

Learning Difficulties and Learning Expected by Students in the Biochemistry Course at Department of Science Education UIN Fatmawati Sukarno Bengkulu

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Abstract: *Biochemistry is a science that has a broad scope of material regarding the chemical-biological and chemical-physiological processes of living things. Biochemistry material that tends to be abstract with pictures and schematics makes it difficult for students to understand biochemistry. The research purpose is to analyze the students' learning difficulties in studying biochemical material and find solutions. The analysis data were obtained through a short questionnaire using the Google form. The research subjects were 40 students of Department of Science Education at UIN Fatmawati Sukarno Bengkulu who had taken courses related to biochemistry. The data were analyzed using the percentage technique. The results showed that the learning difficulties experienced by students regarding the subject matter of Biochemistry were about biochemical terms, molecular structures, metabolic pathways, and biochemical processes. The students learn biochemistry dominated by group discussion methods and lecturer explanations and assisted by video and image explanations. Learning sources in exploring biochemical material are through the internet (scientific articles, videos, pictures), discussions with lecturers, colleagues, and textbooks. To overcome the problem of student learning difficulties, it is necessary to use simple language, deliver sequential material, develop e-module teaching materials, and link biochemical materials in everyday life.*

Keywords: *Learning Difficulties; Biochemistry; Learning*

INTRODUCTION

Biochemistry is a science that describes chemical-biological and chemical-physiological processes. Biochemistry derives from the application of physics and the study of biological phenomena. Biochemistry is a basic science in medical science. Based on the idea that every manifestation of biological activity originates from chemical processes, the teaching and research of biochemical studies are about chemical components, characteristics, and metabolism (RH Garrett, CM Grisham, 2010). The book *Lehninger Principles of Biochemistry* volume I contains Basic Biochemistry material which, includes structure and catalysts: water; amino acids, peptides, and proteins; the three-dimensional structure of the protein; protein function; enzyme; carbohydrates and glycol-biology; nucleotides and nucleic acids; DNA-based information technology; lipids; biological membranes and transport; and bio-signaling.

Part two covers bioenergetics and metabolism: principles of bioenergetics; principles of metabolic regulation; citric acid cycle; fatty acid catabolism; amino acid oxidation and urea production; oxidative photophosphorylation; carbohydrate biosynthesis in plants and bacteria; lipid biosynthesis; biosynthesis of amino acids, nucleotides and related molecules; hormone regulation, and integration of mammalian metabolism. The final section also discusses information pathways: genes and chromosomes; DNA metabolism; RNA metabolism; and protein metabolism. (Nelson DL and Cox MM 2013). Yohanes Ngil (2009) explains that biochemistry discusses the principles of metabolism, carbohydrate metabolism, the citric acid cycle, lipid metabolism, oxidative phosphorylation, and nitrogen metabolism.

The mapping project of the human genome has been mapped so that the treatment of diseases such as Aids, Cancer, TB, Malaria, and others caused by gene mutations needs to be handled from a biochemical perspective, therefore some universities and even schools include biochemistry as one of the subjects. According to Wijayanti and Lestari (2016), one of the achievement standards for biochemistry courses is students understand the biochemical reactions that occur in the body's metabolic processes. Biochemical studies also include the study of chemical reactions, the nature of chemical reactions that occur in cells. Learning resources such as textbooks, modules, and scientific articles as a whole have different systematic of material but have the main elements or components of biochemistry and metabolism (Kurniawan, Z. I., and Jailani, 2020). The biochemistry course at the Department of science education UIN Fatmawati Sukarno Bengkulu explained the basic elements or basic biochemical compounds such as amino acids, proteins, carbohydrates, lipids, enzymes, vitamins, and metabolic concepts. This Biochemistry course

specifically discusses and recognizes biochemical elements or compounds, basic structure, and function. The mechanism of chemical reactions is discussed in the Bimolecular and Metabolism class (Advanced Biochemistry). The biochemistry course provides students with an understanding of the chemical reactions that occur in the cells of living organisms and their relation and application in everyday life. Therefore, the biochemistry course is an important interdisciplinary subject for students as prospective science teachers.

Students have attended biochemistry lectures since the fourth semester and continued in the fifth semester. Before the Covid-19 period, lectures are conducted face-to-face with the *Focus Group Discussion* and *Student methods. Active Learning* Lectures were followed well and enthusiastically. At the end of the lecture, a practicum is held to strengthen the theory. During the Covid-19 period, where all lectures were conducted online, biochemistry lectures continued to use the *Focus Group Discussing* and *Student method Active Learning*. The media used are the WhatsApp application (Qomariah H, 2020) and the *Collaboration Application* with the WhatsApp and Google Meet applications (Qomariah H, 2021). Learning carried out in such a way does not give good results. This can be seen in the results of the Mid-Semester Examination for the academic year 2021/2022 and the results for the Final Semester Examination for the academic year 2020/2021. Low learning outcomes are an indication that there are learning difficulties in the biochemistry learning process.

The imbalance between the student learning process and the results of student learning in biochemistry courses encourages the need to solve this problem. The problem that occurs in students who take biochemistry courses is that students have difficulty in capturing learning. Moreover, Learning difficulties according to *The United States Office of Education* (USOE) cited by Abdurrahman (2003) is a disorder in one or more of the basic psychological processes that include understanding and using teaching or written language. Meanwhile, according to Utami (2019), learning difficulties can be interpreted as psychological disorders in students who have perfect physiques but find it difficult to accept or understand learning well. So learning difficulties can be interpreted as a condition or process where students experience an inability to capture lessons as expected. Learning difficulties can be diagnosed by conducting tests, diagnostic tests of non-test abilities, through interviews, observations, and so on. (Zenia Luthfi, K and Jailani, 2020).

The diagnosis of learning difficulties in biochemistry courses has been carried out by Halmo et al (2018) finding that students have learning difficulties in amino acid material and non-covalent interaction mechanisms. Meanwhile, the latest research conducted by Zenia Luthfi, K, and Jailani (2020) showed that students' learning difficulties in biochemical material were about molecular

structure, metabolic pathways, and terms in biochemistry. According to Rahmatan (2016), the hardest concept to understand is the challenge of carbohydrate metabolism. Because of contains abstract material and processes, the solution given to help students understand biochemistry is to use drill and practice model techniques packaged in software that can measure the mastery of concepts and creative thinking skills of students. Another reason many students fail to understand biochemical concepts is that biochemical material is very dense but the time given is limited (Munawaroh et al., 2019), many biochemical concepts and irrelevant in student life (Wahyuni, 2019). Based on the observations of the researchers, students also experience difficulties in studying biochemical material as a basic concept that can be related to the understanding of Islam based on the Qur'an and Hadith.

From the explanation above, the researcher feels the need to conduct research or analytical action on the problems of learning biochemistry experienced by students of the department of science education of UIN Fatmawati Sukarno Bengkulu. This research study needs to be carried out as an effort to evaluate the biochemical learning process and as an analytical study of student learning difficulties. In addition to evaluating and analyzing the learning difficulties of students, this research is expected to find solutions to this problem.

METHOD

This research is a descriptive study with a survey method through a questionnaire given to students. The populations in this study were students of the science education program who had taken courses related to biochemical concepts. Student participation in this study was several batches selected based on the purposive sampling technique. The research was conducted in December 2021 in the Science and Technology Building of the teacher and science faculty of UIN Fatmawati Sukarno Bengkulu. The data was obtained using an instrument in the form of a questionnaire (questionnaire) containing several open-ended questions as indicators of the Biochemistry learning process. The questions that will be given are:

1. What are the student learning resources related to biochemistry?
2. How do students learn to understand biochemical material?
3. What form of biochemistry learning is expected by students?
4. What material is the most difficult for students to understand?

The data obtained will be analyzed qualitatively using the percentage technique.

RESULTS AND DISCUSSION

This research was conducted by distributing questionnaires through the *Google form media* to students who have taken biochemistry lessons. The questions can be answered openly by students. The following are the results of the questionnaire answers which are presented through diagrams and tables:

Figure 1. Results of Analysis of Difficulties in Biochemical Materials



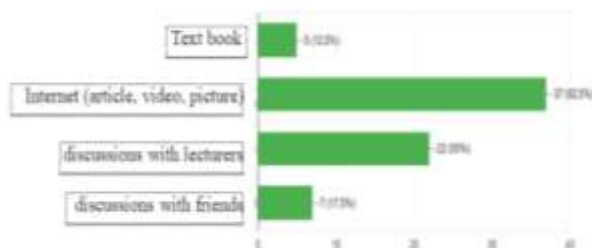
Based on the results of the data above (Figure 1) that there are 4 (four) student difficulties with biochemical material, namely about the molecular structure of biochemistry, metabolic pathways, biochemical terms and processes of biochemistry. The highest difficulty is in the material terms in biochemistry as much as 80%.

Figure 1. Diagram of Data Analysis Results of Learning Biochemical Materials



Based on the data from the analysis in the diagram above, it can be seen that students prefer to study biochemical material by means of group discussions (10%) and lecturer explanations (10%). The practicum method puts the third position as much as 7.5%. The rest of the students liked the assignment method (5%), understanding journals, studying pictures, studying videos and assignments.

Figure 3. Diagram of the results of data analysis on Student Learning Resources



Based on the diagram above (Figure 3), it can be seen that the sources of student learning in studying biochemistry are through the internet, textbooks, discussions with lecturers and discussions with colleagues. Internet sources occupy the highest percentage position, which is 92.5%, then discussions with lecturers are 55%, and discussions with friends are 17.5% and textbooks are 12.5%.

Figure 4. Results of data analysis on how to learn biochemical materials expected by students



Based on the results of the data analysis in Figure 4 above, it can be seen that almost most of the students liked the learning method with presentations and group discussions, which was 35%. As many as 5% of students expect learning by using videos and pictures.

The learning difficulties experienced by students related to the biochemical material contained in Figure 1 are events that occur not only in students of the science education program, UIN Fatmawati Sukarno Bengkulu, but also occur in other study programs. The learning difficulties of students are terms in biochemistry, biochemical molecular structures, and metabolic pathways. This is also experienced by students of the Teacher and Science Faculty at Mulawarman University class 2018/2019 where the level of difficulty in understanding biochemical terms is 22% (Kurniawati, ZL and Jailani, 2020; Fauzi, Ahmad and Mitalistiani, 2018). The three categories of material above are

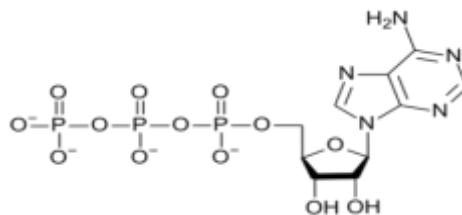
because biochemistry has a broad scope of material and a short time to study. (Munawarah, 2019)

Students also experience difficulties in biochemical structures which are usually presented in the form of pictures. Likewise, metabolic pathways are usually presented in the form of diagrams. According to Green CM (2008) that pictures or diagrams are presented for complex and abstract material. Interpretation in reading diagrams is usually only on a shallow level of interpretation, so students need to further explore the meaning of diagrams or images presented in biochemical structure material. Students' skills in reading and interpreting diagrams and pictures can only be obtained through various student learning practices. (Lowe, 1993). When there is an error in reading and interpreting biochemical pictures and diagrams, there will be a misunderstanding of the concept of biochemical molecular structure material, especially in complex molecules and pictures of metabolic processes.

Metabolic pathways are a series of biochemical reactions that occur in the body of living things in order to produce energy. According to Wood, EJ (1990) in his article, the difficulty in reading diagrams is because biochemical material is very detailed material. Metabolic pathway materials generally use diagrams showing chemical formulas, molecular structures and names, arrows depicting the direction of reactions and equipped with enzymes that catalyze each reaction. The details of this metabolic pathway material cause students' learning difficulties where they are required to understand and memorize every step of the reaction.

Biochemical terms are widely used in biochemical material. Each structure has its own term; a change in the molecular structure causes a change in the term. In everyday life we often hear the word energy, which in terms of energy biochemistry is termed Adenosine Triphosphate or ATP. Furthermore, ATP has the following structure:

Figure 5. Structure of Adenosine triphosphate



Another example of difficulty is when students are asked to understand the term hyperglycemia. Where in this term students need to understand the basic structure of carbohydrates, enzymes and metabolic pathways related to

these terms. Difficulties in understanding these terms increasingly make students experience difficulties in understanding biochemical material (Kurniawati, ZL and Jailani, 2020).

In general, learning difficulties are influenced by two factors, internal factors and external factors (Agnesti Y and Amelia, R. (2021); Listiani, FD (2020)). According to Munawaroh (2019), the internal factors of student learning difficulties are caused by student conditions, interests and motivations as well as student learning methods. Meanwhile, according to Kurniawati, ZL and Jailani, 2020 external factors such as the characteristics of the biochemical material itself, teaching materials and teaching methods. Biochemistry contains material that is very broad and complex, sometimes biochemical material is not relevant to everyday life. In a short time, broad and complex material causes students as prospective teachers to be able to integrate biochemical material with contextual events that occur in their daily lives. Other external factors are pedagogical factors, for example the limitations of methods in biochemistry learning. For the science education program students of UIN Fatmawati Sukarno Bengkulu, based on the results of the researcher's analysis, the lecturer's explanation method and group discussion are still the students' favorite methods. In addition, explanations with pictures and videos can also complement the method. The Covid-19 pandemic period made students experience difficulties in discussing with lecturers and colleagues so that media such as videos and pictures were not optimal to increase their knowledge.

Diagnosis of learning difficulties aims to minimize the problem of student learning difficulties in studying biochemistry. In Figure 4, there are several learning methods expected by students, namely presentations and discussions, assisted by pictures and videos. The development of teaching methods with the help of pictures and videos can be developed using teaching materials in the form of e-modules. This is also concluded from the results of the analysis of research conducted by Munawaroh (2019) and Agnesti Y and Amelia, R. (21). Another effort that can be made in the problem of learning difficulties in this Biochemistry course is the need for practicum. Biochemistry learning practicum activities can be used as evaluations in the main learning process and learning achievement strategies. According to Usman (2019), the problem of biochemistry learning difficulties can be overcome by developing critical thinking skills through problem-based learning. Based on the results of the analysis above, the writer concludes that 1). The use of simple language can help students understand biochemical material; 2). The presentation of the material is delivered systematically and gradually so that students can regulate the flow of thinking; 3) the development of teaching materials, both teaching materials modules or practicum modules, can use e-modules; 4) Biochemical

material needs to be related to problems or phenomena that occur in everyday life so that they of course also gain experience as a provision to become a prospective teacher.

CONCLUSION

Based on the research result and the presentation of the discussion, it can be concluded that the learning difficulties of science education program students at UIN Fatmawati Sukarno Bengkulu regarding Biochemistry subject matter, biochemical terms, molecular structures, metabolic pathways, and processes. The way students learn in understanding biochemistry is dominated by group discussion, lecturer explanations, and video and image explanations. The Learning source in exploring biochemical material are through the internet (scientific articles, videos, pictures), discussions with lecturers, colleagues, and textbooks. To overcome the problem it is necessary to use simple language, deliver sequential material, develop e-module teaching materials, and link biochemical materials in everyday life. ■

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