

ABILITY INVESTIGATION AND QUANTITATIVE PROBLEM SOLVING OF PROSPECTIVE TEACHER ABOUT RESPIRATION

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Abstract

The purpose of this study to obtain information on investigative skills and quantitative problem solving prospective teachers about respiration. The method used in this research was descriptive. The research subjects consisted of one class of prospective teachers of biology as many as 30 students of a university in Bandung. The results showed that the investigative skills of student teachers was high, approaching the moderate classified. The investigation capabilities include the ability to plan activities was high, carrying out investigations was high, creating reports and presentations was high, and the evaluation was moderate. Quantitative problem-solving skills of student teachers were moderate, approaching the high classified. Components of the problem-solving skills include the ability to understand the problem was moderate in classified, the ability to choose the formula was high, and the ability to calculate the formula was moderate. Learning that involves investigating and problem solving was important issues to be implemented and enhanced.

Keywords: investigation, problem solving, respiration, prospective teachers.

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A.INTRODUCTION

Respiration in particular the concept of respiration quotient is one of the biological material in particular physiology for some student teachers of biology relatively not easy to understand. The material is abstract, predictive, involving formulas and calculations, as well as the necessary investigations through the lab to understand [10,11]. Investigation capability is the ability of a complex which contains powers of observation and ability to solve problems is a proper scientific capabilities possessed prospective teacher [4,5,6]. The demand to make the student teachers are able to solve the problem must become a central theme in learning. By being able to solve the problem, it means having an understanding and be able to

apply understanding [7, 10]. An understanding of respiration is a must when student teachers studying biology, because respiration is one of the basic materials for understanding the biology.

Investigation is one approach to learning that includes an action plan, conducting investigations, preparing reports, report presentation, and evaluation [5,6,9]. Learning through investigation could have an impact on problem-solving abilities. Solving the problem requires an understanding and knowledge can have an impact on the formation of [3,4,5,7]. Problem solving is a mental process involving asimililasi and or accommodation. Assimilation is a process of forming a new concept of knowledge through association with schemes already existing concepts in students. Accommodation is the process of knowledge formation that begins with the formation of the concept in the student scheme [2.10]. Some of the results of previous studies with regard to the investigation and problem solving skills, including learning investigation concluded that the effect on comprehension and problem-solving abilities of students. Investigation capabilities and quantitative problem solving of these studies are less excavated and still needs to be disclosed. [2,3,7,9].

The purpose of this study to get an overview of investigative skills and problem solving skills student teachers about respiration. The results of this study can be used as the basis for the repair or formulate better learning so the ability investigation and quantitative problem solving ability of students to be better.

B. RESEARCH METHOD

This research was conducted in the Department of Biology at a university in Bandung, the S1 students were attending the 5th semester Practical Plant Physiology in odd semester 2015/2016. Students who become subjects of research that as many as 30 students, including 10 men and 20 women. The method used is descriptive [1].

Learning studied were plant physiology lab (3 credits) of respiration. Variables examined included investigative skills and problem-solving skills. The ability of the investigation includes multiple components phases namely the setting of student groups (each group: 5-6 students) and identify the topic of investigation, making practical plans, carry out practical work and observation, to prepare and present a report and evaluation [5,6,11]. Problem-solving skills include several components: understanding the problem, set the formula, and calculate the appropriate formula. Lecturers act as mentors and facilitators [3,4,5,7,10]. After the study ends in doing the test.

The instrument used in the research were instruments investigative skills and ability to solve quantitative problems. Investigative skills in the net with the observation rubric and quantitative problem-solving skills in the nets with the arithmetic test. Research data both data investigative skills, as well as a data problem solving ability of respiration, analyzed and grouped on very tinggi (> 80), high (70-80), moderate (59-69), low (39-58), and very low (<39).

C. THEORITICAL FRAMEWORK

Respiration is one of the biological material that is very important and needs to be understood by the student teachers. The materials include the following respiration respiration quotient (KR), involving formulas and calculations in the discussion [11]. Learning material should ideally be done through practical respiration or investigation, and problem solving. Investigations can be done to solve the problem. Investigative skills and problem solving skills in students can be measured by a particular instrument or measuring instrument.

Investigation of the learning activities that provide the possibility for students to develop an understanding through various activities. Learning activities begins with the

problems of teachers or students, while further learning can be open, meaning not strictly structured by the teacher, and the implementation refers to the theory of investigation. This model is highly customizable and comprehensive combines academic goals investigations, social integration, and social learning, and can be used in all fields of study, at all levels of age [6,7,13].

Investigation is the process of investigation of the student, and the student subsequently communicate the results prolehannya, prolehan compare it with other students, so that an investigation can be obtained in one or more results. Investigations relating to the activity observed in detail and assess systematically [4,5,12].

Investigations can be conducted in accordance with the interest. For example, a student interested in investigating parts of X and students interested in investigating other part B, or A student interested in investigating the surface, and students interested menyelidiki B deeper part, because of its ability. That is why the investigation referred to also open an activity that is not limited, because this activity is highly dependent on the interest and the differences in the ability to think every student would be different.

Learning to use the investigation model includes six stages. First, identify the topics and organize students in groups. Second, plan tasks to be learned. Third, carry out observation or investigation. Fourth, prepare a final report. Fifth, presented the final report. Sixth, evaluation, teachers and students collaborate in evaluating the learning routine. Learning with the investigation provide opportunities for students to solve problems [5, 12].

Learning biological material particularly respiration, involves solving problems. Solving these problems can not be separated from the application of concepts and principles. Problem-solving skills are important components that need to be owned by everyone. Such capabilities are key components that need to be developed and the flyer in the learning process [10, 11]. Currently there is a strong impetus in education to make problem solving as a key component in the curriculum [9, 10].

Problems exist in every aspect of life, including learning, thus required the ability to solve it. Problem-solving skills are important components that need to be owned by everyone. Such capabilities are key components that need to be developed in the learning process [9, 10]. Currently there is a strong impetus in education to make problem solving as a key component in the curriculum . Problem solving is an effective way to explore new ideas. Troubleshooting can be viewed as an activity that is mechanistic, systematic, and often asosiasi with an abstract concept [3, 8, 9].

Troubleshooting is a process that involves the use of heuristic measures. Heuristics is a guideline or general measures are used to guide the settlement of the problem. Troubleshooting can also be viewed as a process of knowledge acquisition or formation. In this case, the issue functioned as a trigger for students to construct knowledge and learning can be regarded as problem-based learning [9, 12]. In line with development cognitive learning theory, problem solving is seen as a mental activity that involves complex cognitive skills. Solving problems involving high-level thinking skills such as visualization, association, abstraction, the manipulation, reasoning, analysis, synthesis, and generalization Thus, essentially problem solving is the synthesis process or the use of different concepts, rules, or formulas to solve problems [5,8].

A new issue can be said to have solved the problem if the solution has been obtained and individuals solve that problem understanding what he was doing, and understand why such a solution [9]. To be able to problem solving need to understand the problem, it can determine the procedures, methods, or formulas appropriate to resolve the problem, and can execute or solve the problem by methods or formulas has been [4,5,8, 12].

D. RESULT AND ANALYSIS

1. Ability Investigation Students About Respiration

Respiration in this case respiration in plants especially the material quotation respiration, revealed through the investigation. Investigative skills student teachers about their mean respiration varies and was high (mean = 72.2). Investigative skills that were analyzed were grouped on, make a plan of investigation was high (72.2), carry out investigations, including evaluation and presentation of reports was high (70.2). Planning the investigation includes determining a title or topic was high (81.1), specify the destination was high (73.0), formulate problems were moderate (69.6), determine the principles was moderate (64.3), formulate hypotheses were moderate (69.7), and establish procedures was high (76).

Investigation execution capabilities student teachers were mixed, while their mean was high (mean = 70.5). Implementation of the investigation includes the implementation plan procedures was high (72.4), the implementation of observation was high (72.0), process data was high (77.1), making inferences were moderate (67.2), presentations were moderate (68, 0) and evaluate classified as moderate (63.9).

From the above data it appears that planning was relatively higher than the implementation. This was likely to make the students plan helped by the availability of practical guides, whose contents relative to equip planning. It is less obtrusive than planning is the ability to make principle (64.3), while others, especially the determination of the topic or make a relatively good title (81.1). It was less obtrusive than the implementation of the investigation primarily evaluation aspects (63.9). As for the other aspects are relatively better, especially in terms of data analysis (77.1).

Investigations are implementing procedures to test or verify the theory in practice involves a lot of practice in addition to cognitive psychomotor. Investigation, also requires affective aspects, such as meticulous, careful, honest, tenacious, persevering, not quick to give up [7,13]. Practical training is inseparable from cognitive thinking habits. The low value makes the principle aspects of the investigation and evaluation of students, partly due to lack of theoretical knowledge, implementation procedures and criteria for the achievement of practical activities. Less prominence of students in making conclusions, among others related to the data obtained are not representative, the lack of repetition, lack of accurate carrying out the procedure, and lack comparing with theory. In this case less diligent student (persist) and sharp in the evaluation.

The high achievements of student teachers about the investigation because the investigation is carried out to expand the discussion, develop alternative answers and arguments based on the experience of students. Even if students are not always the right answer or even wrong because the underlying preconceptions of students' thinking is incorrect. But from those mistakes by discussion and developed communication can correct their mistakes. They learn from their own mistakes by asking, why others obtain a different answer to the answer. With an attitude of openness in the investigation, students can learn by looking for the truth of the answers to the problems, also seek the path of truth using common sense and their mental activity [5,6,13].

2. Quantitative Problem Solving Ability Students About Respiration

Problem-solving skills about respiration of prospective teachers were moderate (mean = 68.7) , approaching high in kategori. Problem-solving skills include understanding the problem, ability to define and use formulas, and can perform calculations according the formula, include the problem Understand can specify which data is known and the question asked. Being able to define and use a formula means it can choose the suitable formula. Can

perform calculations according the formula means it can calculate correctly based formula. Data values problem-solving skills student teachers can be seen in Table 1.

Table 1. Data Quantitative Problem-Solving Ability of Prospective Teachers

Mean Quantitative Ability Problem-Solving Ability of Prospective Teacher			
Understand the problem	Exact determine the formula	Calculating correctly according to the formula.	Average
69,0 (moderate)	72,0 (high)	65,0 (moderate)	68,7 (moderate)

Based on data in Table 1, the ability of the least prominent was the ability to calculate applying the formula (mean = 65). It is generally underprivileged students in solving problems solving problems related to the count, and that concerns the chemical equations and calculations. As for the aspects related to the concept and the procedure is relatively not problematic. This is in accordance pennelitan earlier [2, 12] Their mistakes include less careful in substituting the calculations and determine which data need to be included in the calculation and which are not. It is also as a result of less maximal understanding of the issues and formulas, as well as the limited time to assimilated issues that affect aspects of their thinking. The selection formula was not so complicated considering there were only two formulas related to respiration were $KR = V2 / V2 + V1$ and $KR = V2 / V2 - V1$ [11].

There are three things that underlies the thinking skills, including problem solving, namely surgery, knowledge, and tendencies [3,4,14]. A person is able to use his brain to think of certain operations in accordance with the working mechanism of the brain. It uses cognitive and metacognitive. The ability to think is influenced by knowledge, ie prior knowledge either in the form of concepts, ideas, ideas, code, or symbol called schemata that can be synchronized with the concepts, ideas, or new ideas being studied. The tendency with regard to environmental influences, the work of the heart, and the feelgood factor [3,4,9,13].

There is a link between problem solving and investigation. In the UK troubleshooting distinguished from the investigation, whereas in the US the two are not distinct, investigation included into the scope of the problem-solving activity [6,10]. problem solving include an activity centered (Convergen activity) where students have to learn to look for Completion. While investigations are activities spread (divergent activity) where students are being given the opportunity to think, develop, investigate interesting things that disturb the curiosity of students [3,6,9].

E. CONCLUSION AND RECOMMENDATION

Investigative skills of prospective teachers in learning respiration belong to the high qualifications, approaching the moderate. The investigation capabilities include the ability to plan activity was high, carrying out investigations was high, creating reports and presentations was high, and the evaluation of moderate. Quantitative problem-solving skills of prospective teachers in learning respiration belong to the moderate qualification, approaching the high . Components of problem-solving skills include the ability to understand the problem was moderat, the ability to choose the formula was high, and the ability to calculate the formula was moderate. Learning that involves investigation and problem solving is recommended can be improved and applied, also developed to the study of respiration concept and another concepts on prospective teachers and another students.

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