Guided inquiry model effect on students learning outcomes in static fluid

R T Kusuma¹², S M Siahaan ², N Andriani ²

¹ MTS Manbaul Hidayah Palembang, Indonesia
² Physics Education Department, Universitas Sriwijaya, Palembang, Indonesia

*Corresponding author’s email: raahmatrikusuma@gmail.com, mr_sardi@yahoo.com

Abstract. Guided inquiry is a suitable model to apply in the science classroom. This research aims to determine the impact of guided inquiry learning model in the static fluid on student learning result of high school grade XI in the second year PUSRI Palembang. The sample of this research was 48 students. A method used was quasi-experimental and pre-test-post-test control group design. Instrument used in this study which was test instrument learning outcomes in the form of 20 questions multiple choice which have been declared valid and reliable. Based on the data analysis of an experimental and the control group found data were that distributed normally and homogeneity therefore, hypothesis testing was committed by using t-test. It can be concluded that guided inquiry learning model impact on student learning outcomes topic of static fluid at senior high school PUSRI grade XI Palembang.

1. Introduction

The study of physics is more emphasis on the process finding. Inquiry, discovery, and improvement science process skills re a way to make physics learning being more effective but the several schools’ physics learning is still implementing yet. Students are expected to absorb information passively and then remember it during the test. Besides, students have been found to have difficulty with the nature of the subject requiring special skills in navigating the variety of learning tasks like using equations/formulas, problem solving, theoretical/conceptual understanding, spatial reasoning, and experimentation [1]. Basically, the nature of teaching physics should regard physics as products, processes, attitudes, and applications in everyday life [2]. The static fluid concept is a physics topic related to daily existence. By learning the static fluid concepts teaches the student to think, find problems in everyday life and solve them based on relevant theories and concepts [3].

Learning outcomes are described as written statements of what a learner is expected to know, understand and/or be able to do at the end of a period of learning [5]. In addition, learning outcome is an indicator to measure learners learning effect as well as a major item for the evaluation of teaching quality [4]. Learning outcomes of students are influenced by many factors [2]. One of them is how to teach concepts based on teaching models. In line with the prior research that the factors affecting low learning outcomes such as learning models [5]. The selection of learning models a very crucial. Effective learning activities use a variety of teaching and learning methods to meet the students’ needs and to
achieve the desired learning objectives [6]. However, the modification of learning mindset always evolves. The learning that allows students to participate actively enables the students to not only receive knowledge, but also gather information, record it systematically, do discussion, compare the data, analyze, and draw conclusions. The time allocation can affect the pupils’ successful learning.

In education, teachers held an important role in achieving the successful learning outcomes. Yet the teacher is seen as a disseminator of knowledge, the knower of the answer and a lecturer who heavily relies on textbooks as the only available instructional material; conveys facts and procedures to students and hardly encourages students to engage in practical and creative learning activities [14]. The traditional lecture method of teaching has been largely criticized for stifling interest and creativity in students thereby limiting academic achievement [7]. Moreover, several of the models used by a teacher are expository and make students to being more passive. In addition, many Indonesia school teachers use traditional lecture model and they have still a huge number teacher-centered learning.

Guided inquiry is an aspect of transformational teaching which has been spurred by the development of several learning principles and methods of instruction, including active learning, student-centered learning, collaborative learning, experiential learning, and problem-based learning [8]. Furthermore, those activities involve the student in the learning process rather than allow the student to passively gather information from a delivered lecture in the more traditional ‘stage on stage’ method of instruction [10]. Thus, one way to improve pupils learning outcomes is to use an inquiry-based learning model. Guided inquiry model can improve students’ cognitive learning outcomes. The Guided inquiry teaching method is a teaching method that enables students to move step-by-step from the identification of a problem defining the problem formulation hypothesis, collection of data, verification of results, and generalization to the drawing of conclusion [17]. Guided inquiry method, on the other hand, is an approach to teaching in which students are guided by the teacher to find facts for themselves. The method also helps students to engage in relatively sophisticated mental processes like formulating problems for investigation, formulating hypotheses, designing experiments, synthesizing knowledge, possessing scientific attitudes. Furthermore, the guided inquiry method enhanced students’ achievement in science lessons, biology inclusive [9].

However, Pupils learning outcomes are still low. The low learning yields of physics, among others, because students infrequently experimenting in learning. The passive process such as traditional or direct learning makes pupils unable to construct their thinking structures that impact memorizing knowledge. Furthermore, unlike the case with physics lesson uses a traditional learning model of requiring a lot of hours. Whereas the class/lecture has a number of finite hours thus content must be covered in a designated time. On the other hand, guided inquiry model is effective learning in the small class size. In the prior research [11] that is classes larger than 250 students have the lowest average inquiry score whereas Classes with less than 50 students have the highest average inquiry score. Another research showed that Undergraduate biology courses at many universities have trouble applying guided inquiry due to variation in student knowledge and large class size [12]. Thus, the present study uses the small class size. Yet, this is not about the query. It is whether it can gain students’ learning outcome in static fluid preferable than lecture model. Therefore, this research is to find out the lecture model and guided inquiry model impact toward students learning outcomes of static fluid.

2. Methods
The research was conducted at public senior high school PUSRI Palembang, Indonesia of the second-year students in February 2016. The sample of this research was 48 students that the research was taken by random sampling. The number of students in the experimental class (guided inquiry) was 24 students, and 24 pupils were control group. The subject taken was XI grade students who have not received static fluid topic.

The method used was quasi-experimental and pre-test post-test control group design. Data were analyzed by N-gain of Hake, normality test using significant Lillifors, a test of homogeneity with F test and statistic test using t-test. The instrument of the study has been validated which consist of 20 multiple
choice questions. The instrument used was the validity test, reliability test of Kuder-Richardson and level of difficulty-test.

Guided inquiry and conventional model were implemented for three weeks in the distinct classes. The learning topics in both were hydrostatic pressures, water lift force, and Archimedes law. Guided inquiry learning used the stages/phases of learning that are an introduction, questioning, planning, implementing, concluding, and reporting.

3. Results and Discussion

An analysis in Figure 1 reveals that the mean of the experimental group (guided inquiry) on the pre-test was 34.37 while that of the control group (traditional lecture model) was 33.33. This indicates that there were variations between the pre-test mean scores of pupils. The mean pre-test score of the guided inquiry group was higher than that of the conservative lecture model group. This result is similar to the prior results [8], [10]. Nevertheless, in the post-test, the control group (traditional lecture model) and the experimental group (guided inquiry) got mean scores of 69.37 and 81.25. The both of the groups were a significant improvement. This upshot can be equally found another research [9].

![Figure 1. Means of experimental and control group](image)

In Figure 2, the mean of male and female pupils who were taught by the guided inquiry model (experimental group) and the traditional model (control group). Female pupils in the control group, their average pretest score was 34.68, their post-test score was 68.75 while their mean gain score was 34.06. Their counterparts in the experimental group (guided inquiry) had a pretest mean score of 33.18, a post-test mean score of 79.09 and an average gain score of 45.9.

The bar graph in Figure 2 shows that the average pretest of male students in the experimental group was 35.38. The post-test, male students in the control group (lecture model), obtained the mean score of 30.62 indicating a mean gain of 39.37. The post-test mean score for male students in the experimental group was 85.38 with a mean gain of 45.9. These analyses exhibit that male and female students in the experimental group (guided inquiry) gained higher mean score in static fluid then those taught with the traditional model.

The results indicated that the pretest scores of the genders’ students in both of the groups were slightly different whereas both of the groups post-test significantly differed. In addition, the mean academic gains of male and female students in the experimental groups were higher than both of the gender of the control group. Nevertheless, data for this study indicated that while male students in both the experimental and control groups had more academic gains than female students in both groups. This finding suggests that male students in both groups performed better than the female students. On the other hand, the finding disagrees with that of [13] who found a contrary that the male pupils were lower academic gains than female pupils in both of the groups. This disagreement could because the present study was on physics, while [13]’s study was on Social Studies. In addition, in the line [14,15] found
that gender discriminated in favor of males in guided inquiry. The author explained that their finding was because boys are typically guided towards scientific or technological knowledge rather than in social studies which is not a science subject.

![Figure 2. Means of experimental and control group (males and females)](image)

Table 1 shows that an experimental group gain was 48.54 and the score of 36.46 was gain of the lecture model. The control group obtained a mean N-gain score of 0.53 with the medium criteria while the experimental group (guided inquiry) got a mean N-gain score of 0.71 (high level). Therefore, the mean learning yield N-gain of pupils taught the static fluid topic with the guided inquiry model was higher (the slightly significant) than that of those taught with the conventional lecture model. It concluded that students learning outcomes improve using guided inquiry model. This finding is in parallel to the previous research results [13] who found the sharply significant on the gain scores of students learning outcomes.

**Table 1. Means of students learning outcomes**

| Treatment Group      | Gain | N-Gain | Criteria   |
|----------------------|------|--------|------------|
| Experimental Group   | 48.54| 0.71   | high       |
| (Guided Inquiry)     |      |        |            |
| Control Group        | 36.46| 0.53   | medium     |
| (Lecture Model)      |      |        |            |

Table 2 describes that normality of the experimental group was 0.158 and 0.104 was the control group. The L-calculated were lower than L-critical at 0.173. The homogeneity-test was 1.37 (F-calculate), it was lower than t-critical at 2.00. The study's data are concluded normally distributed and homogeneity, it has met the requirements for testing the hypothesis. After the data meets the provisions of homogeneity and normality then test this hypothesis using t-test.

The t-calculated is higher than the t-critical at 2.021, there is a significant discrepancy between groups therefore the null hypotheses is not accepted. The sharply divergence is in favor of a guided inquiry model implying that the pupils taught with the model performed better than those taught with lecture model. This finding is in the parallel to some prior research results [13,16] who found no significant the t-calculated hence the mean scores of post-test was slightly increased.

Students in the guided inquiry model were more engaged in tasks and activities than the students taught with the traditional lecture. They followed the guided notes, reviewed and studied them carefully, did their assignments timely and evaluated them by themselves [13].
Table 2. Normality-test, homogeneity-test, and T-test of experimental and control groups

| Treatment Group              | Normality-test | Homogeneity | t-test       |
|------------------------------|----------------|-------------|-------------|
|                             | SD             | L-calculated| F-calculated| T-calculated|
| Experimental Group (Guided Inquiry) | 48.58          | 15.214      | 0.158       | 1.37         | 3.023       |
| Control Group (Lecture Model)  | 36.45          | 12.978      | 0.104       |              |             |

This study examined the influence of guided inquiry teaching model on student learning outcomes in fluid static. The upshot of table 2 is control group which preached students using the lecture model that is lower than students in the guided inquiry. Besides, both of groups of pretest outcomes did not show the appreciable discrepancy significantly because they have not been given the affecting implementation. The finding [9,10] was the leverage of guided inquiry in producing students learning yield. These researchers found out that guided inquiry model makes the positive effect for students. It means that reducing low learning outcomes in static fluid can take this model to give learning in the classrooms. The physics teachers commit this model in teaching static fluid thus students' low learning proceeds can be improved.

4. Conclusion
Guided Inquiry learning had a significant positive impact on pupils learning upshots more than the conservative lecture model. This model is possible a learner to be favorable amplifying in a topic and focuses on students. Various adversities encountered that is low performance of physics, there is a topic in everyday existence that is able to be decreased misconception in the guided inquiry model what is efficacious and teacher-led. It is the activity-oriented nature which can whet pupils being attractive to study. The research upshots have attested taking the guided inquiry model in static fluid that boosts a teacher to improve the students learning outcomes. Thus, the preceptors require to be trained on how to manage time, class participation, interaction, and turn-taking in guided inquiry.

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