The Analytical Thinking Skill of Grade XI Students of SMA Negeri 15 Semarang

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Info Articles

Abstract

This research aims to study the development of students' analytical thinking skill during animal tissue learning. The other aim is to identify the obstacles experienced by the teacher in developing the students' analytical thinking skill during learning process. The study used case study design. The study was held on odd semester of academic year 2017/2018. The samples were XI IPA5, XI IPA6, dan XI IPA7. The datas in this research are the data of learning implementation, students' analytical thinking skill, and the teacher's obstacles during the learning. The data of learning implementation was obtained from observation sheets. The data of students' analytical thinking skill was obtained from observation and test. The data of challenge which was experienced by teacher and students' response were obtained from teacher and students' questionnaire. The data of learning implementation is analyzed by measuring the percentage of learning process implementation. Based on that percentage, the implementation of learning held by teacher can be categorized into very well, well, and dissatisfactory. The data of analytical thinking skill was analyzed by calculate the score of analytical thinking skill test. Based on that score, students were grouped into 3 categories; high, medium, and low. The data of teacher and student responses were analyzed by calculating the score percentage of teacher and students questionaires. The result of study showed that students' analytical thinking skill developed well through lecture method (67%), and it developed very well through discussion method (89%). Most of the students (68%) had medium analytical thinking. The teacher challenged the development of indicator of analytical thinking skill in evaluating opinion, and collecting and assessing information. According to the students, their analytical thinking skill developed well during the learning.

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INTRODUCTION

The ability to think analytically is one of the higher-order thinking skills (HOT). Noma *et al*. (2016) explained in Bloom's revised Taxonomy, the high-level thinking abilities cover several aspects, namely analyzing (C4), evaluating (C5), and creating (C6). Heong *et al*. (2011) explained that students with high levels of thinking skill can learn well. Novita *et al*. (2016) explained that good analytical thinking skill allows students to achieve good learning outcomes. Student with less analytical thinking skills is able to be inhibitory achievement of learning outcomes. This study reveals the level of analytical thinking skills of XI grade student in SMAN 15 Semarang on the learning process of animal tissues material. In this study, the level of analytical thinking skill of XI grade students was measured through the matter of animal tissue material developed based on indicators of analytical thinking skill according to Pertiwi *et al*. (2013).

Syllabus of Biology subject in 2013 curriculum revised edition of February 2016 for class XI contains 14 KD (Basic Competencies) that have to be mastered by students. In the cognitive domain, there are 12 basic competencies that require students to have the ability to analyze. Two other basic competencies, namely KD (Basic Competence) 3.1 require students to understand cells and KD 3.11 requires students to have the ability to evaluate. Those competencies shows that the most dominant KD in Biology class XI material is KD analysis, so it can be concluded that analytical thinking skills are needed by students, especially XI grade students. One of the Biology materials in class XI is structure and function of animal tissue material. The basic competencies that contain the material are KD 3.4. KD 3.4 requires students to have the ability to analyze the relationship between tissue structure, location, and function of organs in animals. The ability to analyze that students get during the learning process on the structure and function of animal tissue material can be a resources for understanding basic competencies of analysis in preceding materials.

Based on the results of the lesson plan (RPP) analysis of the Biology teacher of class XI SMA 15 Semarang, the learning indicator of structure and function of animal tissue material, some have demanded students have analytical skills. The learning indicators of the structure and function of animal material tissues in lesson plan are on C2, C3, and C4 levels. In this case, there is already a C4 level for analytical skills. In RPP Biology for the structure and function of animal tissue material in SMA Negeri 15 Semarang, it is known that the teacher uses the Discovery Learning model. This learning model is one of the learning models suggested by the Ministry of Education and Culture to be used in the 2013 Curriculum learning process. According to Rahmat (2016) Discovery Learning model influences students' high-level thinking skills, including analytical thinking skills. This is supported by Novita *et al.* (2016), which explain that discovery learning models can improve students' analytical skills. One of the discovery learning syntaxes is verification. At the verification stage, students are asked to analyze the results of data collection to be compared with the hypothesis so that it proves the accuracy of the hypothesis.

Information about the level of analytical thinking skill of the XI grade students at SMA Negeri 15 Semarang is needed as a basis for developing analytical thinking skills for further learning and choosing the right learning model. So, students are able to develop

analytical thinking skills to the maximum as the support for the achievement of basic competencies to analyze which students must master.

RESEARCH METHOD

This study used case study design. The research was conducted on odd semester of academic year 2017/2018. The research's sample was determined by purposive sampling technique. The sample class consists of three classes, namely Class XI IPA 5, XI IPA 6, and XI IPA 7. The datas in this research are the data of learning implementation, students' analytical thinking skill, and the teacher's obstacles during the learning. The data of implementation learning was gained through observation using observation sheet. The data of students' analytical thinking skill is obtained through observation and tests. The observations were made during the learning process of animal tissue material using analytical thinking skill observation sheets. The test carried out after the learning process has ended, using 6 essay questions that developed based on indicators of analytical thinking skill according to Pertiwi *et al.* (2013). These indicators include, (1) interpreting information and ideas; (2) evaluating opinions; (3) compile opinions to support a conclusion; (4) integrating knowledge and experience; (5) collecting and assessing information from written, electronic, and observation sources; and (6) compile and support the hypothesis. The students's analytical skill from the test result is expressed in high, medium, or low categories based on Arikunto (2013). The data of obstacle experienced by teachers in developing students' analytical thinking skills during learning process were obtained through teacher's questionnaire responses. Student response's data on the implementation of learning held by the teacher is obtained through student responses' questionnaire.

Data on the implementation of learning was analyzed by calculating the percentage of the learning process implementation. Based on those percentages, the implementation of learning by teachers were categorized into two, namely the learning process that has facilitated the development of student's analytical thinking skills and the learning that have not facilitate the development of student's analytical thinking skills. The learning implementation that has facilitated the development of analytical thinking skills are divided into three categories: the learning process has facilitated the development of student's analytical thinking skills very well, well, and poorly. The data of analytical thinking skills which was obtained through tests were analyzed by calculating the scores obtained by students. Based on these scores, students are grouped into three categories: high, medium, and low level analytical thinking skill. The teacher's response data were analyzed by calculating the percentage score of teacher response questionnaire. Based on those percentages, it is known that teachers experienced many obstacles, few obstacles, or without obstacles in developing students' analytical thinking skills. Student response data were analyzed by calculating the percentage score of students ' questionnaire responses. According to the percentage, the implementation of learning held by teachers can be categorized as good or not good.

RESULTS AND DISCUSSION

The results of observing the learning implementation are presented in Table 1.

Table 1 The use of lecturing and discussion method in learning process in relation with indicator of analytical thinking skill

Indicators of Analytical Thinking Skill	Learning Activities by Teacher	The method used	
		Lecture	Discussion
Interpret information and ideas	The teacher provides LDS or other media that contains problems or questions in the form of tables.	√	√
	The teacher provides LDS or other media containing problems or questions in the form of images.	√	√
Evaluate opinions	The teacher asks students to respond to the results of other group discussions	-	√
Arrange opinions to support a conclusion	The teacher provides opportunities for students to express their opinions in class discussions.	-	√
	The teacher asks students to convey a conclusion of today's learning.	-	-
Integrate knowledge and experience	The teacher asks students to explain the relationship between the material that being studied and the material that has been studied	√	√
	The teacher asks students to explain the relationship between the material that being studied with phenomena in the environment	√	√
Collect and assess information from written, electronic and observation sources	The teacher provides opportunities for students to open books and search for information on the internet related to learning materials.	√	√
Compile and support the hypothesis	The teacher asks students to identify the name and function of the animal tissue during learning.	√	√
	Percentage (%)	67	89
	Criteria	G*	VG*

*VG= very good; G=good

Table 1 shows that teacher had facilitated the development of analytical thinking skills for students. During carrying out the learning, the teacher used the lecture and discussion methods. The use of both methods includes most indicators of analytical thinking skill to develop students' analytical thinking skills. However, the development of thinking skills is more facilitated by the use of discussion methods. Based on the results of the students' questionnaire responses to the learning held by the teacher (Table 2), known that most students (67%) argued that the learning held by the teacher was in the good category. However, there are two indicators of analytical thinking skill that have not been facilitated during learning process, namely collecting & assessing information indicator and interpreting information & ideas indicator.

Based on the observations of the implementation of the learning in Table 1, it is known that there are 3 indicators of analytical thinking skill that have not been facilitated in the lecture method. The meant indicator was indicator number 2 (evaluating opinions), indicator number 3 (arranging opinions to support a conclusion), and indicator number 4 (integrating knowledge and experience). Only indicator number 2 (arranging opinions to support a conclusion) has not been facilitated in learning process using discussion methods.

The development of analytical thinking skills for interpreting information and ideas indicator has facilitated during learning using the lecture method. The techer shows the material in form of power points. The power point displayed by the teacher contains a table of characteristics of each animal tissue along with supporting images. In addition, the teacher

strengthens the explanation by directly drawing and describing various animal tissues and their parts on the board. Learning media that contains pictures makes it easy for students to understand the structure of animal tissues that cannot be observed with the eyes. This is consistent with the opinion of Handini *et al.* (2012) that by giving pictures of animal tissue through learning media, especially slide presentations can make it easier for students to understand the concepts of animal tissue material. Whereas at the discussion method, teacher provides LDS (students' discussion sheet) that contains tables and pictures of various types animal tissues. Students search for the information needed to solve problems in LDS actively with their groups. Giving LDS can be used to develop students' analytical thinking skills. This is in accordance with the opinion of Maghfiroh & Sugianto (2011), which is the ability to think analyticaly can be trained when learning through giving questions in student worksheets and student discussion sheets.

Table 2 Percentage of students in each category of animal tissue learning implementation held by the teacher

The Category of Learning Implementation held by the teacher	Percentage of Students (%)
Good	67
Not good	33

The development of analytical thinking skills for evaluating opinions indicator less facilitate during the lecture learning method. This was because there was no class discussion that allows the discovery of differences between groups such as the discussion method using LDS. Based on Table 3, it was known that teachers experience few obstacles in developing students' analytical thinking skills, especially when using the lecture method. This was in accordance with the opinion of Harahap (2013) that students tend to be passive and students' motivation to learn is low in the learning using lecture method. Teachers experienced obstacles in developing evaluating opinions indicator. The teacher had difficulty in motivating students to ask questions and respond to other groups. During group discussions, there were still many students who were less active in asking questions and answering questions.

Table 3 The teacher's response to the validity of the test item and the obstacles faced by the teacher during the learning implementation on animal tissue material

Statement	Score
The questions about animal tissue material given to students in accordance with the learning that has been done.	4
The questions about animal tissue material given to students in accordance with KD 3.4.	4
The questions made by the researcher can be used to measure students' analytical thinking skills.	4
I have a desire to develop analysis type questions for other material.	4
The questions of animal tissue material given to students are too easy for students.	2
I have no difficulty in applying the learning model that I use.	4
I have no difficulty in teaching structure and function animal's tissue material.	4
I have no difficulty in facilitating students to develop analytical thinking skills.	4
Total score	30
Percentage (%)	75%
Criteria	few obstacle

The development of analytical thinking skill for arranging opinions to support conclusions indicator does not exist in learning using lecture and discussion. The teacher does not ask students to convey the conclusions of learning that has been done at each meeting. Conclusion withdrawal is an important part of learning, because of the making conclusions students become aware of the correct concept after differences of opinion in the discussion. According to Manto *et al*. (2017), drawing conclusions is the process of displaying the essence of the results of interpretation and evaluation. The core activities include searching for the meaning of data and giving explanations.

The development of analytical thinking skill for the integrating knowledge and experience indicator have facilitated during learning with the lecture method and discussion with LDS. The teacher asks students to provide examples of phenomena in the environment related to animal tissue material. However, the teacher has not asked students to explain the relationship between the material being studied and the material that has been studied. This is in line with the research conducted by Aryulina (2009), which in the lecture method, the teacher does not ask about the relationship between the materials being studied and the material that has been studied but asks about the relationship between the materials being studied with everyday phenomena. At the time of learning using LDS discussion, teacher guides students to discuss the feedback from other group members about environmental phenomena related to animal tissue material.

The development of analytical thinking skill for collecting and assessing information indicators has been facilitated in the learning using lecture and discussion methods. The teacher gives students opportunity to find information both from textbooks, student worksheets, and from the internet. Wegerif (2002) explains that technology is a good support and source for learning that develops thinking skills. The ability to process information allows students to find and collect relevant information, sort, classify, compare, and analyze parts/relationships as a complete part. The use of the internet in discussions can be used as a media to obtain information to increase students' knowledge about animal issue material in addition to using LKS or textbooks. This is in accordance with the opinion of Bae (2007) which explains that through the use of the internet, the development of thinking skills for students can be facilitated. Based on the results of the teacher response questionnaire, the teacher had difficulty in developing collecting and assessing information indicators. During the learning implementation, the teacher had difficulty in inviting students to read animal tissue material so that students had difficulty understanding the scientific terms that emerged during the learning process and scientific terms in the test.

Most students only rely on information from LKS that contains a little animal tissue material when learning during lecture method. Only a few students brought textbooks from the library. Susilowati & Anam (2017) explained that in the learning process, learning resources help students achieve learning goals and facilitate the teaching and learning process. Due to the lack of learning resources during the learning process, there needs to motivate more the students, so they want to borrow books that available in the library to support the student's learning process. When students discuss with their groups, many students prefer to look for information on the internet rather than reading textbooks. In this case it is necessary to motivate students to read textbooks so that students understand more about the concepts of animal tissue material and they can improve their analytical thinking skills. This is in line with the opinion of Yuliati (2013) that the ability to master the material in the learning process will help students in an effort to improve their

thinking skills. Indicators of composing and supporting hypotheses have been facilitated when learning using lecture method or discussion using LDS. At the time of learning using the lecture method, the teacher asks students to identify images of animal tissue displayed through PPT and the blackboard. The LDS provided by the teacher contains the characteristics of the animal tissue and students are asked to determine the name of the tissue based on its characteristics.
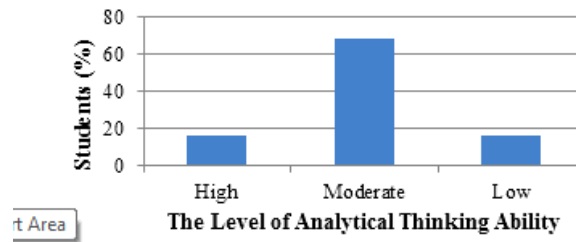
Students' analytical thinking skill was known through observation during the learning process and analytical thinking skill tests. The results of the students' analytical thinking skill observation are presented in Table 4.

Table 4 The results of student learning activities observation during the learning process to develop students' analytical thinking skill

Indicators of Analytical Thinking Skill	Activities of Students Observed	The method used by the teacher	
		Lecture	Discussion
Interpret information and ideas	Describe the contents of an existing table in the instructional media used.	√	√
Evaluate opinions	Give response to the results of another group discussion.	-	√
Arrange opinions to support a Conclusion	Convey the conclusion of the learning material that has been done	-	-
	Describe the results of group discussion correctly accordance with the material being studied	-	√
Integrate knowledge and experience	Mention the relationship between the materials that has been studied at the previous meeting with the material being studied.	-	√
	Mention the relationship between the materials being studied with phenomena in the environment.	√	√
Collect and assess information from written, electronic and observation sources	Open the textbook or search the internet of things related to the material being discussed.	√	√
	Explain the results of group discussion based on the information that has been found.	-	√
Compile and support the hypothesis	Mention name the tissue based on its characteristics.	√	√
	Total	4	8

Table 4 shows that there were 4 out of 9 activities carried out by students during the learning of animal tissue material using the lecture method. Only one activity was not carried out by students on learning by discussion methods. This shows that the development of students' thinking skills was more facilitated by the use of discussion methods applied by the teacher during the learning process. Based on the results of the analytical thinking skill test as in Figure 1, it is known that most students (as much as 68%) were at medium level of analytical thinking skill, 16% of students were at high level of analytical thinking skill, and

16% of students were at low level of analytical thinking skill. Based on the results of the test difficulty level analysis, it is known that most students had mastered animal tissue material and mastered the indicators of analytical thinking skill, especially interpreting information and ideas indicator, compile opinions to support conclusions, and integrate knowledge and experience.

Figure 1 The level of students' analytical thinking skill of XI grade students

The results of students' analytical thinking skills observation as in Table 2 showed that the indicators of analytical thinking skills which were conducted by students were showed more on learning with discussion method than when learning using the lecture method. This is supported by the opinion of Fatmawati *et al.* (2013) which explains that group discussion can increase student activity in expressing opinions and asking questions. During the learning using lecture method as in Table 4, students are able to master the indicators of interpreting information and ideas shown by the students were able to explain the contents of the table displayed by the teacher. Indicators of evaluating opinions are not carried out because there is no discussion activity on the lecture method. Students did not respond to the results of other group discussions, but there were some students who gave responses to the teacher about the material presented during the lesson. Indicators compiling opinions to support conclusions were not made by students because students do not carry out discussions and at the end of the learning the teacher does not ask students to convey the conclusions of the learning that has been done. Indicators of integrating knowledge and experience for student activities to mention the relationship between material that being studied with the material that has been studied was not done by students, but students could explain the relationship between the materials being studied with phenomena in the environment. This can be seen during learning, students can mention examples of animal tissue found in everyday life and mention diseases that can attack animal tissues.

The indicator of collects and assesses information especially on the activity of explaining the results of group discussions according to the information found was not carried out by students during the learning using lecture method. However, during the learning process students open books or search the internet for matters related to the material. Compile and support hypotheses indicator carried out by students during learning. Students were able to name the tissue based on its characteristics. Only compile opinions to support conclusions indicator that were not made by students when learning using discussion methods. Students who actively engage in activities that reflect for analytical thinking skills indicators were the students who have medium and high level of analytical thinking skills. During learning, students who have high analytical thinking skills are more active in asking questions to teachers and other groups. This is consistent with the

results of Afcariono's (2008) study which shows that by asking questions can spur the thinking process so as to improve students' thinking skills.

The level of student's analytical thinking skill was known from the test results. Based on the test results, it is known that 68% of students have medium analytical thinking skills, 16% of students are at a high level of analytical thinking skill, and 16% of students are at a low level of analytical thinking skill. The least percentage of students with high level of analytical thinking skill was due to the most of the lecture method used by the teacher for the mainly time allocation to teach animal tissue material. In the learning process of animal tissue material using lecture method, there were still indicators of analytical thinking skills that had not been facilitated, namely evaluating opinions indicator and formulating opinions to support conclusions indicator. These ended up students did not carrying out activities that reflect both of these indicators during the learning process which caused students did not master the indicators and the test results become doesn't optimal. The results of the test difficulty analysis showed that students did not experience difficulties in answering questions about animal tissue material, especially items 1, 3, and 4. The item was a development of analytical thinking skill's indicator for interpreting information and ideas indicator, compiling opinions to support conclusions, and integrating knowledge and experience indicator. Item numbers 2, 5, and 6 which are the development of evaluating opinions indicator, collect and assess information, and indicators compile and support hypotheses were on the medium category. This showed that students had mastered animal tissue material that had been taught by teacher and mastered all indicators of analytical thinking skill.

The results of analytical thinking skill observation showed that the students were still weak in mastering indicators for evaluating opinions and compile opinions to form conclusions. Pertiwi *et al.* (2013) explain that the students' achievement in indicators of analytical thinking skill number 2 (evaluating opinions) lower than other indicators. Based on these results, it was known that it was necessary to strengthen the development of analytical thinking skill indicators for evaluating opinions indicator and compile opinions to support conclusions so that the students' analytical thinking skills got better. The students' mastery for compile opinions to support conclusions indicator was still weak related to students' reasoning skill. Wegerif (2002) states that reasoning skill is a provision for students to give reasons for opinions, actions to draw conclusions, make decisions, and explain every thought of reason or fact. Lestari (2016) explains reasoning is defined as the process of achieving logical conclusions based on relevant facts and sources. Adriani *et al.* (2015) explains that the skill to receive and process information contributes well to reasoning skill. If students have good skill in receiving and processing information, it will facilitate students to do reasoning activities. In this case, the analytical thinking skill's indicator for assessing information (indicator number 5) contributes to the indicator of compiling opinions to support conclusions (indicator number 3). In addition, the students' low mastery skill for creating opinions to support conclusions is because students are not required to draw conclusions during learning. This is in line with the opinion of Maghfiroh & Sugianto (2011) that students' inferior abilities that are still low can be improved by familiarizing students to deduce the material he had learned.

Based on the results of learning implementation observations, it was known that students rarely carry or read books that support subject matter, such as textbooks. Textbook learning support available in the school library, but every student is limited only to borrow

some books and many students decide to borrow books for other material. Students only open and read the LKS that they had when learning in the classroom. Based on the results of the student response questionnaire analysis, only a few students (less than 50% of students) were accustomed to reading printed books on animal tissue material before learning was carried out. Reading books before learning was one form of students' readiness to participate in learning. The readiness of students influences the skill of students to understand material and student learning outcomes. This is in accordance with Mulyani's opinion (2013) which explains that with good learning readiness, students easily absorb the lessons conveyed by the teacher.

Based on observations of the learning implementation and student response questionnaires, it was known that students prefer to search for information on the internet rather than reading books. Students of XI IPA 5 and XI IPA 6 classes prefer to read material on the internet rather than reading books. This was consistent with Saleh's (2016) opinion that someone in the information technology era prefers to read information in electronic form (eg electronic books) because the electronic books not only contain information in the form of text, but also images, audio, and video. Whereas by reading books, students can understand the correct concepts istead of reading information on the internet and LKS that contain less animal tissue material than textbooks. This is in accordance with Siregar *et al.* (2016) which explain that material books can improve students' material understanding. Lack of reading habits results in difficulties experienced by students when encountering scientific terms in animal tissue matter. This is in accordance with the opinion of Rahmadani *et al.* (2016) that learning difficulties experienced by students one of them is due to foreign terms (Latin) that appear in the learning material.

CONCLUSION

Based on the data analysis and discussion, it can be concluded that most of the student who studied using discussion and lecture method have medium analytical thinking skill category. Most of the students in very good analytical thinking skill category were studied using discussion method. During learning process, teacher challenged obstacles in developing analytical thinking skill for student, especially in developing evaluating opinion indicator and collecting and assessing information indicator. According to the students, their analytical thinking skill developed well after attend the learning which was conducted by the teacher.

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