Measuring the Effectiveness of Guided Inquiry-Based Modules for Training Analytical Thinking Skills in Teaching Materials on the Structure and Function of Plant Tissues for Class VIII SMP Negeri 22 Surakarta

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Abstract

Research and development objectives: measure the effectiveness of analytical thinking skills through guided inquiry-based modules. Data analysis used during research and development is descriptive analysis, percentage techniques and anacova tests. Research and development of teaching modules uses the Borg & Gall procedural model which has been modified into nine stages: 1) research and information gathering stage, 2) planning stage, 3) initial product design development stage, 4) initial field trial stage, 5) initial first stage product revision, 6) limited field test stage, 7) second stage product revision stage, 8) operational field test stage, 9) final product revision stage. The results of research and development show: the guided inquiry-based module is effective in training analytical thinking skills, because based on the results of the Anakova test, it shows that there are differences in post-test results between the experimental, control and model classes. teaching material on the structure and function of plant tissues with F Table (0.05) = 2.37 < F Calculate (0.05: 2) = 6.35.

Keywords: Teaching Module, Guided Inquiry Learning, Analytical Thinking Skills, Guided Inquiry-Based Module, Structure and Function of Plant Tissue.

INTRODUCTION

The competencies needed in the 21st century are the ability to think critically, problem solve, collaborate and think creatively (Kay, 2010). Critical thinking ability is one of the 21st century competencies which consists of the ability to interpret, analyze, evaluate, explain, conclude and self-regulate (Fascione, 2013). Analytical thinking ability is one element of the critical thinking ability that every individual has to describe and connect patterns of problems that occur in the surrounding environment. Analytical thinking ability is the ability to collect information, identify events, connect and combine data from various different sources, identify patterns of cause-and-effect relationships, and draw conclusions (Sexton, 2013). Analytical thinking skills are closely related to inquiry learning because inquiry learning contains analyzing activities, solving problems based on facts found so that conceptual understanding is obtained (Rusche & Jason, 2011). Inquiry learning is the process of collecting relevant information and using logical analysis through inquiry, as well as investigating surrounding problems so that students solve problems in the surrounding environment (Joyce & Weil, 2000).

Inquiry learning has various types and covers a wide spectrum: structured inquiry, guided inquiry, combined inquiry and open inquiry (Sadeh & Zion, 2011; Rooney, 2009). Guided inquiry is one type of inquiry learning. Guided inquiry has the characteristic that students carry out learning activities based on instructions in the form of guiding questions, while the teacher acts as a facilitator (Sumiati, 2008; Baron, 2010). The questions presented are in the form of problems in the surrounding environment, thus motivating students' curiosity in exploring information about the problems presented. Guided inquiry learning is

learning that builds students' thinking skills, so that guided inquiry learning is in line with constructivist learning theory. Guided inquiry learning is constructive learning, because students learn to construct their own knowledge actively (Trianto, 2008). Constructive learning gives students the opportunity to think about their experiences by analyzing, using their knowledge to solve problems, getting to know, collecting ideas followed by exploring ideas, putting forward explanations, formulating solutions, and taking logical actions or decisions (Kim, 2005; Demirci, 2009).

The constructivist characteristics of guided inquiry learning have the potential to develop students' thinking abilities, because various surrounding phenomena can be perceived through the five senses. Constructivist learning develops high-level thinking skills, critical thinking, analytical thinking, research activities, communication and collaboration (Gazi, 2009). The ability to think has an important role for students in trying to interpret the objects of biological study, constructing their own knowledge and looking for relationships with the surrounding environment. Students' thinking abilities experience gradual changes because they are influenced by factors that influence each student's learning process, both internally and externally. Internal learning factors are problems that arise from within students which are biological and psychological in nature. Biological problems are physical problems: health or disability, while psychological problems are psychological problems: motivation, attention, interest, emotions and mental health. External learning factors are problems that arise from outside the student: learning facilities, learning atmosphere, media and learning resources. Learning facilities are one of the external factors that are often used at SMP Negeri 22 Surakarta. Learning facilities are an important external factor in developing students' thinking abilities, because students are used to interacting directly with learning facilities.

Learning facilities play an important role in honing students' thinking skills, because the use of appropriate learning facilities makes it easier for students to absorb the lessons delivered by the teacher. The learning facilities that are often used at SMP Negeri 22 Surakarta are laboratories, libraries and printed teaching materials. Printed teaching materials are one of the learning tools used at SMP Negeri 22 Surakarta and are the main reference for students. Printed teaching materials at SMP Negeri 22 Surakarta use general printed teaching materials based on specification aspects of objectives, materials, activities, evaluation questions, delivery method and use (Mulyasa, 2006). The printed teaching materials used at SMP Negeri 22 Surakarta are Electronic Means Books (BSE), ESIS and teaching modules. The results of the analysis of BSE, ESIS and teaching modules that use analytical thinking indicators show the average value of aspects: 1) Objectives of 4.32%, 3.70% and 1.23%. 2) Material of 9.87%, 4.93% and 6.17%. 3) Activities of 2.87%, 1.23% and 1.23%. 4) Evaluation questions were 2.87%, 1.23% and 4.32%. 5) Delivery method is 4.94%, 4.93% and 14.19%. 6) How to use 3.08%, 6.17% and 8.64%. The results of the analysis of printed teaching materials that use analytical thinking indicators at SMP Negeri 22 Surakarta show that students have not developed analytical thinking skills.

Printed teaching materials are a learning tool that interacts directly with students. Printed teaching materials used in schools influence students' analytical thinking abilities. Printed teaching materials influence the development of students' cognitive abilities and higher thinking abilities in classifying, comparing, differentiating and analyzing (Oyola, 2013). The hope is that the printed teaching materials used at SMP Negeri 22 Surakarta are to present learning activities that guide students actively in investigating and discovering concepts, thereby facilitating students in honing their analytical thinking skills.

Based on thinking that aims to develop analytical thinking skills, namely, by developing and improving the teaching modules used at SMP Negeri 22 Surakarta. Teaching modules are a way of organizing learning material that refers to the sequence of presentation of learning material and shows students the relationship between facts, concepts, procedures and principles contained in teaching material (Prastowo, 2012). The teaching module acts as a link between students' knowledge and the object being studied through the activities contained in the module and provides students with the opportunity to master one unit of teaching material before moving on to the next unit (Prastowo, 2012). The characteristic of the teaching module developed to train analytical thinking skills is that it combines the components of the teaching module through guided inquiry learning, resulting in a guided inquiry-based module format. Guided inquiry-based module format: 1) Introduction to students of the investigation area: observation. 2) Finding and looking for problems: formulating problems. 3) Identifying the problem being studied: designing experiments, designing hypotheses and conducting experiments. 4) Determine strategies to solve problems based on the facts found: collect data, analyze data, draw conclusions and communicate experimental results (Joyce & Weil, 2000; Martin, et al., 2005; Gengarelly & Abrams, 2008).

Guided inquiry-based modules are modules that direct students to apply problem-solving skills and formulate alternative solutions, determine the stages of problem solving, use the principle concepts of problem-solving solutions so that students construct their knowledge and develop their metacognitive abilities (Suk-cho, 2012). Guided inquiry-based modules are expected to train analytical thinking skills, because students are guided to identify problems and their relationships, ask questions, make answers to questions, make assumptions and make logical conclusions (Hanson, 2006). Analytical thinking indicators used: 1) Asking questions related to the problem. 2) Formulate goals. 3) Using information in the form of data, facts, observations and experiments. 4) Make assumptions. 5) Imply. 6) Using concepts; 7) Using other references/discourse. 8) Make conclusions (Elder & Paul, 2007). Analytical thinking is based on the thought process of each student to analyze and generate student insight in interpreting problems, because analytical thinking is a process that teaches students to solve problems based on facts and make decisions or solutions to surrounding problems. Analytical thinking requires high thinking skills in understanding problems that occur through activities of identifying, analyzing, remembering and using available information so that appropriate alternative solutions are obtained (Amer, 2005).

RESEARCH METHODS

The research and development method uses the Borg & Gall (1983) procedural model which is modified into nine stages. The research and development procedures carried out are: 1) Research and information gathering stage. 2) Planning stage. 3) Stage of developing initial design. 4) Initial trial phase. 5) First stage product revision. 6) Limited field test phase. 7) Second stage product revision. 8) Operational/effectiveness field tests. 9) Third stage product revision. The analysis technique used is the Anakova test. Statistical analysis techniques are assisted by the SPSS 18 for Windows analysis program

RESEARCH RESULTS AND DISCUSSION

Measuring the Effectiveness of Guided Inquiry-Based Modules for Training Analytical Thinking Skills in Teaching Materials on the Structure and Function of Plant Tissues for Class VIII SMP Negeri 22 Surakarta. The effectiveness of the guided inquiry-based module for training analytical thinking skills in teaching material on the structure and function of plant tissue for class VIII SMP Negeri 22 Surakarta was calculated using the Anakova test.

Table 1. Anakova Test

Variable	F	Sig	*Partial eta squared*	Conclution
Experimental, control & model classes	6.35	0.003 (sig < 0.05)	0.145	There are differences in post-test scores between the experimental, control and model classes

Table 1 shows that there are differences in post-test scores between the experimental class, control class and model class because the significance level of 0.003 is smaller than 0.05. Anakova's test results concluded that the guided inquiry-based module was effective in training students' analytical thinking skills on teaching material on the structure and function of plant tissue. The effectiveness of guided inquiry-based modules in training analytical thinking skills is 0.145 or 14.5% (Widhiarso, 2011). Anakova's test results prove that guided inquiry-based modules are effective in training analytical thinking skills compared to school modules with a guided inquiry model, because guided inquiry-based modules are arranged systematically based on aspects of objectives, materials, activities, evaluation questions that use analytical thinking indicators in the dimensions of facts, concepts and procedural. Guided inquiry-based modules contain experimental activities that guide students to analyze, identify problems and interaction patterns that arise, describe problems, use data, evaluate answers to solve problems based on facts found so that conceptual understanding is obtained (Kai-wu & Chou-en, 2008; Khan & Iqbal, 2011).

Guided inquiry-based modules present constructive activities, because students learn to construct their own knowledge actively, thus honing analytical thinking skills. Guided inquiry-based modules have the potential to develop constructivist and analytical thinking skills because students need high thinking skills in understanding problems that occur through identifying differences, analyzing, remembering and using available information so that appropriate alternative solutions are obtained (Amer, 2005; Barron, 2010 ; Gazi, 2009).

CONCLUSION

Conclusions are: Guided inquiry-based modules are effective for training guided analytical thinking skills on the structure and function of plant tissue teaching materials compared to classes that use school modules with a guided inquiry model for class VIII SMP Negeri 22 Surakarta because they show post-test scores with F Table (0.05; 2.37) < F Calculate (0.05; 6.35). Recommendations are: Guided inquiry-based modules require improvement and development until a better guided inquiry-based module is created. Guided inquiry-based modules still require widespread testing (Disseminate) to perfect the research stages according to Borg & Gall development procedures.

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