**Guided Inquiry-Based Learning to Train Creative Thinking Skills of Students (High School)**

**Abstract.** The purpose of this study is to apply guided inquiry-based learning tools to practice the creative thinking skills of Grade X students on Pteridophyta material. This type of research is a pre-experimental research study using one class without any control class. The research design used was One Group Pretest-Posttest Design. The learning tools used are learning implementation plans, student activity sheets, and creative thinking test instruments. The research instrument used was a sheet of observations of the implementation of the learning model, student activities and test instruments of creative thinking skills. The pre-test and post-test results of students 'creative thinking were analyzed using N-Gain analysis which is the result of the progress of students' creative thinking skills after learning is done. The conclusion of this study is the Guided Inquiry-based Lesson plan (RPP) to train high school students' creative thinking skills on pteridophyta material implemented in the very good category. The application of the results of the development of a guided inquiry-based learning tool to train students' creative thinking skills resulted in an increase in creative thinking skills as seen from the value of N-Gain obtained by an average of 0.43 with moderate criteria. Students respond positively to the results of the development of devices and the implementation of inquiry-based learning. This is seen from the results of the analysis of student response data as much as 83.5% of students responded with very strong criteria.

*Keywords: guided inquiry-based learning, Pteridophyta, creative thinking skills.*

**1. Introduction**

Education is an important aspect of life because it is a means to form reliable human resources who are able to solve problems in their lives. Along with the swift global challenges, the government seeks to make improvements in learning practices with the aim of improving education to anticipate the flow of development of science and technology, one of which is to emphasize student-centered learning with the hope that students will be able to become independent learners throughout life so that able to form qualified individuals who are able to manage, use and develop thinking power, one of which is creative thinking. Creativity is the ability to create ideas or new ideas. Someone who has creativity is able to solve problems more effectively1. Mossing2 suggests that the benefits of creative thinking are not only to enrich and deepen the learning experience, but also to prepare students to become independent individuals so that they are able to make decisions to solve problems in everyday life. Therefore, to face the challenges of modern life that is dynamic and full of uncertainty, it is necessary to develop the ability to think creatively in learning 3. Creative thinking has four aspects or indicators4, namely: fluency, flexibility, originality, elaboration.

Science learning is a study of the natural surroundings, which is related to how to find out about nature systematically so that it is directed to find out and act so that students can be more active in developing a number of knowledge concerning problem solving skills, understanding concepts, and their applications. In fact, the learning process of science in schools, especially in biology, has not been a means to empower students 'creative thinking skills, because it still relies on how to understand concepts, principles, and memorize terms in biology so that students' thinking abilities are still relatively low. Students are not given the opportunity to find answers or ways that are different from what is taught by the teacher and the learning process is too dominated by the teacher (teacher centered) and has not provided access for students to develop independently through the process of discovery 5. This will have an impact on the lack of student motivation in the learning process as a result of student activity and creativity in the learning process is reduced and students become passive. In an effort to increase the level of creative thinking of students, it is necessary to apply guided inquiry-based learning because this model is considered capable of increasing student motivation and developing understanding by building new knowledge 6 and independent learning because it allows students to actively find their own concepts or knowledge new through the process of hands-on and mind-on activity.

The purpose of this study is to apply guided inquiry-based learning tools to practice the creative thinking skills of Grade X students on Pteridophyta material.

**2. Methodology of Research**

This type of research is a pre-experimental research study using one class without any control class. This research was conducted in March 2019. The research subjects consisted of 22 high school grade X students on the Pteridophyta sub-material. The research design used was One Group Pretest-Posttest Design. The learning tools used are learning implementation plans, student activity sheets, and creative thinking test instruments. The research instrument used was the observation sheet of the implementation of the learning model, the activities of students and the test instruments of creative thinking skills.

Pre-test and post-test results of students 'creative thinking were analyzed using N-Gain analysis which is the result of the progress of students' creative thinking skills after learning is done, calculated using the following equation:

Information:

Spost = postes average score

Spre = pretest average score

Smax = maximum score

From the N-Gain calculation, the results are converted with the criteria as in Table 3.7 below.

Table 3.7 Normalized Gain Criteria

|  |  |
| --- | --- |
| N-Gain score | Normalized Gain Criteria |
| 0,3 ≤ N-Gain ≥ 0,7 | Medium |
| N-Gain ˃ 0,7 | High |
| N-Gain˂ 0,3 | Low |

**3. Result of Research**

The results of the validation of learning instrument include syllabus and lesson plans, worksheet, and assessment sheets will be described as follows:

*3.1 Implementation of Guided Inquiry-Based Learning*

The implementation of guided inquiry-based learning is observed through the stages in the lesson plans with the teacher's practice when learning activities in class. This data analysis aims to determine the quality of the implementation of learning by the teacher. The quality of the lesson plan implementation was observed by two observers during the two meetings.

The results of the quality of the implementation of guided inkuri-based learning are shown in Table 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Aspect | Delinquency | | Total average score at the meeting- | | Average | Categori |
| **P1** | **P2** | **1** | **2** |
| 1. | Preliminary activities | 1 | 1 | 4 | 3,8 | 3,9 | Very good |
| 2. | Core activities | 1 | 1 | 3,5 | 3,4 | 3,45 | Good |
| 3. | Closing activities | 1 | 1 | 3,6 | 3,4 | 3,5 | Good |
|  | Average Implementation of RPP |  |  |  |  | 3,6 | Very good |

**Information:** P1: observer 1; P2: observer 2

Based on Table 1, it can be seen that the quality score of the implementation of the guideline-based learning implementation of the preliminary, core, and closing activities has been carried out both at the first and second meetings. The average value of the implementation of the lesson plan at two meetings was 3.6 with a very good category. This shows that the teacher is very good at carrying out learning activities in class according to lesson plans together.

*3.2 Students' creative thinking skills*

Students' creative thinking abilities are measured based on the results of tests of creative thinking skills. Provision of tests carried out before (pretest) and after (posttest) learning with guided inquiry methods on Pteridophyta material. Data obtained from the results of students 'creative thinking abilities tests were further analyzed to determine the categories and improvement of students' creative thinking abilities. The purpose of this categorization is to find out the qualifications of students 'creative thinking abilities and the extent to which students' creative thinking abilities have improved after being taught using guided inquiry methods. The results of students' creative thinking abilities tests are presented in Table 2

Table 2 Analysis of N-Gain Score for Creative Thinking

| No. | Name | Pre Test | | | Post Test | | | N-Gain | Criteria |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Average | Score (%) | Criteria | Average | Score (%) | Criteria |
| 1 | A | 1,14 | 29 | KK | 2,29 | 57 | CK | 0,40 | Medium |
| 2 | B | 1,14 | 29 | KK | 2,29 | 57 | CK | 0,40 | Medium |
| 3 | C | 1,14 | 29 | KK | 2,29 | 57 | CK | 0,40 | Medium |
| 4 | D | 1,71 | 43 | CK | 2,86 | 71 | K | 0,50 | Medium |
| 5 | E | 1,14 | 29 | KK | 2,86 | 71 | K | 0,60 | Medium |
| 6 | F | 1,14 | 29 | KK | 2,29 | 57 | CK | 0,40 | Medium |
| 7 | G | 2,29 | 57 | CK | 3,43 | 86 | SK | 0,67 | Medium |
| 8 | H | 1,71 | 43 | CK | 2,29 | 57 | CK | 0,25 | Low |
| 9 | I | 1,71 | 43 | CK | 2,29 | 57 | CK | 0,25 | Low |
| 10 | J | 1,14 | 29 | KK | 1,71 | 43 | CK | 0,20 | Low |
| 11 | K | 1,14 | 29 | KK | 2,29 | 57 | CK | 0,40 | Medium |
| 12 | L | 1,71 | 43 | CK | 2,29 | 57 | CK | 0,25 | Low |
| 13 | M | 1,71 | 43 | CK | 2,29 | 57 | CK | 0,25 | Low |
| 14 | N | 2,29 | 57 | CK | 2,86 | 71 | K | 0,33 | Medium |
| 15 | O | 2,29 | 57 | CK | 3,43 | 86 | SK | 0,67 | Medium |
| 16 | P | 1,71 | 43 | CK | 2,86 | 71 | K | 0,50 | Medium |
| 17 | Q | 2,29 | 57 | CK | 2,86 | 71 | K | 0,33 | Medium |
| 18 | R | 1,14 | 29 | KK | 2,29 | 57 | CK | 0,40 | Medium |
| 19 | S | 2,29 | 57 | CK | 2,86 | 71 | K | 0,33 | Medium |
| 20 | T | 1,71 | 43 | CK | 2,86 | 71 | K | 0,50 | Medium |
| 21 | U | 2,29 | 57 | CK | 2,86 | 71 | K | 0,33 | Medium |
| 22 | V | 1,71 | 43 | CK | 3,43 | 86 | SK | 0,75 | High |
| Average | | 1,50 | 41,7 | KK | 2,31 | 65,4 | CK | 0,43 | Medium |

**Information:** KK: less creative; CK: quite creative; K: creative; SK: very creative

Based on Table 4, information can be obtained that from the submitted test, the student pretest scores are between 29 – 57 and experienced an increase after the posttest with a range of values with an N-Gain value of 0.43 with the medium category.

If analyzed for each indicator of creative thinking, namely fluency, flexibility, originality, and elaboration, the resulting increase in the value of pretest and posttest can be seen in Table 5

Table 5 Enhancing Each Indicator of Creative Thinking Ability

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Indicator of creative thinking | *N-Gain* score | Categori |
| 1. | fluency | 0,97 | High |
| 2. | flexibility | 0,93 | High |
| 3. | originality | 0,37 | Medium |
| 4. | elaboration | 0,16 | Low |

The results of the analysis of creative thinking ability indicators show the value of N-Gain on each indicator increases with a high category for fluency and flexibility indicators, while the originality indicator increases with a medium category, and elaboration indicators increase with a low category.

*3.3 Student Responses*

 The questionnaire is used to gather information about students' responses to the learning tools that have been developed. Questionnaire is given after students finish implementing the learning. The results of the questionnaire analysis of student responses can be seen in Table 6

Table 6 Results of Analysis of Student Responses

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Description** | **Responses** | | **Criteria (%)** | | **Category** |
| **Interested** | **Not interested** | **Yes** | **No** |
| 1. | he learning process of Pteridophyta material biology using the guided Inquiry learning model is very interesting and fun | 19 | 3 | 86 | 14 | Very strong |
| 2. | Learning biology in Pteridophyta material using guided Inquiry learning model is new to you | 18 | 4 | 82 | 18 | Very strong |
| 3. | Pteridophyta material biology learning using guided Inquiry learning model can help you in understanding the concept of material | 18 | 4 | 82 | 18 | Very strong |
| 4. | Using the guided Inquiry learning model, you are interested in learning Pteridophyta material | 19 | 3 | 86 | 14 | Very strong |
| 5. | Using the guided Inquiry learning model attracts your interest in learning other material | 17 | 5 | 77 | 23 | Strong |
| 6. | You feel happy with the learning model applied by researcher | 19 | 3 | 86 | 14 | Very strong |
| 7. | Guided Inquiry learning model can increase your interest in understanding the material | 18 | 4 | 82 | 18 | Very strong |
| 8. | By applying the guided inquiry learning model you feel you have the opportunity to show your ability to express opinions | 17 | 5 | 77 | 23 | Strong |
| 9. | The teacher conveys information clearly | 19 | 3 | 86 | 14 | Very strong |
| 10. | The test given is in accordance with the material being taught | 20 | 2 | 91 | 9 | Very strong |
| Rata-rata respon siswa | | | | 83.5 |  | Very strong |

Based on the results of the analysis of student responses to the development of learning tools and the implementation of guided inquiry-based learning, it was found that 83.5% of students responded positively with very strong criteria.

**4. Discussions**

*4.1 Implementation of the Implementation Learning Plan*

Observation of the implementation of the Lesson plan (RPP) is carried out with the aim to find out how much the teacher's success in implementing the stages of learning. The implementation of the lesson plan can be known from the percentage results given by two observers which are stated in the criteria of doing and not doing. The observations made by two observers showed that the RPP developed in the trials were obtained on average by 100%, so it can be said that the RPP in the trial were implemented well.

The assessment of the implementation of the lesson plan is given by two observers who get a high score with a very good category because all stages of learning are carried out and several other things namely in the core activities students are given the opportunity to observe the phenomena listed on the worksheet so that this will lead students' thoughts and ideas to formulate the problem is based on the topic given. The process of observing the phenomenon that is followed by the questioning and reasoning activity of the question is an individual process to be creative 2. After students succeed in formulating the problem or question, the problem will be the student's reference as an inquiry process. The process of finding temporary answers in the form of hypotheses to problems by exploring students' initial knowledge from reading textbooks and various learning resources will construct their own knowledge. This is consistent with Ausuble's theory that underlining the main idea is a form of initial organizing to link the new idea with existing knowledge in learning. after formulating hypotheses, students design experiments. At this stage students determine the experiment variables, determine the tools and materials and sort the steps of the experiment. All stages start from presenting the problem, making hypotheses, determining the experiment variables, determining tools and materials and sorting the steps of the experiment. The last stage, the teacher gives the opportunity for group representatives to present and communicate the results of the experiment and the teacher can comment on the course of the discussion and provide reinforcement and rectify that is not quite right. Guided inquiry learning is an activity involving students, helping students develop a complete understanding of concepts and the development of scientific processes and scientific attitudes. Presentation of the results of experiments using presentation media can help someone in adding creativity as well as the ability to think5.

*4.2 Student Creative Thinking Skill Test Results*

In this study, students' creative thinking abilities were measured by giving a test of students' thinking abilities to find out an increase in students' creative thinking abilities. To find out an increase in students' creative thinking abilities, this test is given at the time before learning and after learning. The creative thinking ability assessment sheet in this study was developed by the researcher by referring to four creative assessments, namely fluency, flexibility, originality, and elaboration. The test developed by this research is associated with pteridophyta material taught. Item selection refers to Guilford's intellectual theory which states that creative thinking or also called divergent thinking, which is the ability of students to provide a variety of alternative answers.

The ability to think creatively or divergent thinking is defined as the ability to find the many answers to a problem (based on available information) with an emphasis on the quantity, accuracy, and diversity of answers 7. Furthermore, the more possible answers given to a problem, the more creative a person is, but the answers given must be relevant to the problem at hand.

Creative thinking is an important component in the development of science and technology, because with creative thinking individuals solve a problem 2. Based on the data analysis results of the creative thinking ability assessment there was an increase in student scores from an average pretest of 41.7 with a less creative category to an average posttest of 65.4 with a quite creative category, and an N-Gain score with an average of 0.43 in the medium category. The gain value included in the medium category states that the guided inquiry-based learning device developed can improve students' creative thinking skills. This is consistent with the statement of Kuhlthau8 states that the guided inquiry based learning model can help students think creatively and find solutions in solving a problem.

Scores of creative thinking skills that have improved after guided inquiry-based learning because all aspects of creative thinking can be improved by students which include 1) fluency aspects, indicators of this aspect include being able to make as many questions as possible relevant to the topics that have been presented 7. The second is the flexibility aspect, an indicator of this aspect is that someone is able to produce several ideas so that they can change the way or method. The third aspect of originality, an indicator of this aspect is to form new ideas so that they can provide answers that are different from the others. Munandar 7 states that original thinking causes a person to be able to give birth to a variety of new and unique expressions. Fourth is the elaboration aspect, the indicator of this must be able to add or detail the ideas of others so that they can describe in detail an idea or expand it 7.

*4.3 Student Response*

Based on the analysis of student responses to the development of learning tools and the implementation of guided inquiry-based learning on average it was found that as many as 83.5% of students gave positive responses with very strong categories.

There are several sections of responses that must be filled by students, among others: the first part is about students' interest in the material using the guided inquiry learning model. This section 86% of students expressed interest in the very strong category. The second part is to find out students' opinions about the novelty of the components in the first part, and 82% of students think new with very strong categories. The third part is to find out the understanding of the concept of material using the guided inquiry model, as many as 82% of students are able to understand the concept of the material using the guided inquiry learning model with a very strong category. The fourth part is to find out the students' interest in learning pteridophyta material using the guided inquiry learning model, and 86% of students are interested in the very strong category. The fifth part is to find out the students' interest in using the guided inquiry learning model in learning other material, and 77% of students expressed interest in the strong category. The sixth part is to find out how students feel about the learning model applied, and as much as 86% feel happy to apply the guided inquiry learning model with very strong self-character. The last part is to find out students' opinions about the suitability of the material with the tests given, and as many as 91% of students think according to the category is very strong.

Based on the results of the analysis it can be seen that the response of students to the development of devices and the implementation of learning during the first trial was positive with very strong categorization. This shows that students support, feel happy, and are interested in learning to use guided inquiry models to practice students' creative thinking skills.

**5. Conclusions**

The conclusion of this study is the Guided Inquiry-based Lesson plan (RPP) to train high school students 'creative thinking skills in pteridophyta material implemented with excellent categories. The application of the results of the development of guided inquiry-based learning tools to train students' creative thinking abilities results in increased creative thinking skills seen of the N-Gain value obtained an average of 0.43 with moderate criteria. Students respond positively to the results of the development of devices and the implementation of inquiry-based learning. This is seen from the results of the analysis of student response data as much as 83.5% of students responded with very strong criteria.

**Acknowledgements**

The authors would like to express an appreciate to Prof. Dr. Endang Susantini, and Dr. Tarzan Purnomo, M.Si as validator. The highest appreciation is present to two lecturer, Dr.sc.Agr. Yuni Sri Rahayu, M.Si and Dr. Yuliani, M.Si, that have guided research from beginning until the article finish.

**References**

[1] Samasonok, K., and Hussey, B.L. 2015. Creativity Development: Theory and Practical Aspects. *Journal of Creativity and Business Innovation,* Vol. 1: 19 – 34.

[2] Mossing, S. 2013. The Importance of Creative Thinking and the Arts in Education. Bowling Green State University ScholarWorks@BGSU (<https://scholarworks.bgsu.edu/honorsprojects/37>).

[3] Hadzigeorgiou, Y., Fokialis, P., and Kabouropoulou, M. 2012. Thinking about Creativity in Science Education. *Creative Education.* Vol. 3 (5): 603 – 611.

[4] Treffinger, D.J., Young, G.c., Selby, E.C.,and Shepardson, C. 2002. Assessing Creativity: A Guided for Educators. *The National Research Center on the Gifted and Talented.* United State Department of Education.

[5] Suhartini, E., Supardi, I., dan Agustini, R. 2016. Pengembangan Perangkat Pembelajaran Model Inkuiri Terbimbing Berbantuan Teknik *Mind Mapping* untuk Meningkatkan Penguasaan Konsep dan Kemampuan Berpikir Kreatif Siswa SMP. *Jurnal Pendidikan Sains Pascasarjana Universitas Negeri Surabaya* Vol. 5 (2): 892 – 902.

[6] Kuhlthau, C.C. 2010. Guided Inquiry: School Libraries in the 21st Century. *School Libraries Worldwide.* Vol. 16 (1): 17 – 28.

[7] Munandar, U. 2014. Pengembangan Kreativitas Anak Berbakat. Jakarta: Rineka Cipta.

[8] Kuhlthau, C.C., Maniotes, L.K., and Caspari, A.N. 2007. Guided Inquiry: Learning in the 21st Century. London: libraries Unlimited. Online (https://books.google.co.id/).