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Development of Practicum Instruction Module Based on Project Based Learning (PjBL) Integrated with Science Process Skills and Scientific Literacy

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Abstract: This research aims to produce a valid practicum instruction module; the result of student assessments regarding the practicum instruction module; there are good results of students' scientific process skills; there is an increase in students' scientific literacy; and student responses to the practicum instruction module. This type of research refers to the 4-D model. The research subjects are Even Semester students for the 2020-2021 academic year. The research was carried out at the Biology Education Study Program, Universitas Samudra. The research instrument consisted of validation sheets, observation sheets, test questions, and questionnaires. The data analysis technique in this study consisted of validation data presented in the form of a percentage; student assessment of the practicum instruction module using percentages process skills data analyzed by N-gain score; learning outcomes were analyzed by N-gain score, and; student responses are presented in the form of a percentage. The results of the practicum module validation are categorized as good with a score of 87.5%; The results of student assessment of the practicum instruction module on product trials are categorized as good in terms of indicators of content feasibility, presentation feasibility, and language; The scientific process skills of students before and after conducting product trials of 0.63% are categorized as high; The scientific literacy ability of students is 0.56%, means it has increased; Student response to the practicum Instruction module is positive.

Keywords: Practicum Instruction; PjBL; Scientific Process Skill; Scientific Literacy

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Introduction

Project-based learning (PjBL) is a learning model that gives teachers the opportunity to manage learning in the classroom by involving work-based projects (Wena, 2014). PjBL is also defined as a method in which students engage in intellectually challenging tasks and stimulate students to acquire knowledge and skills used to solve complex problems (Movahedzadeh et al., 2012). PjBL requires students to design and develop systems that can be used to investigate and solve real-world problems (Sababha et al., 2016). Complex activities in PjBL begin with challenging questions or problems that involve students in project design, problem-solving, decision making, or investigative activities and provide opportunities for students to work independently for a certain period of time and ultimately produce real products (Fitrina et al., 2016). Therefore, it can be said that PjBL is effective learning to develop science process skills and students' scientific literacy knowledge (Tasiwan, 2015). Students who carry out PjBL activities will have more significant learning outcomes than those who use regular learning as usual (Çakici & Turkmen, 2013). PjBL also provides

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opportunities for teachers to motivate students to develop appropriate strategies, design projects, and conduct investigations in solving real problems they face. Therefore, it can be concluded that student-centered learning can make students more critical, able to carry out investigations, communicative and interactive in conducting experiments (Farida, et al., 2017).

Science process skills are intellectual, social, and physical insight or knowledge that comes from basic abilities that principally already exist within students (Tawil and Liliasari, 2014). The level of science process skills can be divided into two stages, namely, basic and integrated process skills (Bulent, 2015). Basic science process skills include observing, classifying, measuring, and using numbers, making inferences, predicting, communicating, and using space and time relationships. These skills need to be realized by teachers in science learning and serve as a scaffold for other cognitive skills such as logical thinking, reasoning, and problem-solving skills. Currently, the science process skills of Indonesian students are in a low category. Therefore, teachers need to be able to implement the learning that promotes students' science process skills. It is important since it will allow teachers to encourage students who may lack the relevant skills (Akani, 2015).

Developing students' science process skills is part of learning science that is very useful for students' future lives. By having science process skills, students will be able to find and develop facts, concepts, and add their own ideas, developing relevant attitudes and values (Semiawan, 2012). The basic components of science process skills include (1) Observing, which is using one or more of the five senses to pay attention to the characteristics of objects or events, (2) Conveying information through language, pictures, or other means of representation, (3) Classifying, namely putting things into in categories according to certain characteristics, (4) Measuring, namely making quantitative observations by comparing each other or with units of measure, (5) Objects related in space and time, namely using space and time relationships in describing and comparing shapes, locations, movement, and patterns (Linda, 1993). The interaction between the development of science process skills with facts, concepts, and principles of science, will ultimately develop the attitudes and values of scientists in students (Dimiyati, 2009). Science process skills become the basis for problem-solving by applying the scientific method (Maknun, 2012). In conclusion, Science Process Skills are very important for every student as a provision to use the scientific method in developing science to acquire new knowledge or develop existing knowledge (Afrizon et al., 2012).

The concept of the scientific method is inseparable from scientific literacy which is the ability to interpret science in everyday life, not just understanding theory but being able to do and provide solutions to the problems encountered (Haryadi, 2015). In line with the opinion of Holbrook & Miia (2009), that scientific literacy is an appreciation of science by increasing the components of independent learning with the aim of having the opportunity to contribute to the social environment. McConey (2014) explains that the evaluation process in literacy can contain higher-order thinking investigations.

Science education develops various abilities in the field of science, one of which is scientific literacy (Sukowati, et al., 2017). Science should be taught based on experience, student attitudes, and self-efficacy (Kazempour, 2014). The development of scientific literacy is needed to prepare students who are literate in the field of science (Udompong, et al., 2014). Other research has also been conducted by Fayhaa & AlMomani (2016) about the importance of scientific literacy in improving the academic abilities of students in the science department and connecting them with social issues. In addition, science education also aims to improve the competence of students in an effort to meet the needs of life in various situations (Baheivan & Kapueu, 2014). According to the NCES (National Center for Education Statistics) (2012), scientific literacy is the knowledge and understanding of scientific concepts and processes needed to make personal decisions, contribute to cultural and social activities, and economic productivity. One of the factors that cause the low score of Indonesia's PISA (Program for International Student Assessment) achievement is because the literacy skills of the students are not optimal (Ratri, 2015). Science learning must emphasize student activities during learning activities that build knowledge through a series of activities to create meaningful learning for students (Fuadi, et al, 2015). One of the learning activities that improve cognitive, affective, and psychomotor competencies is practicum activities in the laboratory (Hazarianti et al., 2016).

One alternative to overcome students' scientific literacy problems is to develop practical instructions based on the Integrated Project Based Learning (PjBL) Model with Science Process Skills and Science Literacy. Learning through PjBL will make students gain new knowledge independently through information processing and reasoning to make learning more effective. Wahyuni's research results (2015) stated that the development of a science practicum book that was developed was quite effective in improving students' critical thinking skills and was in the proper category. In line with Prayitno's research (2017), the microbiology practicum book has met the very valid criteria from experts, practitioners, and students which means it is feasible to be used in microbiology practicum; (Anggraini, 2016) There is no revision of the practicum instructions produced, this indicates that the practicum instructions with the PBMP scheme are feasible to be used in the practicum process.

The results of the interview on the implementation of the practicum to the students of the Biology Education Study Program, Faculty of Teacher Training and Education, Samudra University said that the practicum activities had been running smoothly. But, there were several obstacles faced including the lack of student understanding of the material to be studied, the inability of students to make learning tools in the form of practical instructions. Then the assessment of science process skills that was carried out previously has not gone as desired because the assessment of science process skills is an assessment that has many steps and requires a lot of time to use. The objectives of this research are (1) to produce a valid PjBL-based practicum instruction; (2) students' science process skills; (3) students' scientific literacy skills; and (4) student responses after using practical instructions.

Method

This study aims to develop a scientific literacy-based Ecology practicum instruction which will then be tested so that this research is categorized as development research. The research subjects were students of the Biology Education Study Program, Universitas Samudra, Even Semester Academic Year 2020/2021. The development model used in this study is a procedural model adapted from the instructional design development model according to Borg & Gall (2003) which has been modified by Nana Syaodih. The development stage that the researcher used consisted of seven stages, namely (1) preliminary research, (2) planning, (3) product development, (4) product validation, (5) product revision, (6) trial, and (7) dissemination.

Product trials were carried out to see the feasibility of practical instructions through a limited assessment by 20 students at Even Semester of the academic year 2020-2021. This data was obtained by distributing assessment questionnaires to students. The data analysis used in this research is descriptive qualitative. The data analyzed in this study included expert validation data, student assessment data on product trials, data on students' science process skills and scientific literacy skills, and data on student questionnaire responses.

Result and Discussion

Validation of Practicum Instruction

The validation process for practicum instructions is carried out by two expert validators, the results of which are shown in Figure 2 below.

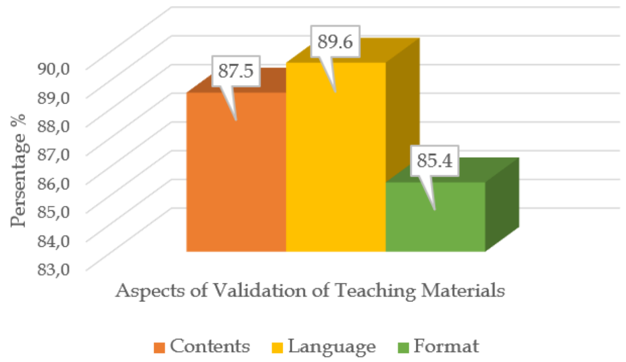

Figure 2. Validation of Practicum Instruction

Based on the results of expert validation, the percentage of the feasibility of practicum instructions on the content aspect is 87.5%, the language aspect is 89.6% and the format aspect is 85.4%, so the practicum instructions are stated in good criteria and feasible to use. The results of this study are supported by Winata et al. (2017) that the validation of scientific literacy-based practicum instructions is categorized as good with the percentage of assessment from the validator being 87.5%. The practicum instruction to improve students' scientific literacy skills are compiled are based on seven scientific literacy measurement indicators developed by Gormally et al., (2012). The seven scientific literacy indicators are 1) identifying valid scientific opinions, 2) conducting effective literature searches, 3) understanding the elements of research design and how they impact the findings/conclusions, 4) making accurate graphs of the data, 5) solving problems using quantitative skills, including basic statistics, 6) understanding and interpreting basic statistics, 7) making inferences, predictions, and drawing conclusions based on quantitative data. A similar study was conducted by Fathurrohman & Astuti (2017) who developed the Basic Physics I module based on scientific literacy on the subject of oscillations and waves which have high validity, readability aspect was easy to understand and effective for increasing scientific literacy of students of Science Education Study Program, UPS Tegal.

Product Trial

The limited trial stage was carried out on 20 students of the Biology Education Study Program, Universitas Samudra Academic Year 2020/2021. The results of product trials include (1) student evaluation of practical instructions; (2) science process skills data; and (3) data on students' scientific literacy skills.

Students' evaluation of practical instructions

The result of students' evaluation of the developed practical instruction-based *Project Based Learning* (Pjbl) model is presented in figure 3.

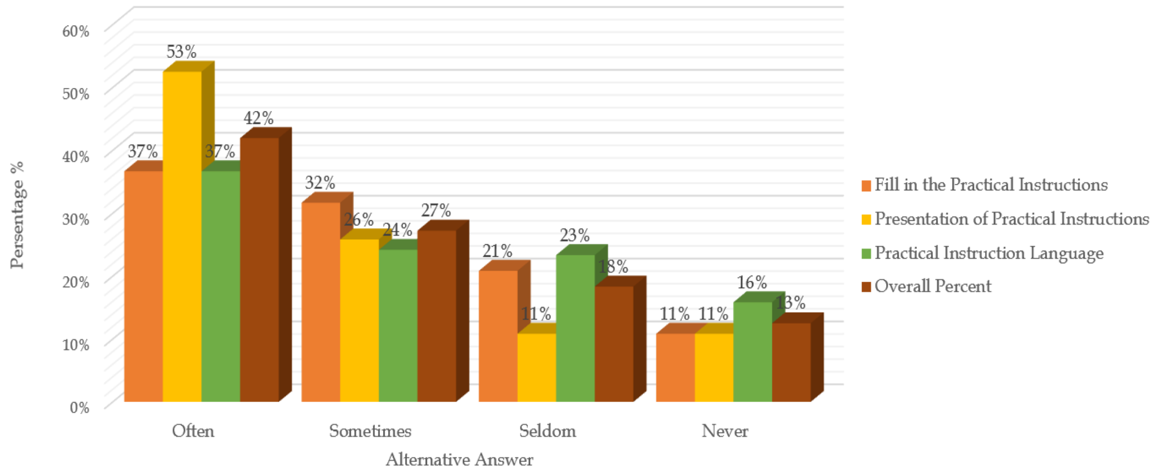

Figure 3. Students' Evaluation of Practical Instruction

The results of students' evaluation on product trials get a high percentage so that the PjBL-based practicum instructions are in good criteria. This is in accordance with the opinion of Anagun and Yasar in Damanik (2013) which suggests that scientific attitude is defined as a tendency, readiness, availability, of a person to provide a scientific response. The feasibility of the teams games tournament-based practicum guide equipped with a practicum performance instrument in the "very good" category based on expert validation and trial process on students (Rahmadani et al., 2015).

Students' Science Process Skills

The data of Students' Science Process Skills is obtained toward the evaluation of 20 students. The result of students' science process skills measurement before and after the trial of the practical instruction is shown in Figure 4.

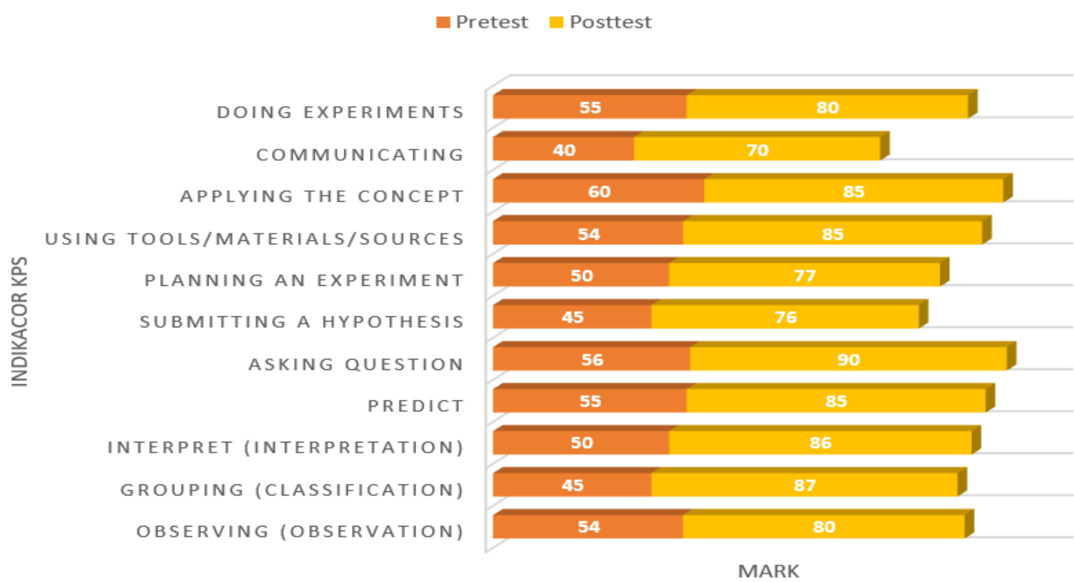

Figure 4. Students' Scientific Process Skills

The score obtained from students' scientific process skills is 0.63% which indicate that students' science process skill is high. This finding is related to the research carried out by Ditasari et al, (2013) about the improvement of science process skills. It is stated that the basic student science process skill will be improved through the application of the practicum module. This research also stated that the PjBL model is effective to use in science class to promote students' science process skills. Moreover, Hidayah, Fitria (2014) explain that practicum instruction can increase students' science process skills with an average N-gain 0,6 (fair). The study of Muniarti et al (2018) results from a high category of developed practicum instruction based on science process skills and the trial of the product result in the easiness of the use.

Students' Scientific Literacy

The data of students' scientific literacy is obtained from the test of 20 students. The finding of students' scores in scientific literacy before and after the practicum book trial is presented in Figure 5.

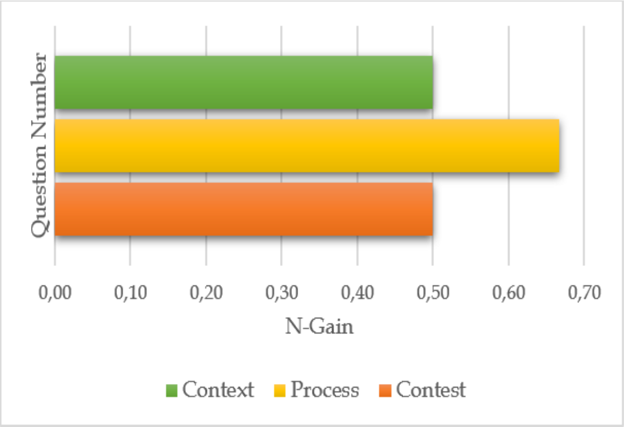

Figure 5. Students' Scientific Literacy

Figure 5 above shows the results of the student's scientific literacy after the implementation of the ecology practicum module with a value of 0.56%, which means that students' scientific literacy has increased. This is in accordance with the research of Seftia et al., (2018) that developing practicum instructions is very suitable to support students' scientific literacy skills because scientific literacy is seen as multidimensional which is not only centered on understanding scientific knowledge. The results of the practicality test of the module on a small scale of students as users obtained a percentage of 82.8% (very good) in the content aspect (Nursamsu et al., 2020).

Students' Responses to Practicum Module

After measuring the student's scientific literacy, the student's response to the developed practicum module was tested by giving a module assessment questionnaire to twenty students. Student response data to the developed module is presented in Table 1.

Table 1. Students' Responses to Practicum Book

No	Indicator	Percentage (%)
1.	Students interest to the component of the module	75.00
2.	The novelty inside the practicum module instruction	85.00
3.	The simplicity In understanding the module	90.00
4.	The novelty of the response component inside the practicum module instruction	80.00
5.	Agree if the following module will be compiled based on Project Based learning model	70.00
6.	Agree if another learning course is taught with a Project-Based learning model	75.00
7.	The clarity of the lecturer guide	90.00
8.	The easiness of completing the evaluation	80.00
	Average Score	80.62

The result of the students' questionnaire to the practical instruction got a score of 80.62% and was categorized as very practical. It means that the practical instruction is feasible to use in the course of Ecology practicum. It is related to Fajriani et al., (2018) that practical instructions can serve as a support for learning in practical activities. The results of the responses given by the respondents were very good, so this product can be used by teachers and students in practical activities by integrating problem-based learning and has included aspects that support students' scientific literacy activities in it. The results of the feasibility test analysis and practicality test are in accordance with Azizah's research (2018) which explains that the Dilan (DL) practicum module for science learning in Class V SD is valid, practical, and effective, with a validity value obtained of 61.5 indicating very valid criteria. The teacher's response to the problem-based practicum guide developed stated that it was feasible to be used as a guide for practicum activities, learning resources, and media teaching materials. The score obtained for problem-based learning practicum instructions get a score of 97.9% (very good) (Hamim et al., 2021).

Through direct experience, students find facts, so they can learn to find knowledge, practice science process skills, and students' critical thinking skills (Sumiyarti, et al., 2019). The results of the regression analysis indicate that there is a strong correlation between the use of students' worksheets to support virtual laboratory activities for knowledge and skills competencies (Hidayati and Masril, 2019).

Conclusion

Based on the findings and discussion it can be concluded that the practicum module based on Project Based Learning (Pjbl) Model Integrated with Science Process Skills and Scientific Literacy that has been developed has (1) good validation results with an assessment percentage of 87.5%; (2) The results of student assessment of the practicum module in product trials are categorized as good both for the components of content feasibility, presentation feasibility, and language; (3) Students' science process skills before and after conducting product trials of 0.63% are categorized as high; (4) The scientific literacy ability of students is 0.56%, means it has increased; (5) Student response to the practicum module is positive.

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