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The Effectiveness of Guided Inquiry Learning Model on Students' Critical Thinking Ability in Simulation and Digital Communication Subjects

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Abstract:

This study aims to find out the difference in students' critical thinking ability between the use of the Guided Inquiry learning model and with expository learning model and to know the effectiveness of the Guided Inquiry learning model on students' critical thinking ability in digital Simulation and Communication subjects. The subject used in this study was a Grade X student of Software Engineering SMK 2 Surakarta. The method used is a quantitative approach with a quasi-experiment that uses a nonequivalent control group design, pretest-posttest. This study used two groups: the control group with the expository learning model and the experimental group with the Guided Inquiry learning model. Sampling techniques in this study with simple random sampling. Data collection using observations and test instruments. Data analysis on hypothesis test using Independent sample T-test with an error level of 0.05. Hypothetical testing showed significant differences in post-tests between the two groups with sig values. (2-tailed) by 0.012 <0.05.

Keywords: *guided inquiry*, *inquiry*, *critical thinking, vocational high school, simulation and digital communication*.

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Introduction

Based on the Program for International Student Assessment (PISA) survey, which reviews the quality of education in the world conducted by the Organisation for Economic Co-operation and Development (OECD), the quality of education in Indonesia has decreased from 2015 to 2018. The survey results showed that Indonesia ranked 74th in reading, 73rd in math, and 71st in science (OECD, 2019). In 21st-century learning, several skills must be mastered by learners called the Framework for 21st-Century Learning. The partnership of 21st Century Skill (2015) suggests that the competencies that learners must master are critical thinking, creativity, communication, and collaboration. In this modern era, an essential component needed in educational approaches and models is to develop necessary thinking skills (Karakoç, 2016). This is in agreement with Lucía et al. (2017) that in recent decades, a popular topic for research, debate, forum, or conference on the role of education is the need to improve critical thinking skills in learners.

Vocational High School is a place to practice critical thinking skills through the intermediary of teachers during the learning process. To improve the quality of learning and the quality of graduates, the Ministry of Education and Culture, through the Directorate General of Teachers and Education Personnel, develops High Order Thinking Skill (HOTS) (Ariyana et al., 2018). Critical thinking itself is part of high-level thinking or High Order Thinking Skill

The selection and application of appropriate learning models make learning more effective and innovative and achieve learning objectives. According to Barr and Tagg (Bihrer et al., 2019), the inquiry learning model is part of the tradition of shifting "from teaching to learning". This follows the orientation of learning in the 21st century that makes students become the centre (student-centred-learning), and from the previous passive learning turned into active learning. However, the transition still needs improvement because many still apply to teachers as centres, so students are less involved and tend to rely on teachers.

Guided inquiry helps learners change their thinking towards High Order Thinking Skills by focusing on the instructions carried out by teachers at each stage of the Inquiry (Kuhlthau et al., 2007). According to Watson (2019), in High Order Thinking Skills, there are several activities, including synthesising, analysing, reasoning, understanding, application, and evaluation. Such activities are included in the orientation of critical thinking in line with the opinion of Ngalimun (2013) that critical thinking is an effort of thinking aimed at exerting the intellectual ability to analyse, as well as conveying his views in determining the correct and appropriate conclusions.

Digital Simulation and Communication are some subjects in Vocational High School that emphasise the ability to communicate ideas and teach how to explore an idea to solve a problem related to products/services. These subjects emphasise students' critical thinking abilities. Based on interviews conducted with teachers who teach Simulation and Digital Communication subjects, teachers use expository learning models, where the learning model emphasises the process of direct instruction. The dominance of teachers in learning is still very high (teacher-centred). Using this model is considered less than the maximum to develop a student's critical thinking ability. Guided inquiry is one of the suitable learning models to develop students' critical thinking skills.

Research conducted by Nisa et al. (2018) explained that the Guided Inquiry learning model effectively improves students' critical thinking skills. The learning process using this model emphasises more on giving problems from a teacher, then requires students to get used to working critically and smoothly in formulating problems, debating, evaluating, and being able to decide what to do.

Research Method

This study employs a quantitative methodology and a pretest-posttest quasi-experiment with a nonequivalent control group design. This design is a standard method for conducting quasi-experiments, with Group A as the experimental group and Group B as the control group. (Creswell, 2014).

Before being treated, the control and experimental groups were given pre-test questions to measure students' initial critical thinking abilities. Furthermore, practical classes are treated as Guided Inquiry learning models and control classes using expository learning models. After that, students are given post-test questions. Thus, researchers can determine the effectiveness of The Guided Inquiry learning model on students' critical thinking ability.

The subject of this study was a Grade X student of Software Engineering at one of the Vocational High Schools in Surakarta. Data collection used in this research is in the form of instruments about students' critical thinking ability tests and observation of the implementation of steps from the Guided Inquiry learning model.

Instrument testing of students' critical thinking ability test using validity and reliability test. Data analysis techniques in this study using independent sample T-test. Previously, a prerequisite test of the analysis was carried out in advance, which included normality, homogeneity, and balance tests.

Result and Analysis

Result

The results of the instrument validity test, as many as 22 questions in the pre-test and as many as 23 items of post-test questions were declared valid. While the reliability test obtained Cronbach's Alpha value of 0.833 in the pre-test and 0.829 in the post-test, which means both values have a very high-reliability category. Instruments about pre-test and post-test have difficulty levels that are difficult, medium, and easy. The category of differentiating power consists of excellent, sound, and sufficient. While the distractor category is accepted on all points of the question in the pre-test and 2 points of the question are not accepted on the post-test question. Data in Table 1, are the results of the question items used for research.

Table 1. Test results of instrument test questions

Results	Pre-test	Questions used: 1, 3, 5, 7, 8, 10, 11, 13, 14, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 Drop: 2, 4, 6, 9, 12, 15, 16, 20
	Post-test	Questions used: 1, 2, 3, 4, 6, 9, 10, 11, 12, 14, 15, 17, 18, 19, 21, 22, 23, 24, 27, 28, 30 Drop: 5, 7, 8, 13, 16, 20, 25, 26, 29

After the test question instrument passes, it is treated as a Guided Inquiry learning model in the experimental class and an Expository learning model in the control class. Table 2 below is the result of observation on the implementation of steps from Guided inquiry as support to answer the objectives in this study is to know the effectiveness of Guided Inquiry in improving students' critical thinking ability.

Table 2. Guided Inquiry Observation Results

Guided Inquiry Observation	Average score	Description
For teachers	2,82	Good/ Effective
For students	2,83	Good/ Effective

Based on the observations, the guided inquiry received a score of 2.82 for teacher observation and 2.83 for student observation. Both scores fall into either or effective categories.

After the implementation of the instrument testing test question, then both classes were given treatment and conducted research data retrieval with the data result in Table 3:

Table 3. Average Pretest-Posttest Results of Students' Critical Thinking Ability

Class	Average Student Critical Thinking Ability Results
Pretest Control Class	63.47
Posttest Control Class	72.59
Pretest Experiment Class	62.66
Posttest Experiment Class	77.91

Based on the average results of the Student Critical Thinking Ability Pretest-Posttest above, students experienced a 23.86% increase in critical thinking ability in the experimental class. While in the control class, students experienced a 14.37% increase in critical thinking ability.

The Figure 1 presents an increase in grades on each critical thinking capability-building indicator in control and experimental classes. Six indicators develop critical thinking ability: interpretation, analysis, evaluation, inference, explanation, and self-regulation.

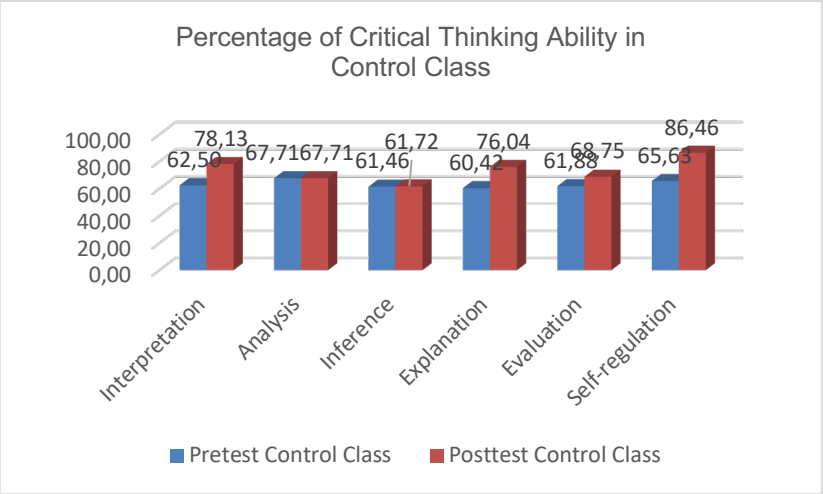

Figure 1. Percentage Data of Students' Critical Thinking Ability in Control Class

Based on the data, it can be known that five indicators have improved, and one indicator has not improved. Meanwhile, the increase in value in each critical thinking indicator in the experiment class is presented in the Figure 2 below:

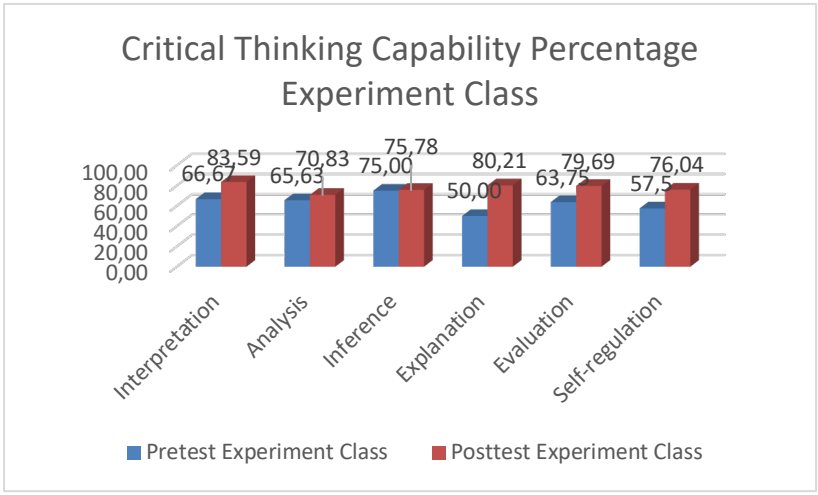

Figure 2. Percentage Data of Students' Critical Thinking Ability in Experimental Classes

Based on the diagram above, the data shows that the percentage of grades from all indicators of critical thinking ability-building students in the experimental class increased.

Table 4 are the results of hypotheses in this study that use an Independent sample T-test:

Table 4. Hypothetical Test Results

Sig.(2-tailed)	Criteria	Decision
0,012	<0,05	there are differences

Based on the results of hypothesis testing using the Independent sample t-test, obtained a sig (2-tailed) value of 0.012, meaning the value of sig (2-tailed) is less than $\alpha = 0.05$. So it can be concluded that H0 is rejected or Ha is accepted, which means there is a difference in students' critical thinking ability between using the Guided Inquiry learning model and the expository model in Simulation and Digital Communication subjects.

Determining the effectiveness of using the Guided Inquiry learning model and expository to improve student's critical thinking ability was also tested using normalised gain with the result depicted in Table 5:

Table 5. Normalised Gain Results

Class	*Standard Gain*	Description
Experiment	0,3985	Good
Control	0,1895	Low

Based on the normalised gain calculation results in the table above, the standard gain in the experiment class is better and categorised than in the control and low classes.

Analysis

There are differences in students' critical thinking skills between control and experimental classes. This is indicated by the average results of the student's post-test scores. In the control class, the average score was 72.59, while in the experiment class, the average post-test score of students was 77.91. Based on these results, the average post-test value in the experiment class was higher than in the control class. Differences in students' critical thinking ability between the control and experimental classes were also shown in the results of hypothesis testing using the Independent sample T-test.

Based on independent sample t-test results in post-test assessment, after being given treatment, that showed a significant difference between the experimental and control classes with the sig (2-tailed) scores of 0.012. According to this, H0 is rejected, while Ha is approved if the sig (2-tailed) value is smaller than the significance level of 0.05. That is, there is a difference in students' critical thinking ability between the use of Guided Inquiry learning models and expository models in Simulation and Digital Communication subjects.

Based on the pre-test results, it is known that students in the experimental class still have low critical thinking ability. The average pre-test value of the critical ability of the experimental class of 62.66 shreds of evidence. Then after being given treatment in the form of implementing the Guided Inquiry learning model, the average value on the post-test rose to 77.91. The average difference in students' critical thinking ability scores from the pre-test to the post-test is 14.95. Thus, learning in the experimental class with the Guided Inquiry learning model caused students to experience a 23.86% increase in critical thinking ability. Learning in control classes using expository learning models, students also experience increased critical thinking skills. Before being treated, students in the control class had less critical thinking ability, with an average pre-test score of 63.47. After being given an expository learning model, students' critical thinking ability increased, with an average post-test score of 72.59. The difference between the pre-test and post-test values in the control class is 9.12. Thus, in the control class, students experienced a 14.37% increase in critical thinking ability.

The increase in students' critical thinking ability in the experimental class was higher than in the control class. The results follow research conducted by Nisa et al. (2018), which explained that the Guided Inquiry learning model effectively improves students' critical thinking skills.

The pre-test, post-test, and hypothesis test results prove that using the Guided Inquiry model is more effective in improving students' critical thinking ability. It is relevant to the presentation presented by Anggriawan et al. (2018) that in the learning process using guided inquiry, students are guided by a teacher about developing student independence by honing their confidence, raising students' spirits through the formulation of their problems, and conducting discussions guided by teachers. Thus, such treatment helps students in developing their critical thinking.

The effectiveness of using the Guided Inquiry learning model is also supported by the results of normalised gain calculations conducted in control classes and experiments; there are differences in both. The experiment class has a higher common gain value when compared to the control class. In the experiment class, the common gain value was 0.3985 (good category), and the control class obtained a standard gain of 0.1895 (low category). Thus, using Guided Inquiry learning models in practical classes is more effective than expository learning models in the control class.

This study also obtained the percentage of value increase data from each indicator of critical thinking ability-building students. Indicators of students' critical thinking ability, according to Facione (2011), include interpretation, analysis, inference, explanation, evaluation, and self-regulation. Exposure from percentage data increase is as follows:

The increase in the value of each indicator of critical thinking ability building students in the control class obtained results in the interpretation indicator percentage of pre-test to post-test grades increased from 62.50 to 78.13. The analysis indicator has the same percentage of pre-test and post-test values of 67.71, so there is no improvement. The inference indicator has almost the same percentage of pre-test and post-test values of 61.46 and 61.72. The explanation indicator has a pre-test value percentage of 60.42 and maximises the increase to 76.04 in the post-test value. The evaluation indicator increased from pre-test to post-test in percentage value from 61.88 to 68.75. The last indicator, self-regulation, also increased the percentage of value from the pre-test to the post-test from 65.63 to 86.46.

While the experimental class obtained a more significant increase in each indicator, the interpretation indicator has a pre-test percentage of 66.67. It maximises the increase to 83.59 in the post-test value. The analysis indicator increased from pre-test to post-test in percentage value from 65.63 to 70.83. The percentage of pre-test to post-test values in the inference indicator increased from 75.00 to 75.78. The explanation indicator has increased the percentage of pre-test to post-test values, which is quite significant, namely 50.00 to 80.21. The evaluation indicator increased from pre-test

to post-test in percentage value from 63.75 to 79.69. The last indicator of students' critical thinking ability, namely self-regulation, also increased the percentage of grades from pre-test to post-test from 57.50 to 76.04.

Each critical thinking indicator in the Guided Inquiry class has increased more than in the expository class. This follows the observations on implementing the Guided Inquiry synth, which resulted in a score of 2.82 observations of teachers and 2.83 observations of students. This means that the guided inquiry model, according to Kuhlthau et al. (2007), used in this research is carried out correctly and effectively.

Conclusion

According to the study results, there are differences in students' critical thinking ability between Guided Inquiry learning models and expository models in Simulation and Digital Communication subjects. Experimental classes improve students' critical thinking skills more effectively than control classes.

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