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The Effectiveness of the Jigsaw Teaching Model Assisted by Online Discussion (JAOD) to Improve Learning Outcomes of Capita Selecta Science in Physics Education Students

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Abstract: This study aims to analyze the effectiveness of the JAOD teaching model to improve the learning outcomes of S1 Physics Education S1 students. The research was conducted by applying a one group pre-test and post-test design for 18 students at the State University of Gorontalo, Indonesia. Before and after the learning process was carried out, students were given a pre-test and a post-test test for the science selecta capita learning outcomes. When the learning process is carried out, observations on the practicality of the model are carried out. The data collected from the pre-test and post-test were analyzed using paired t-test and n-gain analysis. The results of the study indicate that the JAOD teaching model is effective in improving the learning outcomes of physics education students' capita selecta of science, which is indicated by: (1) there is a significant difference in the learning outcomes of physics selecta capita learning outcomes before and after the application of cooperative teaching model assisted by online discussion; (2) Improving the learning outcomes of science selecta capita with n-gain in the high category.

Keywords: Capita Selecta Science; Jigsaw; Online Discussion.

Introduction

St. Science learning in schools, especially both junior high schools and in Madrasah Tsanawiyah is expected to be a vehicle for students to learn about the environment and the surrounding nature, and apply it in daily life. The purpose of science education emphasizes an understanding of the environment and the surrounding nature and the wealth it has that needs to be preserved and maintained in the perspective of biology, physics, and chemistry. The integration of various concepts in science and social studies subjects uses the approach of various disciplines, where the boundaries of disciplines are no longer visible firmly and clearly, because the concepts of the disciplines blend and / or are related to the problems encountered around them. These conditions make it easier for science and social studies learning to become contextual learning.

Integrated science learning is integrated through biological, physical, and chemical content. Integration can be done by connecting, namely learning is done on the content of a particular field (e.g. physics), then the content of other relevant fields is also discussed. For example, when studying temperature (physical content), the discussion is related to the efforts of warm-blooded living things to maintain body temperature (biological content), as well as compounds used in the AC system (chemical content).

Previous learnings that were implemented in science learning, especially physics concepts at one of the State Junior High Schools in Gorontalo were then implemented in capita learning selecta of physics science II in the Physics education study program of Gorontalo State University. The teaching of the science selecta II capita is related to integrated science learning at the junior high school level. Science concepts related to

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physics, chemistry and biology concepts with connected models. Learning is carried out using an innovative model that has been applied in science learning at one of the state junior high schools in Gorontalo City. Innovative learning in the form of applying a jigsaw learning model based on laboratory activities. In the lecture, discussion of potential and obstacles in implementing learning models at the junior high school level was carried out. The goal is that students who are prospective teachers have the ability to innovate in learning at the junior high school level.

Implementing Lecturer Assignment in School, especially one of junior high school in Gorontalo City in capita lectures as close as science II can improve the quality of preparation of prospective professional teachers, among others, is to develop various innovations both learning and media developed in the study program. Physics education to Laboratory Schools and/or Partner Schools related to the rapid development of educational sciences and learning theories, facilitating lecturers to provide an overview of the experience of learning application in Mitra Schools, and strengthening partnerships between physics education study programs and Laboratory Schools and/or Partner Schools, whose estuary is to improve the quality of student graduates. prospective teachers of the physics education study program.

The implementation of Lecturer Assignment in School in junior high schools uses a Jigsaw-type cooperative learning model. In its application there is an improvement in the quality of learning and learning outcomes from the first cycle to the second cycle. Teaching using a cooperative model is one of the learnings that can play an important role in student-centered teaching. one type of cooperative learning model is the Jigsaw. In the jigsaw students into teams of several people studying academic material that has been divided into several subs (Rahmawatia & Azma, 2018). Many previous studies have shown that the jigsaw method improves student activity and learning outcomes at different levels of education. Many previous studies have shown that the jigsaw method increases the activity and learning outcomes of students at various levels of education in learning science, both cognitive learning outcomes, skills or attitudes (Suroso, 2018; Gaffar, 2017; Rahmawatia & Azmia, 2018).

In the implementation of jigsaw learning model activities in addition to using face-to-face discussions through expert group discussions and origin groups, also utilize online discussions by utilizing social media. The use of social media in learning has become a development in the digital era. Guru as an educator can design learning that utilizes features in social media to support teaching and learning in schools (Fatimawati et al., 2020)(Gardenia et al., 2019).

Based on the description in the introduction, the study aims to analyze the effectiveness of the JAOD teaching model to improve the learning outcomes of S1 Physics Education S1 students.

Method

This research is an experimental research carried out in the Capita Selecta Science 2 course. Research emphasizes the effectiveness analysis of jigsaw cooperative models assisted by online discussions to improve learning outcomes on the concept of integrated science. Analysis of the effectiveness of the JAOD teaching model was carried out by: testing the difference in the average score between the pre-test and post-test statistically at $\alpha = 5\%$; calculating the average n- gain; and testing the difference in the average score of n-gain; and calculating the average percentage of student responses for each component.

This research was conducted on capita learning selecta science 2 with the Jigsaw cooperative teaching model. The number of samples in the study was 18 students from a population of 36 students who took capita lectures in science selecta 2 at the Physics Education Study Program, Gorontalo State University, Indonesia.

The experimental research design used is one group pre-test and post-test design, namely: O_1 X O_2 (Fraenkel, Wallen, Hyun, 2012). Before the group of students learns about the capita selecta of science, students are given a preliminary test (pre-test) about the capita of the science selecta (O_1). The group of students was then given acapita learning selecta of science using the JAOD (X) teaching model with learning tools consisting of: Semester Learning Plans, Student Teaching Materials, and Student Activity Sheets. The use of learning devices during the lecture process until the learning process is complete, after which all student groups are given a final post-test (O_2) test with the same topic and problem as the pre-test. Meanwhile, to get data about: capita learning outcomes as close as students' science II, learning implementation, and student response.

The data that has been collected is analyzed to obtain the practicality and effectiveness of learning with the JAOD teaching model to improve the ability of learning outcomes of science ii selecta ii physics students. Data analysis of the practicality of the JAOD teaching model was carried out using the calculation of the average implementation score of each phase. Meanwhile, analysis of the effectiveness of the JAOD teaching model was carried out by analyzing the average pre-test and post-test scores with: (a) paired-sample t-test or non-parametric analysis of Wilcoxon's test; (b) calculate the average n-gain with the Hake formula (Formula 1):

$$n - gain = \frac{(\text{post test score} - \text{pre test score})}{(\text{maximum score} - \text{post test score})} \quad (1)$$

with categories: (1) high if the n-gain ≥ 0.70; (2) moderate if 0.70 > n-gain ≥ 0.30; and (3) low if the n-gain < 0.30 (Odja & Hasan, 2022)

Result and Discussion

Results The implementation of each phase of the JAOD teaching model was observed at each meeting for all groups. The performance scores of each phase of the JAOD teaching model for all groups are presented in Table 1. Pre-test and post-test scores of capita learning outcomes of science selecta for all students, Figure 1 average pre-test and post-test before and after a capita lecture of science selecta using a jigsaw model assisted by online discussions.

Table 1. Percentage of Pre-Test and Post Capita Tests Is At The Same Time as Science

Respondents	Pretest (%)	Post-test (%)	N_Gain
Respondent 1	9.52	97.6	0.97
Respondent 2	4.76	88.10	0.88
spondent 3	4.76	80.95	0.80
Respondent 4	1.43	92.86	0.93
Respondents 5	4.76	97.62	0.98
Respondent 6	0.48	92.86	0.93
Respondents 7	19.05	92.86	0.91
Respondent 8	2.38	95.24	0.95
Respondent 9	2.38	92.86	0.93
Respondents 10	14.29	97.62	0.97
Respondents 11	4.76	95.24	0.95
Respondents 12	2.38	90.48	0.90
Respondents 13	11.90	85.71	0.84
Respondents 14	9.52	97.62	0.97
Respondents 15	7.14	90.48	0.90
Respondents 16	7.14	95.24	0.95
Respondents 17	4.76	95.24	0.95
Respondents 18	2.38	95.24	0.95
Average	6.32	92.99	0.93

From Table 1 it is shown that the increase in capita learning outcomes of science II is in the high category both individually and on average. In figure one is also shown the average results of pre-test and post test results of capita learning as close as science II.

Figure 1 shows that based on the average pre-test and post-test scores the capita learning outcomes of science are higher in the percentage of post-tests than pre-tests. This shows that the learning of social media-assisted jigsaw models has an effect on capita learning outcomes as close as science. To test the influence of learning significance, a test is performed differently on average with the Wilcoxon test. The significant test is shown by Table 2.

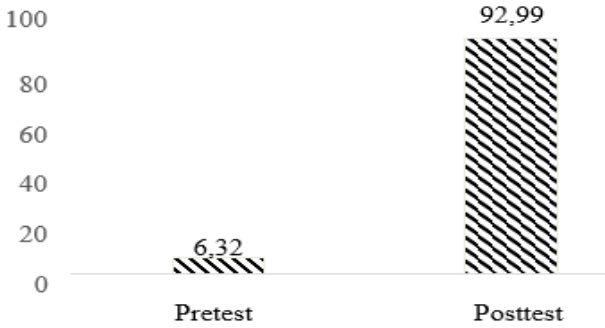

Figure 1. Pre-test and post-test Average Scores of Capita Learning Outcomes as High as Science II

Table 2. Wilcoxon Test on Pre-Test and Post-Test Results

	Post-test - Pre-test
Z	-3,732a
Asymp. Sig. (2- tailed)	.000

a. Based on negative ranks.
b. Wilcoxon Signed Ranks Test

Wilcoxon's analysis in Table 2, showed a significant difference between the learning outcomes of science ii selecta before teaching and the Jigsaw learning model assisted by online discussions and after the implementation of the model. This is indicated by the significance value of 0.000 in Table 2.

Based on data analysis, the improvement of learning outcomes and statistical tests of average differences showed a significant increase between learning outcomes after lectures using a revised jigsaw learning model and assisted by online discussions. Improvement is possible because of various aspects including: students are given the opportunity to discuss the concepts of capita selecta science with other students in expert group discussions, discussions in the expert group there are two students who come from the same group so that the students if they return to the original group complement each other in providing explanations of concepts obtained from the expert group. Group members in both the expert group and the original group have a sense of responsibility in providing explanations on the concepts being discussed. Students in addition to studying with responsibility for themselves are also responsible with group friends and classmates to study together. This is as revealed by previous research which states that jigsaw-type collaborative learning, students not only learn and accept what is presented by the teacher/lecturer but also learn from other students and at the same time can teach other students (Adams, 2019; Rahmawatia et al., 2018). These results are in accordance with research on the application of cooperative learning by integrating 21st

century skills to improve students' written communication skills (Gardenia et al., 2019; Gaffar, 2017).

In addition to face-to-face discussions of expert groups and groups of origin, there are also online discussions about topics and assignments that have not been completed in the classroom. These online discussions can help students explain to each other about topics and assignments that are not yet understood. Face-to-face discussions and online discussions will complement each other towards understanding the concepts/topics discussed. The use of social media in online discussions can provide great benefits if it is optimized to complete understandings that all students do not understand. Survey results and data analysis in several studies found that social media can improve communication skills and academic abilities (Mukhaini & Al-badi, 2014; Boateng & Amankwaa, 2019; Fatimawati et al., 2020; Gardenia et al., 2019). Social media designed in helping effective learning improve the objectives of various aspects of learning. Several studies by the author and other researchers show the effective results of social media learning in learning environments both at universities and at schools (Tess, 2013; Fatimawati et al., 2020; Gardenia et al., 2019). This is in line with the opinion of Ledimo and Martins who stated that in remote distances, learning through social media can be a good way to connect learners and support collaboration (Yarker et al., 2018; Fatimawati et al., 2020; Gardenia et al., 2019). It also allows learners to connect with content in a different way than face-to-face meetings, as well as create and share content in digital form.

The combination of face-to-face discussions and online discussions (blended learning) on the application of jigsaw in lectures, in addition to improving learning outcomes for science capita selecta, is also a solution to the limited time for face-to-face discussions. Through online discussions, various discussion topics or tasks that have not been resolved at face-to-face meetings can be resolved through online discussions. Student enthusiasm in discussing the online assisted jigsaw model is a potential indirectly in mastering the concept of capita science II which discusses science learning at the junior high school level both in terms of science content (especially physics concepts combined with biology and chemistry concepts) and learning concepts and practices. The results of the research are in line with several learning studies that apply blended learning strategies to science concepts which affect learning outcomes both cognitively related to understanding concepts and problem solving skills (Odja & Hasan, 2022; Jelita et al., 2022; Bokingo & Odja, 2022)

Conclusion

Based on the results of the research and discussion above, it can be concluded that the capita lecture as close to science II with the JAOD teaching model, has been proven effective, which is indicated by: (a) there is a significant increase in student science capita learning outcomes at $\alpha = 5\%$, (b) the average n-gain capita of students thanks to high categories.

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Author Contributions

The entire research process was carried out by the author in the Capita Selecta Science 2 course, starting from learning design, learning implementation and data analysis after learning.

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Conflicts of Interest

The author declares that there is no conflict of interest in this paper.

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