
DEVELOPMENT OF STUDENT WORKSHEET IN NATURAL SCIENCE LEARNING BASED ON PREDICT-OBSERVE-EXPLAIN (POE) TO IMPROVE SCIENCE PROCESS SKILLS

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Abstrak:

Penelitian ini bertujuan untuk mengetahui: (1) kelayakan LKS dalam pembelajaran IPA berbasis POE menurut dosen ahli dan guru IPA, (2) peningkatan keterampilan proses IPA siswa setelah menggunakan LKS dalam pembelajaran IPA berbasis POE, dan (3) respon siswa terhadap LKS dalam pembelajaran IPA berbasis POE yang dikembangkan. Penelitian ini merupakan penelitian pengembangan dengan model 4D. Subjek penelitian ini adalah siswa kelas VIII SMP Negeri 2 Pleret yang berjumlah 11 siswa. Desain uji coba produk menggunakan one group pretest-posttest design. Analisis data adalah konversi nilai kuantitatif menjadi nilai kualitatif satu skala empat, perhitungan persentase, dan perolehan skor. Hasil penelitian menunjukkan bahwa: (1) LKS pembelajaran IPA berbasis POE untuk meningkatkan keterampilan proses sains dinyatakan layak oleh dosen ahli dan guru IPA dengan kategori sangat baik, (2) penguasaan keterampilan proses sains melalui observasi termasuk kategori baik, sedangkan peningkatan keterampilan proses sains ditinjau dari hasil pretest-posttest berada pada kategori sedang, dan (3) respon siswa terhadap LKS pada pembelajaran IPA POE berada pada kategori sangat baik.

Kata kunci: POE, keterampilan proses sains, lembar kerja siswa

Abstract:

This study aims to determine: (1) the feasibility of students' worksheet in natural science learning based on POE according to expert lecturers and natural science teachers, (2) students' science process skill enhancement after using student worksheet in natural science learning based on POE, and (3) students' responses to student worksheet in natural science learning based on developed POE. This research was a development research with 4D model. The research subject were 11 eighth grade students of Junior High School 2 Pleret. The product trial design used a one-group pretest-posttest design. Data analysis was the conversion of quantitative scores into qualitative values one a scale of four, calculation of percentages, and gain scores. The result showed that: (1) student worksheet in natural science learning based on POE to improve science process skills were declared feasible by expert lecturers and natural science teachers with very good category, (2) mastery of science process skills through observations included good category, while the improving science process skills in terms of pretest-posttest result was in the medium category, and (3) student responses to student worksheet in natural science learning POE was in the very good category.

Keywords: POE Model, Science Process Skills, Science Student Worksheet.

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Introduction

Natural science learning emphasizes providing direct experience to develop students' competence in exploring and understanding the natural surroundings (Listyawati, 2012). Indicators of success of a learning can be seen from the achievement of learning completeness of natural science in general according to the reality of natural science according to Chiappetta & Koballa (2010), namely (1) science

as a way of thinking, (2) science as a way of investigating, (3) science as a body of knowledge, and (4) science and its interaction with technology and society.

Natural science as a process (a way of investigating) emphasizes that learning natural science is not only accepting the findings, but also is a process to find a concept, principle, or theory (Trianto, 2014). Based on observations of learning activities carried out at SMPN 2 Pleret, the science process skills possessed by students are still low. Most natural science learning is more result-oriented and has not been emphasized on process. The learning activities carried out do not involve experimental activities, so that science process skills such as observing, predicting, analyzing data, and concluding skills have not been achieved optimally.

In order to support the optimization of science process skills, an appropriate learning model is needed, namely the POE model. Nana (2019), explains that learning with the POE model consists of three main stages, namely predict, observe, and explain. In the predict stage, students predict, guess, or suspect an event based on the problems that arise. Activities carried out in the observing stage are students making observations or experiment and recording data to prove initial predictions. Activities carried out at the explaining stage are students analyzing data, describing, and expressing their own ideas about the suitability of the initial predictions with the results observations. Utama (2019), stated that the POE learning model involves experimental activities and the steps in the learning process are arranged systematically using scientific methods. These scientific activities can directly contribute to improving science process skills. In line with the opinion of Rozana et al. (2018), learning activities using the POE model cause the acquired knowledge to be embedded in memory and science process skills will increase.

Application of learning using the POE model in improving students' science process skills can be done using student worksheet. Student worksheet are teaching material used to support the learning process both individually and in group (Astawan & Agustiana, 2020).

Student worksheets are useful for activating students in the learning process, developing concepts, and obtaining information through systematic learning activities (Markhamah et al, 2020). Student worksheets contain several components, namely titles, objectives, brief theories related to materials, tools and materials, activity procedures, result data, discussion question, and conclusions (Trianto, 2014). Based on the results of observations at SMPN 2 Pleret, the student worksheet used have not been able to facilitate students to be actively involved in learning because the student worksheet only contain a summary of material and questions in the cognitive domain.

Based on the problems that have been described, a teaching material is needed according to the needs of students at SMPN 2 Pleret, namely Student Worksheet in Natural Science Learning based on Predict-Observe-Explain (POE) to Improve Science Process Skills.

Method

The study is a research and development (R&D) study with a 4D model according to Thiagarajan et al. (1974). This research consists of the stages of definition, design, development, and dissemination. Development research with limited trials was carried out at SMPN 2 Pleret in the even semester of the 2020/2021 academic year, from February to March 2021. The population in this study were students of class VIII, while the sample in this study were 11 students of class VIII B of SMPN 2 Pleret. The design used in this study is one-group pretest-posttest design. Data collection technique in this study are using tests and non-test. The data collection instruments used were: the product feasibility validation sheet, student responses questionnaires, learning implementation observation sheet of science process skills, and pretest-posttest questions of science process skills.

Analysis of product feasibility data and student responses to student worksheet is carried out by calculating the average score for each aspect of the assessment. The score is then converted into qualitative data on a scale of four with the criteria listed in Table 1.

Table 1. Four Scale Score Conversion

Number	Score	Value	Category
1.	$X \geq \bar{X} + 1.Sbx$	A	Very Good
2.	$\bar{X} + 1.Sbx > X \geq \bar{X}$	B	Good
3.	$\bar{X} > X \geq \bar{X} - 1.Sbx$	C	Enough
4.	$X < \bar{X} - 1.Sbx$	D	Less

(Mardapi, 2008)

Description:

X = Score achieved

$\bar{X}$ = $\frac{1}{2}$ (max score + minimum score)

Sbx = $\frac{1}{6}$ (max score – minimum score)

The analysis of the implementation of learning on the use of the POE model which is integrated in the student worksheet product was using the calculation of the percentage of implementation. The percentage result converted into category values according to Table 2 below.

Table 2. Conversion of Learning Implementation Percentage.

Number	Percentage (%)	Category
1.	$80 \leq X \leq 100$	Very good
2.	$60 \leq X \leq 80$	Good
3.	$40 \leq X \leq 60$	Enough
4.	$20 \leq X \leq 40$	Less
5.	$0 \leq X \leq 20$	Very less

(Source: Widoyoko, 2017)

Analysis of mastery of science process skills based on observation sheets was carried out by calculating the percentage of each aspect of science process skills. The percentage results in the form of quantitative data are converted into qualitative data according to Table 3 below.

Table 3. Percentage of Mastery of Science Process Skills

Number	Mastery Level (%)	Value	Predicate
1.	86-100	A	Very Good
2.	76-85	B	Good
3.	66-75	C	Enough
4.	55-65	D	Less
5.	<54	E	Very less

(Source: Purwanto, 2006)

The improvement of science process skills based on the result of the pretest and posttest scores was analyzed using the gain score calculation formula according to Hake (1998), namely:

$$g = \frac{\bar{x} \text{ skor posttest} - \bar{x} \text{ skor pretest}}{\text{skor maks} - \bar{x} \text{ skor pretest}}$$

The gain score is interpreted based on the criteria according Table 4 below.

Table 4. Gain Score Criteria

Gain index	Interpretation
$g \geq 0,7$	Height
$0,7 > g \geq 0,3$	Medium
$g < 0,3$	Low

(Source: Hake, 1998)

Result

Research Development of Student Worksheet in Natural Science Learning Based on Predict-Observe-Explain (POE) to Improve Science Process Skill for Class VIII Junior High School Student is a development research using a 4D model (Define, Design, Develop, and Disseminate). The define stage is carried out by conducting front-end-analysis, learner analysis, task analysis, concept analysis, and specifying instructional objectives. The design stage is carried out by constructing criterion-referenced test, media selection, format selection, and making initial design of student worksheet products. The

develop stage is carried out with product reviews by supervisors, product validation by expert lecturers and natural science teachers, and product development trials. The disseminate stage is carried out in a limited way, namely to natural science teachers at SMPN 2 Pleret.

Product feasibility assessment of student worksheet in natural science based on POE was carried out by several validators, namely material expert lecturers, media experts, and natural science teachers. Assessment by material expert lecturers includes aspects of the feasibility of content, language, and presentation. The result of the product feasibility assessment by material expert lecturers can be seen in Figure 1 below.

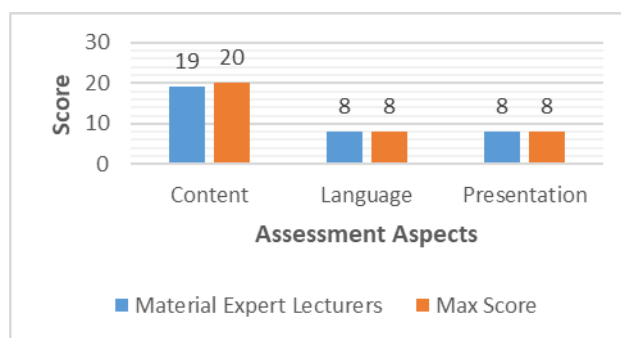


Figure 1. Diagram of the Feasibility of Student Worksheet According to Material Expert Lecturers.

The diagram shows the result of the product feasibility assessment in terms of material included in the very good category (A), which is getting a score of 35 out of a maximum score of 36 in the overall assessment of aspects.

The assessment of the feasibility of student worksheets by media expert lecturers includes aspects of presentation and graphics. The result of the assessment of media expert lecturers can be seen in Figure 2 below.

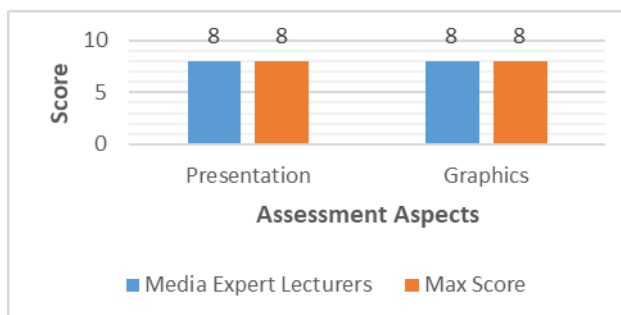


Figure 2. Feasibility Diagram of Student Worksheets According to Media Expert Lecturers.

The diagram shows the results of the product feasibility assessment in terms of the media included in the very good category (A) because the overall assessment of aspects obtained a score of 16 which is the maximum score.

The assessment of the feasibility of student worksheets by natural science teacher in junior high school includes aspects of the feasibility of content, language, presentation, and practicality. The result of the assessment by natural science teachers can be seen in Figure 3 below.

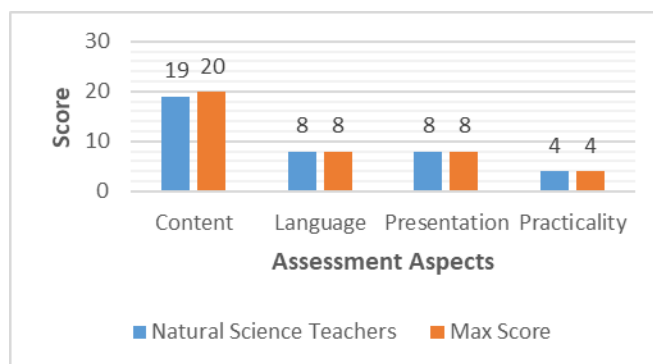


Figure 3. Feasibility Diagram of Student Worksheets According to Junior High School Natural Science Teachers

The diagram shows the result of the product feasibility assessment by natural science teachers included in the very good category (A) because the overall assessment of aspects obtained a total score 39 out of maximum score of 40.

The overall feasibility assessment of student worksheet products by material expert lecturers, media expert lecturers, and natural science teachers obtained A value in the very good category. The A value indicates that the natural science student worksheets are appropriate in terms of materials, media, and their use for natural science teachers, so they are suitable for using at school.

Student worksheet in natural science were declared feasible by the validator, then tested on a limited basis to 11 students in learning. The implementation of the integrated POE learning model in student worksheet products can be seen in Figure 4 below.

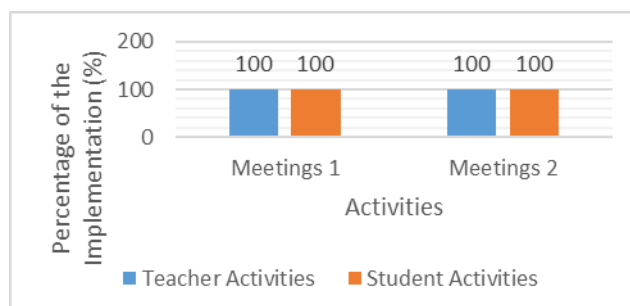


Figure 4. Diagram of the Implementation of Learning with the POE Model.

Based on the diagram, the percentage of the implementation of teacher and student activities at meeting 1 and 2 is 100%. These result indicate that all stages of learning in accordance with the design of the implementation of learning can be implemented so that it is includes in the very good category.

Mastery of students' science process skills during learning is measured through observation sheets. The result of these measurements can be seen in Figure 5 below.

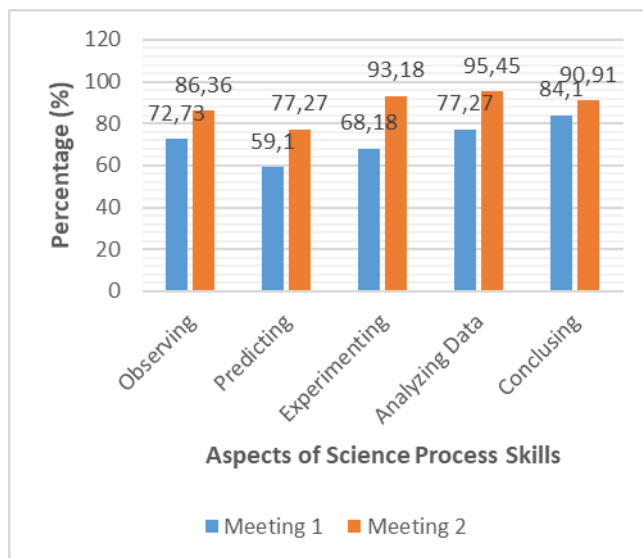


Figure 5. Percentage Diagram of Students' Science Process Skills in Each Aspects.

The diagram shows that the overall mastery of science process skills from meeting 1 to meeting 2 has increased. The average mastery of science process skill in the first meeting was 72,28% including the sufficient category (C), while the second meeting was 88,63% including the very good category (A). The increase in mastery of observing skills is 13,63%, predicting skills is 18,17%, experimental skills are 25%, data analysis skills are 18,18%, and conclusion skills are 16,35%. The science process skills that experienced the highest increase were the skills to conduct experiments. The increase is based on the use of student worksheet that contain the stages of the POE learning model in each activity. Sulistri et al. (2018: 69-70), explained that learning using the POE model provides opportunities for student to find and solve problems directly through experiments. The high increase in skills in conducting experiments is because students are enthusiastic to directly test their initial prediction with the theory that has been submitted.

The improvement of science process skills can also be known based on the results of the pretest-posttest scores. The average pretest and posttest scores for science process skills can be seen in Figure 6.

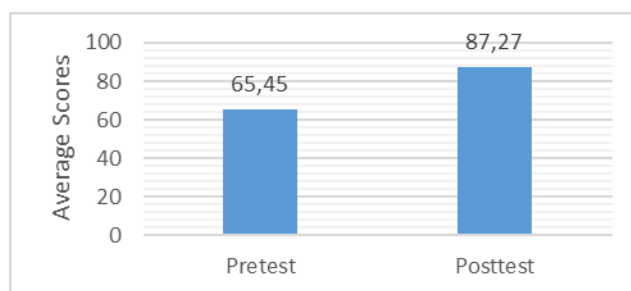


Figure 6. Diagram of the Average Pretest and Posttest Values of Science Process Skills.

Based on Figure 6, the average pretest value is 65,45 and the posttest value is 73,33. This value is used to calculate the n-gain, so the result is 0,63 which is includes in the medium category. Factors that cause the increase in science process skills included in the moderate category is the number of research subjects 11 students. Few subject in the study greatly affect that overall n-gain result. Another factor is that learning using student worksheet based on POE is limited to sub materials with a time allocation of 2 meetings, so that is not fully optimal for improving science process skills. A habit is needed to obtain optimal improvement results.

Based on the results of the study, the overall products of the developed student worksheet can improve science process skills. This increase is supported by the integrated POE learning stages in the product. According to Rozana et al. (2018), learning using the POE model causes the acquired knowledge to be embedded in memory and scientific process skills to increase. Utama (2019), explained

that the POE learning model involves experimental activities using scientific methods. These activities can directly contribute to improving science process skills.

Student response data after using student worksheet based on POE in the learning process were obtained using a questionnaire which included an assessments of graphic aspects, content feasibility, language, and presentation. The result of student responses to student worksheets can be seen in Figure 7 below.

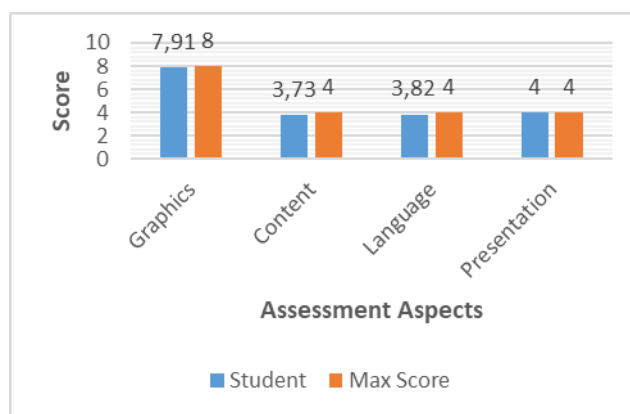


Figure 7. Diagram of Student Responses to Student Worksheets.

The diagram shows a very good student response (A) to the student worksheets that have been used, namely obtaining an overall aspects score of 19,46 from a maximum score of 20. So that student worksheet product developed in the field of the natural science is declared feasible based on the student responses after using the product. Based on the results of the study, overall it shows that the natural science student worksheet based on Predict-Observe-Explain (POE) that were developed can improve students' science process skills. The student worksheets were declared suitable for using in learning natural science at SMPN 2 Pleret.

Conclusion

Based on data analysis and discussion above, it can be concluded that: (1) student worksheet in natural science learning based on POE to improve science process skills were declared feasible by expert lecturers and natural science teacher with very good category (A), (2) mastery of science process skills through observations at meeting 1 was 72,28% in the sufficient category and observation at meeting 2 was 88,63% in the very good category, while the improvement of science process skills in terms of the result pretest and posttest is in the medium category with n-gain of 0,63, and (3) student responses to the student worksheet of natural science learning based on POE was in the very good category (A).

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