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Analysis of Learning Difficulties of Class XII High School Students on Genetic Material

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Abstract

Learning difficulties are obstacles or distractions experienced by students in learning activities that hinder the achievement of learning objectives. In this case, students have learning difficulties with genetic material. Genetics is the science that studies the inheritance of traits, similarities, and differences in traits inherited by living things or passed on from parents to their offspring. This material is one of the materials studied in Biology in class XII. This study aimed to analyze the learning difficulties of class XII students on genetics. This descriptive study aims to describe and determine the causes of learning difficulties on genetics for class XII students at one high school in Cibeber, Indonesia. The data collection technique in this study used a questionnaire with a sample of class XII students at a high school in Banten, Indonesia. Through the research that has been done, it can be concluded that students have student learning difficulties found in genetic material (chromosomes, genes, DNA, and RNA) and foreign concepts and terms found in the process of cell division and inheritance.

Keywords: Genetics, Learning Difficulties, High School Students

INTRODUCTION

Education is the place where the learning process or educational activity takes place. Education is a planned, conscious effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious and spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by society, nation, and state (Republic of Indonesia, 2003). Education is also a learning process directly or indirectly by a person or group of people intentionally or unintentionally carrying out the learning process indoors and outdoors activities designed to increase the knowledge of students who do not know to know (Cano, 2005; Sari & El Islami, 2022). The educational process can be completed with the learning process.

Learning is a process that causes a change in behavior within a person (Sauce & Matzel, 2013; Hasani et al., 2020). Still, this behavior change is not necessarily due to a process of learning outcomes but can be caused by natural processes or circumstances in a person. A study is intended to achieve learning objectives. If students can achieve learning objectives, then these students can be successful. However, in the learning process, it is often found that students have yet to achieve the set learning objectives. If students cannot achieve learning objectives and encounter obstacles in the process, then these students can be said to experience difficulties in learning. Students with learning difficulties need help to reach standards in learning. Learning

difficulties are one of the things that need attention in the world of education. Learning difficulties that are left unattended will have an impact on not achieving learning goals (Ismail, 2016; Putri, 2018). Learning difficulties experienced by students are not always caused by external factors such as environmental, social, cultural, and learning facilities (Sari et al, 2022); individual factors can also cause them.

Learning difficulties become obstacles or distractions experienced by students in learning activities, hindering the achievement of learning objectives. Each learner's experience of learning difficulties is different. It can be seen in motivation, intelligence, emotion, learning speed, spontaneity, and environment. The difficulties experienced by students are very influential in the learning process, including ways of thinking and learning outcomes achieved.

Based on the results of observations at state high schools in Banten, student learning difficulties are often found in the genetic materials. Genetic material is a very important part of biology. Genetics is the study of genetic material (Nusantari, 2014). Genetics broadly discusses seven main concepts, namely 1) the meaning and scope of genetics, 2) the structure of genetic material, 3) the reproduction of genetic material including cell reproduction, semiconservative DNA replication, and others, 4) the work of genetic material covering the scope of genetic material, 5) changes in genetic material, 6) genetics in the population and 7) genetic material engineering. This shows that genetic material is very important in biology, so students' mastery of this material is highly expected. However, genetic material is difficult for high school students to learn. If the learning difficulties experienced by students are not identified, it will hinder the learning process of these students. Thus, students' learning difficulties must be known and overcome as early as possible so that instructional objectives can be adequately achieved. Steps to diagnose learning difficulties need to be done to help students obtain optimal learning results. Therefore, this study aimed to analyze the learning difficulties of class XII high school students in genetics.

METHOD

This research is descriptive research which is a method aimed to describe the nature of a thing that is ongoing during the research so that it can find out the cause of a certain phenomenon (Ramdhan, 2021). The descriptive method aims to answer questions concerning something at the time the research was conducted (Umar, 2005). Descriptive research was used to find out the causes of learning difficulties for class XI high school students in the subject of Genetics. Data collection techniques in this study used survey techniques through questionnaires to determine students' learning difficulties in genetic material. Questionnaires are tools for collecting data for research purposes (Sugiyono, 2014). Questionnaires are used

by circulating a form containing several questions to several subjects or respondents to obtain written responses. As well as analysis techniques using a qualitative approach. The sample in this study was class XII students at a public high school in Banten, Indonesia.

RESULTS AND DISCUSSION

Learning is the main task of a student. Success in learning is expected from these students and those around them. But in this case, after learning, students will find two things that are very related, namely success or failure. If successful, during the learning process, the student enjoys the process. But if it fails, then the student has several difficulties or does not enjoy the process. Learning difficulties are problems that hinder the teaching and learning process so that learning success is not achieved.

This research was conducted by distributing questions through Google Forms. The questions we spread were questions about the causes of the learning difficulties they experienced in biology, especially genetics.

Student Knowledge of Genetic Material

Table 1. Knowledge Of Genetics

Knowledge of Genetics
Genetics is a science that deals with the inheritance of traits inherited from parents
The study of DNA, RNA, genes, and chromosomes
Genetics is the science that studies the inheritance of traits in living things
Genetics is the study of heredity
Genetics is a branch of biology that studies the inheritance of genes in organisms and sub-organisms
The science of heredity that studies various human problems such as health
Genetics is a branch of biology that deals with the inheritance and expression of inherited traits
Information that every living cell has that can be passed on to their offspring
Genetics is a branch of biology that is concerned with heredity and variation.
About the passing of genes from parents to their children
Genetics are traits passed on by parents to their children
Genetics is the inheritance of traits from parents to their children

Based on Table 1, shows the initial knowledge of class XII students about genetics. It is known that their initial knowledge about genetics is only limited to the inheritance of traits from parents to their children or offspring. But in essence, genetics is a branch of biology that tries to explain the similarities and differences in the inherited traits of living things. In addition, genetics can answer what is inherited or passed on from parents to children or offspring, what is the mechanism of inheritance, and what is the role of this genetic material in determining an

individual's character (Effendi, 2020). Initial knowledge of the concept of genetics is an important goal in learning biology at school. Because initial knowledge of genetic concepts gives an understanding that the genetic concepts taught are not just rote memorization but must be understood (Wulandari et al., 2021). Suparno (2005) explains that before participating in formal learning, students have already explored and found out genetic concepts through daily experiences or previous formal learning because it could be that their initial knowledge of genetics can be different from the experts.

Based on these data, students' initial genetics knowledge still needs improvement. Prior knowledge becomes an important subject in students' forming knowledge. Students will build and respond to new information based on their initial knowledge. Initial knowledge that needs to follow the new knowledge that will be obtained is a source of student learning difficulties, ultimately hindering students from learning (Panggabean, 2020). Therefore, it is necessary to strengthen students' prior knowledge of the material being taught to reduce student learning difficulties. Learning must start from the initial knowledge of students. In addition, the role of the teacher is also needed to become a bridge for students when students experience different understandings between prior knowledge and new knowledge, which will become a conflict in triggering learning difficulties. The goal is continuity between the initial knowledge and the knowledge to be learned.

Student Learning Difficulties

Based on the results of the analysis carried out, the location of students' learning difficulties varies. Four things become the location of students' learning difficulties, including making pictures of the structure of genetic material (DNA, RNA, chromosomes, and genes) as much as 7%, the concept of genetics and reproduction and cell division as much as 43%, DNA structure, chromosomes, and genes as much as 40%, inheritance properties as much as 10% (Figure 1).

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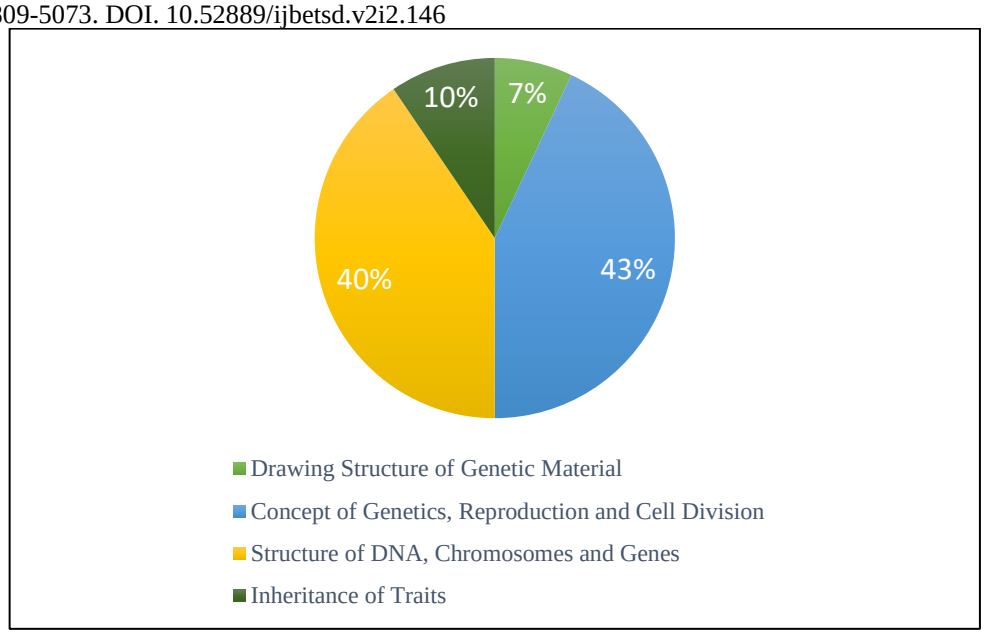

Figure 1. Diagram of the percentage of students' learning difficulties in Genetics material

Based on Figure 1, the highest percentage of student learning difficulties is in DNA Structure, Chromosomes, and Genes, namely 43%. This is because students think that the relationship between chromosomes, genes, DNA, and RNA is quite complicated; namely, chromosomes are a condensation of chromatin threads visible when cells divide and then produce structures called chromosomes. Chromosomes are divided into two, namely body chromosomes (autosomes) and sex chromosomes (gonosomes). On the chromosome, there is a space called a locus that contains thousands of genes so that the chromosome is a gene carrier. Genes are composed of nucleic acids, which consist of DNA and RNA. DNA (deoxyribonucleic acid) is a polymer composed of repeated nucleotide units. One nucleotide is composed of a purine nitrogen base (guanine, adenine) and a pyrimidine nitrogen base (thymine, cytosine), a phosphate group, and deoxyribose sugar which has a double helix structure (twisted double chain) (Firmansyah et al., 2007; Karmana, 2006). So if they are given an image containing these three terms, they will have a headache deciding where to place them.

Learning difficulty with the structure of DNA, Chromosomes, and Genes is also due to the need for students' ability to draw. As much as 7% of students' learning difficulties lie in drawing the structure of genetic material (chromosomes, genes, DNA, and RNA) or when there is pictorial material. Drawing the structure of genetic material is also because many students feel that they need the ability to draw, so understanding genetic material is complex for students to form. The ability to draw material visually correlates with students' understanding of the material. Students who can draw good material will be able to understand the material better when compared to students who do not have a drawing (Nuriswati, 2020).

Furthermore, 43% of respondents answered that learning difficulties were found in the genetic concept sub-material during cell division or self-propagation and the process of producing offspring. Where after fertilization occurs, there is such a thing as cell division. Cell division is divided into 2, namely mitotic cell division and meiosis; then, in each division, some stages and processes occur at each stage. Each mitotic and meiotic division in living things has a different place, outcome, and purpose. Then in the process of cell division, there is something called Mendel's law 1 (free separation) and Mendelian law 2 (free association), where during cell division by mitosis or meiosis, the genes in the cell will separate freely and then recombine freely as well. The number of foreign terms in this sub-material is the cause of this sub-material being one of the locations of student learning difficulties. Students feel dizzy and tired when they have to memorize all the existing terms. In addition, internal and external factors are not enough to motivate students to suggest that they have difficulty learning and become unable to concentrate on the sub-material in Genetics. This was demonstrated by 10% of respondents who felt that cell division and inheritance was difficult because it required high concentration.

Learning difficulties experienced by students need to be studied as evaluation material for subsequent learning. Based on the research results, there are factors that influence learning difficulties, consisting of internal and external factors. Internal factors are factors that come from students regarding readiness and interest, and motivation of students (Matondang, 2018). While external factors such as the learning process, as well as facilities.

The readiness factor in learning is very important because if students want to do learning but still need to prepare and focus on the learning to be carried out, it will affect the learning outcomes obtained—readiness to learn influences student achievement. However, based on observations, many students are still not ready to take part in learning. Many students are still talking with their friends, and attention and focus are still not prepared. An effort must be made by the teacher when starting learning, namely focusing students by attracting attention to matters related to the material to be studied.

Next is interest and motivation. Interest and motivation are internal components within an individual that influence his actions. An individual will feel the need to do something or even explore something if there is interest in him. The importance of motivation to learn can be revealed from the notion of motivation itself. So the lack of interest and motivation will be very influential in overcoming student learning difficulties, especially in genetic material.

One of the most influential in the learning process is the teacher. Teachers who master the material well, use appropriate methods and media, and can manage classes well will affect overcoming student learning difficulties, especially on genetic material. And the last is

facilities. Facilities are a factor that influences student learning outcomes because facilities become a support in the learning process. Some of them and their students do not have books, and some have never read the books they already have.

Based on the description above regarding the factors that influence students' learning difficulties, the factors of student interest and motivation are among the biggest percentage factors. Therefore, teachers can foster student interest and motivation. There are many ways to help students overcome learning difficulties. However, not all methods can be used to overcome students' difficulties because each student has various learning difficulties. So, the teacher needs to understand the main location of learning difficulties. After knowing this, try several ways in accordance with the learning difficulties experienced.

CONCLUSION

Based on the research results, it can be concluded that students have difficulties with genetic material. Like drawing the structure of genetic material (chromosomes, genes, DNA, and RNA) because the pictures are not clear enough to make them dizzy and challenging to interpret the images. Then on the concept of genetics about cell division and inheritance, because the learning process uses foreign terms, it requires high concentration in studying it. The factors that can cause these things are the readiness of students to receive the material, interests, and motivation because not all students like genetics, the learning process where the teacher is less proficient in conveying material, and facilities and infrastructure.

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