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Development of Just in Time Teaching (JITT) Based on a Scientific Approach on Mushroom Materials to Improve Analytical Thinking Ability of Class X Senior High School Students

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Abstract *- This study aims to: 1) Develop a JiTT based on a scientific approach, 2) Find out the feasibility of a JITT based on a scientific approach, 3) Find out the effectiveness of a JITT based on a scientific approach to improve analytical thinking skills for class X SMA on mushrooms. This study uses the Research and Development (R & D) referring to the Borg & Gall model with the stages: 1) research and information gathering, 2) planning, 3) initial product development, 4) initial trial, 5) first product revision, 6) limited field test, 7) second product revision, 8) operational field test, 9) third product revision, 10) dissemination. The feasibility of the model was validated by model experts, material experts, biology teachers (practitioners), and students. Data were collected using questionnaires, observation sheets, interviews, and tests. The research data were analyzed using qualitative descriptive and quantitative descriptive methods. Analytical learning ability was analyzed using a t-test (t-test) with a posttest-only control group design. Based on the results of the study, it can be concluded as follows: 1) the development of JiTT is carried out by taking into account the characteristics of the model, namely the syntax, social system, support system, student role, teacher role, instructional impact, and accompaniment impact, 2) the results of model development learning JiTT is feasible to be applied to mushroom material. Learning model JiTT based on the assessments of experts, practitioners, and student responses which overall gave a good category to product development, 3) the JiTT able to improve students' analytical thinking skills. Statistical tests on analytical thinking ability showed that there was a significant difference (sig 0.00 < 0.05) between the control class and the experimental class.*

Keywords*: JITT learning model, scientific approach, analytical thinking skills*

I. INTRODUCTION

Mushrooms (fungi) are one of the subjects that must be studied by class X science high school students in semester 1. The subject matter of mushrooms includes general characteristics of mushrooms, classification of fungi, methods to obtain nutrition, and the role of fungi. Based on interviews with several Biology teachers for class X, information was obtained that the mushroom material is material that is difficult for students to understand. This opinion is also evident from the analysis of the results of the National Examination (UN) in 2012-2013 on mushroom material which shows that the absorption and mastery of students' concepts are still below the Minimum Completeness Criteria (KKM), which is 64.15%. Most of the questions on mushrooms are rote so that students' activeness and analytical thinking skills do not develop. The ability to think analytically is needed by students because if students have good analytical skills, then they will be better prepared to face challenges in their daily lives and as a provision for their lives in the future (Rahmawati, 2013). Analytical thinking can make it easier for students to think logically, regarding the relationship between concepts and the situations they face (Marini, 2014). Trianto (2007) states that a good education is an education that not only prepares students for a profession or position but to solves problems in everyday life. Kawuwung (2011) said that analytical thinking ability is closely related to cognitive learning outcomes and students' initial abilities. Based on some of these opinions, it can be concluded that the ability to think analytically is a thought process that is not just memorizing and conveying known information. The ability to think analytically is the ability to connect, manipulate, and transform knowledge and experience already possessed to make decisions and solve problems in new situations and all of that cannot be separated from everyday life. The causes of low analytical thinking skills on mushroom material can be viewed from four aspects, namely students as students, teachers as educators, methods, strategies, and learning models, as well as the material being studied. Students consider the mushroom material to be rote, and quite difficult because it consists of nomenclature in Latin. Students' learning motivation is also likely to be low, and students' readiness to learn this material is likely to be lacking. One of the reasons students consider this material is less important. Based on the results of observations and interviews at SMA Negeri 1 Cepogo and SMA 2 Karanganyar, the condition of students in passive student learning is that students rarely ask questions related to problems, rarely formulate goals, do not use data information, facts, observations, and experiments, rarely make assumptions, imply, using concepts, other references/discourses, and rarely draw conclusions indicating that students' analytical thinking skills are still low. In addition, based on the student's analytical thinking ability test, shows that the analytical thinking ability has not been optimally empowered. As many as 60% of class X3 students of SMA Negeri 1 Cepogo and 52% of students of X MIA 1 SMA N 2 Karanganyar class have not reached the criteria for completeness.

Teachers' centered learning causes students not to be actively involved in learning activities can result in low students' analytical thinking skills. In terms of material, namely mushroom material is difficult because the characteristics of mushroom material are concrete, but there are some microscopic ones, making it difficult for students to observe them directly, there are many Latin languages, and students do not find this group with the naked eye every day, so students can only be groping, guessing, and imagining without being able to see mushrooms. The study material in mushrooms is also too dense (Purwaningsih, 2010; Sari, 2013). To improve students' analytical thinking skills, it is necessary to apply a model that can encourage students to be actively involved in every learning activity and is based on constructivist learning, namely inductive learning. Inductive learning includes inquiry, PBL, PjBL, discovery, case-based, and Just in time teaching (Prince & Felder, 2006). Based on the analysis of the problem, and the characteristics of the mushroom material, the learning needs to strengthen the long-term remembering aspect, which is obtained through learning that is not memorizing, but constructs constructivist concepts, through direct observation, dialogue, investigation, or in line with a scientific approach. Students also need to be motivated to be ready to learn by stimulating students to prepare before class begins. Students' understanding and initial concepts also need to be known so that the new concepts to be built do not experience errors. Teachers need to understand the initial concepts of students one by one before starting learning. Activities that can be done are to give a pre-test interestingly. The learning model that can be used for this purpose is Just in Time Teaching.

II. RESEARCH METHODS

The research carried out is research and development (Research and Development), namely the development of JiTT trains analytical thinking skills in teaching materials describing the characteristics of mushrooms in class X SMA. The development is carried out using a procedural model by adapting the research and development model of Borg & Gall (1983).

Borg & Gall (1983) stated that the research and development approach is research-oriented to develop and validate the

products used in research. Borg & Gall (1983) arrange the steps in research and development: 1) Conduct research and collect information. 2) Make a plan. 3) Develop an initial product design (draft). 4) Conduct initial field trials. 5) Revise the first stage of the product. 6) Conduct a limited field test. 7) Revise the second stage of the product. 8) Conduct operational field tests. 9) Revise the final product. 10) Conduct product deployment and implementation. Research and development are carried out using steps 1 to 9 because based on time and cost considerations when deploying and implementing the product.

Research Subject

The test subjects in this study consisted of 3 groups of subjects which included an initial field test consisting of 3 expert validation, 2 model practitioners, and 15 class X students, the main field test using class X SMK Bintang Karanganyar students who will be the class to test the effectiveness of the JiTT. The subjects of the operational field test were class X SMA N 1 Cepogo and SMA N 2 Karanganyar.

Types of data

Data analysis needs were obtained from the results of tests, observations, giving questionnaires, and interviews with students and teachers about classroom learning and teaching materials. Data from

the initial field test results from expert validation results, assessments of educational practitioners, and student assessments of the model were obtained through a model feasibility questionnaire. Data from the main field test results in the form of qualitative data obtained through a model feasibility questionnaire by students. Data from the operational field test results were obtained through a model feasibility questionnaire by students, while quantitative data was obtained through an analytical thinking test

Data Collection Instruments

Data collection instruments were in the form of a validation sheet to determine the feasibility of the model from the validator in the initial field test, and a model feasibility questionnaire to determine the feasibility of the model according to educational practitioners and students on the main field test. The test was to determine the effectiveness of the JiTT before and after students received learning using the JiTT at the operational field test stage.

Data Analysis Techniques

The data obtained in this study is descriptive qualitative data analysis used for data analysis of expert validation results, assessments of educational practitioners (teachers) and students from initial, main, and operational field tests in the form of input, feedback, suggestions, and criticism of model JiTT scientifically based Quantitative descriptive analysis is used to describe the data in the form of percentages. percentage technique is used to present frequency data on the responses of research subjects to the JiTT.

Data from the post-test of analytical thinking process dimensions were calculated using the different tests of two averages of two parties (t-test) which aims to determine whether there are differences in analytical thinking abilities in the experimental group and the control group. Previously, the statistical prerequisite test for parametric normality was carried out with Kolmogorov Smirnov and homogeneity with Levene's.

III. RESULT AND DISCUSSION

JITT-based scientific to improve analytical thinking skills in mushroom material for class X SMA students. model JiTT was specifically developed to improve analytical thinking skills. Indicators

of analytical thinking used, among others: 1) Asking questions related to the problem. 2) Formulate goals. 3) Using the information in the form of data, facts, observations, and experiments. 4) Make assumptions. 5) Implies. 6) Using the concept. 7) Using other references/discourses. 8) Making conclusions (Elder & Paul, 2007). Analytical thinking indicators are used to train students to answer the questions that appear on

a) Warm Up

activities up include assignments students are given by the teacher and collected sometime before the teaching and learning process begins. Assignments encourage students to think about future lessons and answer simple questions. Students are expected to develop answers as far as they can. A Warm can also be called a pretest. Pretest has many advantages in exploring the learning process that will be implemented. Therefore, pretest plays an important role in the learning process. The functions of the pretest can be stated as follows: a) To prepare students in the learning process, because with the pretest their minds will be focused on the questions they have to answer/do, b) To overcome the level of progress of students in connection with the learning process carried out. This can be done by comparing the results of the pretest with the posttest, c) To find out the initial abilities that students have regarding teaching materials that will be used as topics in the learning process, and d) To find out where the learning process should start, which objectives have been mastered students, and goals that need special emphasis and attention. To achieve the third and fourth functions, the results of the pretest must be checked immediately, before the implementation of the core learning process is carried out. Examinations must be carried out quickly and carefully, so as not to disturb the learning atmosphere, and not distract students. For this reason, when examining the pretest, it is necessary to give other activities, such as reading handouts, or textbooks. should be done in writing, although it can be carried out verbally or in action.

b) Adjusting Concept

The concept adjustment stage can be carried out using various approaches and methods such as scientific approaches, process skills, life skills approaches, role-playing methods, laboratory experiments, group discussions, and others. Students are expected to experience changes in the concept in the right direction so that in the end the concepts they have been by the concepts of scientists. At the end of the concept formation stage, students have been able to understand whether the analysis of the issues or the resolution of the problems raised at the beginning of the lesson is by the scientists' concepts. The concept adjustment stage includes observing, collecting data, and processing data. Observing is a method that is very useful for fulfilling the curiosity of students. So that the learning process has a high meaning. Through observing pictures, students can directly tell the conditions as required in Basic Competence (KD) and indicators (Permendikbud, 2013). Good observing ability is when students use all their senses, see similarities and differences in objects, detail the differences in objects observed, and identify the characteristics of objects. Observation activities empower analytical thinking skills, namely formulating goals because with the observation/observation method students find the fact that there is a relationship between the object being analyzed and the learning material used by the teacher so that students can understand/formulate learning objectives when faced with interesting media. The questioning activity empowers analytical thinking skills, namely asking questions related to problems. Teachers must be able to inspire students to want and be able to ask questions. When the teacher asks questions, the teacher must guide and guide students to ask questions properly. When the teacher answers questions, the teacher encourages students to be good listeners (Permendikbud, 2013). Students' questioning ability is considered good if students can ask a variety of questions using the right question words, and by the concept being discussed.

Collecting data can be done by conducting experiments, reading sources other than textbooks, observing objects/events, activities, and interviews with resource persons. Data collection activities empower analytical thinking skills, namely using data information, facts, observations, and experiments, making assumptions, using concepts, and using references/other discourses. Students in this activity are expected to be able to make assumptions / formulate hypotheses on existing problems using concepts supported by existing literature.

c) Applying Concept

The concept application stage in life is armed with a correct understanding of the concept, students are expected to be able to analyze issues and find correct problem-solving. Students must take an example of action on the issue or problem raised at the beginning and must be able to explain why the action was taken. The concept application stage includes activities to process data and form a network. Data processing activities are processing data/information that has been collected both from the results of collecting and observing activities. Processing of information collected from

those that are adding depth to processing information that is looking for solutions. Data processing activities empower analytical thinking skills, which can make implications for existing problems. Learning activities to practice trying or investigating skills are as follows: 1) determine a theme or topic according to basic competencies, 2) learn how to use the tools and materials available and must be provided, 3) learn the relevant theoretical basis from the results. previous experiments, 4) conduct and observe experiments, record phenomena that occur 5) analyze, and present data, 6) conclude the experimental results, and 7) make reports, and communicate experimental results (Permendikbud, 2013). and the 7th can be included in the fifth activity in the scientific approach. The activity of forming a network consists of three steps, namely concluding, presenting, and communicating. Data activities empower analytical thinking skills, namely forming networks to make conclusions. Concluding can be done together in a single group, or it can be done alone after listening to the results of information processing activities. Presenting data in various forms of product portfolios, one of which is a written report. Written reports can be used as one of the materials for group and or individual portfolios and although assignments are done in groups, it is better if the results of recording are carried out by each individual so that they can be included in the file student portfolio In the final activity, students are expected to be able to communicate the results of the work that has been compiled together in groups and/or individually. The teacher can provide clarification so that students know exactly whether what has been done is correct or if something needs to be improved. directed as confirmation activities (Permendikbud, 2013)

IV. CONCLUSION

Conclusions are drawn from JITT model research and development scientifically based on mushroom materials including:

1) JiTT learning model development scientifically based on mushroom material is carried out taking into account the characteristics of the model learning, namely the existence of syntax, system social, support system, student role, the role of teachers, instructional impact, and impact accompaniment
2) Model development results in scientific-based JiTT learning on mushroom material deserves to support learning on the material. Appropriateness scientific-based JiTT learning model based on the judgments of experts, practitioners, and overall student response gives a very good category to the product development,
3) JiTT. learning model scientifically based able to empower students' analytical thinking skills. This matter is indicated by the difference that is significant in the average ability test results in analytical thinking between the control class and the model implementation class, with class value the application of the model is better than the class control.

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