Development of science student worksheet containing local potential of geplak to realize problem-solving skill for junior high school students

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Development of Science Student Worksheet Containing Local Potential of Geplak to Realize Problem-Solving Skill for Junior High School Students

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Abstract. This study aims to reveal a science student worksheet containing the development of geplak as a local potential that is appropriate in science learning, know the effectiveness of science student worksheet containing the development of geplak as local potential towards the students' problem-solving skill, and the students' responses after using science student worksheet containing the development of geplak as local potential. This study used the R&D method by 4D model (Define, Design, Develop, and Disseminate) with questionnaires for feasibility science student worksheet, pretest-posttest, and the questionnaire students' responses of science student worksheet. The data were analyzed by four-scale score conversion, paired samples t-test, and gain score. The result showed that the science student worksheet containing the development of geplak as a local potential that was appropriate in science learning as very good (A), the science student worksheet effective to improve students' problem-solving, these results were proven by the paired sample t-test with (2-tailed) showing less than α (0.05) and gain score on the mid-category level to 0.48, and students' responses after used science student worksheet were obtained by very good (A) category.

INTRODUCTION

Natural science studies various natural phenomena, including living and non-living things. Scientists use the result of their research as the basis for the development of natural sciences to get answers about what, why, and how about natural phenomena and their application [1]. Natural science includes four dimensions, namely attitude, process, products, and application. The attitude dimension is curiosity about objects, natural phenomena, living things, and the settlement procedures to solve problems. The process dimension is a mechanism for solving a problem using the scientific method. Product dimensions include facts, principles, theories, and laws. And the application dimension is the application of scientific methods and scientific concepts in daily life. The development of the nature of science in learning is able to improve the quality of students and the life in their environment [2].

Natural science as a way of thinking, a way of investigating, and a body of science from the investigation. Thus, it is a basic component of learning science to develop scientific processes so that they are able to form the thought patterns of students [3].

Global changes of the 21st century require students to have thinking skills, verbal and non-verbal communication, teamwork, creativity, research skill, and problem-solving skill [4]. Problem-solving skill are one of the skills that must be developed to face the global challenges of the 21st century. Problem-solving skill are abilities possessed by each individual to understand problems, develop a plan to solve the problem, carry out the problem-solving plan, and looking back at the result [5].

Based on the results of an interview with one of the science teachers at SMP Muhammadiyah 2 Depok, it was explained that the problem-solving skill of class VIII students in the odd semester of the 2020/2021 school year had been trained but had not yet been obtained maximum results because only a few students were able to provide

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appropriate solutions regarding problems given by the teacher in science learning. In addition, teaching materials for science learning at SMP Muhammadiyah 2 Depok have not facilitated students to develop problem-solving skill. This is because the teaching materials used are science books for SMP class VIII odd semester 2013 curriculum published by the Ministry of Education and Culture and Modul Hibrida published by Muhammadiyah Regional Leadership (PDM).

Based on the description of the problems above, in science learning activities, teaching materials are needed that are able to provide facilities for students to develop problem-solving skill. Thus, the appropriate teaching material to be developed based on the above problems is the student worksheet (LKPD). A student worksheet is teaching material in the form of sheets containing instructions for carrying out learning activities and aiming at achieving the desired basic competencies [6]. Student worksheet used in learning activities is expected to make it easier for students to improve their understanding and involve their experiences through scientific activities and problem-solving [7].

The results of another interview with a science teacher at SMP Muhammadiyah 2 Depok, explained that teaching materials in science learning have not been linked to the local potential. Meanwhile, in 77 N of Government Regulation Number 32 of 2013 explained that each education unit is to develop a curriculum in accordance with the potential of the students' regions so that learning is more meaningful. Science learning that is integrated with local potential is able to create meaningful learning, so that students can apply their knowledge and skills to solve problems in scientific phenomena [8]. Students need to study science related to local culture to obtain original knowledge in society based on the results of scientific investigations so that students are able to develop concepts independently [9].

Indonesia has a variety of local potentials which can be linked to learning activities and the creation of teaching materials. One of the local potentials that can be linked in the student worksheet as teaching material for science learning is the local potential of the geplak. Geplak is a typical Yogyakarta food with a sweet taste, made from the main ingredients in the form of grated coconut and sugar. Geplak production is widespread in Yogyakarta region due to increasing market demand [10].

Science learning materials that can be related to the local potential of geplak are additives for students of SMP class VIII odd semesters. The sub-chapter on additive material on the use of natural and artificial food additives can be related to the local potential of geplak. In addition, the problem in the local potential of geplak is the use of additives in the manufacturing process. Thus, science activities that are associated with the local potential of geplak, can be carried out through the results of the development of student worksheet and are expected to be able to realize students' problem-solving skills related to the use of additives in food ingredients. Therefore, it is necessary to conduct research on the development of science student worksheet containing local potential of geplak to realize problem-solving skill for junior high school students. This study aims to reveal a science student worksheet containing the development of geplak as a local potential that is appropriate in science learning, know the effectiveness of science student worksheet containing the development of geplak as local potential towards the students' problem-solving skill, and the students' responses after using science student worksheet containing the development of geplak as local potential.

METHODS

This research was conducted using the Research and Development (R&D) method which was adapted from Thiagarajan (1974) namely the Four-D (4D) model covering the Design, Define, Develop, and Disseminate stages [11]. This research was conducted in November 2020 at SMP Muhammadiyah 2 Depok. The subjects of this study were eight grade students of D class at SMP Muhammadiyah 2 Depok in the odd semester of the 2020/2021 school year. While the object of this research is science student worksheet containing local potential of geplak to realize problem-solving skill for junior high school students. This research was conducted through the stages of Design, Define, Develop, and Disseminate. The define phase includes initial analysis, students analysis, task analysis, concept analysis, and formulation of learn objectives. The design phase includes instrument preparation, selection of students' worksheet media, format, and design of the product. The develop phase includes reviews product by supervisors, revision of phase I, assessment of the feasibility product by expert lecturers and science teacher, revision of phase II, and product development trial. The Disseminate stage was carried out in a limited manner at the school where the research was conducted, namely to the science teacher as a validator.

The result in this study is quantitative data including student worksheet feasibility assessment scores, pretest-posttest scores of problem-solving skill, and student response scores after using student worksheet. This study uses a

questionnaire instrument for feasibility science student worksheet, pretest-posttest, and the questionnaire students' responses to the science student worksheet.

The feasibility of the student worksheet can be determined based on the results of the assessment by expert lecturers and science teachers. The average score of the assessment results is converted into quantitative data. The average score of the assessment results is converted into quantitative data showed at Table 1 [12].

TABLE 1. Guidelines for four scale score conversion

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

Note:
X = achieved score
$\bar{X}$ = ideal average score
= ½ (maximum score + minimum score)
Sbx = standard deviation
= 1/6 (maximum score – minimum score)
Maximum ideal score = ∑ criteria x highest score
Minimum ideal score = ∑ criteria x lowest score

The results of the pretest-posttest students' problem-solving skills were analyzed by paired sample t-test and gain score using The equation 1.

$$< g >= \frac{Spos - Spre}{Smax - Spre} \quad (1)$$

<g> = normalized gain score
Spos = average posttest
Spre = average pretest
Smax = maximum score
The following criteria is showed in Table 2 [13].

TABLE 2. Gain score criteria

Gain score	Criteria
(<g>) ≥ 0,7	Heigh
0,7 > (<g>) ≥ 0,3	Medium
(<g>) < 0,3	Low

The results of student responses after using the student worksheet were analyzed by converting the average score that had been obtained into qualitative data with the conversion guidelines in Table 1.

RESULT AND DISCUSSION

The results of the feasibility assessment of the student worksheet by expert lecturers and science teachers were obtained by means of a questionnaire containing aspects based on the examination of the material, namely content, presentation, language, characteristics and achievements. While the assessment is based on press reviews, namely the graphic and characteristic aspects. The results of the student worksheet eligibility assessment are shown in Table 3.

TABLE 3. The result of feasibility according to expert lecturers and science teacher as material expert

Aspects	Average	Max Score
Content	20	20
Presentation	12	12
Language	8	8
Characteristics	8	8
Achievement	5	5

The content aspect obtained an average score equivalent to the maximum score because the elements of the statement on all indicators of this aspect were met, including compliance with the basic competencies and the basic competencies, the truth of the substance for learning, product updates, product content conformity with the development of students, as well as the addition of knowledge and values in everyday life.

The evaluation of the second aspect, namely the presentation aspect, obtained an average score of 12. The maximum score in the evaluation of the presentation aspect was 12. The results of the evaluation were equivalent to an A value. which was a very good category because the items of the statement in each presentation aspect indicator had been met. Indicators for this aspect include presentation of learning objectives, completeness of the information contained, and order of presentation.

The results of the language aspect reached the maximum mark because all the elements of the statement of the indicators of the effective and efficient use of the language as well as the use of the type and the size of the letters in the product have been achieved. The language aspect assessment obtained an A in the very good category.

The characteristic aspect, which obtains an average score of 8 out of a maximum score of 8. The evaluation of the characteristic aspect obtains an A value which is equivalent to the category very well. These results obtained the maximum score because the items of the statement in the indicators on the aspect of characteristics were met as a whole. The indicators on the characteristic aspect are the integration of local potential learning resources and the realization of the learning concepts.

The results of the achievement aspect reached a maximum score with an A value which was equivalent to the category very good. The performance aspect fulfilled all the elements of the statement based on indicators in the training of students' problem-solving skills.

Based on the results of the student worksheet feasibility assessment of expert lecturers and science teacher as material experts, can see achieve the maximum score because all aspects of the assessment have been completed. The results presented in Table 4.

TABLE 4. The result of feasibility according to expert lecturers and science teacher as media expert

Aspects	Average	Max Score
Graphics	16	16
Characteristics	4	4

The results of the graphic appearance fulfill all the elements of the declaration based on the indicators of readability of the text in the product, the layout of the content of the product, the composition of the colors in the product, and the use of additional information.

The results of the characteristics obtained an average score of 4. Obtained an A value which equates to the category very well. These results obtained the maximum score for fulfilling the items of the statement based on the characteristic aspect, namely the integration of local learning resources. In this aspect, the validator reviews the product developed, namely the scientific learning sheet containing the local potential of the geplak with the characteristics of the local potential that it contains.

Based on the results of the science worksheet feasibility assessment by expert lecturers and science teacher as media experts, it can be seen if the results of the assessment get the maximum score because all aspects of the assessment have been met. Thus, the results of the assessment of the feasibility of science worksheet containing local geplak potential carried out by expert lecturers and science teacher as material and media experts obtained very good results (A).

The assessment of students' problem-solving skill was obtained from the results of the pretest-posttest which were analyzed using paired sample t-test and gain score. The results of the paired sample t-test showed a normal distribution with a pretest significance of 0.710 and a posttest of 0.085. The result is greater than the level of significance (0.05). Paired sample t-test obtained is Sig. (2-tailed) of 0.004 which is smaller than (0.025). Based on the results of the paired sample t-test analysis, it can be seen that there are differences in the pretest-posttest scores

of students' problem-solving skill in learning science using student worksheet with local potential geplak. The results of the pretest-posttest of the students were continued with gain score analysis for each step of problem-solving to ensure how much improvement in problem-solving skill. The results presented in Table 5.

TABLE 5. The result of gain score of problem-solving skill

Problem-solving Skill Steps	Gain Score	Category
Understanding the problem	0.45	Medium
Developing a plan to solve the problem	0.84	Heigh
Carry out the problem-solving plan	0.27	Low
Looking back the result	0.34	Medium

Based on the gain score in Table 5. it can also be seen that the overall problem-solving skill gain score is 0.48 in the medium category. The improvement of students' problem-solving skills after using the student worksheet containing the local potential of geplak in science learning is the result of integrating contextual learning. Thus, these learning activities are able to train students' abilities to identify authentic problems. In addition, activities in identifying problems related to local potential are able to train students' abilities in evaluating problems based on the results of understanding problems [14]. Student worksheet that train problem-solving skill is able to improve students' problem-solving abilities because they contain indicators that guide students to learn and find knowledge independently based on a problem that involves the discovery of concepts and formal ways of thinking [15].

Based on the results of research and development that have been carried out, the local potential of the region can be linked to the development of science learning materials. Students are able to apply the knowledge and skills they already have to solve problems in scientific phenomena [8]. Therefore, the local potential of geplak which is one of Yogyakarta's special foods can be introduced to students more closely through science learning activities using the student worksheet developed.

Students who have used science worksheets containing geplak local potential responded to the use and obtained the results presented in Table 6.

TABLE 6. The result of student' responses after using the student worksheet

Aspect	Average	Max Score
Content	3.89	4
Construction	3.56	4
Language	3.78	4

Based on these results, it can be seen that the score is not too far from the maximum score by very good (A) category in the aspects of feasibility of content, construction, and language. The results of student responses after using LKPD can be used to support product development activities for science learning, with a student worksheet containing local potential of geplak. In addition to the results of the responses to using the LKPD, some students also gave feedback in the form of suggestions or comments on the LKPD for science learning. The answers given by the students are in the linguistic aspect. These results are due to the learning of the sciences, in particular of the additive material, there is a scientific vocabulary that is not yet known to the pupils.

CONCLUSION

The result of this research showed that the science student worksheet containing the development of geplak as local potential that was appropriate in science learning was very good (A). The science student worksheet effective to improve students' problem-solving. These results were proven by the paired sample t-test with (2-tailed) showing less than α (0.05) and gain score on mid-category level to 0.48. The students' responses after used science student worksheet were obtained by very good (A) category.

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