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Courses perceived difficult by undergraduate students majoring in biology

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ABSTRACT

Some previous reports inform many students having learning difficulties on some science subjects. The purpose of this study is to map the courses considered difficult by undergraduate students majoring in Biology. This study used survey research design. Participants in this study are undergraduate students of Biology Education Study Program and undergraduate students of Biology Study Program, from the Department of Biology in one of the state university in Malang. The instruments used in this study are questionnaires of difficult courses in the Department of Biology and descriptive analysis is used as a data analysis technique. The results of this study are the majority of Biology Education students positioning Genetics, Genetics, and Biochemistry as the first, second, and third most difficult courses, while the majority of Biology students positioning Genetics, Genetics, and Botany as the first, second, and third most difficult courses. The Genetics, Statistics, and Biochemistry are the three most frequently selected courses as the three most difficult subjects in Biology Education Study Program, while in Biology Study Program is Genetics, Biochemistry, and Botany.

INTRODUCTION

The science development (Ekanem, Ekanem, Ejue, & Amimi, 2010; Gonzalez-brambila, Reyes-gonzalez, Veloso, & Perez-angón, 2016) as well as science education development (Kingdom & Maekae, 2013; Kola, 2013) play an important role in the development of a country. The reason, in this 21 century, both the level of scientific literacy of community and the mastery of

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various concepts of science in the various field will be the backbone of a nation to compete with other nations (Liu, 2009; Mcfarlane, 2013). In line with these conditions, a nation should not only be able to produce scientists but also be able to provide high-quality science education (Kaptan & Timurlenk, 2012; Kola, 2013). The existence of good education at the university level is one factor that guarantees the condition (Nulhaqim, Heryadi, Pancasilawan, & Fedryansyah, 2016). One of the existing science education at the university level and contributed to the development of a country is Biology education (Araoye, 2016).

At the university level, the Department of Biology is generally divided into two study programs, the Biology Education study program and the Biology study program (Non-Education program). One of the main objectives of the biology education study program is to produce biology educators, while one of the main objectives of the biology study program is to produce scientists. In order to produce competent alumni, the study program ran the curriculum with courses that supported the skills required by the students. Various courses provide students to master the various concepts of biology where various biological concepts are very useful in various fields of human life (Chu, 2008; Reece et al., 2011). In terms of course content, science education researchers have reported many students to have difficulty learning on some of the science concepts (Topçu & Şahin-Pekmez, 2009). These conditions also occur in biology education field (Buah & Akuffo, 2017; Etobro & Fabinu, 2017; Ogunkola & Samuel, 2011). There have been many studies of student learning difficulties on biology at the secondary school level, both studies that focus on factors causing learning difficulties (Zikra, 2016) until studies that identify which topics are considered difficult by students (Çimer, 2012; Etobro & Fabinu, 2017). Of the various studies, several biological topics such as Genetics, coordination systems, circulatory systems, metabolism, to cell division are reportedly often perceived difficult by students (Buah & Akuffo, 2017; Çimer, 2012; Muspikawijaya, Iswari, & Marianti, 2017; Topçu & Şahin-Pekmez, 2009).

Various factors have been reported as the cause of some biology concepts/topics become difficult to learn. Etobro & Fabinu reported teaching strategies, student attitudes, lack of learning resources, along with learning habits are the cause of students having difficulty in learning some Biology concepts/topics (Etobro & Fabinu, 2017; Ichsan & Mulyani, 2018). In (Çimer (2012) report, the nature of the topic, the teacher's teaching style, the way of learning and students' habits, the negative feelings and attitudes of students on some biological topics, and the lack of learning resources are several main factors that make Biology become hard to learn. Another report by (Muspikawijaya et al., 2017) also reported that teacher-centered learning strategies, the low intensity of learning, and less supportive of learning infrastructure is some cause of student learning difficulties in Biology subjects.

The condition of student learning difficulties is not only happening in the high school level but also seems to appear at the university level. However, unlike in high school, the study of learning difficulties at the university level is very difficult to find. Therefore, research on learning difficulties at the university level seems to need to be studied to gain a broader picture of the problem. Mapping of difficult courses at the university level can be used as information for subsequent research or for lecturers to improve the lecturing process, especially on courses that are difficult for students.

In Malang, there is a state university which has a Department of Biology at the Institution. Department of Biology in this institution can be said have a complete study program because it has Biology Education Undergraduate Program (S1 Pendidikan Biologi), Biology Undergraduate Program/Non Education Program (S1 Biologi/Non Pendidikan), Biology Education Master Program (S2 Pendidikan Biologi), Biology Master Program/Non Education Program (S2 Biologi/Non Pendidikan), Biology Education Doctoral Program (S3 Pendidikan Biologi), and Teacher Profession Program (Program Pendidikan Profesi Guru). Mapping subjects that are considered difficult for undergraduate students seem to need to be done in this study. Therefore, the general purpose of this study is to identify the courses that are considered difficult by the undergraduate students in the Department of Biology at the State University. In more detail, this study is designed to answer some of the following problem formulations.

1. What courses are considered the most difficult by undergraduate students, both students in biology education program and non-education program?
2. What courses are most often positioned as the three most difficult courses, both in biology education program and non-education program?

This study has several aspects that distinguish it from previous studies. First, the subjects of this study are students majoring in biology, both educational and non-educational programs. Usually, research of learning difficulties is still more common at the secondary school level. Second, this research aims to map the courses considered difficult by the undergraduate students. Such a study is still hard to find in Indonesia. Third, the study asked respondents to determine which courses they positioned as the first, second, and third toughest courses. In the previous study, respondents were only asked to determine which courses/topics they considered difficult without ranking them into the three most difficult courses/topics.

METHOD

Design of the Study

This study used survey research design and quantitative approach was chosen as a research method in determining which courses were considered the most difficult by the students. This research was conducted in the Department of Biology from one of the state university located in Malang, East Java, Indonesia. This study was conducted from April to June 2018.

Participant

This study was conducted on the final-year Department of Biology students (class of 2014). The total participants involved in this study were 72 students. Participants consisted of 5 men and 67 women. The age range of respondents was from 20 to 24 years. A total of 37 students were students of the Biology Education Study Program, while 35 students were students of Biology/Non-Education Study Program.

Instrument

The instrument used in this study was a questionnaire. In the beginning, the questionnaire asks for general information about student identity. Then, the questionnaire presents a selection of courses that direct students to select the first, second, and third most difficult courses. In addition, students were also asked to provide reasons for the choices they provide.

Data Analysis

Data analysis techniques used in this study was descriptive statistics. In the questionnaire, students were asked to determine the first, second, and third difficult courses. Thus, information on which courses were most often regarded as the most, second, and third difficult courses will be obtained. In addition, each course was also calculated how many times the course was selected as the three most difficult courses. Through this step, it will be obtained the information about which courses were the most often included in the top three difficult courses. The chosen frequency of the courses was then converted to percentage form and then presented in the bar graph.

RESULTS AND DISCUSSION

The findings obtained from this study are organized based on several research questions that have been compiled before, namely: 1) the most difficult courses according to the students of Biology Education and Biology Program; and 2) the courses are most often selected as the top three most difficult courses by Biology Education students and Biology Program.

The three most difficult courses in the Department of Biology

The distribution of difficult courses based on the responses of the students of the Biology Education Study Program presented in Figure 1, whereas the distribution of difficult courses based on the responses of the students of the Biology Study Program presented in Figure 2. Based on Figure 1, the courses are most often considered the first, second, and third most difficult by Biology Education students were Genetics, Genetics, and Biochemistry, while in Biology students were Genetics, Genetics, and Botany.

Based on the results of this study, Genetics courses were the most frequently considered as the most difficult (first and second toughest) courses for both educational and non-educational students. Associated with these conditions, Genetics is a branch of biology that contains many difficult concepts. This condition is reinforced by some previous reports, as in Chu's report and Topcu & Sahin-Pekmez report (Chu, 2008; Topçu & Şahin-Pekmez, 2009). As a result, studies of learning difficulties often report Genetics as a topic/concept often perceived as difficult by students, both students in secondary schools level (Çimer, 2012; Mardin, 2017), as well as university-level students (Murray-Nseula, 2011). Therefore, in this study, Genetics courses were the most commonly positioned as the first and second most difficult courses by students in both programs at the Department of Biology.

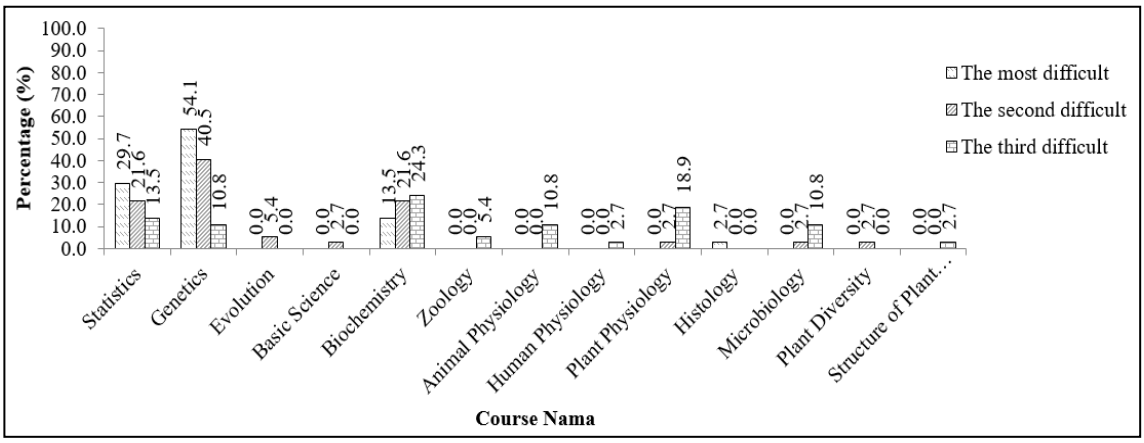

Figure 1. Difficult Courses Distribution in Biology Education Study Program

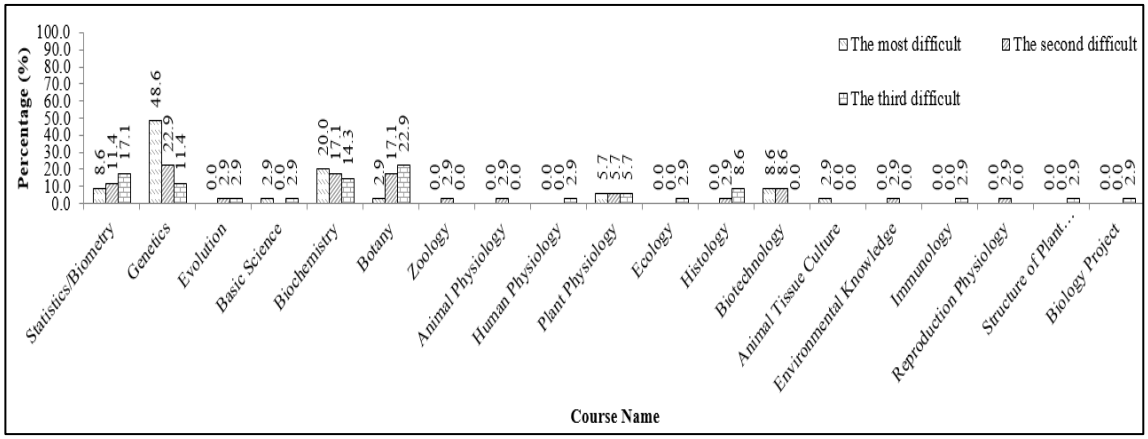

Figure 2. Difficult Courses Distribution in Biology Study Program.

Then, the courses that most often positioned as the third most difficult course by Biology Education Program students is Biochemistry, while students of the Biology Program is Botany. This information is in line with some previous reports that positioning Biochemistry (Vanderlelie, 2013) and Botany (da Silva, Guimarães, & Sano, 2016) as difficult courses. The emergence of biochemistry as the third most difficult by the majority of biology education students in this study in line with the study that conducted by Rahmatan (2016) who conducted research on Biology Education Studies Program at other universities. In Rahmatan report, carbohydrate catabolism, lipid

catabolism, and protein catabolism are the most difficult concepts to be studied in the Biochemistry course. On the other hand, in general, botany course is often regarded as a very theoretical and less desirable class by students (Elster, 2007). This characteristic reinforces Botany's position as a difficult course to learn by students (da Silva et al., 2016).

The courses in the Biology Department are often chosen to be the top 3 most difficult courses

The frequency distribution of courses that often referred to the three most difficult courses for the students of Biology Education Study Program is presented in Figure 3, whereas from the students of the Biology Study Program is presented in Figure 4. Based on Figure 3., the three most frequently courses from Biology Education Study Program were Genetics, Statistics, and Biochemistry, whereas from the Biology Study Program are Genetics, Biochemistry, and Botany. Based on this information, Statistics courses appear as courses that are also often considered the most difficult for Biology Education students. In line with this condition, in the Biology Study Program, there are only four courses with a percentage is above 10%, one of them is Statistics / Biometry.

The difficulty of the Statistics course for the students of Biology Department in this study is in line with some of the previous researchers who positioned Statistics as a difficult course in the Department of Biology (Allen, Folkard, Lancaster, & Abram, 2010; Metz, 2008). The difficulty of Statistics courses for students is also happening in various other majors (Hannigan, Hegarty, & Mcgrath, 2014). However, despite being a difficult course, Statistics is an important major course for students from various departments at the university level (Slootmaeckers, 2012).

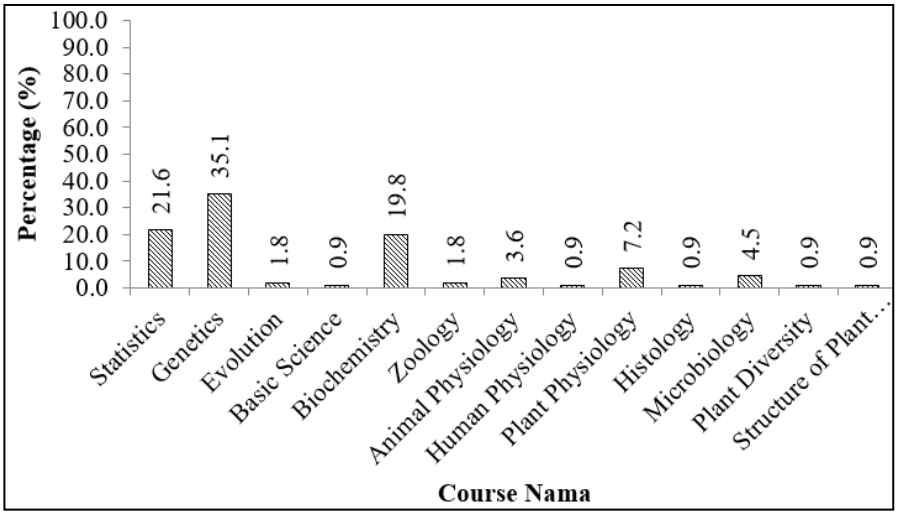

Figure 3. The Most Common Courses Perceived as Three Most Difficult in Biology Education Study Program

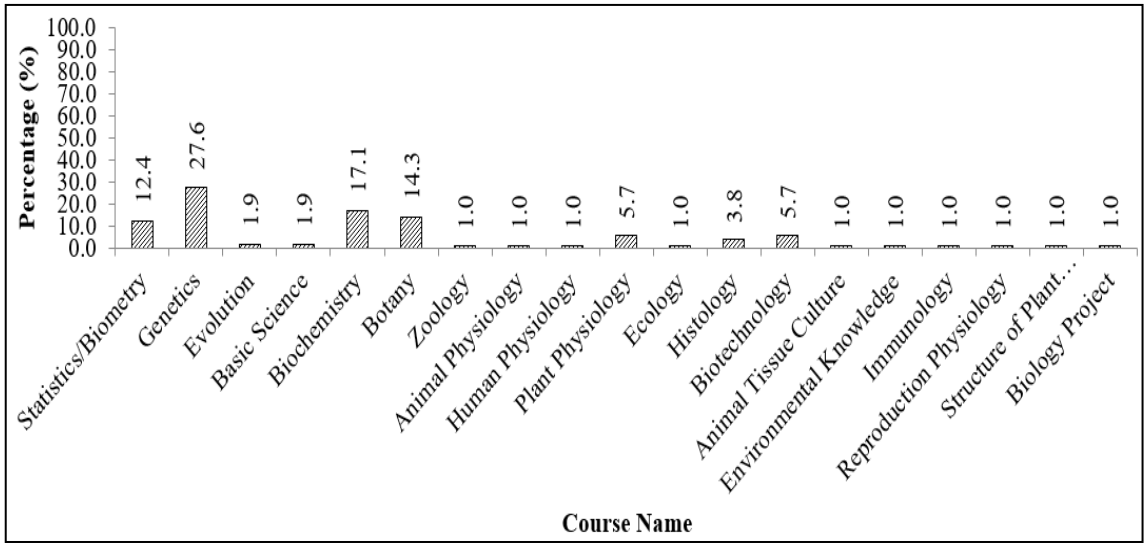

Figure 4. The Most Common Courses Perceived as Three Most Difficult in Biology Study Program

Summary of factors causing some courses is considered difficult based on the explanation of the students of Biology Education Study Program presented in Table 1, whereas from the students of Biology Study Program is presented in Table 2. The reasons why some courses are considered difficult by the students are actually very diverse, but from the diversity for these reasons, it can be grouped into four main categories as presented in Tables 1 and 2. Those four main factors are in line with Çimer (2012) explanation.

Based on Table 1 and Table 2, the main cause of the difficulties of Genetics courses that are often explained by Biology Education students is because of the number of foreign terms and too many concepts learned in this course. The abundance of concepts studied in Genetics courses is also the most common cause expressed by non-educational students. In the Genetics courses in this institution, there are seven major concepts that must be mastered by the students. In relation to the many concepts studied in Genetics, when students are continuously introduced with new information, theories, techniques, concepts, and new terminology, students will be more inclined to remember concepts than to study Biology meaningfully (Almroth, 2015; Çimer, 2012; Tekkaya, Ozkan, & Sungur, 2001).

Table 1. The Percentage Distribution of Factors Courses Perceived Difficult by Biology Education Undergraduate Students

Course Name	Factors (%)				
	Abstract	Too Much	Foreign Term	Difficult to Understand	Others
Statistics	14.7	32.4	5.9	44.1	2.9
Genetics	20.3	25.0	28.1	21.9	4.7
Evolution	100.0	0.0	0.0	0.0	0.0
Basic Science	27.3	18.2	27.3	27.3	0.0
Biochemistry	36.8	10.5	5.3	47.4	0.0
Zoology	0.0	50.0	50.0	0.0	0.0
Animal Physiology	0.0	40.0	20.0	40.0	0.0
Human Physiology	0.0	100.0	0.0	0.0	0.0
Plant Physiology	23.1	23.1	23.1	30.8	0.0
Histology	0.0	100.0	0.0	0.0	0.0
Microbiology	14.3	14.3	42.9	28.6	0.0
Plant Diversity	0.0	0.0	100.0	0.0	0.0
Structure of Plant Development	25.0	25.0	25.0	25.0	0.0

In addition, more than 20% of students' responses, both undergraduate and non-educational, reveal the concepts learned in Genetics courses are difficult to understand. This condition is in line with the statement described by Tekkaya et al (2001). Tekkaya explains some of the prerequisite concepts required by students to understand certain concepts. If they do not master the prerequisite concepts, students will have difficulty understanding the concepts they are learning. On the one hand, Genetics is the basis of other branches of biology. On the other hand, because as a core of biology, students will have difficulty studying Genetics if they have not understood the concepts of other branches of biology. Moreover, the various concepts of Genetics are abstract and complex, making Genetics more difficult to learn (Murray-Nseula, 2011).

Then, in the Biochemistry course, the difficulty of understanding the concepts studied in this course are the most commonly expressed by undergraduate students on this course. Students are often faced with numerous chemical formulas and chemical reactions in Biochemistry courses. This condition causes the Biochemical concepts difficult to master by Biology students (Rahmatan, 2016). The characteristics of biochemical concepts that are different from the characteristics of other biology subject matter make the students less adaptable to study biochemistry. This condition causes students to perceive Biochemistry as one of the difficult subjects for them.

Table 2. The Percentage Distribution of Factors Courses Perceived Difficult by Biology Undergraduate Students.

Course Name	Factors (%)				
	Abstract	**Too Much**	**Foreign Term**	**Difficult to Understand**	**Others**
Statistics/Biometry	0.0	50.0	0.0	35.7	14.3
Genetics	16.7	47.6	11.9	21.4	2.4
Evolution	100.0	0.0	0.0	0.0	0.0
Basic Science	50.0	0.0	0.0	50.0	0.0
Biochemistry	11.5	26.9	15.4	46.2	0.0
Botany	14.3	38.1	19.0	28.6	0.0
Zoology	0.0	0.0	100.0	0.0	0.0
Animal Physiology	0.0	0.0	0.0	100.0	0.0
Human Physiology	0.0	0.0	0.0	100.0	0.0
Plant Physiology	25.0	0.0	12.5	50.0	12.5
Ecology	0.0	12.5	0.0	0.0	0.0
Histology	12.5	25.0	25.0	0.0	0.0
Biotechnology	37.5	0.0	12.5	12.5	25.0
Animal Tissue Culture	0.0	0.0	0.0	0.0	12.5
Environmental Knowledge	0.0	0.0	0.0	0.0	12.5
Immunology	0.0	0.0	100.0	0.0	0.0
Reproduction Physiology	0.0	0.0	100.0	0.0	0.0
Structure of Plant Development	0.0	100.0	0.0	0.0	0.0
Biology Project	0.0	0.0	0.0	0.0	100.0

Then, too many topics studied in the course and the difficulty of understanding the concept are two reasons that most commonly expressed by Biology Program students on Botany course. The difficulty of mastering the concepts in Botany lectures will lead students to be less motivated and less interested in this course (da Silva et al., 2016). In order to solve the problems of Botany's learning difficulties, Zhonghua (2005) recommended the application of some form of learning, such as concept maps, problem-based learning, case studies, and web-based learning.

In Statistics, the two main causes most often expressed by the students about why they perceive Statistics as the difficult course are too much the number of topics studied and difficulty understanding the topics. In general, the students' response to this course is, in Statistics course, there is too much statistical test being studied and they also have difficulty determining which statistical test is best suited to the case they are dealing with. The difficulties of mastering Statistics for Biology students can also be caused by differences in static lecture material characteristics with other Biology courses. In general, Biology courses require students to understand the concepts they are studying, while in the course of Statistics students are required to master mathematical calculations. In order to facilitate more meaningful Statistics lectures, Metz recommends the application of inquiry-based learning to facilitate students to directly apply statistical analysis to biological cases (Metz, 2008).

In relation to the results of this study, which positioned Genetics as the most difficult course, this result is in line with previous reports that report Genetics more frequently as a difficult topic than any other biological topic (Chu, 2008; Çimer, 2012; Mardin, 2017; Topçu & Şahin-Pekmez, 2009). Characteristics of the concepts that exist in Genetics, such as the existence of foreign terms, the number of concepts that must be understood, as well as the abstract and complex nature of the concept makes Genetics as a difficult subject to master by students. Conventional lectures will retain the position of Genetics as a difficult subject to be mastered by students. In connection with these conditions, some research reports provide recommendations as a solution in the course of Genetics (Dewi & Ichsan, 2018; Fauzi, 2017; Fauzi & Corebima, 2016a, 2016c, 2016b; Fauzi, Corebima, & Zubaidah, 2016; Fauzi & Ramadani, 2017). These solutions, among others, by using model organisms in learning some of the concepts of Genetics until designing authentic-based research activities.

On the other hand, various researchers in Indonesia have conducted various researches to seek the solution to overcome various problems of biology learning. Various research designs and methods were used in the various studies (Fauzi & Pradipta, 2018). In relation to the many concepts that must be studied on various biological courses, some previous research reports have also reported and recommended the use of some learning models (Buku, Mite, Fauzi, Widiansyah, & Anugerah, 2015; Fauzi, 2013; Fauzi & Ramadani, 2017; Ramadani, Fauzi, Sukmawati, & Corebima, 2015; Sukmawati, Ramadani, Fauzi, & Corebima, 2015). In addition, to address the abstract problem of the concept being studied, some previous reports recommend the use of learning media (Emda, 2011; Mehdipour & Zerehkafi, 2013; Mukti & Nurcahyo, 2017; Widiansyah, Indriwati, Munzil, & Fauzi, 2018).

CONCLUSION

Mapping of difficult courses on Biology Department at the university level has been done in this study. Genetics, Genetics and Biochemistry are most often positioned as the first, second, and third most difficult courses in Biology Education Program, while in the Biology Study Program, the order of the three most difficult courses are Genetics, Genetics, and Botany. Genetics, Statistics, and Biochemistry are the three most frequently mentioned courses in the three most difficult subjects by Biology Education students, while Genetics, Biochemistry, and Botany are the three most commonly mentioned courses by Non-Educational Biology students.

Through this report, lecturers in the Department of Biology can obtain information about students' assumptions about difficult subjects. The information is expected to have implications on lectures in the Department of Biology, especially those related to courses that discuss the topics. One limitation of this study is its data collection technique just used questionnaires that ask undergraduate students to rank the first, second, and third difficult courses along with the reasons for choosing those courses. Therefore, it is recommended in further studies, the questionnaires that will used is questionnaires that has been developed by other study or other questionnaires that can gather more information about learning difficulties in biology education.

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