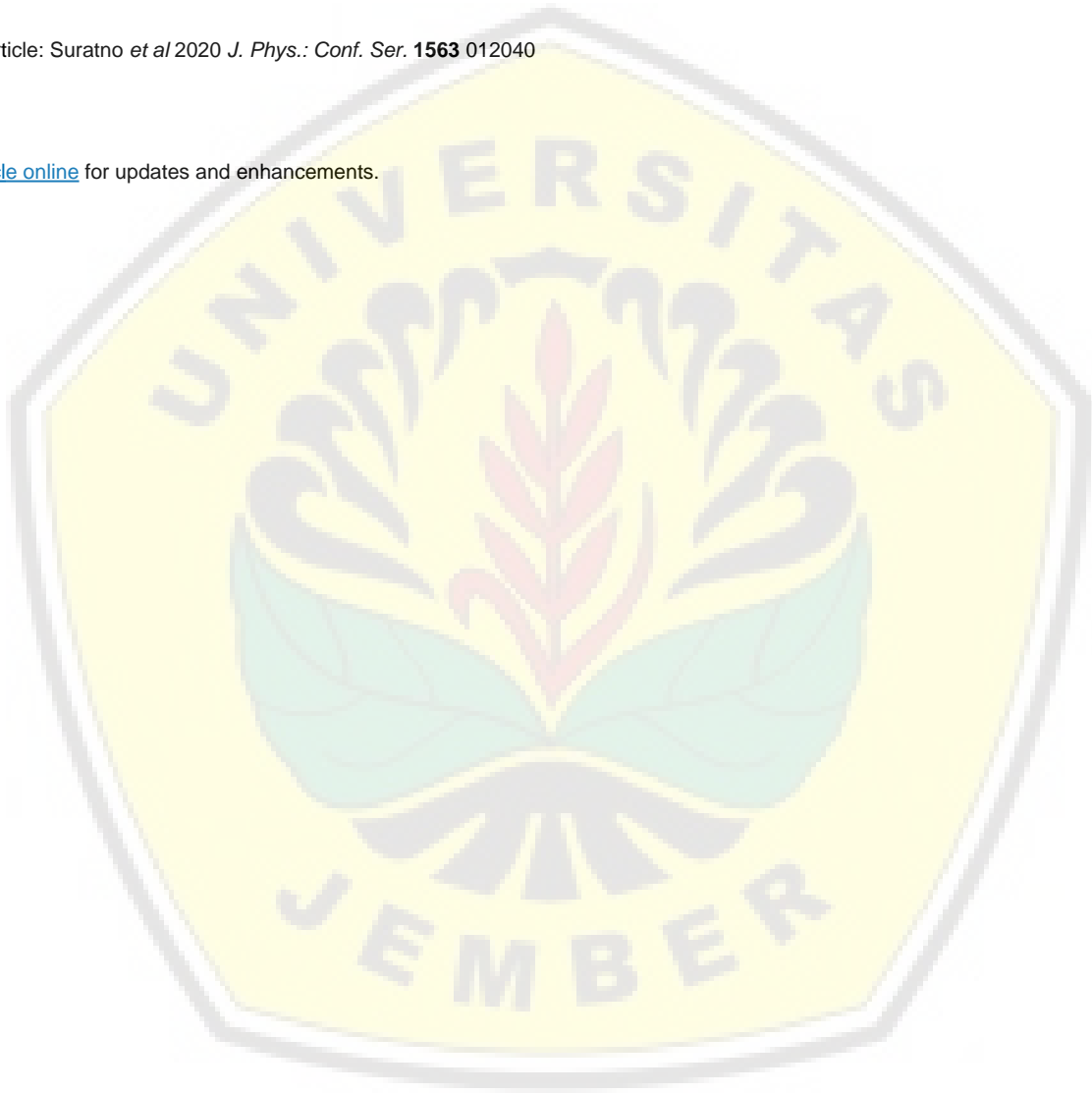


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Biotechnology concept: questioning of analysis with lesson study for learning community (LSLC) for higher ordered thinking skill on coffee area plantation

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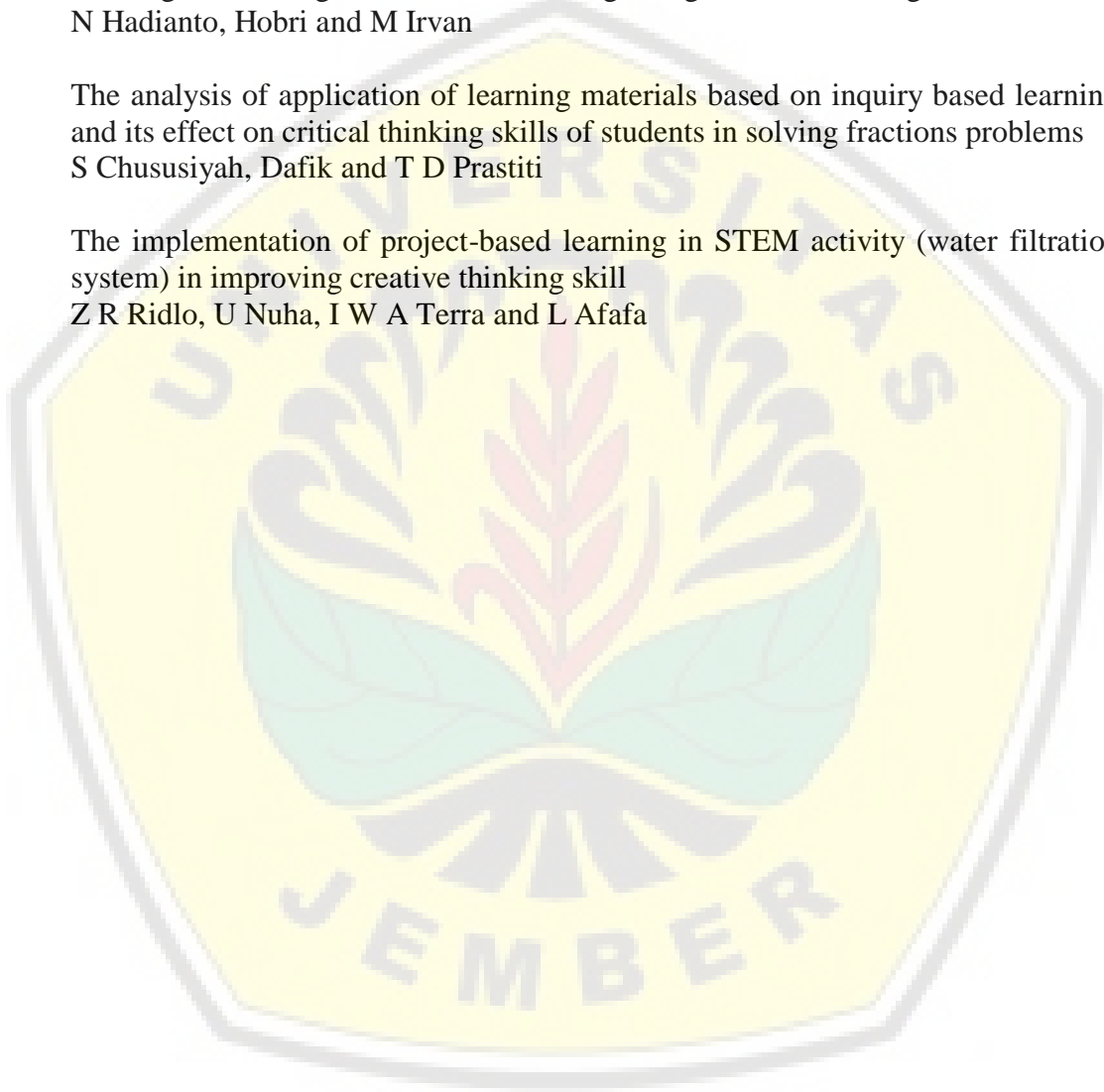
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Biotechnology concept: questioning of analysis with lesson study for learning community (LSLC) for higher ordered thinking skill on coffee area plantation

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Abstract. Students often have difficulty when completing analysis level questions. An important strategy used in learning is through lesson study to improve students' weak points. The purpose of this study is to describe the ability of students to solve problem analysis problems with the lesson study for learning community. The research methods used were tests, observations, and interviews. The research subjects consisted of 36 high school students in Biology subject to the concept of Biotechnology material. The concept of Biotechnology material includes the concept of basic of Biotechnology, mechanism of Biotechnology, concept traditional Biotechnology, and advance Biotechnology. Components of analytical problems that students solve include the analysis of the elements or elements of the concept of learning material, the relationship between parts of the concept of learning material, and the organization between the concepts of learning material for Biotechnology material. This research is a descriptive study. Analysis of students' ability to solve analytical problems is done through video tests and analytical methods. The results showed that students' ability to analyze questions with lesson study for learning community on high, medium and low abilities was different

1. Introduction

The era of the industrial revolution 4.0 was marked by many changes in the way of life, including education [1]. Education in this era must be able to identify problems, work in multi-disciplinary teams, find solutions in completing complex tasks, be able to synthesize ideas and be able to communicate effectively [2]. To answer these challenges, a generation that can be competed globally is needed. Many factors cause students to be less able to compete in a globalized world.



One of them is that learning in school only memorizes facts and procedures, without a conceptual understanding of a complex concept. Students in this era must have new knowledge creativity for work skills so as to produce new ideas and products. Students must be able to evaluate what they are reading, understand scientific thought, and needed to learn integrated knowledge [3]. Integrated learning can be done in educational institutions. Without education, quality resources will not be created. The quality of science subjects with biology and science topics is still low [4].

Research by PISA in 2012, the value of science ability in students aged 15-16 years (high school) is only 382 which is far lower than the international average of 501 [5]. TIMSS 2011 results for biology show that only 70% of students can answer correctly about biological content of genetic material and only 46% can answer correctly, this is different from International average of 83% and 57% [6]. Besides, most high school students in Indonesia are still at level 1, which is the level where students still have very limited scientific knowledge and this knowledge can only be applied to similar situations not in different contexts of situations [5]. These results indicate that the questions given by the teacher in various components greatly affect the ability of students.

One of the capabilities of the field of science, especially biology is genetics that need to be understood in general. Genetic concepts that are abstract and difficult to understand cause concepts to be difficult to change so students need to have a high ability to understand abstract concepts. Several studies reveal students fail to understand the concept of basic genetic knowledge. As a result, learning objectives is not achieved maximally [7].

Learning objectives will be achieved to the maximum extent determined by teaching in the form of a lesson plan created by the teacher. The concept of using lesson study involves groups of teachers who meet orderly to work on design, implementation, testing, and to improve the competency results of the subjects taught [8]. In connection with this problem, coaching efforts, especially with the lesson study for learning community, need to be applied to overcome them. In simple lesson study can be said to “learn from learning” or “assessment of learning” [9]. The lesson study implementation is believed by [10] to increase basic knowledge in learning, increase the professionalism of educators, and build learning communities. The same thing was expressed by [11], professionalism development can be developed through lesson study. Knowing various benefits of Lesson Study [12] suggests the implementation of lesson study as a solution to solving learning problems, because the lesson study can facilitate any method used. Broadly speaking, the implementation of the student's learning process is outlined in the following aspects: 1) do (work in groups / individually), 2) speak up, 3) ask / question / discussion, and 4) listen [13].

Slightly different from lesson study, LSLC is considered as able to increase understanding of learning through collaborative approaches and also emphasizes the importance of observing student's learning, compared to assessment of how teachers teach and mastery of material. Although lately a lot of research has been done that discusses teacher groups and teacher competency development activities [14]. The presence of LSLC activities can connect gaps (problems) in the learning process through an integrative exchange of information in determining learning methods, preparation of learning lesson plans and implementation in the teaching-learning process.

In this study, Bloom revealed three types of analytical skills, namely (1) analyzing elements, where students can distinguish factual statements; (2) analyze relationships, where students can see the ability to recognize the essential facts that underlie an argument that supports it; (3) analyze the principles of organization, where students can decipher tools, and materials to decipher their meaning. Students' abilities in completing analytical questions about teaching, and learning situations is: high, medium, and low. Students with high levels of ability have greater ability to compile information and solve problems because they are independent, preferring theoretical and abstract ideas. Students with medium abilities, they need more helped to achieve goals and involve social material. While students with low ability, they do not like / avoid math subjects [15]. The purpose of this study are (1) to describe the ability of students to analyze

questions by learning lesson study for learning community with high ability; (2) describe the ability of students in analyzing questions with lesson study for learning community with medium ability; (3) describe the ability of students to analyze the questions by learning lesson study for learning communities to low ability.

2. Methods

This type of research is descriptive research. Data is collected by purposive sampling. The initial steps taken in this study were to determine the place of study in senior high school student in Jember and the schedule of implementation of the research. The next step is to compile research instruments including lesson plans, ability tests with analytical questions, interview guidelines, and student activity observation sheets. Data collection techniques to analyze the ability of high school students to answer analytical questions through assignments, observations and interviews. The sequence of steps taken during the research can be seen in Figure 1.

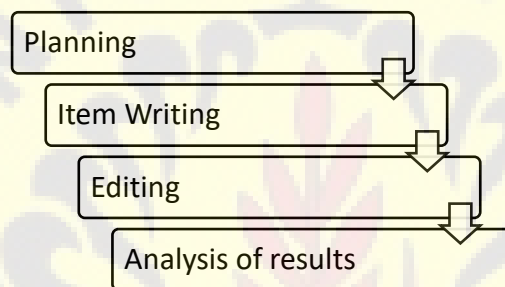


Figure 1. Sequence of research steps

This study analyzes the ability of students to solve analytical problems in the biology of the concept of genetic material. The concept of genetic material includes the concept of chromosomes, the concept of genes, protein synthesis and differences in the protein synthesis in prokaryotic and eukaryotic organisms with lesson study learning community.

2.1 Student task

In this study, researchers gave students assignments related to the concept of genetic material including chromosome concepts, gene concepts, protein synthesis and differences in the protein synthesis in prokaryotic and eukaryotic organisms. Here is one of the analyses questions given to students.

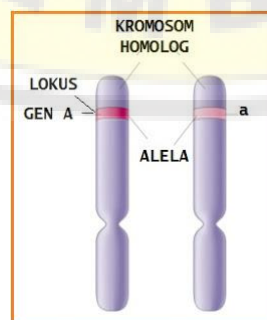


Figure 2. Homologous chromosome

Based on Figure 2, genes and alleles are located at the same locus in 1 chromosome because the gene and alleles are a pair. Based on the statement above, analyze the truth of the statement! and describe the relationship between genes and alleles!

3. Result and Discussions

Lesson Study for Learning Community (LSLC) is carried out in three stages, namely Plan, Do, See. Lesson studies contribute to the development of early Pedagogical Content Knowledge (PCK) [16]. In the first stage, the teacher and researcher conduct a Focus Group Discussion (FGD) to discuss the problems encountered during learning. After that, researchers formulate learning planning activities that will be carried out by selecting the material to be taught, models, methods, learning techniques, and making teaching materials outlined in the learning kit.

The results of the FGDs as well as observations and interviews conducted, it was found that the obstacle experienced by the subject teacher was that students had difficulty in completing the analysis questions. This can be seen when students are given HOT questions with analysis, many of them are not quite right in answering the questions given. The results of other interviews, the teacher also revealed that learning biology on genetic material including chromosome concepts, gene concepts, protein synthesis and differences in protein synthesis in prokaryotic and eukaryotic organisms is not enough if taught by the lecture method, but carried out by a variety of methods, models, teaching techniques, making worksheets and project-based learning with the development of portfolio assessments.

The results of the discussion in the FGD plan stage, it was agreed to teach genetic material to design 2 meetings. The topic discussed at the first meeting was about genes and chromosomes using learning models with PjBL. The second meeting about protein synthesis in eukaryotic and prokaryotic organisms with the DL learning model. The do phase is carried out with active learning activities using a predetermined learning model. After the teacher gives motivation, learning activities begin by giving articles about exchanging babies in the hospital, and students are given an assignment to make questions related to reading. The observer observes every student who is active to ask questions. Furthermore, in the core activities, students are asked to create models to be able to explain the structure of chromosomes, DNA and DNA replication by using used items that are around collaboratively. The teacher uses rubrics to monitor important activities during learning and assess student product outcomes. Teachers and students develop discussions to improve performance during the learning process so that eventually new findings are found to answer the problems raised in the first stage of learning. In the second meeting, the teacher displays a picture of genetic material. Students are asked to ask questions. Students are given analysis questions related to genes, DNA, chromosomes and the process of protein synthesis. Observer observes when the learning process takes place until it ends with reflection. The most important thing in lesson study, the observer must pay attention and record every learning process activity carried out by students. In the see stage, the observer gives constructive input regarding the evaluation of the learning process. Reflections are conducted openly, wisely, and delivered in a good way so as not to offend the teacher of the model.

The results of student ability in completing the analysis questions were 36 students can be seen in Table 1, 4 students had high analytical skills, 26 students with medium abilities, and 6 students with low abilities. Learning with LSLC is done by creating discussion groups, which consist of groups 1-9, each group consisting of 4 students, so that, 9 groups are formed. Classification of students is based on the level of ability possessed, 1 group of students with high ability, 6 groups of students with medium ability, 2 groups of students with low ability.

Table 1. Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pre test	68.50	36	8.567	1.428
Post test	73.36	36	8.482	1.414

For the pre-test scores, the average results of the analysis questions were 68.50. As for the post-test value obtained an average value of 73.36. The number of samples in the study were 36 students. For the value of the standard deviation at 8.567 pre-test and 8.842 post-test. The default

value of the pre-test error is 1,428, while the standard value of the post-test error is 1,414. Pretest value. Paired Differences can be seen in Table 2.

Table 2. Paired Samples Test

	Paired Differences		Std. Error Mean	95% Confidence Interval of the Difference	t	df	Sig. (2-tailed)
	Mean	Std. Deviation					
Pretest- Posttest	-4.861	0.762	0.127	-4.603 -38.292	-38.292	35	.000

Based on the paired sample test, it is known that the value of sig (2-tailed) is 0,000 <0.05 so there is a difference in the average ability of pre-test and post-test students with lesson study for learning community. All student answers are checked and scaled. To see the percentage of student work for each indicator of the achievement of competency analysis questions can be seen in Table 3 below.

Table 3. Percentage of Acquisition of Competency Achievement Indicators.

Indicators of Competence Achievement	Question	Percentage
Describe the transcription process that occurs in the nucleus in the process of protein synthesis	If there is no DNA, can transcription be formed? explain the reason!	44.4%
Link the relationship between DNA, codons, anticodons, and amino acids	If a DNA change occurs because of a mutation, what will happen to the anticodon? Explain the reason!	27.7%
Explain the translation process in protein synthesis	If there is no mRNA, can translation be formed? Explain the reason!	33.3%
Describe the relationship between genes and alleles	Genes and alleles are located in the same locus in one chromosome because genes and alleles are pairs. Based on the statement above, analyze the truth of the statement and describe the relationship between genes and alleles!	50%
Linking the structure of chromosomes with their function in the process of inheriting the nature of living things	How are chromosomes related to inheritance?	83.3%

Based on the test results there are several indicators that have a low percentage including indicators describing the transcription process that occurs in the nucleus in the process of protein synthesis, linking the relationship between DNA, codons, anticodons, and amino acids, and explaining the translation process in the protein synthesis. Students who get low test results are interviewed, they says that they are not able to understand the problem correctly and lack knowledge about the material. Although all the subjects of this study were female. Gender in the study subjects had no significant effect [17].

However, when referring to research [18], female students have a better understanding, and faster thinking in genetic concepts. Based on the results of observations when learning takes place, students who are less able to do analytical problems are students who are less prepared in learning, less focused, and passive when discussing. This is what causes less than the maximum in solving the given problem.

The results obtained in the study, students are able to analyze different questions. The results of the work of Subject 1 can be seen in Figure 3.

The statement of genes and alleles located in the same locus is true, while it is wrong to state that genes and alleles are pairs. An allele is a pair of genes found on homologous chromosomes that exhibit alternative properties to each other. An example of the alternative nature of the fellow is allele B shows the nature of round seeds, whereas allele b determines the shape of wrinkled seeds.

Figure 3. Subject Work Results 1

Based on the results of the work of subject 1, the level of ability to analyze subject matter 1 which is classified as having a high ability that is fulfilling the 3 types of abilities stated by Bloom, subject 1 can analyze the elements, relationships, and principles of the organization. The ability to analyze elements is proven by the ability to distinguish statements. The ability to analyze relationships can be seen from the ability to recognize the essential facts that underlie an argument that supports it. The ability to analyze organizational principles can be seen from the ability to decipher tools, and materials to decipher their meaning. Subject 1 can differentiate gene and allele statements in detail, and there is an emphasis on answers, genes, and alleles located in the same locus are correct, while those that state that genes and alleles are a pair is wrong. An allele is a pair of genes found on homologous chromosomes that exhibit alternative properties to each other. Examples of alternative nature are allele B shows the nature of round seeds, whereas allele B determines wrinkled seeds. Subject 2's work results can be seen in Figure 4

The statement is true. Genes and alleles are located in the same locus on homologous chromosomes. Alleles are variations / alternative forms of genes. For example there are genes that carry / regulate eye color in which there are black eye alleles or blue eye alleles. The composition of genes and alleles is called genotype.

Figure 4. Subject Work Results 2

The results different in subject 2 which has medium ability, the level of ability to analyze subject matter 2, meet 3 types of abilities proposed by Bloom, namely subject 1 can analyze the elements, relationships, and principles of the organization. The ability to distinguish statements is included in analyzing elements. The ability to analyze relationships can be seen from the ability to recognize the essential facts that underlie an argument that supports it. The ability to analyze organizational principles can be seen from the ability to decipher tools, and materials to decipher their meaning. In contrast to subject 1, subject 2 answers are less able to explain alleles and genes in detail and there is a less emphasis. Subject 2 answers, the statement is true. Genes and alleles are located in the same locus on homologous chromosomes. Alleles are variations / alternative forms of genes. For example, there are genes that carry/regulate eye color in which there are black eye alleles or blue eye alleles. The composition of genes and alleles is called genotype. Subject 3's work results can be seen in Figure 5

An allele is a pair of genes located in a locus that corresponds to a homologous chromosome with the same or opposite task for a certain trait

Figure 5. Subject Work Results 3

Subject 3 who has the low ability to only fulfills 2 types of abilities proposed by Bloom, namely subject 1 can analyze elements and relationships. The ability to analyze elements can be seen from the ability to distinguish statements. The ability to analyze relationships can be seen from the ability to recognize the essential facts that underlie an argument that supports it. The result of the answer of subject 3, alleles are pairs of genes located in the locus that correspond to homologous chromosomes with the same or opposite task for a certain trait. Subject 3 is less able

to analyze the elements and principles so it is less able to provide examples of tools and materials to clarify their meaning. The results of the analysis of students' answers in groups of 4 different people. The pattern of answers found can be seen in Figure 6 and Figure 7

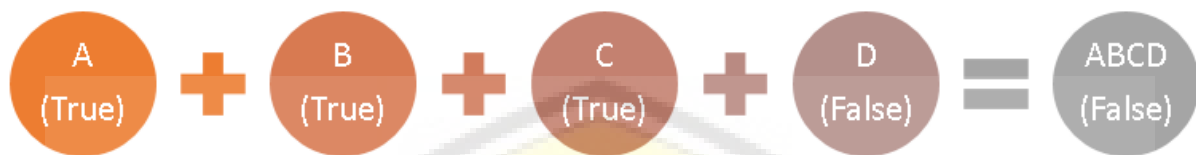


Figure 6. Patterns of Student Answers after Discussion (Answering False)

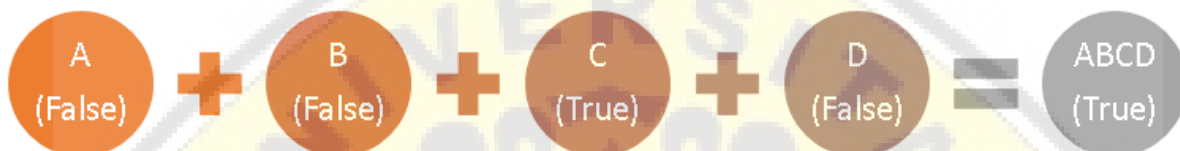


Figure 7. Patterns of Student Answers after Discussion (Answering True)

Learning with LSLC is done by doing the questions given by the teacher. The questions are done by each student before grouping. After working on the problems, students group and discuss the answers that have been done. In Figure 6, student A does the problem correctly, student B does the task correctly, so does student C, but student D has the wrong answer. After discussing and presenting to the class, the answers they delivered were wrong. This case occurs when students A, B, and C cannot defend their answers. Student D seemed to dominate in the discussion because he had high verbal ability compared to his three friends. In contrast to Figure 7, student A's work is wrong, student B is wrong, student C is correct and student D is wrong but the answer given is correct. Based on the analysis, C students are classified as having high ability and able to maintain answers, as well as having high verbal abilities so that they can explain answers to other friends in the form of different ideas.

The provision of analytical questions in learning is also considered as able to provide a lot of experience and new information because they analyze the material he has learned and outlined in the answer ideas. This is following [19], the advantage of students in analyzing learning material problems is that they get a lot of information and experience even though they have a lot to learn to make decisions. Different things are found in students with low ability, they tend to be less active in group discussions and lack experience in learning because of the answers in solving analysis problems are almost the same as reading books. The completion of the analysis questions involves students in making judgments about the information presented. The analysis activity is not just an understanding, interpretation and application for problem-solving. A good analysis must conduct a complete analysis, using a set of strategic options that are relevant and prioritize the process of developing high learning skills beyond knowledge and understanding [20].

Based on research that has been done, learning with LSLC is considered as able to increase the ability of students to gain additional knowledge and to increase group discussion activities and create a good atmosphere of collaborative learning. This is following some characteristics in learning with the community, namely, collaboration, shared responsibility, shared values and vision, caring for other friends, having meaningful relationships. With community learning, students can have a passion for a topic to deepen their knowledge with continuous interaction [21]. Building a learning community is very important to be done to create and foster knowledge practices carried out by joint investigation. Learning success is influenced by competent educators, the learning environment, subject matter, and intelligence and motivation to learn [22].

LSLC is important to observe problems about students that are done through observing lessons in the classroom openly and is useful for teachers to spend more time planning joint learning,

educational management, subject viewpoints, and strengthening committee partners between school components [23]. The most important thing in LSLC is that teachers must provide assistance so that some important aspects of learning are not lost, and they must focus on observing student's learning so that the LSLC process runs smoothly [24]. Teachers must renew their abilities and knowledge to continue professional development that greatly impacts work, achievement, skills and attitudes, and performance [25]. Good learning should be a place for students to voice questions or in other words, students should be encouraged to ask questions about something unknown, so they struggle to seek help with other peers. Learning also requires an appropriate cognitive conflict process.

The results of other studies through lesson study learning, the teacher knows how students think so the teacher can change the learning plan. Based on this, lesson study activities are important to create better learning instruments and focus on the way/activities of students learning not the way teachers teach [26]. In short, the teacher comes with questions about the lessons learned during observation, plans for learning, checks, discuss what they observe, through several literacy processes, the teacher discusses learning and influences student's learning [27].

Lesson studies are widely used in science learning, the results show that changes can be observed based on academic learning, lesson structure, and student reactions when learning is done. Student learning with lesson study in class is done by choosing focus on specific pedagogical titles, making lesson plans with the team, other teachers observing the learning process, recording the learning process for analysis and reflection, discussing the results of the do with the team and accepting criticism and suggestions [28]. The results of the lesson study activities can be used for research that leads to professional improvement that has a long-term impact on learning practices. With the right support, they can be enthusiastic about doing lesson study activities. But lesson study is not done much because they feel inadequate ability and lack of confidence with the team [8].

4. Conclusion

High school students have the ability to solve different analysis questions. The results show that the ability of analyzing questions about high ability students is fulfilling 3 types of abilities proposed by Bloom, the ability to analyze questions about medium ability students is fulfilling 2 types of abilities expressed by Bloom, the ability of analyzing questions about low ability students is fulfilling 1 type of abilities proposed by Bloom.

Acknowledgments

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