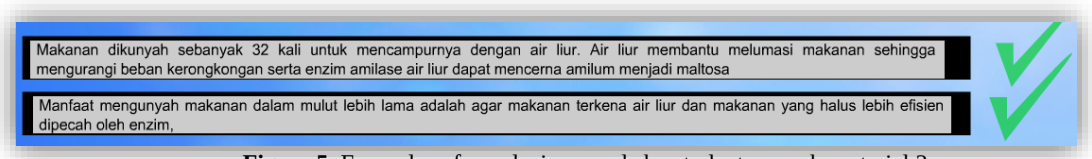

Figure 5. Examples of conclusions made by students on sub-material 2

To find out how much improvement in science literacy ability in the first and second experimental class, it is necessary to calculate n-Gain. The competence of science literacy ability is scattered in the questions items given to the students. Based on the calculation of n-Gain of science literacy capability in experimen class 1, the average n-Gain is 0,63 (medium category) and experiment class 2 got the average n-Gain 0,64 (medium category). Then the average n-Gain for each aspect of the science literacy capability in the experimental class 1 and experiment 2 is shown in Figure 6.

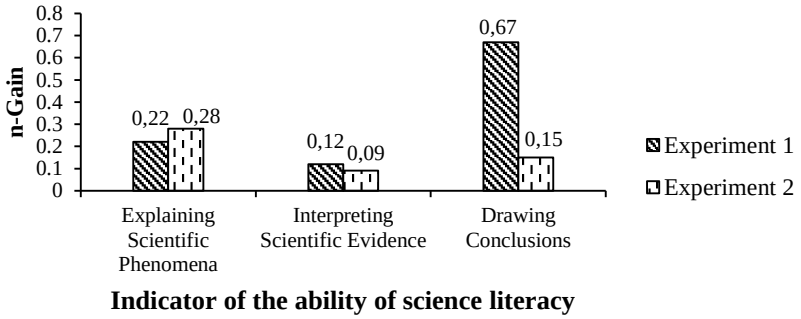

Figure 6. Average n-Gain for each literacy skill literacy competency in the first and second experimental class

The highest literacy of science literacy is "drawing conclusions" while the lowest rated indicator is "interpreting scientific evidence" (Figure 6). To know the magnitude of the difference between the value of pretest with experiment class 1 postes and experiment 2 need to be calculated effect size. Based on the calculation results, there is an effect size of 0.95 (large) for the experimental class 1 and 0.94 (large) for the experimental class 2 (Figure 7).

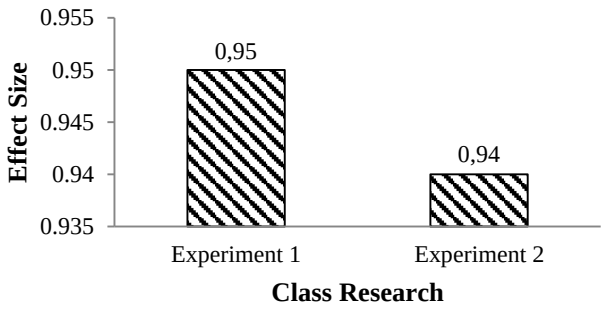

Figure 7. Effect size of in the first and second experimental class

The learning process in the first experimental class is influenced by 95% of the use of interactive multimedia, as well as in the second experimental class 94% learning process is influenced by the use of interactive multimedia and the rest is influenced by the supporting factors in the learning process (Figure 7). The effect size difference in the first and second experimental class were caused by the experimental class 1 being taught by the researcher himself while the experimental class 2 was taught by the science teacher. Researchers already understand how to manage and use interactive multimedia because the researchers themselves who create interactive multimedia, while science teachers are not used to using interactive multimedia even science teachers have been trained before using it in the classroom. This is because the first new science teacher uses interactive multimedia based on guided inquiry in the learning process and also the teacher's knowledge about the science

literacy is still limited. Astuti, Prasetyo and Rahayu (2012) said that the teacher's knowledge of science literacy is still so limited that its application in learning is not optimal.

The third upgrade of science literacy competence is not high because interactive multimedia based on guided inquiry is new first applied to the students. It provides an overview of the role of the use of multimedia learning in improving the competence of science literacy. Latip and Permansari said that the success of multimedia learning in improving the competency domain of science because of multimedia is designed to facilitate students 'science competencies so as to help students understand the various scientific processes, as well as with various videos or simulations contained in interactive multimedia can improve students' scientific competence in interpreting scientific evidence.

When learning uses interactive multimedia based on guided inquiry, teachers and students respond very well. In general, the percentage of teacher and student responses to learning using interactive multimedia based on guided inquiry can be seen in Table 3.

Table 3. Percentage of teacher and student response to learning using interactive multimedia

Response	Persentage	Category
Teachers	93 %	Very high
Students	95 %	Very high

Based on the data in Table 3, it is known that teachers give a good repon when asked to observe the learning process by using interactive multimedia based on guided inquiry. Teachers agree that in learning using interactive multimedia based on guided inquiry, students are passionate and not quickly bored, students often interact with other students, teachers, and learning resources. Teachers also agrees that the guided inquiry-based interactive multimedia user makes student-centered learning. Learning using interactive multimedia based on guided inquiry enables students to be more active in the learning process, engaging students to formulate problems related to digestive system material and making students explore to find a concept or information and provide a conclusion.

Students provide good repon using interactive multimedia based on guided inquiry in learning. All students argue that learning the material of the digestive system becomes more interesting, fun, navigational presented makes it easy to choose the material presented and the visualization fully supports the subject of the digestive system being studied. Visualization makes learning easy to understand with the material described with the help of dynamic visual media using animation and video. In textbooks students display only static images that can not show how food processes are digested by the body and travel in the body. Dynamic visual media has advantages that are more realistic in describing the events and digestive processes of food in the human body. According to Suyatna, Anggraini, Agustina, and Widyastuti, "using dynamic visuals, giving students the opportunity to observe events / phenomena that appear realistic because of the motion of the image, the student can also analyze, prove and conclude himself about an event related to the material".

Results of teacher and student responses to learning using interactive multimedia categorized that very high of synergy with the effect size that also categorized large. This indicates that the interactive multimedia based on guided inquiry has an impact on improving students' literacy skills. In guided inquiry learning, students learn to relate the previously acquired information to new information in solving problems to obtain satisfactory answers (Kemedikbud, 2014). In line with the research of Chairisa, Sholahuddin and Leny (2017) said that inquiry learning is guided to influence the development of student science literacy because learning with guided inquiry model makes students science literacy better developed than the discussion lecture model. This is in line with the statement Maikristina, Dasna, and Sulistina (2013) "... the learning outcomes obtained by memorizing are temporary and have an impact on the mastery of the underdeveloped concepts that may lead to misunderstandings in developing the basic concepts under which they are subjected to solving various development problems”. Yuanita and Ibrahim (2015) said that conceptual knowledge is one of the essential parts that students must have to solve problems, which must be stored in long-term memory and easy to re-access.

The results of this study are also in line with Latip and Permanasari (2016) study which states that the use of multimedia can increase science literacy. Furthermore, Mayer and Moreno (2003) said that multimedia learning can create more meaningful learning. Meaningful learning is a learning that leads to a deep understanding and able to apply the concept to real, new and different conditions.

CONCLUSION

Based on the result of data analysis, it can be concluded that interactive multimedia based on guided inquiry to effectively improve science literacy ability that is there is significant difference between mean of pretest value and posttest of science literacy of student in first and second experimental class with effect size big category. Furthermore, teachers and students respond well to learning by using interactive multimedia based on guided inquiry in learning.

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