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THE EFFECT OF INQUIRY LEARNING WITH SCAFFOLDING ON MISCONCEPTION OF LIGHT MATERIAL AMONG FOURTH-GRADE STUDENTS

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ABSTRACT

The purpose of this study is to determine the effect of Inquiry learning with scaffolding to decrease the percentage of light material misconception among fourth-grade students. The method used was Quasi-experimental with a non-equivalent control group design. The population was fourth-grade students of the Surya Buana Islamic Elementary School, Malang. The result of Anacova showed that for the "Class" variable, the value of Significance (P-value) obtained was smaller than the α significance level of 0,006 < 0,05. Based on the results of the Anacova test it was concluded that there was a significant effect from the use of Inquiry learning with scaffolding to decrease the percentage of light material misconception in fourth-grade students of Surya Buana Islamic Elementary School, Malang. The average percentage of students' misconceptions in the experimental class at the initial conception was 38.7% and dropped to 15.4% in conception after inquiry learning with scaffolding. While the average percentage of students' misconceptions of control class at the initial conception was 37.8% and dropped became 22.7% at conception after conventional learning. The decrease in the percentage of students' misconceptions of the experimental class was greater than the control class by a difference of 10.7%. Further research is suggested to examine more deeply the effect of inquiry learning with scaffolding on process skill, learning achievement, and other aspects of learning that are likely to be developed in students.

Keywords: inquiry; scaffolding; misconception; three-tier test

INTRODUCTION

Knowledge in science learning is constructed and understood by students in the form of concepts. According to Dewi & Priamyana (2019), science learning aims to help students develop a meaningful understanding of concepts and make students know how concepts can be applied in everyday life. According to Suryawati & Osman (2017) learning science in elementary school aims to instill curiosity, scientific attitude, and develop scientific process skills, so students can construct knowledge to understand concepts based on natural phenomena. Referring to this description, it can be seen that the content of science learning needs to be learned in elementary school so students are able to describe and connect between one concept to other concepts to explain natural events that occur in everyday life.

Science learning in elementary school is carried out in an integrated thematic way so it presents a variety of interrelated concepts. If one of the concepts is not well understood, it can affect the subsequent concepts that are related. According to Khairaty et al. (2018), understanding concepts in science learning is very important to describe and relate a concept with other concepts, so students can explain natural phenomena as a whole. But the reality that occurs in the field, most students cannot understand the terms of science content, and students often do not understand the content of science in depth

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(Awang, 2015). This is because students are more inclined to memorize the material that contains concepts rather than understanding the concepts (Karpicke & Blunt, 2011).

Students who have difficulty in understanding a concept will provide their interpretation as a process of reconstructing initial knowledge and new knowledge gained. The result of the interpretation allows mistakes because of the limited ability of students to choose between concepts, material, and ideas in their minds. The result of students' interpretation that is not in accordance with the concept of explanation from experts is then called misconception (Yunitasari et al., 2013). A misconception is a concept that is not following the concept conveyed by the expert (Suparno, 2013). Pesman & Eryilmaz (2010) state that misconception is a cognitive structure that is not appropriate and can affect students' experiences of scientific concepts so it must be solved immediately to learn scientific concepts effectively.

One of Science material in elementary school that mostly found misconception is the topic of light (Valanides & Angeli, 2008; Uzun et al., 2013; Senja et al., 2018). The results of previous studies show that the misconception in light material is experienced by most students ranging from elementary school, junior high school, senior high school, and up to the university level (Uzun et al., 2013; Munawaroh & Falahi, 2016). The result of the research conducted by Munawaroh & Falahi (2016) & Heywood (2005), found that in the topic of light in elementary school, most students experience misconception on several concepts such as the relationship of light to the vision process, the direction of propagation of light, reflection of light, and refraction of light. So, students are unable to explain and understand concepts about light as a whole. Misconception on light material can be caused by the inability of students to reconstruct material that involves the concept of light in the process of vision, the properties of light, and the use of light in daily life.

The misconception of light material that occurs at various levels of education can be caused by the initial knowledge that students have at the previous level. According to Fink (2013), before learning takes place, students brought several experiences and ideas that have been obtained previously. Laksana (2016) & Longfield (2009) stated that ideas that have been owned by students before learning namely preconception or alternative conception often emerge as one of the causes of misconceptions. Another factor that causes the misconception is learning that does not attempt to investigate and develop concepts through scientific evidence and empirical facts (Suparno, 2013; Yuliati, 2019). Therefore, the learning process that allows students to look for and find the concept meaningfully as early as possible at the elementary school level as an effort to prevent misconceptions on related concepts is needed. Students who have wrong preconceptions should be able to transform into true science conceptions through a scientific learning process. In constructing science knowledge, the application of learning that optimizes the learning environment and the scientific thought process is needed so that students can build an understanding of concepts following the steps taken by scientists (Passmore et al., 2014; Safaruddin et al., 2020).

The results of observation and interview conducted showed that in science learning, the teacher used a learning model that prioritizes student activity. Yet, the learning model used by the teacher was less able to guide students to learn and construct knowledge through the scientific process, so there were still students who fail in understanding the overall concept. The learning models used by teachers in science learning were observation and experiment. In constructing science knowledge, it is necessary to implement a learning process that optimizes the process of thinking scientifically so students can develop an understanding of the concept following the steps taken by scientists.

Inquiry learning is one of the learning models that allow students to search and find the concept through meaningful scientific activity. According to Juniati & Widiana (2017), the use of inquiry learning will create more memorable learning activity and improve the understanding of concept. The use of inquiry learning can train students to think and act scientifically to understand a concept. According to Purnamawati et al. (2017), inquiry learning contains scientific activities that involve students to investigate, ask question, make hypothesis and test hypothesis to obtain true knowledge. Scientific steps in inquiry learning enable students to follow the procedure and thoughts of scientists so they can understand the concept correctly and prevent misconception. The implementation of inquiry learning in the classroom has several weaknesses. According to Sanjaya (2006), the main weaknesses of the implementation of inquiry learning are: (1) learning success is determined by the ability of each student to construct the concept of knowledge; and (2) it requires a long allocation of learning time. To overcome the shortcomings contained in inquiry learning, some efforts are needed to provide learning assistance in accordance with the development of each student to construct knowledge so there is no misunderstanding of the concept.

One of the learning assistance for students who have difficulty in constructing understanding is scaffolding. Puspitaningsih et al. (2018) stated that the implementation of scaffolding can overcome learning difficulties and can correct students' misunderstanding of the concept. The use of scaffolding as a learning aid can also prevent misconception on students. Misconception is related to the cognitive structure of each student, so each individual can experience different misconception even on the same material. Slavin (2006) stated that scaffolding is a learning aid from someone who is more competent in form of instruction, question, direction, encouragement, problem-solving steps, giving examples, or other actions that make students enable to solve their learning difficulties properly.

Scaffolding needs to be applied in inquiry learning to help students who have learning difficulties. The use of scaffolding in learning has several advantages to prevent students' misconception. The advantages of using scaffolding include being able to improve student investigation and performance (Simons & Klein, 2007), keep students from failing to understand (Bean & Stevens, 2002), and can bridge students' learning difficulties (Puspitaningsih et al., 2018). According to Kim & Hannafin (2011), scaffolding learning support is needed for the classroom with cooperative inquiry learning because assignments will become more complicated and students' abilities may decrease. Based on the result of Choi & Mantik (2017), cooperative learning that implements structured scaffolding can be an effective learning model to help students build knowledge well. The application of scaffolding in this study is given to groups or individuals who have difficulties in the form of "direct scaffolding" from the teacher, scaffolding in student worksheets, and peer scaffolding. It is expected that the application of scaffolding in inquiry learning can help the learning process difficulties while preventing students from misconceptions.

Many studies try to uncover students' misconception, especially in science material of elementary school (Sözen & Bolat, 2011; Uzun et al., 2013; Munawaroh & Falahi 2016; Widiyatmoko & Shimizu, 2018) and applied a learning model to remediate the misconception experienced by students (Aydin, 2012; Mulungye et al., 2016; Senja et al., 2018; Sari & Linuwih, 2019). However, there are still very few studies that seek to optimize the implementation of inquiry learning with special learning assistance to prevent misconception of science concept on students. Based on this description, inquiry learning with Scaffolding was chosen as a form of learning used to optimize learning and prevent students' misconception on light material. Light material at the Elementary School level is taught in class IV in Theme 5 entitle "My Hero". Therefore, in this study, inquiry learning with Scaffolding will be carried out on Theme 5 entitle "My Heroes" in class IV, semester I.

To determine the level of students' misconception on light material after being given inquiry learning with scaffolding, steps are needed to identify the misconception that occurs. One of the ways that can be done to identify misconception is to use the Three-tier test. The Three-tier test is a diagnostic test that has three levels of the question. The first level is a multiple-choice question, the second level states the reason for the answer at the first level, and the third level states students' confidence in the answers at the two previous levels (Khairaty et al., 2018). The selection of the Three-tier test is based on several advantages. According to Pesman & Eryilmaz (2010), the Three-tier test has several advantages: (1) it is possible to calculate the percentage of positive and negative errors without interviewing with students; 2), evaluating misconception, understanding the reasons given by students, and identifying students' lack of knowledge.

Based on the description above, This study aims to determine the effect of the use of Inquiry learning with scaffolding to decrease the percentage of light material misconception in fourth-grade students of elementary school.

METHODS

The type of research used was quantitative research with a Quasi-experimental method. The design was Non-equivalent control-group design by using experimental and control groups in which the determination of the sample was not randomized, both groups were given a pre-test, carried out the treatment, and given a post-test (Creswell, 2012). Experiments in this study were conducted to determine the effect of inquiry learning with scaffolding on decreasing the percentage of light material misconception for fourth-grade students of elementary school.

The population in this study was the fourth-grade students of the Surya Buana Islamic Elementary School, Malang. Surya Buana Islamic Elementary School was chosen because based on preliminary observations and interviews, most fourth-grade students experience misconceptions of light material on their initial knowledge (preconception). The sampling technique used was purposive sampling, which is a sampling technique with special consideration and criteria (having homogeneous learning outcomes) to obtain more representative data (Masyhud, 2016). The samples in this study were as many as two classes obtained from students in the fourth grade of Surya Buana Islamic Elementary School, Malang who met the criteria of having homogeneous science learning outcomes. The determination of the experimental class and the control class in this study were carried out randomly (lottery) after carrying out a homogeneity test. The homogeneity test was carried out for all fourth grades at Surya Buana Islamic Elementary School, Malang. The data used in the homogeneity test were data on the value of the Middle Semester Examination (UTS) of fourth-grade students of Surya Buana Islamic Elementary Students, Malang. in this study, the Homogeneity test conducted was used the Levene test.

Based on the result of the Levene homogeneity, it was known that the significance value (Sig) of IV A, IV B, and IV C classes were greater than the α significance level namely 0.05 or Sig value > 0.05, so it can be concluded that IV A, IV B, IV C classes have the homogeneous ability or there is no difference in ability variance between the three classes. After the lottery was conducted, it was determined that class IV A as an experimental class and would be treated by using inquiry learning with scaffolding and class IV B as a control class that used conventional learning or learning that is commonly done every day. A homogeneity test result that had been carried out in class A and Class B obtained Sig value of 0.429, because the value of Sig> 0.05, it can be stated that class A and B have a homogeneous variance of ability.

After determining the experimental and control classes, the next step was given a pre-test in the form of a Three-tier test to determine misconceptions in students' preconception of light material before receiving learning. After giving a pre-test, the experimental class was given treatment by using inquiry learning with Scaffolding, while for the control class used learning that was usually done by the teacher (conventional). After the treatment was given, then the final measurement or post-test was done in form of Three-tier test to determine the effect of inquiry learning with scaffolding on students' misconception of light material in both classes.

This study used data collection instruments in the form of a test. The test method used was the Three-Tier test instrument. In this study, the Three-tier test consists of three levels of questions. The first level is a multiple-choice question to evaluate the understanding of students' light concepts, the second level question contains multiple-choice questions to find out the conceptual reasons for the answers at the first level, and the third level states certainty of student responses (sure/not sure) to the answers given at the previous two levels (Caleon & Subramaniam, 2010).

Before the three-tier test instrument was used to collect data, the quality of the instrument was developed including expert validation, empirical validity, and reliability testing. The expert validators selected in this study were experts in elementary science education material and experts of science education assessment. The data obtained from the questionnaire was then analyzed to improve the quality of the three-tier test questions based on light material before the instrument was used to identify misconceptions in data sources, namely fourth-grade elementary school students. Based on the results of validation by experts, the total value of Va was 3.56. It can be concluded that the validity level of the instrument is categorized as "very valid" so that the instrument can be used (Hobri, 2010).

After the Three-tier test instrument is declared valid by the expert, then empirical validation and reliability were conducted. A total of 26 questions were tested for empirical validation, obtained 13 item items that have been valid for use in research. 13 items that were declared valid then were tested for reliability. Based on the result of the reliability calculation that had been done, the Guttman split-half Coefficient value obtained was 0.860 so it can be concluded that 13 Three-tier test questions were categorized as having high reliability (Masyhud, 2016).

Student answer data obtained from the Three-tier test with light material were analyzed descriptively. Three-tier test result on the light material was then analyzed to get description and explanation of the data obtained. The categorization of the result of the Three-tier test assessment followed the category of conceptual understanding based on the answer patterns developed by Kaltakçi & Didiç (2007) in the following Table 1.

Table 1. The Category of Students' Understanding Level Based on Three-tier Test Result

Analysis of The Question	Categories	Type of The Answer
Three-tier test	Understand the Concept (UC)	Correct answer, correct reason, CR sure
	Eror (E)	Incorrect answer, correct reason, CR sure
	Lack of Knowledge (LK)	Correct answer, correct reason, CR not sure
		Correct answer, Incorrect reason, CR not sure
		Incorrect answer, correct reason, CR not sure
		Incorrect answer, Incorrect reason, CR not sure
	Misconceptions (M)	Correct answer, Incorrect reason, CR sure
		Incorrect answer, Incorrect reason, CR sure

The result of students' answers was adjusted according to the guidelines in Table 1 with a combination answers of right, wrong, and belief (CR) in answering the questions (the Three-tier test), then the data were categorized into four categories: students who understand the concept (UC), error (E), lack of knowledge (LK), and misconception (M). To find out the percentage (P) of a group of students who are categorized to understand concept, error, lack of knowledge, or lack of understanding and misconception in each item is calculated using the following equation (Sudijono, 2009).

$$P = \frac{f}{N} x100\%$$

Information:
P = percentage of each item (% of group)
F = the number of students included in each category
N = the total of students as research subject

To find out the effect of inquiry learning with scaffolding on students' decreasing of misconception was done by analyzing the percentage of each student's misconception based on the result of the Three-tier test. In this study, the analysis of misconception data of each student in the experimental class and control class was used Anacova statistic. Before the data were analyzed by using the Anacova test, a pre-requisite test (classical assumption test) was used, namely the normality and homogeneity tests of variants in the research data. If the requirements were met then the Anacova test can be carried out.

RESULTS AND DISCUSSION

Before the treatment of each class began, the experimental class and the control class were given the same pretest by using the Three-tier test instrument to discover the students' initial conception of light material. From the result of the pretest, the average percentage of light material misconception in the experimental class and control class were similar. The result of the recapitulation of the students' initial conception can be seen in the following Table 2.

Table 2. The Recapitulation of Early Conception of Experiment Class (IV A) Students and Control Class (IV B) Students

No	Concept Indicators (CI)	Percentage of Categories IV A (%)				Percentage of Categories IV B (%)			
		UC	E	LK	M	UC	E	LK	M
1.	Light moves without the need for a medium.	8	12	16	64	18	9,1	22,7	50
2.	Natural light source and artificial light source.	40	4	8	48	54,5	0	9,1	36,4
3.	Light moves straight.	60	8	8	24	68,2	9,1	0	22,7
4.	Light penetrates transparent objects.	32	8	16	44	36,4	4,5	0	59,1
5.	Light can be reflected.	68	0	16	16	81,8	0	9,1	9,1
6.	Reflection of light on a flat mirror.	60	0	16	24	68,2	0	22,7	9,1
7.	Reflection of light on a convex mirror.	8	0	40	52	13,6	4,5	27,4	54,5
8.	Reflection of light on a concave mirror.	0	16	48	36	0	13,6	31,9	54,5

No	Concept Indicators (CI)	Percentage of Categories IV A (%)				Percentage of Categories IV B (%)			
		UC	E	LK	M	UC	E	LK	M
9.	Light can be refracted.	0	12	28	60	18	4,5	22,7	54,5
10.	Light can be decomposed.	32	0	20	48	13,6	0	22,7	63,7
11.	Benefits of applying the nature of light in the surrounding environment.	12	20	36	32	9,1	13,6	45,4	31,9
12.	Relationship of light with the vision process.	12	12	44	32	13,6	13,6	50	22,7
13.	The nature of light that plays a role in the process of seeing.	44	0	32	24	59,1	4,5	13,6	22,7
	Average	28,9	7,1	25,2	38,7	35	5,9	21,3	37.8

Information:
UC = Understand the Concept
E = Error
LK = Lack of Knowledge
M = Misconceptions

Table 2 shows that the average percentage of students' misconception (M) in the pre-test of the experimental class and the control class appeared to have almost the same average of 38.7% and 37.8%. After the treatment was finished, the experimental class and the control class were given a post-test by using the Three-tier test instrument to find out whether there was a significant effect of inquiry learning with scaffolding on decreasing the percentage of students' misconception of light material. From the post-test result, it was obtained an average percentage of the students' light material misconception that was different in the experimental class and the control class. The recapitulation of students' conception after giving this treatment can be seen in the following Table 3.

Table 3. The Recapitulation of Percentage of Students' Conception after Treatment in Experiment Class (IV A) and Control Class (IV B)

No	Concept Indicators (CI)	Percentage of Categories IV A (%)				Percentage of Categories IV B (%)			
		UC	E	LK	M	UC	E	LK	M
1.	Light moves without the need for a medium.	64	0	4	32	59,1	0	0	40,9
2.	Natural light source and artificial light source.	80	0	1	16	54,5	0	4,5	27,3
3.	Light moves straight.	96	0	4	0	81.8	0	0	18
4.	Light penetrates transparent objects.	96	0	0	4	77,3	0	0	22,7
5.	Light can be reflected.	92	0	8	0	100	0	0	0
6.	Reflection of light on a flat mirror.	84	0	4	12	77,3	0	0	22,7
7.	Reflection of light on a convex mirror.	48	0	12	40	50	4,5	0	45,4
8.	Reflection of light on a concave mirror.	68	8	12	12	59,1	0	9,1	31,9
9.	Light can be refracted.	92	0	0	8	81,8	0	0	18
10.	Light can be decomposed.	32	0	20	48	72,7	0	4,5	22,7
11.	Benefits of applying the nature of light in the surrounding environment.	96	0	4	0	59,1	0	0	40,9
12.	Relationship of light with the vision process.	72	0	0	28	81,8	4,5	0	13,6

No	Concept Indicators (CI)	Percentage of Categories IV A (%)				Percentage of Categories IV B (%)			
		UC	E	LK	M	UC	E	LK	M
13.	The nature of light that plays a role in the process of seeing.	76	0	0	24	72,7	0	4,5	22,7
	Average	80	0,6	4	15,4	72,4	0,7	1,7	25,2

UC = Understand the Concept
E = Error
LK = Lack of Knowledge
M = Misconceptions

Based on preconceptions (in the pretest), an average percentage of light material misconceptions of experimental class and control class students was obtained. This can be seen in Table 2 and Table 3 which show the percentage of students' misconceptions in the initial conception of the experimental class and the control class appear to have almost the same average of 38.7% and 37.8%. The misconception is part of the initial conception that students can get before receiving learning. Students always carry preliminary knowledge or preconceptions from previous experiences that are often incompatible with scientific truth (Garnett et al., 1995; Widiyatmoko & Shimizu, 2018). Many misconceptions occur because of the life experiences of students outside the classroom that form the wrong preconceptions (Keeley, 2012; Önder et al., 2017). Based on the recapitulation data of students' conception contained in Table 2 and Table 3, it can be seen that the average result of the light material misconception percentage of students in experimental class (IV A) and control class (IV B) before being given treatment (pre-test) and after being given treatment (post-test) experienced changes. The changes in the percentage of the light material misconception of experimental class and control class students on the pretest and post-test results are presented in Figure 1 and Figure 2.

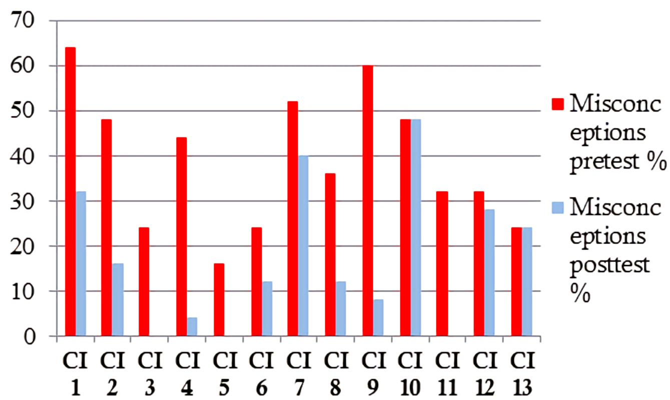

Figure 1. Misconception Recapitulation Chart of Pre-test and Post-test in Class IV A

The data in Figure 1 show that there was a decrease in the percentage of the light material misconception of experimental class students (IV A) before inquiry learning with scaffolding and after inquiry learning with scaffolding was given. From the 13 Concept Indicators (CI), there were 11 CI that had decreased the percentage of misconception, there were 2 CI with a percentage of misconception that was fixed, and there was no concept indicator that had increased in percentage. A decrease in the average percentage of students misconception of the experimental class as a whole can be seen in Table 2 and Table 3. The initial conception in Table 2 shows that the average percentage of students' misconceptions of the experimental class was 38.7%, while in the conception after inquiry learning with scaffolding displayed in Table 4. The average value of the percentage of the light material misconception of experimental class students decreased to 15.4%. These results indicate that the implementation of Inquiry learning with scaffolding in the experimental class can reduce the average percentage of students' misconception of light material as a whole by 23.3%.

Changes in students' conceptions are the effects of cognitive process schemes including the stages of assimilation, accommodation, and equilibration that occur during learning (Jalan et al., 2016). According to Piaget (1977), in cognitive development schemes, the development of knowledge in a child begins from accepting facts or new experiences in the assimilation stage and modifying the schema in themselves according to facts or experiences received at the accommodation stage, so as to achieve a balance of knowledge (equilibration). According to Metaputri et al. (2016), Inquiry learning can be used to develop the process of assimilation and accommodation of students among previously believed knowledge of new facts to achieve better understanding. A form of inquiry learning that includes observing and investigating concrete evidence can help students construct concepts correctly. Yuliati et al. (2018) stated that the implementation of inquiry-based learning gives students direct experience so that it is effectively used to overcome the problem of misconception in students. In this study, the overall class of experiments experienced a decrease in the percentage of misconceptions by 23.3%.

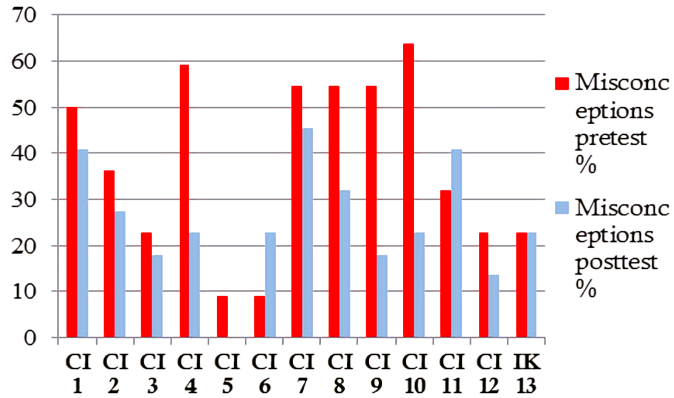

Figure 2. Misconception Recapitulation Chart of Pre-test and Post-test in Class IV B

Based on Figure 2, it can be seen that there is a change in the percentage of the light material misconception of control class students (IV B) before conventional learning and after conventional learning is given. Conventional learning given in the control class was also able to reduce the percentage of misconception experienced by students. From the 13 CI, there were 10 CI that experienced a decrease in the percentage of misconception, 1 CI which had a percentage of misconception fixed, and there were 2 CI that experienced an increase in the percentage of misconception. A decrease in the average percentage of the misconception of control class students as a whole can be seen in Table 2 and Table 3. The initial conception in Table 2 shows that the average percentage of the misconception of control class students was 37.8%, while in the conception after conventional learning was given in Table 3, the average value of the percentage of the light material misconception of control class students decreased to 25.2%. These results indicated that the implementation of conventional learning in the control class could reduce the average percentage of students' misconception of light material as a whole by 12.6%.

Based on the description above, it can be concluded that inquiry learning with scaffolding given to the experimental class and conventional learning given to the control class could reduce the percentage of students' misconceptions of light material. The decrease in the percentage of students' misconception from the result of the pre-test and post-test in the experimental class was greater than the control class. For the experimental class, the percentage of misconception decreased by 23.3%, while in the control class the percentage of misconception decreased by only 12.6%. The decrease difference in the percentage of students' misconception between the experimental class and the control class was 10.7%. So it can be concluded statistically that the class used inquiry learning with scaffolding was more effective in reducing the percentage of misconception of light material for fourth-grade students compared to the class that did not use inquiry learning with scaffolding. Learning that does not use the stages of a scientific approach is not effective for building concepts in learning science (Gormally et al., 2009). The results of this study are in line with previous research findings which prove that conventional learning is less effective in developing the concept of science (Puspitaningsih et al., 2018).

Class IV A as an experimental class that used inquiry learning with scaffolding conducted learning activities according to scientific steps in inquiry learning with the help of Student Worksheet (LKPD) of light material. LKPD of light material was designed based on the inquiry learning stage which was equipped with scaffolding to ensure that students could develop concepts systematically and correctly. Experimental class students did learning activities in a group starting with problem orientation activity in daily life around the light material to be studied, followed by formulating a problem based on illustration, compiling provisional estimates to answer questions that have been formulated, doing various variations of experiments with the group to collect data, discuss to determine the correct provisional assumption based on the data obtained, and the final step was to draw a conclusion. At each stage of learning inquiry in LKPD*,* there was scaffolding in the form of instruction and questions to help students understand the objectives of the activities carried out except at the problem orientation stage. Examples of scaffolding are guiding questions used in LKPD, such as:

"Guess what answers might arise from the questions you have made before?" (The stage of constructing a hypothesis)

"Try to look back at the results of your experiments, observe in what direction the trajectory so that light can propagate?" (The stage of making conclusions as the light moves straight)

Beside of scaffolding contained in LKPD*,* direct scaffolding activities are carried out by researchers to the groups who have problems in the learning process. Examples forms of scaffolding directly from the teacher to groups that experiencce problems such as the following.

"…to make a conclusion, try looking at your experimental data again about... " (hint question)

"…if you still don't know, look at the difference in the results of experiment a and experiment b about... "(Keywords)

"…if you still don't understand, look in your experiments, how is the direction of the path so that the light can propagate?" (Instructions)

"…if you still don't understand, pay attention to the demonstration I will do... "(Demonstration)

Direct scaffolding in the form of hint questions, keyword, instruction, and demonstration was also given in the group by researchers. This direct scaffolding allows researchers to help students according to their needs and encourage them to overcome problems experienced by groups so that the process of student concept development becomes more optimal. scaffolding is also given individually by colleagues who have understood the concept (peer scaffolding) if there is a student who is still having difficulty in concluding the concepts.

The implementation of a series of inquiry learning activities with scaffolding can involve students in the experimental class actively and build the concept systematically through scientific activities so as can obtain meaningful concepts and reduce the occurrence of misconception (Tompo et al., 2016). Inquiry learning that is equipped with scaffolding can facilitate and provide learning guides to achieve better concept mastery (Hung et al., 2013). According to Zydney (2010), the provision of structured scaffolding combined with an inquiry-based learning model can help students understand complex concepts and effectively prevent misconceptions. Therefore in the experimental class, the application of inquiry learning is equipped with scaffolding in oral and written forms so that it helps students understand the concept of light well. This is consistent with the result of previous research which states that inquiry learning carried out systematically by implementing written scaffolding and direct scaffolding can correct student's misunderstanding of the concept (Van-Uum et al., 2017).

In the control class (IV B), learning was done conventionally or commonly done by lecturing, question and answer, discussion, and assignment. Control class learning activities included explaining material about light in general to students and students were asked to observe pictures and explanations in a textbook, discuss with peers, summarize material about light, and conduct questions and answer to strengthen students' understanding of light material. Conventional learning in the control class that lacked scientific activities in acquiring concept is caused students to be less effective in constructing conceptual understandings correctly in their minds (Gudyanga & Madambi, 2014). Students can only remember notes, summarized explanation, and cannot understand them meaningfully. This can be seen from the decrease in the percentage of misconception on the post-test result of students in the control class who were not too far from the percentage of misconception on the pre-test result. It can be concluded that the conventional learning of students in the control class was still less effective in reducing the percentage of light material misconception. This is in line with the opinion of Suparno (2013) that stated, one of the main factors causing misconception is derived from the way of teaching students who do not try to develop concept meaningfully through scientific evidence.

Based on data of misconception percentage for each student, it can be seen that there was a decrease in the recapitulation result in the percentage of misconception for each student at the initial conception (pre-test) and the conception after treatment was given (post-test) both in the experimental class and the control class. The overall difference in the misconception percentage of pre-test and post-test in the experimental class that using inquiry learning with scaffolding was 23.3%, while the difference in the misconception percentage of pre-test and post-test in the control class that did not use inquiry learning with scaffolding was 12.6%. The total difference for the decrease in the percentage of students' misconceptions that occurred between the experimental class and the control class was 10.7%.

To find out whether or not there was a significant effect on the implementation of inquiry learning with scaffolding to the decrease of light material misconception for fourth-grade students of Surya Buana Islamic Elementary School, Malang, this study used Anacova parametric statistical analysis. Anacova statistical test result is used data post-test in the experimental class and the control class with the pre-test value as the covariate that can be seen in Table 4 below.

Table 4. The Result of Anacova Test for Misconception Percentage of Each Student

Tests of Between-Subjects Effects			
Source	**df**	**Mean Square**	**Sig.**
Corrected Model	2	1293.214	.001
Intercept	1	407.894	.109
Misconceptions Pretest	1	1363.376	.005
Class	1	1298.267	.006
Error	44	152.839	
Total	47		
Corrected Total	46		
a. R Squared = .278 (Adjusted R Squared = .245)			

The result of Anacova test in Table 4 shows that for the variable of "Class", the value of P-value (Sig.) obtained was 0.006. Thus the value of the P-value (Sig) of "Class" variable was smaller than the significance level α namely 0.006 <0.05, so the null hypothesis (H0) was rejected and the alternative hypothesis (Ha) which reads that there is a significant difference in the class that implements inquiry learning with scaffolding with the class that does not apply inquiry learning with scaffolding to the decrease in the percentage of misconception of light material in fourth-grade students of Islamic Surya Buana, Malang is received.

The result of this study states that inquiry learning can facilitate students to conduct a scientific investigation and develop concept correctly to prevent misconception. A significant decrease in the percentage of students' misconception of experimental class (IV A) in the initial conception and after treatment conception compared to the control class showed that inquiry learning applied could justify a wrong concept to reduce the occurrence of misconception effectively. The result supports previous research which revealed that the existing natural misconception in students can be changed with the true concept with the inquiry learning model (Barthlow & Watson, 2014; Asyhari, 2015; Muallifah et al., 2017).

The presentation of scaffolding during the implementation of inquiry learning in this study helped students to maximize the effect of inquiry learning and overcame the difficulties experienced during the learning process. According to Van-Uum et al. (2017), in inquiry learning, scaffolding needs to be applied to help them understand learning activities that cannot be understood by themselves so they do not interfere in the process of concept formation. The scaffolding assistance has a positive impact in reducing difficulties in the process of understanding students' concept during the implementation of inquiry learning to help students not to misunderstand the concept (Bean & Stevens, 2002; Saye & Brush, 2002; Simons & Klein, 2007; Puspitaningsih et al., 2018). The result of this study proves that the implementation of inquiry learning with the help of scaffolding learning applied can reduce the percentage of students' misconception of light material. This is reinforced by the result of previous research which revealed that the implementation of inquiry learning combined with scaffolding learning assistance can help students effectively to develop conceptual understanding of higher science material than students who do not receive such treatment (Hsu, et al., 2015; Van-Dijk & Lazonder, 2016; Van-Uum, et al., 2017; Muliastrini et al., 2019). The result of the research conducted by Zydney (2010) also stated that the presentation of scaffolding combined with an inquiry-based learning model can help students understand the complex concept and effectively help students prevent misconception.

In this study, Anacova statistical test used the percentage of students' pre-test misconception as the covariate. This was done to find out whether the percentage of students' conception of initial conception or the result of the pre-test in the experimental class and the control class influenced the decrease in the percentage of students' misconception on the post-test result. In Table 4, the significance value for the "Misconception_pre-test" variable was 0.005. Because the value of P-value (Sig.) < α Significance level was 0.005 <0.05, it can be concluded that the percentage of students' misconception on the initial conception (pre-test) affected the percentage of students' misconception after being given treatment (post-test). Based on the result above, it can be concluded that the percentage value of students' misconception at the initial conception can affect the percentage value of misconception after learning both in the experimental class (IV A) and the control class (IV B). This can occur because students' experiences about a concept that is manifested in the initial conception can confuse students in the learning process (Agnes et al., 2015). Students' daily experiences (preconceptions) about light have a close relationship with mastery of the light material concept and can be a source of causes of misconception (Suniati et al., 2013; Widarti et al., 2016).

Anacova test result shows that students who have a high percentage of misconception on the initial conception tended to have a high percentage of misconception and also on the conception after being given treatment and vice versa. Students who have a low percentage of misconception on the initial concept tended to have a low percentage of misconception and also at conception after being given treatment. The result of this study is in line with the opinion of Longfield (2009) & Suparno (2013) which stated that the initial conception possessed by students before receiving learning is one of the factors that often arises as a cause of misconception. The stronger the misconception at the student's initial conception, the greater the chance of experiencing a misconception at the end of learning.

To find out the simultaneous effect of the inquiry learning model with scaffolding and the percentage of students' misconception on the pre-test on decreasing student misconception, it can be seen in the "Corrected Model" variable. Based on Table 4, the significance value for the "Corrected Model" variable was 0.001. Because the value of P-value (Sig.) < α Significance level namely 0.001 <0.05, it can be concluded that simultaneous inquiry learning with scaffolding and the percentage of students' misconception on the initial conception or pre-test result affects decreasing the misconception percentage of fourth-grade students in Surya Buana Islamic elementary school, Malang.

CONCLUSION

Based on the research, it can be concluded that there was a significant effect of the use of inquiry learning with scaffolding to decrease the percentage of light material misconception in fourth-grade students of Surya Buana Islamic Elementary School, Malang. This was proven by the difference in the decrease of the misconception percentage of experimental class students (IV A) and control class students (IV B) in the initial conception (pre-test) and conception after treatment (post-test). The average percentage of students' misconception of experimental class at the initial conception was 38.7% and dropped to 15.4% in conception after inquiry learning with scaffolding, while the average percentage of students' misconception of control class at initial conception was 37.8% and dropped became 22.7% at conception after conventional learning. The decrease in the percentage of students' misconception of the experimental class was greater than the control class students by a difference of 10.7%

Based on the Anacova test result that has been done, it showed that for the "Class" variable the value of P-value (Sig.) obtained was smaller than the α significance level of 0,006 < 0,05, so H0 was rejected and Ha read that there was a significant difference in the class that implemented inquiry learning by scaffolding with a class that did not implement inquiry learning with scaffolding to the decrease in the percentage of light material misconception in fourth-grade students of Surya Buana Islamic Elementary School, Malang was received. Also, the Anacova test result obtained the significance value of the covariate variable "Misconception_pretest" was 0,005. Because the value of P-value (Sig.) < α Significance level namely 0,005 < 0,05, it can be concluded that the percentage of students' misconception on the initial conception (pre-test) affected the percentage of students' misconception after inquiry learning with scaffolding (post-test) both in the experimental class (IV) A) and the control class (IV B).

The result of the research that has been conducted showed the implementation of inquiry learning with scaffolding has a significant effect on decreasing the misconception of light material in fourth-grade students of elementary school. Therefore it is recommended that inquiry learning be combined with scaffolding learning assistance and it can be implemented by teachers for daily learning in class so it can prevent misconception, especially on other elementary science material content. This study proved that inquiry learning with scaffolding has an effect on reducing the percentage of students' misconception, but further research needs to be done on the effect of inquiry learning with scaffolding on process skill, learning achievement, and other aspects of learning that are likely to be developed in students.

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