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Development of Innovative Student Worksheets Based on Project-Based Learning: Improve the Learning Outcomes

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Abstract

This study aims to: (1) develop project-based student worksheet media on the concept of respiratory organs in humans; (2) reveal the feasibility of developing student worksheet media according to media experts, material experts and students; and (3) improving student natural science learning outcomes through innovative student-based worksheet media based on project-based learning. This research was employed a development research design that refers to the ADDIE model. The research subject was elementary school fifth-grade students. Data collection techniques were tests and non-tests. The data instruments were expert validation questionnaires, student response questionnaires, and multiple-choice questions. The feasibility of instructional media was developed and analyzed using the conversion of five quantitative categories. The results of this development were project-based learning student worksheet media. Based on validation, response, and questions, the project-based student worksheet media i is feasible according to media experts, material experts, and students.

Keywords: learning outcomes, project-based learning, innovative student worksheets

Pengembangan Lembar Kerja Siswa Inovatif Berbasis Proyek: Meningkatkan Hasil Belajar

Penelitian ini bertujuan untuk: (1) mengembangkan media LKS berbasis proyek pada konsep organ pernafasan pada manusia; (2) mengungkapkan kelayakan pengembangan media LKS menurut ahli media, ahli materi dan siswa; dan (3) meningkatkan hasil belajar IPA siswa melalui inovasi media LKS berbasis proyek berbasis proyek. Penelitian ini merupakan penelitian pengembangan yang mengacu pada model ADDIE. Subjek uji coba adalah siswa kelas V sekolah dasar. Pengumpulan data dilakukan melalui tes dan non tes. Instrumen yang digunakan adalah angket validasi ahli, angket respon siswa, dan soal pilihan ganda (MCQ). Kelayakan media pembelajaran dikembangkan dan dianalisis menggunakan konversi lima kategori kuantitatif. Hasil pengembangan ini berupa media LKS pembelajaran berbasis proyek. Berdasarkan hasil validasi, respon siswa dan pertanyaan yang diberikan dapat disimpulkan bahwa LKS pembelajaran berbasis proyek layak menurut ahli media, ahli materi, dan siswa.

Kata kunci : hasil belajar, pembelajaran berbasis proyek, lembar kerja siswa inovatif

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INTRODUCTION

In general, education is carried out through the learning process. The main and important principle that must occur in the learning process is the involvement of all or most of the potential possessed by students so that engagement presents meaningful new experiences (Suyanto & Jihad, 2013). But lately, it seems that the learning process is still teacher-centered. The method used in general is the lecture method and is less varied. Wibowo (2018) states that the teacher's tendency to choose lecture methods causes teaching and learning activities to be unattractive, not challenging, and difficult to achieve the specified achievement targets. The teacher still has difficulty in explaining the material to students (Yerizon, Putra, & Subhan, 2018). This causes student activities to be limited. Students' scientific skills in learning will be ignored.

Students who study science are expected to recognize, respond to, and appreciate science and technology and can instill habits of thought and behavior that are critical, creative, and independent. Science learning for elementary students must be modified so that students can learn it. Ideas and concepts must be simplified to fit the abilities and stages of cognitive, affective, and psychomotor development.

Based on the author's preliminary observations in elementary school, the science learning process has adopted a group method, but not all steps have been met. The teacher did not use a learning model that involved student activity in the learning process. This results in classroom conditions becoming noisier, and learning outcomes are still inadequate. The author also stated that the students' science learning outcomes are still unsatisfactory from the results of interviews. From the students' daily test scores, only about 35% of students achieved the Minimum Completion Criteria, especially in the concept of respiratory organs in humans, which were presented at regular worksheets.

Previous studies have shown the positive impact of using innovative project-based learning (PjBL) based on student worksheets (LKS, *in the Indonesian language*). Research conducted by Robert Pucher and Martin Lehner shows that project-based learning affects unusually high student learning outcomes (Pucher & Lehner, 2011). Student worksheets also got positive responses from students in terms of ease of use, attractiveness, ease of understanding, the benefits of worksheets, and time efficiency (Yerizon et al., 2018).

This phenomenon is the researchers' background to research the development of innovative student worksheets based on project-based learning to improve learning outcomes. This developmental research yields improved learning results. This research is also intended to improve the use of student-based project worksheets based on learning science in the concept of respiratory organs in humans. This research is an ADDIE development research model. In Januszewski and Molenda (2013), Gagne and colleagues state "provide an extension of the ADDIE stages into a more detailed procedural guide, namely: analyze, design, development, implementation, and evaluation".

According to Otter (1992), learning outcomes are defined as what is known or can be done by learners. Learning outcomes indicate that knowledge and understanding of certain subjects increase (Sumantri & Satriani, 2016). "Learning outcomes are statements of what a learner is expected to know, understand, and be able to demonstrate at the end of a learning experience" (Adam, 2004). High-quality learning outcomes are the primary goal of education (Trigwell & Prosser, 1991). From some definitions, it can be concluded that learning outcomes increase the form of achievements obtained by students after participating in learning activities at school.

Worksheets provide instructions or descriptions of something to go through when solving a problem. Students can read worksheets as they work on study assignments and can use them to monitor their progress during problem-solving (Choo, Rotgans, Yew, & Schmidt, 2011). Worksheets provide better pedagogical advantages compared to other media for students (MacMillan, 2004). Worksheets are structured and can be integrated (Ulaş, Sevim, & Tan, 2012). Worksheets consist of assignments and questions that are

carefully arranged to provide adequate communication between students and worksheets. Students are expected to build answers for themselves through discussions with classmates and with the teacher. It is assumed that they develop their own true conceptions after most students subscribe to others through discussion. In this process, the teacher does not explain the topic but asks questions that are designed to help students find their own conceptions (Atasoy, Kucuk, & Akdeniz, 2011).

Therefore, LKS is defined as sheets that are used by students as a guide in the learning process and contains tasks to be done by students both in the form of questions and activities to be carried out by students. Learning models are patterns or systematic ways that are used to maximize the learning process to achieve the expected goals. Project-based learning has been a category of pedagogical practice for many years and involves various scientific fields where students usually concentrate on group learning and present various results (Tseng, Chang, Lou, & Chen, 2013).

Project-based learning (PjBL) is also an important model that embodies the socio-cultural perspective of learning in educational settings (Heo, Lim, & Kim, 2010). With the PjBL learning model students succeed in finding literature and other resources or specific domains. This is done to improve expertise (Choo et al., 2011). The PjBL learning model also focuses on the concepts and core principles of a discipline of study, which involve students in problem-solving investigations and other meaningful task activities, allowing students to autonomously construct their knowledge and reach a peak in producing a work (Thomas, 2000). PjBL plays an important role in exposing students to meaningful learning processes when they are involved in completing their projects (Musa, Mufti, Latiff, & Amin, 2012).

The PjBL model is also part of the learning process, which emphasizes problem-solving as a collaborative effort carried out in the learning process at a certain period (Richmond & Striley, 1996). Working with school learning projects provides students opportunities to face real problems and combine their knowledge to solve authentic problems (Heo et al., 2010).

From some of the expert opinions stated above, it can be concluded that the PjBL Model is a learning model that involves students actively in the learning process through collaborative project work to increase student creativity, motivation, and learning outcomes in the learning process. Based on the explanation above, the researcher will develop Innovative Student Worksheets Based on Project-Based Learning to improve the learning outcomes.

METHODS

This type of research used in the preparation of this research is research and development (R&D). Research and development is a research method used to produce certain products and test these products. Research and development contain steps to develop new products or improve existing products, which can be accounted for. The subjects in this research development were students of SD Negeri 101739 Sei Sending Grade V. The total sample was thirty-six students.

The procedure for developing an innovative worksheet based on PjBL is carried out through five stages. These stages are:

1. Analysis, i.e., analyzing science competencies used as material considerations and analysis of students' needs, is used to consider models applied in the products developed.
2. Product design or design, namely designing PjBL-based student worksheets on Respiratory Organ material in Humans for class V students.
3. Initial product development, namely revising and developing PjBL-based student worksheets on Respiratory Organ material in Humans for grade V students based on

validation or input from several validator experts (media experts, material experts, and learning design experts).

4. Implementation, which is applying or using PjBL-based student worksheets on Respiratory Organ material in Humans that has been developed for 36 fifth grade students in SD Negeri 101739 Sei Mencirim, which is referred to as the stage of field trials or product implementation tests.
5. Evaluation, which evaluates PjBL-based student worksheets on Respiratory Organ material in Humans based on the results of field trials by testing the product's feasibility obtained from expert validation data and testing the effectiveness of the product in improving the science learning outcomes obtained from the learning outcomes test data.

The data collected is quantitative. Data collection techniques in research and development using the expert validation questionnaire and learning achievement test. The questionnaire was used to find out the response and assessment given by expert validators regarding the products developed in the form of the innovative worksheet based PjBL. A questionnaire from the expert validator of media, learning material, and design is used to measure the product's feasibility in terms of content, concept adequacy, linguistic and interesting presentation by the syntax of the PjBL model. The learning achievement test was conducted to determine the PjBL-based innovative worksheets' effectiveness in improving the learning outcomes of the fifth-grade science students on the concept of Respiratory Organs in Humans. The learning achievement test is an objective test in the form of multiple choices with four alternative answers (a, b, c or d). The learning achievement test is given at the time of the pretest (before the PjBL-based innovative worksheet is applied) and post-test (after the PjBL-based innovative worksheet is applied). Before the learning achievement test is used, the instrument validation is carried out by the material expert validator, and then it is tested on students so that a valid and reliable research instrument is obtained in gathering research data.

The feasibility test of the PjBL-based innovation student worksheet uses the percentage score of the expert validator questionnaire (material expert, media expert, and learning design expert), namely (see Table 1):

Table 1. Product Validity Classification

Achievement Levels	Classification
81,25% <P< 100%	Very valid
62, 50% < P < 81,25%	Valid
43,75% < P < 62,50%	Quite valid
25% < P < 43,75%	Invalid

Source: Sudjana and Rivai (2010)

Test the effectiveness of increasing science learning outcomes analyzed using the effectiveness of classification tables. But before being tested for its effectiveness, it must be known first the increase in learning outcomes with the gain score formula, namely (see Table 2):

Table 2. Product Effectiveness Classification

Formula	Average score	Classification
$X > X_i + 1{,}8 \times Sb_i$	X > 37	Very high
$X_i + 0{,}6 \times Sb_i < X \leq X_i + 1{,}8 \times Sb_i$	29 < X ≤ 37	High
$X_i - 0{,}6 \times Sb_i < X \leq X_i + 0{,}6 \times Sb_i$	21 < X ≤ 29	Medium
$X_i - 1{,}8 \times Sb_i < X \leq X_i - 0{,}6 \times Sb_i$	13 < X ≤ 21	Low
$X \leq X_i - 1{,}8 \times Sb_i$	X ≤ 13	Very Low

Source: Sugiono (2013)

FINDINGS AND DISCUSSION

The assessment results from experts are used as product validation. There are three validators, namely the material expert validator, the media expert validator, and the learning design expert validator.

The Expert Validation Results

The following are the material expert validation analysis results, which consists of material expert, media expert, learning design expert, and the average score of all expert.

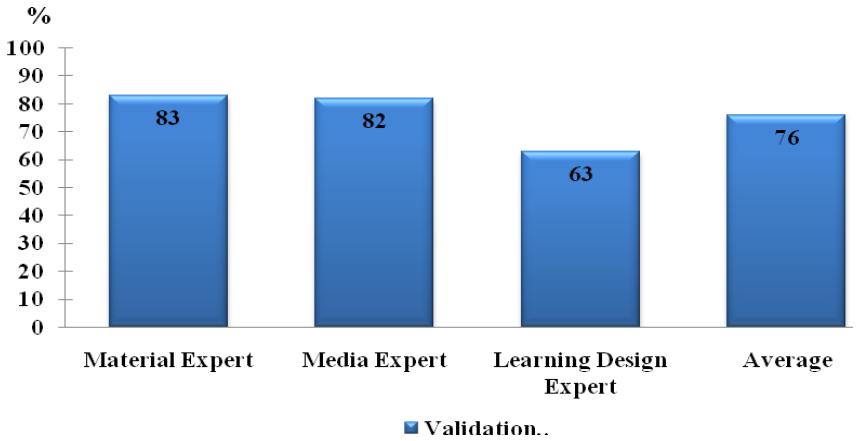

Figure 1. Results of Expert Validation of Innovative LKS Based on PjBL

Figure 1 showed that the evaluation of the material expert validator obtained a percentage of 83% or categorized as very valid so that it can be stated that the PjBL-based innovative student worksheets developed on the concept of respiratory organs in humans are valid and suitable for use by fifth-grade elementary school students because it is in accordance with the material and learning objectives of natural science. Likewise with the evaluation of the validator of media experts who obtained a percentage of 82% or categorized as very valid so that it can be stated that the innovative PjBL-based student worksheets developed on the concept of respiratory organs in humans are very valid and very worthy of using fifth-grade elementary school students because they successfully carry out their roles as a mediator, achieving the goals of using student worksheets, and making it easier for students to understand science material. The lowest assessment was obtained from the learning design expert validator at 63%, although the lowest was still obtained by the valid category so that it could be stated that the PjBL-based innovative student worksheets developed on the concept of respiratory organs in humans were valid and fit for use by fifth-grade elementary school students because of the learning design or the learning steps in the developed student worksheet are in accordance with the PjBL learning model and also in accordance with the characteristics of fifth-grade elementary school students.

The average rating of an expert validator is 76% or a valid category, so it can be stated that an innovative PjBL-based student worksheet developed on the concept of respiratory organs in humans is valid and suitable for use by fifth-grade elementary school students because, in terms of material, media and learning design is in accordance with the natural science material of fifth-grade elementary school, in accordance with the function of student worksheets as a mediator that makes it easy for students to understand natural science material, according to the stages in the PjBL model, and in accordance with the characteristics of fifth-grade students. Thus, it can be concluded that the product in this study is an innovative PjBL-based student worksheet developed on the concept of respiratory organs in humans suitable for use in fifth-grade students.

Science Learning Outcomes

Science learning outcomes were taken from the control class and the experimental class. The data for both classes in pretest and post-test could be seen in the figures below. First, the science learning outcomes of the control class can be seen in Figure 2.

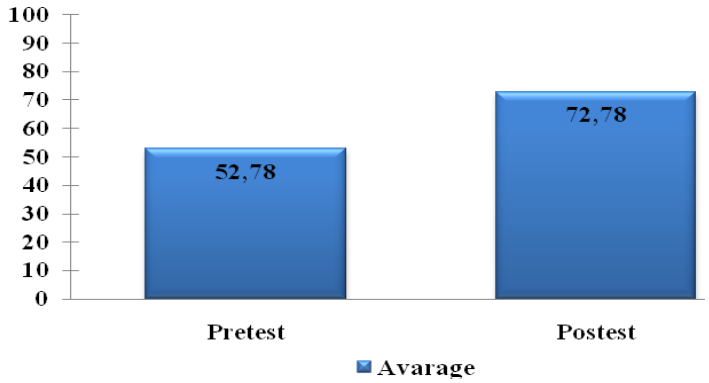

Figure 2 Science Learning Outcomes Control Class

Figure 2 showed that students in class V-B (control class) obtained an average score of learning outcomes in natural science, which were 52.78 at the pretest and 72.78 at the time of the post-test. These results indicate an increase of 20 in the average value of natural science learning outcomes after using ordinary student worksheets. But the results of learning natural science have not been said to be complete because the scores obtained by students when after using ordinary student worksheets do not reach the limit the minimum specified completeness criteria value is 74. Furthermore, the science learning outcomes of experimental class can be seen in Figure 3.

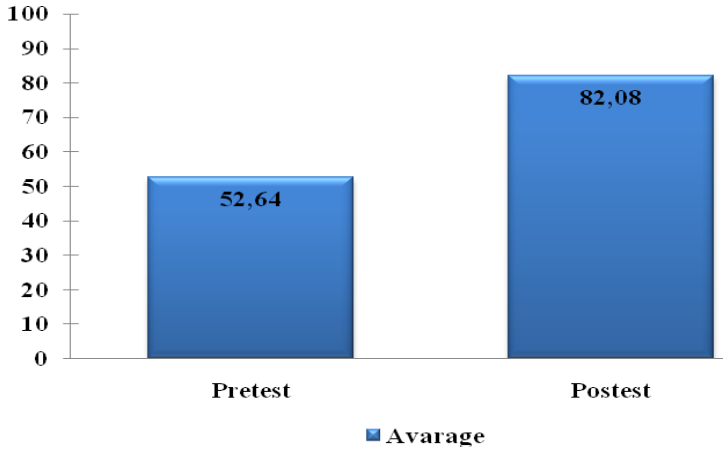

Figure 3. Science Learning Outcomes of Experimental Classes

Figure 3 showed that students in class V-A (experimental class) obtained an average score of learning outcomes in natural science that is 52.64 at the time of pretest and 82.08 at the post-test. These results indicate that an increase of 29.44 in the average value of natural science learning outcomes after using an innovative PjBL-based student worksheet developed on the concept of respiratory organs in humans. Furthermore, natural science learning outcomes have been said to be complete because students' values after using the PjBL-based innovative student worksheets developed on the concept of respiratory organs in humans reach the specified minimum completeness criteria value of 74. The gain score test results for the control class and experimental class could be seen in Figure 4.

Figure 4. Gain Score Test Results

Figure 4 showed that students in class V-A obtained an average score of learning outcomes in natural science that is 52.64 at the time of pretest and 82.08 at the post-test. These results indicate an increase of 29.44 in the average value of natural science learning outcomes after using an innovative PjBL-based student worksheet developed on the concept of respiratory organs in humans. Furthermore, natural science learning outcomes have been said to be complete because students' values after using the PjBL-based innovative student worksheets developed on the concept of respiratory organs in humans reach the specified minimum completeness criteria value of 74.

The use of scaffolds in general and PBL contexts have shown varying degrees of impact on student achievement. This study revealed that students who were given access to scaffolding had significantly better performance in the post-test than groups that did not have scaffolding. Findings show that scaffolding can influence student inquiry and performance in the PjBL environment (Choo et al., 2011). The results of the influence of the PjBL model on students 'creative thinking show that there are differences in students' creative thinking through the Project-Based Learning model with the KWL Worksheet and Cooperative Learning models to solve problems in Physics. The learning process makes students think of applied ideas to solve physics problems based on theory in practice (Mihardi, Harahap, & Sani, 2013).

CONCLUSION

Based on the results, it can be concluded that the student worksheets based on Project-Based Learning have valid quality and enhance learning outcomes. Suggestions given for the product's use are as follows: (1) the limitations of breathing organ material in humans contained in student worksheets so that additional learning resources are needed. (2) teachers can use online applications to attract students' attention to not only focus on book sheets.

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