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Biodiversity Literacy Skills in Problem-Based Science Lectures: A Grounded Theory Research

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Abstract: The aims of this study to describe the students biodiversity literacy skills in natural science lectures. The data research from the observation and the test scores. Biodiversity literacy skills indicators were established. Analysis of data using qualitative descriptive methods. The results showed the biodiversity literacy skills are within medium, high and very high criteria. Based on indicators of biodiversity literacy skills, it is in the criteria of being able to define biodiversity and its use, being able to distinguish biodiversity at the gene, species, ecosystem level, and being able to construct solutions to biodiversity problems. This biodiversity literacy skill can encourage the character of concern for biodiversity decline so that students are able to come up with solutions to existing biodiversity problems.

Keywords: biodiversity literacy skills, science lectures, grounded theory approach.

Abstrak: *Penelitian bertujuan mendeskripsikan keterampilan literasi keanekaragaman hayati mahasiswa pada perkuliahan IPA yang menerapkan model Problem Based Learning. Data penelitian diperoleh melalui observasi dan nilai tes. Ditetapkan enam indikator keterampilan literasi keanekaragaman hayati. Analisis data menggunakan metode deskriptif kualitatif. Diperoleh hasil bahwa nilai tes keterampilan literasi keanekaragaman hayati berada dalam kriteria sedang, tinggi dan sangat tinggi. Berdasarkan indikator keterampilan literasi keanekaragaman hayati, berada pada kriteria mampu mendefinisikan keanekaragaman hayati dan pemanfaatannya, mampu membedakan keanekaragaman hayati pada tingkat gen, spesies, ekosistem, dan mampu mengkonstruksi solusi permasalahan keanekaragaman hayati. Keterampilan literasi keanekaragaman hayati inidapat mendorong karakter kepedulian terhadap penurunan keanekaragaman hayati sehingga mahasiswa mampu mengemukakan solusi atas permasalahan keanekaragaman hayati yang ada.*

Kata kunci: *keterampilan literasi biodiversitas, perkuliahan IPA, pendekatan grounded theory.*

▪ INTRODUCTION

The existence of biodiversity or what is more widely known, namely biodiversity, is a very important component in the sustainability of systems in nature. Biodiversity is currently experiencing various disturbances that threaten its existence. Forms of disturbance to biodiversity mostly occur as a result of human activities. This in turn can have a significant impact on various species of flora and fauna. The impact is in the form of the rapid disappearance of various species of flora and fauna and in the end this condition can also directly affect the existing biodiversity. The existence of this fact provides a consequence for carrying out activities to guard and protect the remaining biodiversity. The form of care and protection is carried out in the form of conservation of this biodiversity. This conservation activity basically does not only rely on aspects of the physical ecosystem but must involve humans. This is intended so that human

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knowledge and awareness in conservation can be sustainable. One form of biodiversity conservation can be applied with an educational approach. Conservation education is a form of effort in maintaining and protecting biodiversity and aims to increase awareness about the importance of biodiversity for life (Katili et al., 2018; Nusantari et al. 2020).

Education is a process that can cause changes in behavior in students. This in the next stage will have an impact on the formation of abilities in students according to what they learn. Biodiversity is a content that has become an integral part of science learning. In teaching the concepts of biodiversity in science subjects, students must be able to accommodate the knowledge and experience in their daily lives, this is very important in defining the characteristics of biodiversity (Lindemann-Matthies et al., 2009; Dikmenli, 2010). Science learning activities place an emphasis on students gaining experience and being able to analyze information from the environment around where they live (Ali, Suastra, & Sudiatmika, 2013). The stages carried out in science learning on biodiversity material will form an ability in students who are familiar with biodiversity literacy skills. This ability will then raise awareness of the importance of biodiversity (Erdoğan et al., 2009). Literacy is an important skill because it is closely related to achieving an understanding that is academic in one's life and becomes an experience that will be used as a reference for the future (Pertiwi & Sudrajat, 2022). The author also believes that the ability of biodiversity literacy can influence the decision-making process by considering scientific principles.

Basically, students' ability to analyze and create scientific literacy has problems in understanding a problem in the course material. The problem that is often experienced by students is in doing course assignments. This results from the provision of material that is ineffective and a learning model that is not in accordance with the material that is applied to students (Santoso et al., 2020). The learning model greatly influences the learning process, because the learning model makes it easy for students to understand course material, so that in doing course assignments students are able to answer according to what is expected by the course lecturer (Meilasari et al., 2020).

The process of achieving a biodiversity literacy capability requires an appropriate form of learning model. Learning models with a scientific approach can be formulated through variables that are accommodative to students' empirical experiences so that these conditions are not only able to increase students' knowledge, but also stimulate empathy to create a commitment to implementing biodiversity conservation in everyday life. Biodiversity literacy skills in learning can be obtained through various learning models. Based on the characteristics of the concept of biodiversity itself, the authors believe that there is a form of model that can be applied in learning biodiversity material in science lectures. The model is a project based learning (PBL) learning model. In the next stage, the application of this learning model is expected to provide information regarding the profile of students' biodiversity literacy abilities. The profile obtained is then analyzed qualitatively and in depth. The results of the analysis will later become the basis for compiling the analysis in this study.

▪ METHOD

This research is a grounded theory qualitative research that seeks to make an analysis of students' biodiversity literacy skills through a problem-based learning model. The population in the study consisted of students who were the object of research,

totaling 30 students who took Science Education courses. The research instrument included the results of the final exams for Ecology courses and assignments and interviews conducted by Science Education students in Ecology courses, more specifically on Biodiversity material. Before giving research instruments to students who were used as research objects, the research instruments had been tested for validation and reliability on 30 students who had the same criteria as the research objects. Analysis in the form of in-depth narratives about the data obtained concerns the biodiversity literacy skills of biology students in ecology lectures which are confirmed by appropriate theories. The information obtained in this study will cover 6 indicators of biodiversity namely; (1) the ability to define biodiversity and its utilization, (2) the ability to define biodiversity at the gene level, species level and ecosystem level, (3) the ability to describe the loss of biodiversity and its causes, (4) the ability to understand the principles of biodiversity conservation, (5) the ability to differentiate biodiversity conservation efforts, (6) the ability to communicate and make solutions to various problems related to biodiversity. The process of data analysis in this study began from the stage of reviewing the collected data. Data analysis procedures were carried out using a flow model with three stages, namely: Data reduction, namely activities that refer to the process of selecting, focusing, paying attention to, simplifying, abstracting and transforming raw data in the field, data exposure which includes data classification and identification , namely writing down organized and categorized data sets so that it is possible to formulate conclusions from the data, and Formulating conclusions from the data that has been collected, before the conclusions are formulated the researcher negotiates the results. The data obtained in this study were in the form of the results of student answers on tests given by teaching lecturers at the end of lectures after being taught with the PBL model. Other data is the result of observations of assignments carried out by students through student worksheets given by lecturers.

▪ RESULT AND DISSCUSSION

Biodiversity is an integral part of IPA. One of the studies in natural science that discusses biodiversity is ecology, while ecology itself is a branch of biology and biology is a branch of science. The need to study biodiversity material, because science learning is closely related to the diversity of natural resources which are indirectly related to everyday life (Rahadian & Aswin. 2017). This implies that the study of biodiversity is part of what is studied in science education. Learning about biodiversity is part of the need to accommodate students' daily experiences by applying various learning models, so that students can have comprehensive skills about the meaning and characteristics of this biodiversity (Lindemann-Matthies et al., 2009; Dikmenli, 2010). Existing studies, apart from emphasizing the physical aspects of conservation, have not paid attention to the methodological aspects that ensure the transfer of knowledge and the formation of awareness in biodiversity conservation. This statement becomes an argument as well as the background of this research. That the application of relevant learning models will be able to improve students' literacy skills and their competence in diversity conservation. In addition, the learning model can be an accommodative variable that can provide empirical experience for students so that in the end this does not only increase student knowledge, but also stimulates empathy to create a commitment to biodiversity conservation. The facts obtained in data collection activities in research are that there are three learning models applied in ecology lectures on

biodiversity material. This fact further provides information regarding the profile of the ability of biodiversity literacy of students who take science courses through the Problem Based Learning (PBL) learning model. Based on the characteristics of the applied learning model and the indicators of biodiversity literacy ability, it can be assumed that the profile of the biodiversity literacy ability of students taking science courses can be assumed. This profile of biodiversity literacy ability will then become the basis for researchers in reconstructing a qualitative model of biodiversity literacy ability profile.

The profile of the biodiversity literacy ability of students who take science courses by applying the PBL learning model has categories at high to very high percentages of test results as well as the percentage of average scores for each test indicator. This fact is allegedly caused by the condition that students are able to understand and analyze information in the biodiversity material they learn in the lecture activities carried out. The existence of the facts obtained can form the basis for researchers to put forward an analysis that in order to strengthen students' biodiversity literacy abilities, the use of the PBL model that has been applied in science lectures can show a tendency that is not much different in the application of learning model assignments. The tendency to have similarities in biodiversity literacy abilities is also deepened in the analysis by presenting and reviewing the analysis of the results of interviews with students who are used as samples to be studied using the PBL model.

PBL or Problem Based Learning is a learning model that provides an active role to students during the learning process by creating a concept of problems in surrounding life (Handayani & Koeswanti, 2021). The PBL learning model is very effectively applied to Science Education students in biodiversity material because it has a close relationship with everyday life (Rahmat, 2018). The PBL model has advantages in training Science Education students in solving problems and analyzing the surrounding conditions on Biodiversity material. It is hoped that research conducted using the PBL model will provide positive results in increasing the ability to analyze science education students' abilities on biodiversity, but a lack of understanding regarding biodiversity can be a barrier in increasing the biodiversity literacy of science education students. This is proven by the results of the analysis of assignments that have been given to the biodiversity material in the Ecology course. This is in accordance with research (Hadi, 2017) that there is a lack of understanding in students in solving problems and analyzing biodiversity material which is an obstacle for students in analyzing problems in biodiversity material. The data was obtained by interviewing science education students who had followed the PBL learning model.

Analysis of the results of the interviews conducted in this study is an in-depth description of the facts obtained by the author directly when interviewing a sample of students who have taken science courses through the PBL model. The instrument in this interview was the researcher himself. There are two types of data that become which is the source in this study, namely data concerning test results obtained by students in science education lectures on biodiversity and data material the results of observations of the tasks that have been done by students and the results of the interview regarding the understanding and mastery of literacy skills the biodiversity of the students who were sampled in this study. Furthermore these data were analyzed using qualitative analysis. There are four categories in the qualitative analysis, namely credibility, transferability, depenability and confirmability The credibility test in this study was

carried out by verifying the data research in the form of document answers to student test results and assignments what students have done. Transferability related to implementation of research results obtained for use by users. On pthis research obtained a good level if the readers of the report can understand, describe, generalize and transfer the context of focus study. Depenability and confirmability in the qualitative research conducted by checking the entire research process. The next step is applying triangulation.

Based on the results of the interviews, the overall understanding and interpretation of students taking science courses showed similarities between one another. This condition is very visible in the description of the answers submitted by each student interviewed based on 6 indicators of biodiversity literacy ability. This fact reinforces the results of the analysis of the profile of students' biodiversity literacy abilities that have been reviewed previously based on the percentage of results given to students at the end of the lecture. There is a tendency for the profile of students' biodiversity literacy abilities to be similar. This can happen because in providing the PBL learning model students find almost similar problems or there could be the same understanding of the concept of biodiversity (Novita et al., 2022). It is believed that the lack of in-depth understanding regarding biodiversity will have an impact on the inappropriate form of solutions that will be constructed by students when they have finished attending science lectures. This is suspected by the authors will have an effect on the actual management and utilization of biodiversity carried out by students. This condition makes the ability of biodiversity literacy an absolute ability to be built in every student. A further relationship is the suitability of this biodiversity literacy ability with the learning outcomes of the course. In the science course, the learning outcomes for this biodiversity literacy ability concern abilitiesexplain and define the concept of biodiversity and construct an analysis of the three levels of biodiversity and learning outcomes regarding abilities mstudents in communicating the results of applying the concept of population, community and biodiversity based on observations both in writing in the form of activity reports, posters, study journals, portfolios and orally in the form of presentations.

Learning concepts in biodiversity and ecosystems in science learning activities should be done by analyzing real natural phenomena, especially regarding biodiversity in everyday life. One model of application in the subject of biodiversity that can provide a real understanding of the concept of biodiversity is by conducting learning outside the classroom such as field work practice (PKL) based on Problem Based Learning (PBL) (Cahyani, 2022). Learning outside the classroom can also provide actual understanding based on the facts that occur, so that it will indirectly hone the thinking patterns of Science Education students to be able to make literacy analyzes about biodiversity (Taqwan, 2019). However, in practice, most of the learning activities concerning ecosystems and biodiversity are mostly carried out using traditional and classical approaches, such as giving examples that do not lead directly to the object being studied or giving examples that are less relevant to the object of study itself. Meanwhile, on the other hand, in learning science, the competency that must be achieved is a comprehensive ability to analyze processes that occur in ecosystems and biodiversity. An example of the competence referred to is for example students must be able to communicate the results of applying the concept of ecosystems and biodiversity based

on written observations (activity reports, posters, study journals, portfolios), students are able to analyze ecological problems and implementation and construct them in the form of scientific report descriptions. Based on this example, it can be said that if the learning model used is only more classical in nature without inviting students to see and observe the real biodiversity, then the achievement of student competence will be low. Biodiversity is an important part of learning science. Holistically learning biodiversity includes ecological and socio-economic aspects (Schaal et al., 2012). This becomes very important in providing variations in learning and learning methods in inspiring students. In particular, the combination of active, participatory and collaborative learning methods with activities in the field can increase knowledge and skills of biodiversity (Ramadoss & Poyya Moli, 2011). In addition, in teaching biodiversity, teachers must be able to relate it to the daily life experiences of students and by using a variety of learning methods so that students can fully define the meaning and characteristics of biodiversity in a comprehensive manner. The learning process of science education emphasizes providing direct experience to develop competencies in order to explore and understand the natural surroundings scientifically (Ali, Suastra, & Sudiatmika, 2013). Science education is directed to inquiry and action so that it can help students gain a deeper understanding of the natural world around them (Kubicek jkubicek@mus-nature.ca, 2005).

Thus Science Education will invite students to get closer to nature where they stand.The study of ecosystems and biodiversity is part of the study in science education is a way of thinking, a method for conducting investigations and a form of knowledge about the interaction of living things with their environment. This interaction will biologically cause variations both from the smallest level, namely the gene, the species level and the larger level, namely the ecosystem. This variation is a biodiversity. Science learning aims to students can achieve and develop competence with an emphasis on hands-on experience in exploring and understand the natural world scientifically. Therefore Students are expected to be as active as possible through observation, experimentation, as well as discussions to find answers to various phenomena that occur in the natural surroundings (Astuti et al., 2012). A form of learning that utilizes the potential of biodiversity available in nature in the field, is an alternative strategy in an effort to increase students' skills in aspects of biodiversity and ecosystem conservation so that it will have a further impact, namely the emergence of a conservation character. That indirectly students who have biodiversity literacy skills will have a character of sensitivity to any changes related to biodiversity that occur in the surrounding environment. The existence of this character at a later stage can make students have a real will in making efforts to protect, maintain and preserve biodiversity and ecosystems broadly. Given the importance of cultivating this character, the strategy from the educational aspect is expected to provide changes to patterns of thinking and touch a deeper awareness of students. Education, both formal and non-formal, must contain values in the four pillars of education, namely; learn to know, learn to do, learn to understand yourself (identity), and learn to live together and respect each other on the basis of equality and tolerance in society. Utilization of the potential of biodiversity and ecosystems as material for study in science learning can be categorized as an effort to develop character for the conservation of natural resources and to instill ethical values of human relations with nature in an integrated manner within students. Character can

be manifested in the form of behavior towards the environment and making efforts in the form of preserving biodiversity. Natural learning resources can be an option in supporting the learning process, because they provide opportunities for students to study the object of their study directly. In addition, with direct interaction with the object being studied, students are able not only to recognize but also to find out, analyze, prove and make conclusions in their own way about the object being studied so that indirectly they can become someone who has worked scientifically. Scientific in question is that students do not only form their own opinions without any facts, but are invited to seek answers to a problem or a phenomenon that is real or directly observed, which is referred to as the scientific approach.

▪ CONCLUSION

It was revealed that the biodiversity literacy abilities of biology students who attended lectures using PBL, were within the criteria for specific biodiversity literacy abilities leading to the ability to define biodiversity at the gene level, species level and ecosystem level, communicate and make solutions to various problems related to biodiversity, and the ability to define biodiversity and its utilization. This competence is absolutely supported by a good, in-depth and perfect understanding of biodiversity and its levels as well as the forms of utilization of the biodiversity itself. Overall, from the application of the learning model, it can be shown that the literacy skills of students' biodiversity in science lectures are more directed to the ability to analyze based on the latest Bloom's taxonomic aspects (Krathwohl).. Biodiversity literacy is a form of competence as well as an achievement in learning which in turn will lead to the character of conservation (Soft Conservation) and the output obtained from this model is soft skills (life skills).

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