

Lesson Plan and Problems on Understanding Basic Concepts of Fungi

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Abstract. It is argued that lesson plan significantly relates to students understanding. This research aims to analyze the lesson plan of Fungi composed by teacher and the obstacles found by students during the learning process of Fungi, and students' thinking skills. Samples are twenty-five of 11th graders of high school and five biology teachers from five senior public and private high schools in Surakarta which were purposively selected. The data of teachers' perception on how to teach the Fungi were obtained based on the analysis of the lesson plan constructed by five teachers. The data of students' learning difficulties and their thinking skills when learning about the Fungi were measured using tests and questionnaire with twenty-five students in each of the senior high schools. It was found that students have difficulties on understanding classification of Fungi (60%), reproduction of Fungi (48%), ecology of Fungi (44%), scientific names of Fungi (60%), and symbiosis of Fungi (44%). The analysis of the lesson plan show that teacher scored 60 on constructing indicators, 75 on content, 60 on method of teaching, 60 on curriculum structure, and 50 on assessment. The result show that gain scores of students' thinking skills test on the levels of remembering (C1) are 76%, understanding (C2) are 73%, and applying (C3) are 60%. It can be concluded that students have difficulties on learning basic concepts of Fungi, and teachers have met the difficulties technological pedagogical content knowledge, particularly on designing the lesson plan of Fungi.

INTRODUCTION

A teacher is one of key components contributing to a successful learning process, and therefore competencies need to be continuously promoted and developed to be able to professionally perform his/her functions and duties. Professional teachers should have competencies in constructing their learning designs [1]. A learning design is defined as improved learning system and its implementation including facilities and procedures to support the enhancement of quality of learning. It covers the coherence among material structures, material-based ways and strategies, intended objectives or competencies to transfer to students, a form of assessment appropriate to the measured competencies [2]. It can include the lesson plan which is constructed by a teacher. It provides an overview of procedures and management of learning by a teacher to achieve one or more competencies in learning. A teacher is expected to create a planned learning environment since it is impossible to maximally achieve learning targets without well-planned lessons. Clearly, constructing the lesson plan should be an initial step done by a teacher [3].

A teacher must have knowledge of the PCK (Pedagogical Content Knowledge) introduced by Shulman in 1986, and later extended into Technological Pedagogical Content Knowledge (TPACK) by Mishra and Koehler in 2006. TPACK is a combination of three essential knowledge by teachers, namely knowledge of technology, pedagogy and content. TPACK need to be controlled by the teacher to the learning activities can be run effectively and efficiently [4]. Each individual is born unequal. Individual difference in learning is associated with different

abilities to think, perceive, and perform in a class. Such difference influences learning process in a class they engage in, some students can easily follow and comprehend the lesson, while some others find difficulties in learning [5]. A teacher should be able to deal with this difference [6]. The learning process may run well if a teacher enables to recognize, understand, and notice students' differences in their ability, readiness, maturity, speed of learning. Learning at school, therefore, should be managed and planned in such a way that learners can actively participate in the learning [7].

The Fungi is included as one of the materials taught in the second semester of grade 10. The topic includes the characteristics of Fungi, the classification of Fungi, and the roles of Fungi in daily life. It introduces issues which are closely related to human life, such as human diseases caused by fungi, damage to cultivated plants as well as agricultural crops, the roles of Fungi in such fields as pharmacy and food industry. The topics of the material do not only cover macroscopic, but also microscopic fungi [8]. Learning about the Fungi indeed involves concrete learning. In practice, however, teachers present the material in such an abstract way by dividing students into several groups to discuss the material and subsequently present the results of their discussion. The learning seems to be less effective since students only learn in an abstract way without the presence of observed objects, whereas in fact fungi are easily found and are related to students' daily life. It is, therefore, required to develop specific learning designs to enable students to practice their thinking skills, particularly their higher-order thinking skills [9].

In reference to the above explanation, it is necessary to further examine teachers' knowledge on the construction of learning instruction design with regards to the contents of the material, the characteristics of learners, learning strategies, learning environment so that an evaluation on teachers' quality [10] and students' difficulties when learning about the Fungi can be done. This research aims to analyze the lesson plan of fungi composed by teacher and the obstacles found by students during the learning process of Fungi, and students' thinking skills.

METHODS

The present research belongs to quantitative research to assess lesson plans constructed by biology teachers and various learning difficulties encountered by 11th graders in Surakarta when learning about the Fungi. The quantitative research was done on obtaining the data of the score of lesson plan, students' learning difficulties, and students' thinking skills. Data were taken from November 2016 to January 2017 in two public and three private senior high schools in Surakarta. Samples are twenty-five 11th graders of high school and five biology teachers from five senior high schools were selected by purposive sampling technique, in which the senior high schools selected as samples included those of which students and teachers were willing to participate in this research. There are seventy biology teachers in Surakarta, and prior to the research, about thirty-five teachers were offered to join the research wick randomly, but unfortunately only five teachers agreed. Table 1 signifies the characteristics of the five teachers.

TABLE 1. The Characteristics of the Participant Teachers

Teacher	Sex	Age (in Year)	Work Experience (in Year)	Education Background
Teacher A	Female	35	8	Bachelor's Degree in Biology Education
Teacher B	Female	43	9	Bachelor's Degree in Biology Education
Teacher C	Female	52	16	Bachelor's Degree in Biology
Teacher D	Female	45	9	Master's Degree in Science Education
Teacher E	Female	25	3	Master's Degree in Science Education

The data of students' learning difficulties and their thinking skills were measured using tests and questionnaire with twenty-five students in each of the senior high schools. The former is the test instrument on students' thinking skills comprising six essay questions on the Fungi formulated by referring to the Revised Bloom's Taxonomy to measure students' thinking skills from C1 to C6 taxonomy levels. A test instrument has been validated by the QUEST program with infit meansquare score of 1.01 and outfit t 0.18 that means the instrument was categorized as good. Meanwhile, the latter is associated with students' learning difficulties when learning about the Fungi was assessed through validated questionnaire which consisted of five items including uneasy to understand aspects of the material, ways to understand the concept of the Fungi, students' perception on teachers' methods, learning situations, and teachers' assessment. The data of teachers' perception on how to teach the Fungi were obtained based on a document analysis of the lesson plan of the Fungi constructed by five teachers. The analysis was performed using an instrument which refers to such aspects as constructing indicators, content, method of teaching, curriculum structure, and assessment. The instrument developed by the authors had been validated by the experts. This instrument consisted of five aspects, i.e. constructing indicators (13 descriptors), content (6 descriptors), method of teaching (4 descriptors), Curriculum structure (4 descriptors), and assessment (12 descriptors). All aspects were scored based Likert scale (1 to 4), which further converted to 1 to 100 points. Based on the score

gained, four categories of lesson plan were developed, i.e. poor (0-25), satisfactory (26-50), good (51-75), and excellent (76-100).

RESULTS AND DISCUSSIONS

Analysis of Lesson Plan of the Fungi

The aspects which were analyzed included constructing indicators, content, method of teaching, curriculum structure, and assessment. Table 2 demonstrates the analysis results of each teacher's lesson plan of the Fungi.

TABLE 2. The Analysis Results of the Teachers' Lesson Plan of the Fungi

No	Aspects	Gain score					Mean Score	Category
		Teacher A	Teacher B	Teacher C	Teacher D	Teacher E		
1	Constructing indicators	75	50	50	50	75	60	Good
2	Content	75	75	75	75	75	75	Good
3	Method of teaching	75	50	50	50	75	60	Good
4	Curriculum structure	75	50	50	50	75	60	Good
5	Assessment	50	50	50	50	50	50	Satisfactory
	Mean Score	70	55	55	55	70	61	Good

Data on the above table indicates teachers' gain scores in each aspect based on the analysis results of the lesson Plan. On the aspect of constructing indicators, the mean gain score of 60 was categorized as good, it means that teacher had not maximally developed learning indicators in the lesson plan. The indicators developed by teachers had not yet been fully in accordance with basic competencies and several inappropriate action verbs were found. On the aspect of content the mean gain score of 75 categorized as good which implies that the scope of the material provided is fair, but additional topics from other resources to broaden and update the scope are required. On the aspect of method of teaching, the mean gain score of 60 was grouped as good. Teachers had not maximally implemented such methods as observing, asking, collecting data, associating, and communicating. They tended to use less varied learning models and to perform incomplete scientific procedures.

On the aspect of curriculum structure, mean gain score of 60 was indicated as good, or the topic sequences presented by the teachers was suitable with the scope of the material. The learning of the material, however, was only based on the topic order of the textbook. Teachers did not use innovative method, for example making use of the living environment of other learning resources. On the aspect of assessment, the mean gain score of 50 was categorized as satisfactory, which shows that teachers had not maximally made assessment since they did not consider domains of attitudes, knowledge, and skills. The assessment developed by the teachers focused merely on the domain of knowledge and was used only for measuring low-order thinking skills.

In reference the analysis results of the lesson plan constructed by five teachers with different ages, durations of experience, and educational backgrounds, it was found that the lesson plan on the Fungi constructed by the teachers on each aspect were not maximally developed. To reveal whether or not the influence of participant teachers' characteristic difference on the analysis results of the lesson plan exists, a further study needs to be carried out. The construction of the lesson plan seeks to design students' learning experience to achieve learning outcomes as a reference in performing the learning based on the expected competencies [11]. The well-constructed lesson plan are the ones which 1) consider the coherence among material structures, material-based ways and strategies, intended objectives or competencies to transfer to students, a form of assessment appropriate to the measured competencies, 2) can be optimally performed in learning activities, and 3) provide operational guidelines for teachers from the beginning until the end of the learning [12].

Several factors supposed to cause teachers to find difficulties in constructing the lesson plan include: 1) teachers' less understanding on the principles of the lesson plan construction, 2) subject specific pedagogy, 3) teachers' assumption that constructing the lesson plan is not important [13]. In reference to several research results, teachers tend to refer to previously existing lesson plan since most learning process do not require the Lesson Plan. Teachers prefer use their textbook as the guideline; they construct and plan learning designs without performing the planned learning process so that the learning objectives cannot be achieved. In short, teachers construct the lesson plan for their administration completion [11]. They find difficulties in achieving effective learning due to inadequate time to prepare teaching materials [14]. In addition, they find it difficult to formulate an assessment

instrument appropriate for learning indicators, whereas in fact an instrument is the important aspect to assess students' level of academic achievement [15].

Students' Various Learning Difficulties

The objective of learning about the Fungi is to enable students to implement classification principle to categorize fungi based on their characteristics, their reproduction method through rigorous and systematic observation. Various students' learning difficulties in understanding the material were found based on the results of interviews with 25 grade 10 students of five senior high schools in Surakarta. They are illustrated in Figure 1.

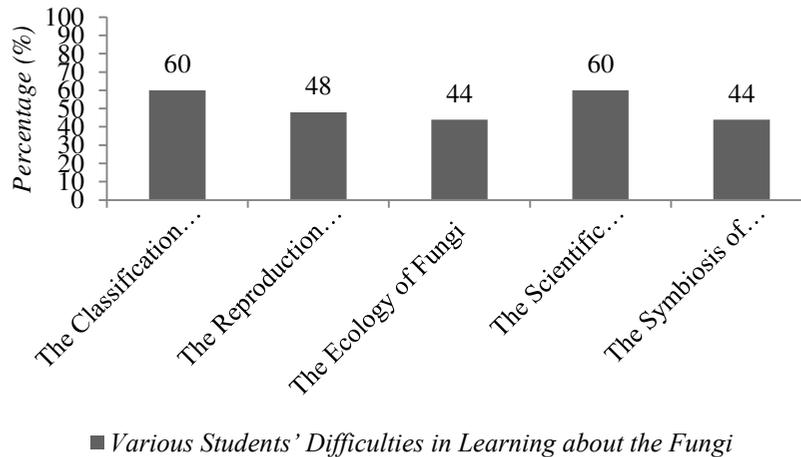


FIGURE 1. Various students' difficulties in learning about the fungi

The results of questionnaire found out that students had difficulties in such topics as the classification, reproduction, ecology, scientific names, and symbiosis of fungi. They further indicated that 60% of students found difficulties in understanding the classification of fungi, 48% in categorizing the reproduction of fungi, 44% in understanding the ecology of fungi, 60% in memorizing the scientific names of fungi, and 44% in comprehending the symbiosis of fungi. Moreover, according to Chamalia [16] revealed that the Fungi was the difficult-to-master concepts due to numerous scientific and Latin names to memorize. Students also found it difficult to understand the classification and life cycle of fungi, as well as to differentiate kinds of spores produced by each division of the fungi [9]. Based on questionnaire results, most students stated the learning situation was not fun because they only learn from the textbooks, and the practicum was rare. The common method which often used by teachers were lectures and power point slides presentations are less able to help the students to understand the concept of Fungi.

Analysis of Students' Thinking Skills Test Results on the Fungi

The gain scores of students' thinking skills test on the level of remembering (C1), of understanding (C2), of applying (C3), analyzing (C4), evaluating (C5), and creating (C6) are 76%, 73%, 60%, 47%, 43%, and 40%, respectively. Students' thinking skills are still dominated by low-order thinking skills, i.e. on the levels of remembering (C1), understanding (C2), and applying (C3). Students found it difficult to deal with items requiring high-order thinking skills, in levels of analyzing (C4), of evaluating (C5), and creating (C6). Several studies ([17] and [18]) point out that learning in average is still dominated by the level of low-order thinking, which is the level of remembering and understanding. The comparison of students' thinking skills test on the Fungi is shown by Figure 2.

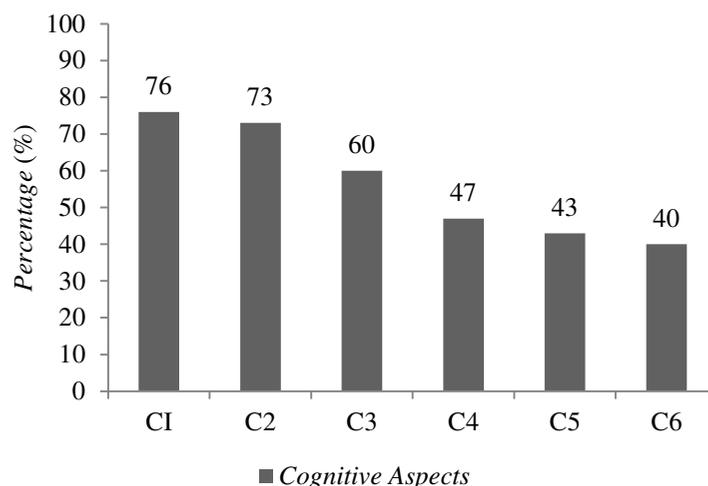


FIGURE 2. The Comparison of Percentages of Students' Thinking Skills Test on the Fungi

Students' difficulties in learning and mastering the material were caused by several factors, including numerous scopes of the material and unfamiliar scientific terms and names. Most students found it difficult to remember Latin terms contained in the material [19]. Also, their difficulties emerged because teachers' strategies had not maximally constructed the concept and practiced the high-order thinking skills, and teachers focused only on teaching recitation [20]. The results of the interviews demonstrated that most of the students learned the concept of Fungi by memorizing. The students considered that most learning methods used by teachers were less attractive and unable to help them understand since most of the teachers explained the material by making presentation and discussion; students rarely got involved in practical works. The research results [21] also indicated that learning designs used by most of the teachers referred to textbooks and required students to memorize the concepts as written in the books. A learning method used by teachers exerts an influence on students' thinking skills [22]. The learning should be done based on problem solving or contextual issues surrounding students, which allow them to practice their thinking skills in order to create a meaningful learning and to help them understand the concept of the material. Students' concept mastery can be given and developed in two ways: challenging students with problems, and involving students in a discussion about related concepts [23].

One of ways to practice students' thinking skills is by employing constructivist learning [9]. Teachers are expected to facilitate students to learn constructively so that they can interact and cooperate each other, do invention activities, and actively involve in the learning; this way, they will be responsible for themselves in the learning [24]. Teachers' understanding related to the construction of accommodative learning designs should be improved. One of constructivist learning models is inquiry-based learning [25]. Students are invited to do inquiry activities related to the Fungi and are asked to ask questions regarding the existing problems. By asking questions, they can sharpen their thinking skills on the characteristics, function, classification, life cycle, reproduction method of Fungi, as well as their roles in life [26]. Such concepts are found by themselves, as the material is closely related to their daily life [15]. Teachers need to clarify each material learned by their students so that the students can have appropriate basic concepts of the learned material and avoid misconception [27].

Such students' difficulties in learning about the Fungi can indeed be minimized by employing constructivist learning model as well as making use of methods and learning media which allow students to improve their creativity and thinking skills in learning about fungi. One of ideal learning methods to teach the material is practical work [8]. In reference to basic competencies stipulated in the curriculum, the Fungi should not only be taught using a lecture method, but also a practical work. The material covers not only macroscopic, but also microscopic fungi, and therefore a practical work to make the concept of microscopic Fungi concrete is required to enhance students' comprehension [28].

Students need to get used to writing and reading scientific name of an object (Fungi), or biological terms contained in the material, understanding meaning and origin of the scientific names and unfamiliar terms by making use of a dictionary of biology so that they can improve their achievement [16]. To deal with difficulties in observing the object, identifying general characteristics of Fungi, and classifying Fungi according to the observable characteristics, students can be trained to observe an object, particularly Fungi, both directly and indirectly by using media, to enhance students' skills in using an observation equipment (microscope), to observe and understand the organelles contained in Fungi, and therefore they will be able to differentiate the characteristics of various types of Fungi [9].

A qualified teacher should be able to consider some important factors which support the learning [3]. An attempt to accelerate teachers' quality is by enriching their Technological Pedagogical Content Knowledge (TPACK) [29]. It covers aspects closely related to teaching activities including Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), dan Technological Content Knowledge (TCK) [4]. The teachers' TPACK can effect his/her ability on developing a good learning tools including lesson plan [30].

CONCLUSIONS

The research found out various students' difficulties in learning about the Fungi and teachers' difficulties in constructing lesson plan of the Fungi. Students were found difficult to understand such topics as the classification, reproduction, ecology, scientific names, and symbiosis of fungi. Students' thinking skills test results indicated that most of the students had not achieved the high-order thinking skills. This reveals that some students' difficulties in learning about the Fungi influence their thinking skills. Information on difficult-to-understand topics is important since it can serve as a basis in constructing learning strategy of the material. The results of the interviews concluded that most students learned the material by memorizing. Students stated that the method used by teachers was less attractive and unable to help them understand the material since most of the teachers explained the material by making presentation and discussion; students rarely got involved in direct observation.

The analysis results of the Lesson Plan of the Fungi constructed by teachers also indicated that the lesson plan had not been maximally constructed on all of aspects, involving constructing indicators, content, method of teaching, curriculum structure, and assessment. It is assumed that the construction of learning designs is closely associated with teachers' knowledge-based teaching and with construction process of concepts of fungi in students. The findings of the study require further studies to prove the assumption.

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