



## Profile of Students' Misconception in The Topic of Population using Four-Tier Diagnostic Test

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**ABSTRACT:** This study aimed at identifying the students' misconception in the topic of population using four-tier diagnostic test. This research was conducted on the lecture of Basic Ecology toward 30 students of Biology Education, IAIN Jember as the subjects. Data were collected using a four-tier diagnostic test then analyzed using a descriptive method. Findings of the study indicate that students' misconception reached 32.8%. It can be concluded that students' misconception in the topic of the population was moderate.

### INTRODUCTION

During the learning process, students will find various challenges in understanding concepts. As we know biology concepts mostly represent common changeable features of objects, principles, events, ideas, thought, and activities (Tanner and Allen, 2004). Students develop concepts at an early development when they undergo thinking and learning process, however it can trigger big problem if the concepts that they comprehend are different from scientific thoughts in which this phenomenon is referred to as misconception.

Several factors can affect the learning process, one of them is scientifically inaccurate conceptions on students or mostly known as misconception. Misconception on students compromises the learning activity. Kumandaş (2018) stated that meaningful learning eliminates information that can confuse students, therefore they can promote meaningful connection between previous and new knowledge. Misconceptions are significant and mostly found by students in understanding scientific phenomenon and biology concepts. Biology consists of complex concepts and various terms that can trigger inaccurate conceptions on students. Students can retain misconceptions throughout learning activity unless they are corrected in a timely manner (Halim et al., 2018).

Many studies have been conducted to identify the misconceptions that occur in the biology learning and teaching. Many students find misconceptions in the biology concepts during the learning process. It has been also found from Munson (2010) that students met

misconceptions in the topic of ecosystem. Furthermore, a study also reported that students found inaccurate understanding in the ecology concepts. Ecology is a part of biology describing many phenomena related to environment and living things. Students' misconception in ecology is particularly important to address since their comprehension has a very real basis in reality. A number of researchers have used paper and pencil test to identify students' misconceptions. One of test that can be used to identify misconceptions on students is a diagnostic test.

Diagnostic tests were developed by many researchers, mostly in the format of two-tier. Two-tier diagnostic test is comparatively suitable for students to answer questions in which it is treasured for teachers to practice in rappers of decreasing speculation and tranquil submission perceptions hooked on students' thinking and reasoning (Rahmi, 2018). The two-tier diagnostic test consists of two tiers; the first is multiple choices asking the concept, while the second tier is the reason for the answer of the first tier.

Although the two-tier diagnostic test is great to use for identifying students' misconceptions, this test has certain restrictions in discerning lack of understanding as of misconceptions, errors, and scientific knowledge (Gurel et al., 2015). This limitation can be replaced by four-tier diagnostic test. The four-tier diagnostic test has four tiers in the format which accumulate confidence of students that can evaluate the power of misconceptions.

The four-tier test is much better than two-tier diagnostic test since it performs students' confidence on the answering questions. Fratiwi et al. (2011) stated that the first tier is a multiple choice of questions related to the concept, the second one is the confidence rating of the answer at the first tier, the third tier is the reason for the answer at the first tier, and the forth tier is the confidence rating for the reason at the third tier. According to the previous views, this study aims at identifying the students' misconception in the topic of population using four-tier diagnostic test.

## METHODS

The study is a descriptive qualitative research conducted on March 2019. It involved a single class consisting of 32 students of Biology Education in the academic year of 2016, Biology Education Department, IAIN Jember as the subjects. Students' misconceptions were identified before the lecture of Basic Ecology was started. It has been conducted to check the prior conceptions on students in ecology concepts in order lecturer can develop learning strategies that are capable to minimize students' misconceptions during the lecture of Basic Ecology.

The misconceptions were identified using four-tier diagnostic test. The first tier is a multiple choice of questions asking the concept of population, the second one is the confidence rating of the answer at the first tier, the third tier is the reason for the answer at the first tier, and the forth tier is the confidence rating for the reason at the third tier. Data of misconceptions were analysed using descriptive method. Students' answers were classified into four categories, namely: understand all concepts, understand some concept, misconception, and do not understand at all which based on the table 1.

**Table 1.** Classification of Students' Answers in Four-Tier Diagnostic Test

Category	Combination of Answer			
	<i>Tier 1</i>	<i>Tier 2</i>	<i>Tier 3</i>	<i>Tier 4</i>
Understand all concepts	True	Sure	True	Sure
	True	Sure	True	Not sure
Understand some concepts	True	Not sure	True	Sure
	True	Not sure	True	Not sure
	True	Sure	False	Sure

Category	Combination of Answer			
	Tier 1	Tier 2	Tier 3	Tier 4
	True	Sure	False	Not sure
	True	Not sure	False	Sure
	True	Not sure	False	Not sure
	False	Sure	True	Sure
	False	Sure	True	Not sure
	False	Not sure	True	Sure
	False	Not sure	True	Not sure
Misconception	False	Sure	False	Sure
	False	Sure	False	Not sure
Do not understand at all	False	Not sure	False	Sure
	False	Not sure	False	Not sure

Then, the percentage of four categories above were calculated using formula below:

$$p = \frac{f}{N} \times 100\% \tag{1}$$

Finally, data in percentage were categorized based on criterias in the table 2.

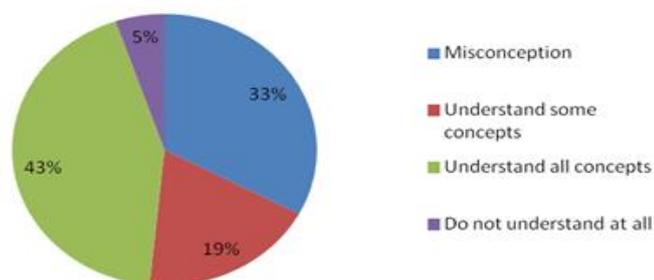
**Table 2.** Criteria of Misconception

Criteria	Percentage (%)
High	61 - 100
Moderate	31 - 60
Low	0 - 30

## RESULTS AND DISCUSSION

Findings obtained in this study indicated that the students' misconception reached on 32.8%. Meanwhile the percentage of students' understanding some concepts was 18.75%, not understanding at all was 5.2%, and understanding all concepts was 43.2% (Figure 1).

**Percentage of Students' Conception**



**Figure 1.** Percentage of Student's Conception on the topic of Population

Student's misconception in this study was identified using four-tier diagnostic test. The development of diagnostic test forms from one-tier become two-tier, three-tier, and four-tier based on several considerations, for instance the certainty of the students' answer and the students' confidence in choosing the answers and explaining the reasons (Pujayanto, 2018).

It has been reported that the four-tier test was much better than two-tier diagnostic test since it performs students' confidence on the answering questions. The four-tier diagnostic

test consists of four tiers. The first tier is a multiple choice of questions related to the concept, the second one is the confidence rating of the answer at the first tier, the third tier is the reason for the answer at the first tier, and the fourth tier is the confidence rating for the reason at the third tier (Fратиwi et al., 2011).

Misconception is a phenomena when students attain incorrect ideas which distant from the facts. It can occur since students encounter biological concepts not only in the school but also in their daily lives and may construct idiosyncratic ideas that are different from accepted knowledge. In addition, when students come to the class, they experience cognitive dissonance. Then they develop new information on previous experiences, probably adapted from the situations that they encounter inside and outside of the school (Short, 2011).

Çetin (2003) said that misconceptions are the output of a divergent set of direct observation of natural objects and formal instructional interference which are shaped by personal experiences. Misconceptions may come from certain experiences that are commonly shared by many students. Students can hold misconceptions that are advanced before and during their formal educational settings. Social interaction and daily life conversation causes spreading misconceptions. It is believed that social environments are important roles to facilitate in educating and correcting misconceptions (Putri et al., 2017).

In order to provide correct scientific knowledge, to reconstruct or remove pre-existing knowledge, teaching concepts is an important role for educators. Teaching should not only give direct knowledge, but also provide discussion of the meanings. Students' understanding of concepts may relate to the method and strategy of learning (Short, 2011). A study from Queloz et al. (2017) reported that educators' positive attitudes, beliefs and perceptions towards biology and content knowledge increased their students' interest in learning, and thinking scientifically.

There are some conceptual change strategies that are also use to elicit students' cognitive structures. These include following: word association tests, prediction-observation and explanation, concept mappings, mind mappings, classroom debates, laboratory and computer based instruction, and conceptual change texts (Gurel et al., 2015).

Students' existing knowledge should be revealed; if they have current misconceptions, they should be resolved. Since some topics have abstract terms and students have difficulties in comprehending them, and so different teaching methods should be applied as much as possible. Further, as Halim et al. (2018) proved that appropriate activities also should be developed to increase students' understanding such as experiments, educational games, concept maps.

Some explicit ideas to correct misconceptions on students included using a social setting for learning, allowing student autonomy, involving engagement and motivation, providing open-ended questions, promoting higher-order thinking, and enhancing peer dialogue with group activities. In addition, some techniques that are used to determine misconceptions may be applied to treat students' incorrect beliefs (Queloz et al., 2017). In conclusion, several studies have shown that treatment with conceptual change strategies are helpful for eliminating on the present misconceptions of student.

## CONCLUSION

According to the findings obtained in this study, it can be concluded that students' misconception in the topic of population which reached on 32.8% was on the category of moderate. Various active learning method and strategies could be implemented to reduce students' misconception.

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