

Biology Education Student's Profile On Microbiology Literacy

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Abstract— The purpose of this study is to investigate the biology education students' profile on microbiology literacy after completing microbiology course in UPI. Descriptive method was conducted in this research. The instrument employed in this study was developed based on PISA 2015 science literacy framework, which covers competence and attitude dimensions. Competence dimension consists of three fundamental competences, namely scientifically explain phenomena related to microbiology, evaluating and designing scientific inquiry related to microbiology, and interpreting data and evidence scientifically. Attitude dimension consist of 2 competencies, which are interested in microbiology and assessing scientific approach in microbiology learning. Competence dimension was captured using microbiology literacy tests with five multiple choice options, while the attitude dimensions was captured using a questionnaire with Likert-scale 1-4. The results show microbiologica literacy on competence dimension is in the moderate, low and very low category which 5.88%, 20.59%, and 73.53% respectively. Attitude dimension shows excellent, good, and moderate category (2.94%, 14.71%, and 82.35 % respectively). The average score for competence dimension is 47.79% (very low category) and for attitude is 71.99 (moderate category).

Keywords— *microbiology literacy; competence dimension; attitude dimension; science literacy PISA 2015 framework*

I. INTRODUCTION

Microorganism as a subject in microbiology has a central role in the biosphere not only physically but also chemically [8]. Microbiology also underlies the development of modern biotechnology, genetic engineering, and bioprocess. Microbiology became the center for studying life sciences through biochemistry, genetics, evolution, or molecular biology. The science of microbiology revolves around two interconnected themes: (1) understanding the nature and functioning of the microbial world, and (2) applying our understanding of the microbial world for the benefit of humankind and planet Earth [5].

Microorganisms are part of the human environment and are therefore important to human health and activities. The study of microorganisms provides insight into life processes in all forms of life. Microbiologists work as researchers or teachers in university, clinical, and industrial settings. They do basic research in the biological sciences; help to perform or devise diagnostic tests; develop and test antibiotics and vaccines; work to control infection, protect public health, and safeguard the environment; and play important roles in the food and beverage industries [1].

The importance of microbiology in human life was shown by the concern of The American Academy of Microbiology which held a conference in Charleston, South Carolina in 2003. This conference discusses important issues about the role of microbes on the Earth, microbiological research aim that will be developed in 21st century, and how to create a literate society towards microbiology [8]. There are five topic in this conference. Discussions centered on: (1) The impact of microbes on the health of the planet and its inhabitants; (2) The fundamental significance of microbiology to the study of all life forms; (3) Research challenges faced by microbiologists and the barriers to meeting those challenges; (4) The need to integrate microbiology into school and university curricula; and (5) Public microbial literacy [8]. Microbiology literacy is the ability to implement microbiological knowledge in daily life, especially in decision-making [4]. Microbiology literacy plays an important role in the life of the present and the future. Microbiology literacy is needed to address the problems and issues developing in society. Students, as a society need to have literacy skills in microbiology.

Microbiology lecture is expected to equip students use concepts, processes, and value of microbiology to solve issues that develop and relate it with daily life. Therefore, it is important to investigate biology education student's microbiology literacy after completing their microbiology course.

Microbiology literacy is developed based on PISA 2015 [6] science literacy framework. Science literacy in PISA (Program for International Student Assessment) 2015 is defined as the ability to use science knowledge on issues and ideas that come out in the society. So microbiology literacy is the ability to use microbiological knowledge on microbiological issues and ideas in the society. In PISA 2015, science literacy is developed into four domains that every domain is directly or not related to each other, those four domains are context, competency, knowledge and attitude. The context for PISA 2015 has changed from personal, social, and global (in PISA 2006) to personal, local / national, and global to make the title more coherent. Domain knowledge in PISA 2015 are described in detail an aspect of the content, procedural and epistemic.

On this article's discussion, the domain that will be discussed competence dimension and attitude dimensions. Basic competencies of competence dimensions are consisted with five indicators. Two points of attitude toward microbiology which are interest on microbiology and assessing toward scientific approach on learning microbiology. Those competencies of attitude dimensions are consisted with three indicators.

II. RESEARCH METHOD

Descriptive method was conducted in this research. The respondents of this study consisted of 34 6th semester students of the Department of Biology Education FPMIPA UPI who have taken microbiology course in 5th semester. Microbiology literacy instrument was developed based on PISA 2015 science literacy framework. Competence dimension consists of three fundamental competences, namely scientifically explain phenomena related to microbiology, evaluating and designing scientific inquiry related to microbiology, and interpreting data and evidence scientifically. Those competencies are consisted with five indicators. Attitude dimension consists of two competencies, namely interest on microbiology and assessing toward scientific approach on learning microbiology. Those competencies are consisted with three indicators. Data was collected by using a questionnaire with a 1-4 Likert scale (strongly agree– agree–disagree–strongly disagree or always–often–rarely–never). Positive answer is scored with 4-3-2-1 pattern, while the negative answer scored with 1-2-3-4 pattern. Data obtained converted into score. Furthermore, the score is categorized as in Table 1. There are five categories (excellent, good, moderate, low, and very low).

TABLE I. MICROBIOLOGY LITERACY SCORE CATEGORY

Category	Score range
Excellent	$86 \leq X \leq 100$
Good	$75 \leq X < 86$
Moderate	$60 \leq X < 75$
Low	$55 \leq X < 60$
Very Low	$0 \leq X < 55$

III. RESULT AND DISCUSSION

Competency and attitude dimension of student's microbiology literacy can be seen in Figure 1, 2, 3, and 4. The percentage of students who have moderate level in

competency dimension is 5.88% (2 students), about 20.59% (7 students) in the low category, and 73.53% (25 students) in very low category. Average score of competency dimension is 47.79% (categorized on very low category). This is due to lack of students' ability to read, understand, and analyze items. Students are not used to reading items with a long text.

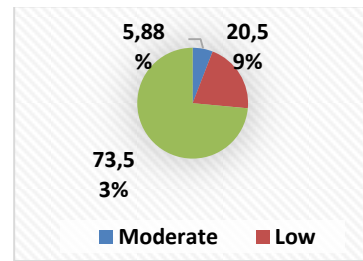


Fig. 1. Percentage of student in Competency Dimension

The highest average score for the competency dimension is achieved in interpreting data and evidence scientifically (55.88). This could be because the students get used to interpret data through practical activities through project-based learning. The low first and second dimensions of competence because of low student analytical skills.

Percentage of students on attitude dimension are 2.94% (1 student), 14.71% (5 students), and 82.35% (28 students), excellent, good and moderate respectively. The total average score for attitude dimension is 71.9 (Moderate category). The highest average score of attitude dimension, which is 74.46, is achieved by assessing toward scientific approach on learning microbiology. Student interest in microbiology has a lower value. This is probably due to the lack lectures to apply it in daily life.

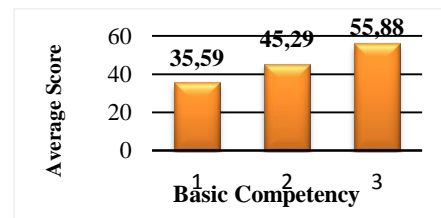


Fig. 2. Average Score for Basic Competency in Competency Dimension

Basic Competence:

1. Explaining phenomena related to microbiology;
2. Evaluating and designing scientific inquiry related to microbiology; and
3. Interpreting data and evidence scientifically.

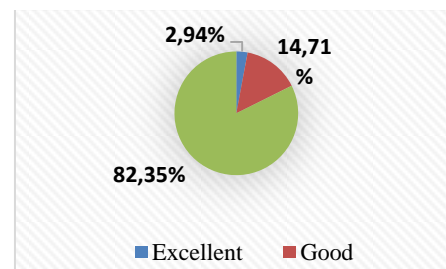


Fig. 3. Percentage of Students on Attitude Dimension

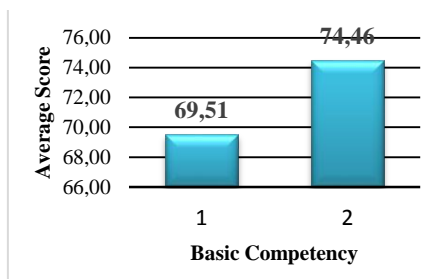


Fig. 4. Basic Competency Average Score on Attitude Dimension

Indicators:

1. Interest on microbiology;
2. Assessing toward scientific approach on learning microbiology.

The low outcome on competency dimension is caused the student not yet accustomed to solve problems required high level thinking skills (HOTS). Even though they have learned and finished the course program that employed project based learning and the contextual content, but it has no significant impact on microbiology literacy. Microbiology literacy can be obtained not only through formal learning, but it can be from a variety of sources that student obtained. This result is same with Herlanti[3], that microbiology literacy can be obtained from the lectures in class, reading textbooks, laboratory experiments, and discussion of socio-scientific issues through social networking. The results of research about microbiological literacy, group discussions socio-scientific issues through social networking showed better results than the control group. The experimental group has more positive perception of the microorganism[3]. Society require microbiology literacy in order to avoid panic on issues of microbiology. Science literacy skills a person can develop lifelong[9]. Likewise literacy microbiology.

Low skills of literacy microbiology also because students are unfamiliar introduced to aspects of scientific literacy since junior high school or senior high school. This is consistent with the results of research Rachmatullah et al.[7]. on scientific literacy junior high school students using the instrument SLA (Scientific Literacy Assessment) is in the category of low and this was due to the low ability students to read. At the senior high school level, the results of research Diana et al.[2]. used the instrument of cognitive SLA also proved less so, while on average the affective domain includes enough. In order for science literacy of high school students is increasing as well, then the teachers are encouraged to start introducing and presenting the content using various strategies to develop scientific literacy, among others taught through experiments that stimulate higher level thinking and contextual. Evaluation of learning is also expected to demand aspects of scientific literacy, not only charged the concept alone, as long as this happens in school [2]. The ability of science literacy someone can develop lifelong [9]. and these capabilities on a person can be very high in a particular field but can be very low in other fields [9].

Therefore, microbiology literacy could be improved through a learning strategy to develop higher level thinking,

such as project-based learning and problem based learning and assessment that could develop high-level thinking skills as well. Besides that, the students have to familiar and sensitive to microbiology related to socio-scientific issues, for example through the assignment like composing articles related to socio-scientific issue in microbiology. Lecturers can use applied microbiological concept in class, for example through problem solving. Some of these efforts are expected to increase students' microbiology literacy and could make people literate in microbiology at 21st century [8].

IV. CONCLUSION

The results showed that competency dimension achieved 5.88%, 20.59% and 73.53% for moderate, low and very low category respectively, while the dimension of attitude to the category of excellent, good, and moderate respectively by 2.94%, 14.71%, and 82.35%. The average score of competency dimension is 47.79 (very low category) and the highest average score for the dimensions of competency achieved by interpreting data and scientific evidence (55.88). As for the attitude dimension average score is 71.99 (moderate category) and the highest average score achieved in the second basic competence, namely assessing toward scientific approach on learning microbiology (74.46). This research could suggest improving the learning process, both of the lectures strategy or assessment that developed to support student microbiology literacy.

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