



The Effectiveness of Inquiry Worksheet with Pair Checks Approach to Improve Learning Outcomes and Scientific Attitudes

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Article Info

Received 3 January 2021

Accepted 11 February 2021

Published 17 February 2021

Keywords:

**Inquiry
worksheet
pair checks
learning outcomes
scientific attitude**

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Abstract

Learning outcomes are important to form intelligent and skilled humans. This study aims to determine the effectiveness of inquiry worksheet with pair checks approach to improve learning outcomes in the cognitive domains and scientific attitudes. The research design used was an experimental control group with pretest-posttest. The research population was eighth grade in SMP N 1 Semarang. The research sample was taken using a simple random sampling technique. This research applies an inquiry worksheet with a pair checks approach for experimental classes and regular worksheet for control classes. The significance test of learning outcomes in the cognitive domain shows differences in learning outcomes for the two samples. The N-Gain value measured the increase in learning outcomes in the cognitive domain. The N-Gain value for the experimental class was 0.39, which was in the moderate category. The N-Gain value for the control class is 0.27 which was in the low category. The result of the observation shows that the inquiry worksheet with the pair checks approach is not effective in improving scientific attitudes. Students' scientific attitude has decreased for every meeting because of constraints for online learning as a result of the pandemic Covid-19. The student response to the application of the inquiry worksheet with the pair checks approach was 82.21% which was in the very good category.

INTRODUCTION

Permendikbud Number 22 of 2016 explains that the learning process is held in an interactive, inspirational manner, motivates students to participate actively, and provides space for student creativity and independence. The learning process produces changes in behavior and abilities called learning outcomes. Permendikbud Number 23 of 2016 explains that student learning outcomes consist of the cognitive domain (knowledge), the affective domain (attitudes), and the psychomotor domain (skills). Learning outcomes are benchmarked to determine student achievement in the material being studied. Sardinah et al. (2012) explained that science learning contains three aspects, including results, processes, and scientific attitudes. The scientific attitude becomes research ethics for scientific activities. Dasna (2012) explains that scientific attitudes form humans who always use ratio in making decisions.

The results of observations at SMP N 1 Semarang showed that the average grade for class VIII E-VIII I in Semester 1 was 70.8. Mulyasa (2013) describes the learning will be successful in the classical if the completeness of student learning outcomes $\geq 85\%$. Interviews with several students including: (1) students participate less active during the learning process, (2) students do not understand the concept of materials science learning because students are more focused on understanding mathematical equation, (3) students are less active in the lab as a direct experience. Using worksheets during the learning process will make it easier for teachers to manage the learning process and make students more active. Nugraheni (2018) explains that applying the inquiry model with worksheets provides significantly different learning outcomes. Hadi & Maidatina (2015) explained that the combination of inquiry learning with cooperative learning would make students more easily understand the concept. Based on this background, this research aims to determine the effectiveness of the inquiry worksheet with pair checks approach to improve learning outcomes and scientific attitudes.

METHOD

The research was conducted online at SMP N 1 Semarang in the even semester of the 2019/2020 school year. The research population was students of class VIII E-VIII I. There were 162 students. The research sample consisted of class VIII F as the control class and class VIII E as the experimental class. The research sample was taken using a simple random sampling technique. This type of research is an experimental control group with a pretest-posttest design. The research design is presented below:

Table 1. Experimental control group with pretest-posttest design

Class	Pretest	Treatment	Posttest
Experiment	Y ₁	X	Y ₂
Control	Y ₃		Y ₄

Description:

Y₁= pretest experimental class

Y₂= posttest experimental class

Y₃= pretest control class

Y₄= posttest control class

X =application of the inquiry worksheet with the pair checks approach

The two sample classes received the same material. The material is vibrations and waves. The control class uses a regular worksheet, while the experimental class uses an inquiry worksheet with a pair checks approach. The methods for collecting data in this research are:

1. Test Method

The test method is used to measure learning outcomes in the cognitive domain. The test questions were tested in ninth grade and validated by five validators using Aiken V.

2. Observation Method

The observation method is used to measure scientific attitude. Observation consists of two activities. First, observing scientific attitudes when students have discussions during online learning. Second, assessing scientific attitudes based on student practicum reports.

3. Questionnaire Method

The questionnaire method was used to determine student responses about the application of the inquiry worksheet with the pair checks approach on the vibration and wave material.

4. Documentation Methods

The documentation method is used to support the research results to be reliable.

RESULT AND DISCUSSION

The results of the research consisted of: (1) pretest data, (2) posttest data, (3) scientific attitude observation results, and (4) documentation.

The Effectiveness of Inquiry Worksheet with Pair Checks Approach to Improve Learning Outcomes in the Cognitive Domain

The t-test results show $t_{count}=3.62$ with a significant level of 5% and $dk = 64$. These results indicate the learning outcomes of the cognitive domains of the two sample classes are significantly different. The N-Gain test shows that the N-Gain value in the experimental class is 0.39 in the medium category and in the control class, it is 0.27 with the low category. The improvement of learning outcomes in the experimental class's cognitive domain that applied inquiry worksheet with pair checks approach was higher than the cognitive learning outcomes of the control class using ordinary worksheets. Data pretest and posttest in the experimental class and the control class are presented below:

Table 2. The mean value of pretest and posttest

Class	pretest	posttest
Experiment	53,13	71,34
Control	44,91	60

Worksheets in learning are highly recommended to support the online learning process. Worksheets can help teachers manage the learning process systematically, activate students, and make it easier for them to understand learning material. Inquiry worksheet with a pair checks approach serves as a guide for students to carry out virtual lab activities on vibrations and waves during online learning. The worksheet is prepared based on the structured inquiry syntax with the pair checks approach. First, students identify and determine the problem's scope based on the statements presented in the worksheet. Second, students plan and predict the results by making problem formulations based on the predetermined scope of the problem. Third, an investigation for data collection through a virtual lab using a PhET simulation. Fourth, interpreting data and developing conclusions. Fifth, reflecting. In reality, pair checks don't work very well during online learning. Students are burdened with learning pair checks, and students argue that pair checks make learning more complicated. Overall, the Inquiry

worksheet with the pair checks approach makes it easier for students to understand the material's vibrations and waves. Syamsu (2017) describes one way to maximize student learning outcomes: good learning resources such as worksheets. The syntax of structured inquiry contained in the worksheet guides students to actively conduct investigations. Annafi (2016) inquiry-based learning with students actively seeking their knowledge will have an impact, including (1) increasing student reasoning and the ability to think freely; (2) the knowledge acquired will be lasting and easy to remember; (3) provide the best learning outcomes. Students carry out virtual lab using PhET simulation individually. Sartika (2016) explains that PhET is a simulation software that can be accessed for free and can be used as a substitute for real laboratory activities. PhET can help students observe abstract physical phenomena and increase students' conceptual understanding of the material being studied through the presented simulation display.

The Effectiveness of Inquiry Worksheet with Pair Checks Approach to Improve Scientific Attitudes

Scientific attitudes are measured using observation sheets. The observation sheet consists of two categories. First, the observation sheet based on the discussion process. Second, the observation sheet is based on individual assignments. The scientific attitude indicator in this study consists of six indicators: (1) open to new ideas; (2) responsible; (3) objective; (4) critical thinking; (5) curiosity; and (6) self-discipline. The results of the observation of scientific attitudes for each indicator are presented in the following table:

Table 3. Open to new ideas indicator

Criteria	Experiment			Control		
	P1	P2	P3	P1	P2	P3
SB	12	18	15	16	11	8
B	9	2	2	8	10	5
C	6	9	10	6	7	11
K	5	3	5	2	4	8

Description:

SB = very good	P1 = Σ students at meeting 1
B = good	P2 = Σ students at meeting 2
C = sufficient	P3 = Σ students at meeting 3
K = less	

Table 4. Responsible indicator

Criteria	Experiment			Control		
	P1	P2	P3	P1	P2	P3
SB	13	12	11	12	8	10
B	7	7	8	12	10	5
C	7	6	7	6	9	5
K	5	7	6	2	5	12

Description:

SB = very good P1 = Σ students at meeting 1
 B = good P2 = Σ students at meeting 2
 C = sufficient P3 = Σ students at meeting 3
 K = less

Table 5. Objective indicator

Criteria	Experiment			Control		
	P1	P2	P3	P1	P2	P3
SB	4	5	5	0	3	4
B	9	12	10	4	9	6
C	9	9	10	11	12	8
K	10	6	7	17	8	14

Description:

SB = very good P1 = Σ students at meeting 1
 B = good P2 = Σ students at meeting 2
 C = sufficient P3 = Σ students at meeting 3
 K = less

Table 6. Critical thinking indicator

Criteria	experiment			Control		
	P1	P2	P3	P1	P2	P3
SB	4	5	6	4	0	0
B	10	9	8	7	10	7
C	8	8	8	15	13	10
K	10	10	10	6	9	15

Description:

SB = very good P1 = Σ students at meeting 1
 B = good P2 = Σ students at meeting 2
 C = sufficient P3 = Σ students at meeting 3
 K = less

Table 7. Curiosity indicator

Criteria	Experiment			Control		
	P1	P2	P3	P1	P2	P3
SB	0	0	3	0	2	4
B	11	12	9	8	10	5
C	4	6	9	12	13	9
K	17	14	11	12	7	14

Description:

SB = very good P1 = Σ students at meeting 1
 B = good P2 = Σ students at meeting 2
 C = sufficient P3 = Σ students at meeting 3
 K = less

Table 8. Self-discipline indicator

Criteria	Experiment			Control		
	P1	P2	P3	P1	P2	P3
SB	12	16	10	12	3	5
B	9	3	5	12	21	9
C	5	10	10	5	4	9
K	6	3	7	3	4	9

Description:

SB = very good P1 = Σ students at meeting 1
 B = good P2 = Σ students at meeting 2
 C = sufficient P3 = Σ students at meeting 3
 K = less

An open attitude to new ideas is shown through students being willing to respect other people's opinions and accept the results of the experiment gracefully. A responsible attitude is shown through students carrying out all the tasks given by the teacher. The objective attitude is shown through students reporting the experimental results according to reality and making conclusions based on the experimental results. Critical thinking is shown by answering worksheet questions correctly, seeking literacy to support investigations, and answering questions during the discussion. An attitude of curiosity is shown by asking questions during the discussion, formulating problems from the phenomena presented in the worksheet. Self-discipline is shown by students collecting assignments on time and carrying out discipline during online learning.

The application of the inquiry worksheet with the pair checks approach during online learning was not effective in improving students' scientific attitudes. The scientific attitude indicator tends to decrease for each meeting. The decline was due to the implementation of online learning due to the Covid-19 pandemic. The presence of Coronavirus Disease (Covid-19) which has been spreading in Indonesia at the beginning of 2020 made-face learning in school is transformed into online learning at home. This transformation has challenges and obstacles that cannot be avoided. Gusty et al. (2020) explain the challenges during online learning, including (1) teachers find it difficult to measure students' understanding and abilities. Face-to-face learning in class allows the teacher to see the development of student behavior directly. Still, in online learning, the teacher only sees students' abilities and understanding based on their tasks. Teachers can do telecommunication videos to conduct interviews with students, but these activities require a long time allocation; (2) standardization and effectiveness of learning. Duplication of student work results during online learning cannot be avoided and controlled; (3) lack of interaction during online learning. Interaction between teachers and students for online learning is needed so that teachers can assess the ability of cognitive, affective, and psychomotor students as a whole. One of the factors causing the lack of interaction during online learning is the internet signal.

Satriawan (2020) explains that students are burdened with the home learning program because the teacher gives assignments in a row according to the lesson plan and the teacher provides the same portion of subject matter between non-pandemic and pandemic conditions. Mastur et al. (2020) explain the obstacles during online learning, including students being late in sending assignments, students being lazy to learn during online learning at home, and teachers having difficulty determining who is doing student assignments at home. Some of the challenges and obstacles during the online learning cause the worksheet inquiry worksheet with pair checks approach is not effective in improving students' scientific attitude on the material vibrations and waves.

The application of the inquiry worksheet with the pair checks approach on vibration and wave material during online learning has advantages and disadvantages. These advantages include (1) the worksheet makes it easier for students to understand the material; (2) worksheets train students to be objective, think critically, respect other people's opinions, be open to new ideas, and have high curiosity; and (3) students get direct learning experiences through investigation. The obstacles to the inquiry worksheet application with the pair checks approach during online learning include (1) students feel confused when using PhET simulation, especially operating the buttons listed; (2) students are burdened with the demands of assignments during online learning; (3) limited learning time; and (4) the implementation of pair checks is not effective.

CONCLUSION

Inquiry worksheet with pair checks approach was effective for improving student's learning outcomes in the cognitive domains. Inquiry worksheet with pair checks approach was not effective for improving students' scientific attitudes on vibrations and waves.

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