



Analysis of Biology Teachers' Difficulties in Understanding Biology material: A Qualitative Study

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ABSTRACT

Teachers are professional educators whose duty is to educate, teach, guide, direct, train, assess, and evaluate students. Based on observations made in several high schools in Bantul, it is known that biology teachers still have difficulty understanding high school biology material. This study aims to determine in detail the internal and external factors that cause teacher difficulties in understanding Biology material, as well as to find out the Biology concepts in class X material that are difficult to understand by high school biology teachers in Bantul Regency.

This research is a qualitative descriptive study. The research population was biology teachers at public and private high schools in Bantul Regency. The stages of the study included initial observation, preparation of research instruments, validation of research instruments, data validity testing, and data analysis. The instruments were arranged in the form of interview guidelines and questionnaires. Instrument validation was carried out by two validators who were experts in their fields. The validity test of the data carried out included testing the validity and reliability of the data. Data analysis includes data reduction, data presentation, and conclusions from the data.

The results showed that several external and internal factors made it difficult for teachers to understand biology material. The external factors obtained are the lack of facilities and infrastructure, especially the tools and materials in the laboratory, and the difficulty in finding valid supporting information. Internal factors experienced are due to the content of the material that is difficult to understand, a large amount of material, the complex and abstract nature of the material, the number of foreign terms, and the wide scope of the material.



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Introduction

A teacher is a person who directly faces students in the learning process in the classroom. According to Law No.14 of 2005 teachers are professional educators whose duty is to educate, teach, guide, direct, train, assess, and evaluate students. Based on Permendiknas No. 16 of 2007 biology teachers must master the competence of understanding concepts, laws, theory of biology in a flexible manner, understanding biological thought processes in studying natural processes

and phenomena, understanding the structure (including functional relationships between concepts) of biology and related sciences, understanding the scope and depth school biology and master the principles and theories of management and occupational safety/learning in the school biology laboratory.

According to Rofa'ah (2016) in Utami & Hasanah (2019), the professional competencies that a teacher must have are as follows: being able to master learning material, structures, concepts, and scientific mindsets that support the subjects being taught; mastery of the basic competency

standards of the subjects being handled; able to develop learning materials creatively and innovatively; carry out reflective activities on an ongoing basis that aim to develop professionalism; able to take advantage of information and communication technology in self-development.

Several studies have examined the difficulties of teachers in teaching biology material in schools. Priyayi et al., (2018) analyzed problems in learning according to the perspective of Biology teachers in the Salatiga and Semarang Regency. The results of his research indicate that there are problems during learning caused by students, infrastructure, subject matter, and factors from the teacher. Insani (2015) examined the difficulties of junior high school teachers in teaching science material. The results of his research found that the main cause of the difficulty is in visualizing biological concepts. The material on the classification of living things is one of the most difficult junior high school science materials to teach. Hadiprayitno et al., (2019) found that biology subject matter that is difficult for high school students and teachers in Lombok includes bacteria and viruses, the endocrine system, cell structure, genetics, and the nervous system.

According to Makdalena et al. (2019) it's important for a teacher to analyze the concept of the material before doing learning in class. Based on preliminary observations made in February 2021 in some public and private high schools in Bantul, it is known that biology teachers still have difficulty understanding high school biology material, especially in grade X material. Some of the causes are the material that is too complex and the nature of the material is abstract. The results of observations also show that some teachers find it difficult to use the latest technology to find materials to be used in the learning process. Indriyani et al., (2019) stated that teachers who experience difficulties in mastering Biology material are the cause of their failure to achieve learning goals. This study aims to determine in detail the internal and external factors that cause teacher difficulties in understanding Biology material, as well as to find out the Biology concepts in class X material that are difficult to understand by high school biology teachers in Bantul Regency.

Method

This research is a qualitative descriptive study. The study population was biology teachers at public and private high schools in Bantul Regency. The sampling technique used in this study was purposive sampling, a sample of

teachers from 7 schools by UN scores below 55. It's hoped that the sample can represent the population that valid and reliable data is obtained about difficulties. Teachers in understanding the biology material of class X SMA. The stages of this research include initial observation, preparation of research instruments, validation of research instruments, data validity testing, and data analysis. The instruments were arranged in the form of interview guidelines and questionnaires. Observations were made at several schools in Bantul Regency. The instruments compiled include interview guidelines and questionnaires. Instrument validation was carried out by two validators who were experts in their fields. The data validity test was conducted, namely testing the validity and reliability of the data. Data analysis includes data reduction, data presentation, and conclusions from the data.

Result and Discussion

Teachers' understanding of biology material depends on several factors. Broadly speaking, two factors influence namely internal and external factors. In this research, external and internal factors will be explored through interviews and questionnaires. In Table 1, the accumulated results of interviews and questionnaires related to these two factors.

Table 1. External and internal factors that make it difficult for teachers to understand biology material in class X

External Factors	Internal Factors
- Lack of facilities and infrastructure, especially tools and materials in the laboratory	- Difficulty in finding valid supporting information
- Difficulty in finding valid supporting information	- The contents of the material are difficult to understand
	- A large amount of material, for example, animals and mushrooms.
	- Complex and abstract nature of matter
	- The nature of the material related to the number of scientific terms,
	- A wide range of materials, for example about animals, protist, ecology (biogeochemical cycle), fungi, Plantae, and viruses

Based on Table 1, it is known that the lack of infrastructure is one of the factors that cause teachers to find it difficult to understand the material. The tools and materials that are in the laboratory are felt to be lacking. Biological laboratory standardization to support practicum activities according to Permendiknas No. 24 of

2007 must meet the minimum facilities and infrastructure criteria which include space, furniture, props, experimental tools and materials, educational media, consumables, and other equipment. Based on interviews with teachers, it was found that the facilities in the form of tools and materials in the laboratory were still limited. This causes teachers to rarely do practicum so that they don't understand the material. Some schools already have laboratories but the available tools are still very limited so that practicum cannot be carried out. The materials available in the laboratory are still lacking, so students are asked to bring practicum materials from home. These various limitations make it difficult for teachers to understand biology material that requires direct practice, especially material on isolating, observing, and staining bacteria as listed in Table 2. According to Adilah (2021) laboratories in schools are very important in supporting biology teaching and learning activities, because there are some materials that in understanding it, it is necessary to make observations or experiments in the laboratory. If the laboratories available at the school do not meet the standards, the practicum activities will not run smoothly, so that the learning objectives that have been set will not be achieved.

Another external factor that becomes an obstacle in understanding biology material is the difficulty of teachers in finding valid supporting information. The results of the interviews show that some teachers still lack knowledge of information technology, especially when looking for journal articles and electronic books that support learning. Regarding journal articles, the difficulty experienced in determining the validity of the journal obtained. This is probably because teachers search for journals on general search engines, not looking for journals on valid search engines such as Google Scholar or Garuda. Class X high school biology teacher in Bantul Regency in learning activities has utilized technology well. This is according to the opinion of Safrudin (2017) that the use of the internet in learning by biology teachers in Bantul Regency is considered good. According to Wulandari et al. (2021) ability of teachers to use various educational applications is a factor that influences online learning in high school.

Based on Table 1, it is known that the internal factors that make it difficult for teachers to understand Biology material in class X include the content of the material that is difficult to understand. Materials that are difficult for teachers to understand are about Biodiversity and Classification of Living Things, Viruses, Bacteria,

Protists, Fungi, Plantae, Animalia, and Ecology. Various things cause the content of the material to be difficult to understand, among others, due to the complex and abstract nature of the material, the wide scope of the material, as well as the many foreign terms and Latin names. According to Yokhebed et al., (2012) biology is concerned with systematically finding out and understanding nature so that biology is not only the mastery of a collection of knowledge in the form of facts, concepts, principles but also a process of discovery (inquiry).

It is estimated that the ability to understand biology class X material is also influenced by certification and length of teaching. A certification is a form of enhancement and recognition of teacher competence in certain subject areas which is taken through the filing and PLPG channels. Certification through PLPG results in better-certified teacher professional abilities (Yusup, 2018). Several teachers in Bantul district schools have not been certified and are still new to teaching (data not shown). Based on the results of the interview, it was found that both certified and non-certified teachers had difficulty understanding some biology material for class X. It can be concluded that in general Biology teachers in Bantul Regency still have difficulty understanding Biology material.

Based on the results of the interview, it is known that teachers in Bantul Regency who have or have not been certified are members of the Subject Teacher Conference (MGMP) which aims to share information related to updated material for class X Biology. MGMP is also used as a forum for sharing related information. training held by various parties to increase mastery of class X biology material. Research conducted by Anggara & Chotimah (2012) concluded that the implementation of MGMP-based lesson study has a positive impact on increasing teacher professional competence.

In addition to extracting data about the factors that cause the material to be difficult to understand, in this study data was also taken about the reasons for the teachers having difficulty understanding the material (Table 2).

Tabel 2. The reason the teacher finds it difficult to understand Biology material

No.	Material and sub-material that is difficult to understand	School initials	Reason
1.	Chapter 2. Biodiversity and Classification of Living Things Submitter : - Diversity of Genes, Types, and Ecosystems - Diversity of Tropical, Coastal, and Marine Rainforests - Classification System of Living Things	- Senior High School A - Senior High School B - Senior High School C	- The content of the material is poorly understood - The material nature of many foreign terms - Complex material properties
2.	Chapter 3. Virus Sub material : - Reproduction of viruses	- Senior High School D	The content of the material is difficult to understand such as differences in the results of the reproduction of lytic and lysogenic viruses
3.	Chapter 4. Bacteria Sub material : - Characteristics of Bacteria - Bacterial isolation by cup method and pour method - Bacterial Observation - Bacterial Painting	- Senior High School E - Senior High School B - Senior High School D - Senior High School A - Senior High School F	The content of the material on techniques and steps in conducting isolation as well as observation and painting of bacteria is poorly understood because there is no practice
4.	Chapter 5. Protista Submitter : - Classification of protista	- Senior High School A - Senior High School E	- The content of the material is poorly understood - The nature of the material related to grouping and its species name is poorly understood
5.	Chapter 6. Mushrooms - Classification of Fungi	- Senior High School A - Senior High School E - Senior High School F	- Content of elusive material - The nature of material related groupings and scientific names of elusive species - Judging from the nature of the material there is an elusive scientific name and a large scope of material.
6.	Chapter 7. Plantae Submitter : - Moss Plants - Nail Plants - Seeded Plants	- Senior High School B - Senior High School C - Senior High School B - Senior High School C - Senior High School C	Teachers have difficulty understanding the material judging by the nature of the material, namely there are many scientific names, many materials, and complex.

		- Senior High School F	
7.	Chapter 8. Animalia Submitter :		
	- Characteristics and classification of Invertebrates	- Senior High School A - Senior High School C - Senior High School F - Senior High School G	Teachers have difficulty in understanding invertebrate classification material and vertebrate classification is seen from the nature of the material that there are many scientific names to be studied, the material is complex and the scope of the material is many.
	- Characteristics and classification of vertebrates		
		- Senior High School C - Senior High School F	
8.	Chapter 9. Ecology Submatter :		
	- Flow of energy	- Senior High School D	Teachers do not understand the material is seen from the content of the material that is difficult to understand material for example the relationship between the energy flow and the food chain
	- -Biogeochemical Cycle	- Senior High School A - Senior High School B - Senior High School C - Senior High School E - Senior High School F	Teachers have difficulty in understanding biogeochemical recycled material is seen from the nature of matter that is a complex material, where there is a combination of matter between biology and chemistry, in addition, there are also complex terms (chemistry)

Several materials are considered difficult by the teacher. One material that is considered difficult is bacteria (Chapter 4). Bacterial material includes the characteristics of bacteria, isolation of bacteria using the scatter plate and pouring plate method, observing bacteria, and staining the bacteria. The teacher considered the characteristics of bacteria difficult because there were Latin names while isolating bacteria, observing bacteria, and staining bacteria were considered difficult by some teachers because they did not understand the technique/steps of staining bacteria. Bacterial material finds it difficult to understand because its objects cannot be seen directly. This is by the opinion of Sudarisman (2015) that the properties of material objects studied in biology are very diverse, both in terms of their size such as microscopy in bacterial material. The material on *Plantae* (Chapter 7) on mosses, ferns, and seed plants was also considered difficult by the teacher because there were many scientific names and too many materials. This statement is reinforced by the opinion of Setyawan (2019) which states that *Plantae* material has a broad scope. In the material on *Animalia* (Chapter 8) a large amount of material, scientific names, and a wide range of material related to the classification of invertebrates and vertebrate classifications are considered difficult by the teacher. This is by research conducted by Suryanda et al., (2020) about 53.8% of the difficult material, namely *Plantae* and *Animalia*, because of the large number of memorization contained in both materials. *Animalia* is one of the materials that have a very broad scope because it includes invertebrates and vertebrates as well as the many uses of Latin so that students have difficulty understanding the material (Setiawati, 2017). The material in Chapter 9 Ecology, namely the biogeochemical cycle is considered difficult because there is a combination of biological and chemical materials, this is supported by research conducted by Diwaluthfi (2017), the characteristics of the biogeochemical cycle material are abstract. Another explanation is given by Adhim (2013) that the material of the biogeochemical cycle is abstract because the process or mechanism of the phenomenon is not visible to the naked eye.

Based on research conducted by Yusup (2018), 2 class X materials are considered difficult by educators or students, namely the classification system for living things 22% and *Animalia* 13%. As for the research of Hadiprayitno et al., (2019), it was concluded that the material that was difficult to understand by students was bacteria and viruses (18.64%), this was due to the content of biological material. The research is relevant to the data obtained that the material that is difficult to understand by teachers and students in the Bantul

district is contained in the classification material for living things, *Animalia*, bacteria, and viruses.

Based on the data obtained, internal factors include the content of the material because the material is difficult to study such as the diversity of species and genes, the making of the key of determination, and a large portion of the material, for example, *Animalia* and fungi. The nature of matter because of the abundance of matter, there are many scientific terms, complex, abstract, and a wide range of material, for example, *Animalia*, protist, ecology (biogeochemical cycle), fungi, *Plantae*, and viruses. If some materials are considered difficult for teachers to understand, it can be said that the professional competence of the teacher is lacking. The ability to understand Biology material in class X is also influenced by certification and length of teaching. Several teachers in Bantul district schools have not been certified and are still new to teaching. Teachers who have been certified include SMAN 1 Piyungan, SMA Muhammadiyah Sewon, and SMA Muhammadiyah Imogiri where teaching experience is more than 15 years. The difficulty of teachers in understanding Biology material for certification teachers and length of teaching is due to the busyness of senior teachers so that teachers cannot take the time to learn new things about Biology material (Lestari, Suci 2015). Meanwhile, teachers who have not been certified and are new to teaching include SMAN 1 Sragkan, SMA Muhammadiyah Pleret, SMA Muhammadiyah Piyungan and SMA Muhammadiyah Bantul. This is due to the lack of training that is attended by teachers regarding biology material for class X SMA (Irwani and Irwanto, 2019). A certification is a form of improvement and recognition of teacher competence in certain subject areas that are taken through the filing and PLPG channels, certification through PLPG results in better-certified teacher professional abilities (Yusup, 2018). Based on the results of the interview, it was found that teachers who had been certified and who had not been certified had difficulty understanding some of the class X biology material. Therefore, teachers in Bantul Regency who had or had not received certification were members of the MGMP which aims to share related information updated material for class X biology. The MGMP group is a forum for sharing information related to training held by universities and parties related to education related to increasing mastery of class X biology material. Research conducted by Anggara and Chotimah (2012) concluded that the application of MGMP-based lesson study has a positive impact on increasing the professional competence of teachers.

Conclusion

There are two factors that make teachers difficult to understand biology material in class X, such as external and internal factors. The external factors obtained are the lack of facilities and infrastructure, especially the tools and materials in the laboratory, and the difficulty in finding valid supporting information. Internal factors that are experienced are due to the content of the material that is difficult to understand, a large amount of material, the complex and abstract nature of the material, the number of foreign terms, and the wide scope of the material.

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