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Analysis of Student Generic Skills in terms of Scientific Literacy Aspects through Research-Based Learning Methods

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Abstract

Generic skills are fundamental skills needed to complete a job or project that can be grown when students go through the learning process. This study aims to analyze and identify students' general skills in terms of scientific literacy through research-based learning methods in the Science Application course. The research uses a quantitative survey type, with a cluster random sampling technique on students taking the Science Application course. Data were obtained through a questionnaire to reveal students' generic skills individually and a questionnaire sheet was used to determine student responses to the research-based learning method. In learning the Science Application course using research-based learning methods, the indicators of observed generic skills are direct observation, indirect observation, awareness scale, symbolic language, logical framework, logical consistency, causal law, modeling, logical inference, and abstraction. The highest score on the logical inference indicator is 82%, while the logistic consistency indicator gets the lowest percentage of 72%. Students gave a positive response to the learning of research-based learning methods with a percentage of 85%. Students have a new, fun learning experience, and their generic skills are formed so that it has a positive impact on improving the quality of learning.

Keywords: Generic skills, Scientific literacy, Research-based learning.

Introduction

Improving the quality of education during the COVID-19 pandemic is a global challenge. Changes in the learning process from the initial face-to-face directly allow internet-based learning. In addition, the challenge of mastering skills in the 21st century is a topic educators at LPTK will never forget, namely by improving the quality of graduates. Crespí & Ramos (2021) reveal that education aims to develop solid human beings to assist students in providing service and excellence in communication as well as professionals. Therefore, in an effort to improve the quality of teaching, educators have changed the teacher-centered learning system to become the center of attention for students. The implementation of a quality learning process does not only develop students' abilities in the knowledge aspect, but in the skills aspect; it is still rare (Mustofa et al., 2019). The need for mastery of competence and habituation to students in the Elementary School Teacher Education study program in terms of knowledge, attitudes, and skills as prospective teachers. Crespí & Ramos (2001) stated that experience is a critical element in learning; this is especially true in terms of generic competencies, which can then be applied to real-world actions and behaviors that lead to stable, healthy, and positive lifestyle habits.

The direction of curriculum content development is highly considered by the Elementary School Teacher Education Study Program. In addition to scientific content, competencies, and skills that prospective elementary school teacher students need to possess (Fakhriyah et al., 2018). Selvianti, Ramdani, & Jusniar (2013) also revealed that in addition to knowledge, students must also have skills in order to carry out special tasks related to cognitive, affective, and psychomotor behaviors as well as possible. In accordance with the 2013 Indonesian National Qualifications Framework (KKNI), it applies that university graduates must be able to solve problems by utilizing science and technology in their fields, be able to adapt to the situation at hand, and master theoretical concepts both in general and specifically in-depth and depth. Able to formulate procedural problem-solving efforts (Ministry of Education and Culture of the Republic of Indonesia, 2013). This encourages that encouraging indicators of skills aspects are one of the keys to the success of an educational process.

Based on this, various competencies and skills of students need to be possessed, trained and developed during the learning process, including scientific literacy and generic skills. Scientific literacy competence is related to mastery of scientific concepts and how to implement them in everyday life (Bybee et al., 2009). Mastery of scientific literacy is expected to make it easier for students to adapt to future advances in science and technology. Everything related to the science learning process must contain the values of scientific literacy (Nurfaidah, 2017). Fakhriyah et al. (2017) revealed that in order to develop

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students' abilities to become prospective teachers, the teaching and learning process in study programs should be directed at equipping students with scientific reasoning skills to support scientific literacy. At the same time, generic skills are basic skills that can be grown when students go through the learning process. According to the Carrick Institute for Learning and Teaching in Higher Education (2007), generic skills associated with university education include high-level skills in terms of written communication, oral communication, critical and analytical thinking, problem-solving, collaboration, independent study, information literacy, skills interpersonal, as well as ethics and values. Because generic skills are relatively independent of disciplines, these skills should also be possessed by university graduates because these generic skills will be useful for continuing education and career success (Yeung, 2007). Mostofa et al. (2019) revealed that the abilities needed in the world of work are not only cognitive abilities but also how to apply cognitive abilities in various forms of skills, namely generic skills or soft skills.

In an effort to develop generic skills, it is necessary to make lectures that were previously unattractive to be interesting, which were felt to be difficult, become easy, which previously did not mean becoming meaningful and not only prioritize cognitive aspects. The Science Application course is one of the mandatory courses held at PGSD FKIP. This course is used as one of the learning evaluation materials in this study. The learning process for the Science Application course has used the Research-Based Learning (RBL) method. One of the steps to achieving effective learning is to organize research-based learning (Chrysti, 2014; Hidayah, 2018). Research-based learning with a scientific approach is one of the methods of learning that can improve students' ability to build knowledge to increase activity (Hidayah, 2018) and students' curiosity in the learning process. The learning process is the implementation of a combination of research and learning characteristics (Usmeldi, 2016; Sota & Peltzer, 2017; Suntusia et al., 2019).

The Research-Based Learning (RBL) method can improve generic skills through simple, practical activities. RBL combines authentic, cooperative, and inquiry learning to find good scientific concepts and attitudes (Lu et al., 2019). Investigation strategies can improve the quality of learning (Susiani, Salimi & Hidayah., 2018), can hone curiosity and critical questions, and find solutions (Guinness, 2012). This is because it involves students to assist in the allocation of time and resources, other resources to complete assignments, and provides a learning experience that involves students (Mustofa, 2015). RBL steps include formulating hypotheses, conducting investigations, analyzing data, testing data, and concluding and presenting the results of the investigation (Suntusia et al., 2019). The implementation of the practicum is carried out to find concepts, hone process skills, and improve scientific attitudes, resulting in an increase in generic skills to strengthen scientific literacy competence. RBL empowers students to master the generic skills needed in an ever-evolving world (Suntusia et al., 2019). Based on the characteristics of this Science Application course, almost 80% of the implementation is carried out with practical activities. Mustofa (2015) stated that, theoretically, practicum courses should improve students' generic skills. Based on this background, this study aims to analyze and identify students' generic skills in terms of scientific literacy aspects through research-based learning methods in the Science Application course.

Method

Research Design

This research is a quantitative survey. Sugiyono (2018) states that quantitative methods can be interpreted as research methods based on the philosophy of positivism, used to examine certain populations or samples, data collection using research instruments, quantitative analysis. Furthermore, according to Sugiyono (2018) the survey method is a quantitative research method that can be used to obtain data that has occurred in the past or present, about beliefs, opinions, characteristics, behavior of variable relationships and to test several hypotheses about sociological and psychological variables from the sample. taken from a certain population, data collection techniques with observations (interviews or questionnaires) that are not in-depth, and research results tend to be generalizable.

Population and Sample/ Study Group/Participants

This research uses a cluster random sampling technique on students of Elementary School Teacher Education Study Program 3rd semester Universitas Muria Kudus for the 2021/2022 academic year, totaling 186 students who are taking Science Application courses.

Data Collection Tools

Students are given the theme of the material then they carry out research until the concept is found and the product concept to be developed is obtained, which is useful in everyday life. The implementation of research-based learning takes place in one month, but they report weekly progress. After that, students were given a questionnaire to reveal their generic skills of students individually, and a questionnaire sheet was used to determine student responses to the applied research-based learning method. The indicators of generic skills that are measured are direct observation, indirect observation, awareness of scale, symbolic language, logical frames, logical consistency, causal law, modeling, logical inference, and abstraction (Sudarmin, 2011).

Data Analysis

The analysis of generic skills questionnaires and student response questionnaires was carried out in a quantitative descriptive manner, with the following criteria Table 1 and 2).

Findings

The Science Application course is the application of science concepts which is carried out through investigation activities to find concepts. In this study, this course is presented using a research-based learning (RBL) method. With that, it is expected to produce research results in accordance with the science concept material that students can master to improve generic skills based on scientific literacy for students. At first, the lecturer gave lectures using the RBL method, where students were asked to look for certain topics based on predetermined themes, then they carried out practical activities, found concepts, and found new products that were useful in everyday life. The product is then tested for effectiveness. The implementation of RBL takes one month, and every week, students must report the progress of their activities. In applying this RBL method, students can produce their research results in the form of reports and documentation of student work in the form of videos.

Students make simple research steps according to the RBL method by identifying research topics, determining objectives, tools and materials, applying theory, conducting investigations, data analysis, results and discussions, and recommendations (Liliana et al., 2019). First, the lecturer gave the theme of Science Concepts; then, the students chose their own topics of practicum material. Next, students observe the environment, look for problem phenomena, and make hypotheses. Then students collect tools and materials, practicum, analyze the results, and make conclusions and reports. All practicum implementation processes are documented in video form. After students get the results, students provide product concepts that are useful for humans related to relevant concepts. When carrying out the project, students' generic skills were measured.

Generic skills analyzed include direct observation, indirect observation, awareness of scale, symbolic language, logical frames, logical consistency, the law of cause and effect, modeling, logical inference, and abstraction as measured by questionnaires via google form because, at that time, the regulation of lectures at UMK limited face-to-face. The average value of students' generic skills based on scientific literacy in the Science Application course can be seen in Figure 1.

Discussion

The percentage of students' generic skills obtained the highest score in logical inference (82%); logical inference is a generic ability aimed at concluding. The conclusions drawn can be in the form of explanations or interpretations of the results of observation or study or the form of conclusions on new problems as a logical result of existing conclusions or theories, without seeing the real concrete meaning. Aspects of logical inference or logical consistency are measured through several indicators, including understanding the rules, arguing based on rules, explaining problems based on rules, and drawing

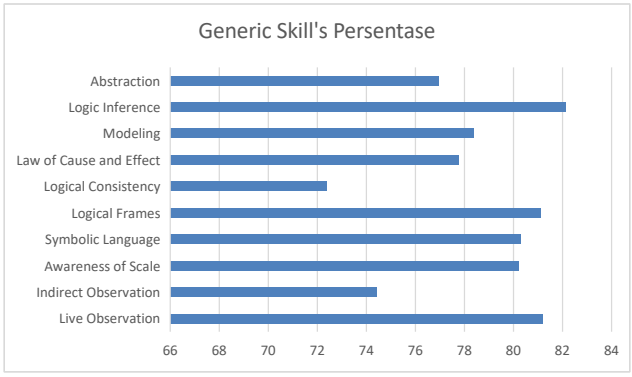

Fig 1: Average student generic skill scores

Table 1. Student Generic Skills Criteria

Total score	*Criteria*
87 ≤ X ≤ 100	Very good
73 ≤ X < 87	Good
60 ≤ X < 73	Enough
X < 60	Less

Table 2: Criteria for Student Response Questionnaires

Total score	*Criteria*
80 ≤ X ≤ 100	Very good
60 ≤ X < 80	Good
40 ≤ X < 60	Enough
20 ≤ X < 40	Less
0 ≤ X < 20	Not very good

Table 3: The average results of students' generic skills scores

No.	*Generic Skills*	*Average score (%)*	*Criteria*
1	Logic Inference	82	Good
2	Live Observation	81	Good
3	Logical Frames	81	Good
4	Symbolic Language	80	Good
5	Awareness of Scale	80	Good
6	Modeling	78	Good
7	Law of Cause and Effect	78	Good
8	Abstraction	77	Good
9	Indirect Observation	74	Good
10	Logical Consistency	72	Enough

conclusions from a symptom based on previous rules or laws (Liliasari, 2007).

This generic ability includes the ability to explore the principles and concepts that underlie practical activities through research methods. In exploring the principles, students are faced with thinking about the working principles of the tools used and the working principles of experiments in research method activities; it is necessary to have a comprehensive understanding of the concepts related to the activities carried out. For this purpose, students need a strong understanding of procedures, theories, and concepts and have cognitive strategies to relate them logically to each other by referring to their understanding. The weakness of students in the generic ability of logical inference generally lies in their inability to make principles. The strength lies in determining the related concepts because students are more accustomed to learning concepts. This is because when face-to-face learning is limited, students are given the concept of the material to be studied, and the topic of discussion is in the form of problems related to natural science phenomena in everyday life, so students are accustomed to finding concepts. These results are in accordance with previous research that students' scientific literacy skills are at the nominal level, namely, students have a good understanding based on the material from the textbooks studied (Fakhriyah et al., 2017). In addition, based on the results of computational thinking, students are at the algorithm stage; namely, students are able to provide problem solutions (Fakhriyah et al., 2019).

While logical consistency gets the lowest percentage of results (72%), logical consistency is drawing conclusions from an experiment carried out; students are required to draw conclusions based on references, integrate various disciplines, use logic and conclusions consistently, and explain problem solutions in detail. The lack of generic skills is because students are not all ordinary and able to make conclusions, solve a problem based on references and make explanations of research and other references. Theoretically, they have obtained the concept of material related to each simple research activity, so they can combine the data obtained from the research results with the theory (Sandy, 2019). However, there are some students who sometimes only include theories from books in their discussion, and there are also those who do not elaborate on the data. In addition, these results are also caused by students experiencing misconceptions. Basically, students understand what is being asked, but they are confused, even having the wrong concept (Masfuah & Fakhriyah, 2019). In addition, the implementation of online learning affects the performance of lecturers and students. Lecturers cannot explain the material in detail even though it has been done virtually, have difficulty monitoring students directly, have difficulty carrying out authentic assessments, and students cannot fully grasp the material. This course weighs three credits, with the implementation of this research virtually three meetings and one face-to-face meeting. The implementation of online learning affects students' abilities. This is in accordance with the results of Napitupulu's research (2020), which found that online learning was ineffective because students were unable to understand the material in detail.

The data is also supported by student responses in using the RBL method based on scientific literacy in science application courses stating a positive response with a percentage of 85% (very good). Most of the students stated that the RBL method based on scientific literacy could improve their generic skills in learning science application courses. Students have new and enjoyable learning experiences because scientific literacy can be defined as scientific knowledge and skills to be able to identify questions, acquire new knowledge, explain scientific phenomena, draw conclusions based on facts, understand the characteristics of science, awareness of how science and technology shape the natural environment. Intellectual and cultural; and a willingness to be involved and concerned with issues related to science (Narut & Supradi, 2019).

Student interest is very important to give focused attention; the learning orientation of the RBL method based on scientific literacy must be owned by students in facing the global era to be able to meet the needs of life in various situations. Scientific literacy is the ability to understand science, communicate science, and apply scientific abilities to solve problems (Yuliati, 2016). To improve scientific literacy skills, besides requiring motivation, it is necessary to consider learning strategies that are in accordance with the conditions and potential in the learning process, which focuses on providing direct experience and the application of the nature of science, one of which is through the RBL method. Because in building and developing scientific literacy skills, you can implement active-oriented learning in understanding and applying the concepts that have been learned to solve problems experienced in everyday life.

Students become more skilled in honing their generic skills. The advantages of this RBL method are that students become more active in thinking and doing, more actively learning on their own with guidance in carrying out research to find practical experience and skills in using experimental tools, seeing firsthand events so as to prove the truth of a theory for themselves, and are trained in using the scientific method. This is because RBL begins with building questions, setting hypotheses, collecting data, analyzing, and concluding until concepts are found through the development of learning theories of behaviorism, cognitive psychology, and constructivism (Poonpan & Suwanmankha, 2005).

The implementation of this learning attracts students' interest. It can be seen from interesting experiences, suggestions, and inputs given, namely, students are more

creative, gain new knowledge, students are more enthusiastic because they experience and do challenging work to find concepts, and increase students' insight because they can use simple items/used goods to make products/ a useful tool, through research activities students can find out the cause and effect and find solutions, make students become edupreuners because they can sell the products they produce and are more thorough. Meanwhile, the difficulty is that some students are rejected by the lecturer on research topics because the theory is not relevant, it is difficult to find tools and materials because they do not do research in the laboratory if there are problems it is difficult to communicate directly with lecturers because of online learning. However, in general, students are more creative, enthusiastic, and enthusiastic so they want to try other research.

Conclusion

Learning Science Applications courses using research-based learning methods, observed generic skill indicators namely direct observation, indirect observation, awareness of scale, symbolic language, logical frames, logical consistency, the law of cause and effect, modeling, logical inference, and abstraction. The highest score on the logical inference indicator is 82%, while the logical consistency indicator gets the lowest percentage of 72%. Students gave a positive response to the research-based learning method with a percentage of 85% with very good criteria. Students have a new, fun learning experience and their generic skills are formed so that it has a positive impact on improving the quality of learning

Suggestion

This research can be continued by developing students' generic abilities more specifically by using relevant learning methods.

Limitation

This study only uses a quantitative survey so that it can be developed in development research with classroom experiments.

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