Implementation of Guided Inquiry Strategy Combined with Scientific Student Worksheets on the Structure and Function of Plant Tissues to Improve Learning Outcomes

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Abstract: This study aims to determine the application of a guided inquiry strategy combined with scientific student worksheets to improve student learning. The research method used is True experimental using pretest-posttest control group design. The population in this study were students of class XI MIPA MA Negeri 1 Pidie. The number of samples consisted of 132 people, and each class consisted of 33 students. The research instrument used is test questions. The data analysis technique of learning outcomes is through the N-Gain test and the independent sample t-test. The N-gain test of learning outcomes obtained that the average of the experimental class was higher than the control class, where each class was classified as a medium improvement criterion. The independent sample t-test showed a significant average difference between the learning outcomes of the experimental class and the control class, namely $t_{count} > t_{table}$ (65.8 > 1.65). The percentage of N-Gain learning outcomes in the experimental class is 77.73% in the high category. This study concludes that there is an increase in student learning outcomes on the material structure and function of plant tissue at MAN 1 Pidie in the experimental class by applying the guided inquiry strategy combined with scientific Student Worksheets.

Keywords: Guided inquiry; student worksheets; scientific; learning outcomes.

Introduction

Biology learning is a visual subject requiring multisensory involvement to understand a sequence of events or a complex mechanism. One of the objectives of learning biology is for students to understand biological concepts and their interrelationships. In achieving this learning, it is necessary to understand the basic concepts of subjects well (Setyowati et al., 2015). Appropriate learning strategies or teaching materials can influence understanding students' conceptions during the learning process.

Based on the results of interviews, students have difficulty in relating the material studied to phenomena that occur in everyday life, especially on the material structure and function of plant tissues. Based on the results of the 2019/2020 odd semester exams, questions related to the material have decreased in value, so that remedial measures must be taken to achieve optimal scores.

So far, the learning process in schools, especially on this material, uses the lecture and discussion method. Learning is still focused on using blackboards and textbooks so that students find it difficult to analyze existing information and are not guided to gain understanding independently. Some students still did not pay attention to the teacher's explanation during the learning process, slept in class, and were less active.

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Some students choose to be silent when invited to interact by asking questions, then when the teacher allows students to ask questions about material that they do not understand, only two or three students ask questions. This causes low learning outcomes for students. This is an essential basis for using concept maps for students in the learning process. Therefore, students should be taught how to use concept maps to make it easier to understand and remember the entire material being studied so that student learning outcomes become more optimal.

Student learning outcomes can be improved by using concept maps in conveying a material so that students feel interested in learning and understanding the material structure and function of plant tissues. Students also do not feel bored during teaching and learning activities, so basic competence 3.3 is to analyze the relationship between cell structure in plant tissues and organ function in plants, which will be achieved using a concept map. The concept map functions as a tool to investigate what students already know, and an evaluation tool can be used to measure learning outcomes (Maurisa and Abdullah, 2016).

Based on the learning outcomes of these students, it is necessary to take action to become better, one of which is by using learning strategies combined with student worksheets. With the student worksheets, it is expected that the learning process can create the effect of the teaching and learning process so that teaching goals can be measured by achieving learning outcomes and helping students build their own understanding.

A good teacher's understanding of the importance of choosing the right strategy in the learning process in the classroom is expected to contribute to improving student learning outcomes. Efforts made by teachers to improve student learning outcomes can be made by applying learning strategies combined with Student Worksheets. One strategy that can empower students' learning outcomes is the guided inquiry learning strategy. Wang & Posey (2011) stated that the guided inquiry strategy could actively involve students and allow them to learn independently, which will provide more opportunities for students to gain a better understanding of concepts.

Guided inquiry learning strategies combined with scientific Student Worksheets are effective in making students more thorough in carrying out activities and providing experiences and lessons related to daily activities (Rahmadani et al., 2012). Scientific Student Worksheets are effective in improving learning outcomes (Marjan, 2014). According to Permendikbud (2013), in the scientific approach, students will carry out five main activities in learning, namely observing, asking questions, gathering information, associating, and communicating.

The advantage of the scientific Student Worksheet strategy developed in this study is that it is designed in such a way with color images to attract students to read and study it. In addition, the scientific Student Worksheet contains questions or activity steps based on five scientific approaches. The images presented in the Scientific Student Worksheet also relate the material concepts to real-life conditions that have practical value. According to Nurjannah and Dwi (2019), the use of teaching materials in the learning process packaged in a creative, innovative, and interesting way can be used to achieve learning objectives.

The results of several previous studies show the effect of applying guided inquiry learning strategies combined with scientific Student Worksheets in the effective learning process used in increasing students' conceptual understanding, making students more active, and helping improve memory so that they can develop critical thinking skills and improve learning outcomes. (Nisa et al., 2018).

Based on the background of the problem, the purpose of this study was to find out that the application of guided inquiry learning strategies combined with scientific Student Worksheets could improve student learning outcomes on the material of plant tissue structure and function.

Method

The method used in this study is a true experiment using a quantitative approach (Creswell & Creswell, 2018). The research design used the Pretest-Posttest Control Group Design. The experimental class and the control class were selected by randomization. Both groups did the pretest and posttest. Only the experimental group was treated (Cresswell & Creswell, 2018).

Table 1. Research Design

Group	Sample	Pretest	Treatment	Posttest
Experiment	Random	O_1	X	O_2
control	Control	O_1		O_2

(Creswell & Creswell, 2018).

This research was carried out at MAN 1 Pidie for students of class XI science which is located in Komplek Pelajar, Jln. Medan – Banda Aceh, Tijue, Pidie District, Pidie District. The total population consists of all students of class XI.IPAMAN 1 Pidie. The research sample was class XI-IPA3, XI-IPA4, XI-IPA5, and class XI.IPA6, each of which consisted of 33 students. The experimental class was given learning material on the structure and function of plant tissue using a guided

inquiry strategy combined with scientific Student Worksheets. The control class used conventional learning, which only used textbooks.

The data collection technique in this study was carried out by means of the test method and the assessment of the concept map contained in the Student Worksheet. The research instrument consisted of multiple-choice questions to see student learning outcomes. Learning tools such as syllabus and lesson plans, research instruments used have gone through a logical validation stage by experts.

The results of the respondents' answers were then analyzed to determine the validity, reliability, difficulty index, discriminating power, and distractor function. After that, valid, reliable, discriminative questions were accepted, index difficulty was moderate to difficult, distractors functioned well and then taken to be given during pretest and posttest to see student learning outcomes on the material structure and function of plant tissue.

Data analysis techniques to determine the increase in student learning outcomes by using the N-Gain test. Analysis of the N-Gain test data using the Gain index formula and criteria (Meltzer, 2002). Next, a hypothesis test was conducted to see whether there was a significant difference between the experimental class and the control class, starting with normality, homogeneity, and hypothesis testing using the t-test (independent sample t-test).

Result and Discussion

The data recapitulation of the average score of pretest, posttest, and N-Gain learning outcomes for students in the control class and the experimental class as a whole is presented in Figure 1 below.
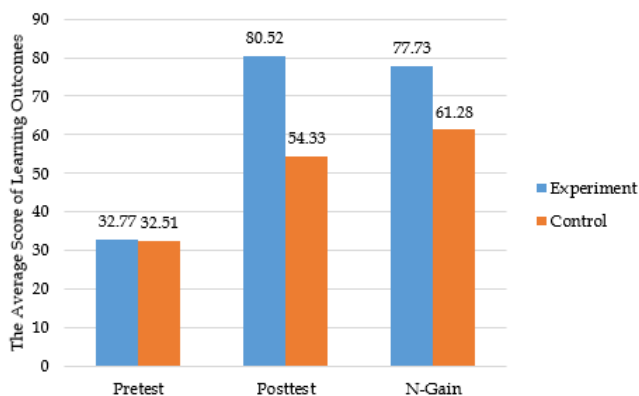

Figure 1. Comparison of the average learning outcomes of the experimental class and the control class

The results of the test of the mean difference between the pretest scores of the experimental class and the control class (Figure 1) showed no significant difference. This shows that students' initial ability in mastering the structure and function of plant tissue at MAN 1 Pidie is the same between the experimental and control classes. After receiving treatment with the application of the Guided Inquiry learning strategy combined with Scientific Student Worksheets (experimental class) and conventional strategies (control class), the mastery of the material increased compared to the initial ability (pretest). This is indicated by the results of the difference in the mean score of the pretest and N-Gain between the experimental and control classes, which are significantly different (Table 2).

Table 2. Recapitulation of Different Tests on Average Pretest and N-Gain Learning Outcomes of Students in Experiment Class and Control Class at MAN 1 Pidie

No		Experiment Class		Control Class	
		Pretest	N-Gain	Pretest	N-Gain
1	Learning Outcome	32.77	77.73	32.51	61.28
2	Normality	5.91	7.66	6.69	8.08
3	T Test	$t_{count} < t_{table}$ (1.36<1.65)		$t_{count} > t_{table}$ (65.8>1.65)	

There is a difference in N-Gain scores between the experimental class and the control class, which means that the increase in student learning outcomes on the material structure and function of plant tissue at MAN 1 Pidie in the experimental class is better than the control class. The material on the structure and function of plant tissue is considered difficult for students to understand because the material is abstract, and the many structures of plant organs are contained in the material. Therefore, the Guided Inquiry strategy combined with scientific Student Worksheets is effectively used to improve student learning outcomes so that learning is more meaningful.

With the application of Guided Inquiry learning strategies combined with Scientific Student Worksheets, students are given the opportunity to understand the concept of the material better to be achieved by gaining their own experience and knowledge, exercising their intellectual abilities, and stimulating curiosity for the knowledge they have acquired. Students can learn from the activity of working on scientific Student Worksheets so that they can master the concepts that have been taught (Astuti & Setiawan, 2013).

Student Worksheets can assist teachers in facilitating students in increasing reading, thinking, and assisting in understanding concepts. This is in accordance with the results of research (Mulyana, 2018; Febriyani et al., 2018; Jack, 2013; Zammiluni, 2018), which shows that learning using the Guided Inquiry

strategy makes a positive contribution to learning outcomes because in the learning process students are required to focus on a large amount of the Student Worksheet that must be completed in groups so that the Guided Inquiry Strategy combined with the Scientific Student Worksheet is not just solving problems, but through the Student, Worksheet students can understand concepts that have been abstract so far become real so that concepts it can be effective and last a long time in his memory.

Several factors that affect the learning process can run well, such as the condition of students who are conducive to learning, the readiness of the teacher and the teaching materials used, and the environment around the class (Helen, 2013). Therefore, the application of the Guided Inquiry learning strategy combined with scientific Student Worksheets on the structure and function of plant tissue can improve the ability of students to achieve the expected goals and obtain maximum learning outcomes. This is different from the learning outcomes obtained by students in the control class.

In the learning process in the control class using conventional learning strategies, students participate less during the learning activities. Only some students are active and involved in giving opinions and asking questions. Thus, student learning outcomes are less than optimal.

Conclusion

Based on the research and data analysis results, it can be concluded that there is an effect of applying Guided Inquiry learning strategies combined with Scientific Student Worksheets to improve student learning outcomes on the material structure and function of plant tissues.

Acknowledgments

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