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Development of problem based learning based student worksheets to improve student learning outcomes in Poigar 1 public middle school

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Abstract
This study aims to produce appropriate and good Student Worksheets based on Problem Based Learning to improve student learning outcomes in human food digestive system material. This research refers to the procedure for conducting research "Research and Development" following the implementation stage according to Borg and Gall. The subjects of the trial consisted of theoretical trials and empirical trials. Theoretical trials consist of learning media experts and learning material experts in the field of science. The empirical trial consisted of 10 small groups in Poigar 2 Junior High School and 20 large groups in Poigar 1 Public Middle School. The instruments used in data collection are interviews, questionnaires, and test results. The data obtained were analyzed descriptively and used the Analyze Compare Means analysis with $\alpha = 0.05$. The results of the learning media expert product validation are included in the very good criteria with a value of 86.95% and the results of the validation of the learning material are included in the excellent criteria with a value of 92%. The results of field test analysis show that learning products are well used in the implementation of learning in the classroom that can be seen through an increase in the average student learning outcomes before and after the implementation of learning.

Keywords: student worksheets, problem based learning models, learning outcomes

Introduction

Science learning (Natural Sciences) emphasizes providing direct experience to develop competencies in order to explore and understand the natural environment scientifically. Science education is directed at helping students to gain a deeper understanding of the surrounding environment (Listyawati, 2012) [6]. For that science learning should foster an atmosphere in such a way that students are actively involved.

Learning is said to be optimal if learning where the teacher does not just explain but students who must be more active to find out and build their own knowledge and the role of the teacher only as a facilitator and motivator. This is so that students become more independent / skilled and active when learning takes place. To create optimal learning must think of models and media that are in accordance with the material. Teachers are given the freedom to utilize various learning models that can foster interest, process skills, attention, and activeness of students so that the learning process becomes more meaningful.

Arsyad (2012) states that media is a communication tool that is channeling messages and can stimulate students' thoughts, feelings, and abilities so that they can encourage an effective and efficient teaching and learning process. So that the learning media is a supporting tool for implementing learning. One type of learning media that is often used by each school is the Student Worksheet (LKS).

Arsyad (2012) explained that Student Worksheets included print media as a result of developing print technology in the form of books and containing visual material. The use of attractive Student Worksheets is expected to generate student motivation in learning.

Based on observations in Class VIII 1 Poigar State Middle School, the Student Worksheets used are a type of conventional Student Worksheets namely Student Worksheets which are generally provided by the teacher and most directly quote the questions in the learning book. Through the application of conventional Student Worksheets in schools, learning models that are not integrated with Student Worksheets are used. This makes learning become monotonous and students will feel bored following the learning process so that it affects student learning outcomes. The average value of student learning outcomes is below the KKM value of 75.

Weaknesses of conventional Student Worksheets required the development of LKS in science learning. At the stage of developing Student Worksheets, the suitability of existing problems is needed with the combined learning model. After studying the conditions of the place and the research situation, the problem based learning learning model is the right model in developing Student Worksheets.

Trianto (2007) argues that the learning model is a conceptual framework that describes systematic procedures in organizing learning experiences to achieve certain goals and serves as a guide for learning designers and instructors in planning and implementing the learning process. One learning model that can be applied is the Problem Based Learning model. This learning model emphasizes the problem solving given by the teacher based on the information students have in particular for science learning where this learning requires a process skill of students to understand in detail because science learning is a learning that connects the environment around students and the material that exists.

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particular for science learning where this learning requires a process skill of students to understand in detail because science learning is a learning that connects the environment around students and the material that exists. The purpose of science learning for students is very great where from a learning, students can know the state of the environment around students how to maintain and maintain it. Before starting the learning process in class, students are asked to observe the problem first so that learning is more meaningful for students, meaning that by doing this activity the students know the learning objectives of the science.

The purpose of this research is to develop student worksheets based on problem based learning models on appropriate and good human digestive system material and produce student worksheets based on problem based learning models on human digestive system material that can improve student learning outcomes.

Research Methods

This research uses research and development methods or "Research and Development" (R & D) by following the stages of development research according to Borg and Gall (in Palilingan, 2014) [7]. Following the 7 development steps, namely planning, exploration studies, initial product development, data collection and analysis instruments, validation, revisions based on the results of validation, and product dissemination. The research was conducted at 1 Poigar State Middle School. The research subjects developed problem based learning based worksheets for instructional media experts and learning material experts each with 1 lecturer. 10 students for a small group trial at Poigar 2 Middle School. 20 students from 1 Poigar Public Middle School for large group field trials.

1. Planning. Formulation of goals to be achieved by developing and producing appropriate and good student worksheets that can improve student learning outcomes. This stage of development is carried out to produce the initial form of learning devices.
2. Exploration Studies. Looking for various information needed related to product development in the form of student worksheets that will be produced in accordance with the applicable curriculum. Carry out observations and surveys in the field to observe directly in order to get various information on the state of the school that is the focus of product development.
3. Development of the Initial Form of Product. The activity in this step is to arrange the initial form of the product in the form of a student worksheet. This activity requires the support of expert review and repairs of student worksheets that take place repeatedly.

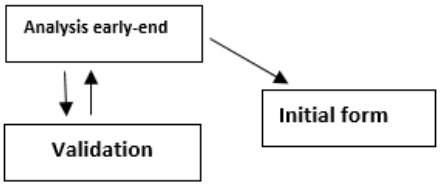

Fig 1: Expert review procedure to produce the initial product form.

1. Data Collection and Analysis Instrument. Instrument used was interviews, questionnaires, and test results. The data obtained were analyzed descriptively and used the Analyze Compare Means analysis with $\alpha = 0.05$. Test analysis was conducted to test the research hypothesis using Paired Sample T Test statistical analysis where to test the average difference between two paired samples taken from the same population by using SPSS 22 data processing software.

2. Validation. In this stage, product repairs are carried out by experts. Various input from experts in the framework of the product will be better that can be used in research. Field testing is a test of product use against the appropriate target subject.

The design used for the field test was quasi-experimental with the same experimental design as the subject.

Fig 2: Subject Design

P = Population for Research
S = Sample
1 = Final observation before intervention
Po = Learning activity before interview
WO = Washing Out (Time to eliminate the effect of the activity before the interview) for one week
P1 = Learning Activities with Interventions
2 = Final observation with intervention

His research hypothesis

Ho: Average Results of the study after learning using LKS products based on the problem based learning model are smaller or equal to the average learning outcomes before learning.

H1: Average The results of the study after learning using LKS products based on the problem based learning model are more greater than the average learning outcomes before learning.

1. Revisions Based on Validation Results. This stage is the final revision of the product produced. Products that already exist at this stage are products that can already be defined. The revision is based on field trials.
2. Product Desimination. This stage is a step to report products that have been produced at scientific meetings or journals.

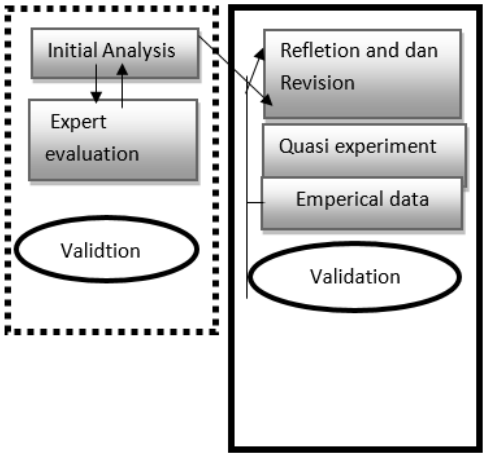

Fig 3: Proses Validasi Produk.

Results and Discussion

1. **Planning**
   Planning is the initial and most important part in the preparation of teaching materials for Student Worksheets. At this stage, planning is carried out to identify the learning objectives achieved and develop student worksheets in the process of learning science in digestive system material in humans by collecting library materials in enriching the contents of the student worksheets used. After the stages of learning planning, product planning stages are carried out which are expected to be able to produce the initial form of learning media in the form of problem based learning based worksheets. This stage is the stage of the realization of the initial form of problem based learning based student worksheets which includes gathering subject matter from various sources, making student worksheets, learning media expert approval, learning media revisions, and publishing products for trials.
2. **Exploration Studies**
   Student worksheets to be compiled using the problem based learning model are preceded by exploration studies. At this stage, preliminary research is carried out to observe the place

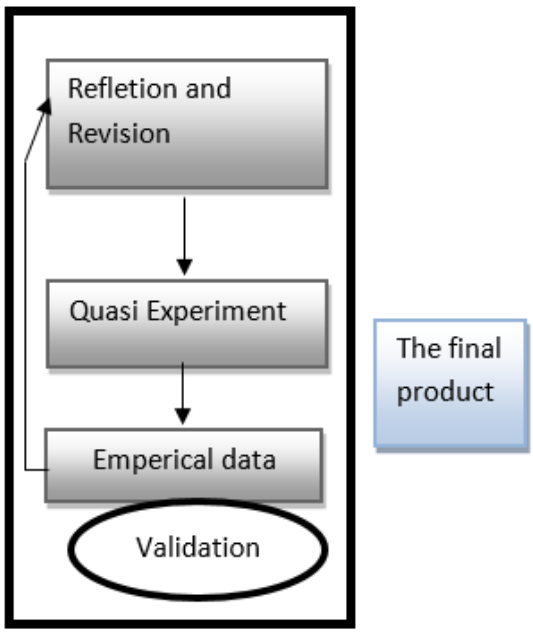

Fig 4: Preliminary Display of Products and Materials

1. **Development of the Initial Form of Product**
   or the school that will be carried out research. Exploration studies carried out through observation of the school environment and interviews with science subject teachers at the school. Stages of exploratory studies are also carried out to review literature from worksheets and materials used at school. Review supporting theories in developing student worksheets. Therefore, it is necessary to develop teaching materials in the form of LKS that can improve students' abilities or potentials both cognitively, affective, and psychomotor students through problem solving and answer discoveries in learning implementation.
2. **Development of the Initial Form of Product**
   At this stage the contents of the problem based learning based worksheet are taken from several sources, namely printed books, the internet in the form of existing journals, then adjusted to the learning objectives to be achieved in accordance with the lesson plan. All material taken from several existing sources is processed into MS-Word to produce problem based learning based worksheets.
3. **Data Collection and Analysis Instruments**.
   The research instrument used was the questionnaire used in this study was an expert learning media questionnaire and expert questionnaire of learning material that was useful in assessing the feasibility of the learning products used. Questionnaire of student responses to learning products produced. This questionnaire is used as one of the instruments in developing student worksheets on digestive system material based on problem based learning models.
   Learning outcomes test is an instrument used to measure the success or achievement of learning processes carried out by students in the digestive system material using a problem based learning model. Interview instruments are used in early information about the condition of students and schools through science subject teachers.
   Data analysis used the SPSS application to test the normality and and to test the research hypothesis by using Paired Sample T Test statistical analysis where to test the average difference between two paired samples taken from the same population by using SPSS 22 Software data processing. Data obtained from the initial test, that is before the treatment and the final test, which is after treatment is given in learning using student worksheets on digestive system material based on the problem based learning model.
4. **Validation**
   This expert on learning media, assesses the product whether it is appropriate or not suitable. He is a doctor in the field of Biology Education and the courses taught are PPL 1 and are experienced in designing good learning devices. The assessment of learning media experts shown by the continuum line is very strong, which is at the number 86.95%, so it can be concluded that the material expert validator responds positively to the learning product and is included in the criteria very well.

Learning material experts assess the suitability of the material with competency standards, basic competencies, learning objectives, and writing the contents of the material. He is a doctor in the field of Biological Education so it is very feasible to assess basic Biology material, especially material for the digestive system of food. In the continuum line, the assessment of material experts is in a very strong category with 92%, so it can be concluded that material expert validators respond positively to the product learning and included in the criteria very well.

This small group trial was conducted at Poigar 2 Public Middle School. The test subjects were grade 8 with human digestive system material with 10 students. The instrument of data collection used was the student response questionnaire. This small group trial is very important to know the quality in terms of product appearance, material content, and product writing method. in general, out of 10 students who were the subjects of small-scale research provided varied responses to the statements submitted in the student response questionnaire. Data from the small group

validation test results with a percentage of 89.3% so that it can be concluded that students give a positive response to learning products and are included in the criteria very well.
Large group trials to determine the effectiveness of products developed to achieve the expected quality of learning. This research was conducted at Poigar 1 Public Middle School with a total of 20 students in the digestive system material and carried out in 4 meetings.
At the beginning of learning the teacher explains the inquiry learning model and portfolio to students and informs that the results of the assignments, as well as the results of student learning will be included in the portfolio document. These learning outcomes are needed to test hypotheses from the research but before that the learning outcomes data are tested for normal data. Here are the results of the analysis of normal data using SPSS version 22 analysis software.

Table 1: Data Normality Test.

	Shapiro-Wilk		
	Statistic	**Df**	**Sig.**
P1T1	.939	20	.234
P1T2	.942	20	.266
P2T1	.943	20	.269
P2T2	.963	20	.612
P3T1	.930	20	.155
P3T2	.908	20	.058
P4T1	.948	20	.335
P4T2	.933	20	.178

The normal data test results obtained most of the learning outcomes data are at a significance level of more than 0.05, so it can be concluded that the dat is normally distributed (P1T2, P2T1, P2T2, P4T1, and P4T2 P1T1, P3T1, and P3T2). After testing the normality of the data, the next step is to compare the average learning outcomes to test the research hypothesis. The following are the results of hypothesis testing analysis using SPSS version 22 using comparative analysis (Analyze Compare Means).
Based on the learning outcomes data obtained from the study, it can be seen the comparison of the average learning outcomes in each test given in each meeting. Hypothesis acceptance criteria if Sig. (2-tailed) smaller than 0.05 so Ho is rejected and H1 is accepted. If Sig. (2-tailed) greater than 0.05 so Ho is accepted and H1 is rejected.
Comparison of the significance values obtained in the first pair of meetings that did not use learning products was 0.121> 0.05 so that H0 was accepted and rejected H1. At the first meeting using learning without products does not have an effect because the significance value is far above the specified significance value.
In general, at meetings 2, 3 and 4 the significance value is far below 0.05, so H0 is rejected and accepts H1. Showing learning products used can have a significant influence in improving student learning outcomes. The comparison results between meetings after learning (Postest results) using products and not using products in pairs 5, 6, and 7 obtained significance values below 0.05. The difference in average learning outcomes using higher products while those who do not use the product is lower because the significance value shows a significance value of less than 0.05. While the comparison of learning outcomes after learning using products in pairs 8, 9 and 10 does not indicate a significant effect because the values obtained are above 0.05. This means that the products used have the same effect, which can improve student learning outcomes

Table 2

		T	Sig. (2-tailed)
Pair 1	P1T1 - P1T2	-1.622	.121
Pair 2	P2T1 - P2T2	-8.222	.000
Pair 3	P3T1 - P3T2	-9.866	.000
Pair 4	P4T1 - P4T2	-8.771	.000
Pair 5	P1T2 - P2T2	-7.229	.000
Pair 6	P1T2 - P3T2	-11.959	.000
Pair 7	P1T2 - P4T2	-13.154	.000
Pair 8	P2T2 - P3T2	-1.077	.295
Pair 9	P2T2 - P4T2	-2.513	.021
Pair 10	P3T2 - P4T2	-1.795	.089

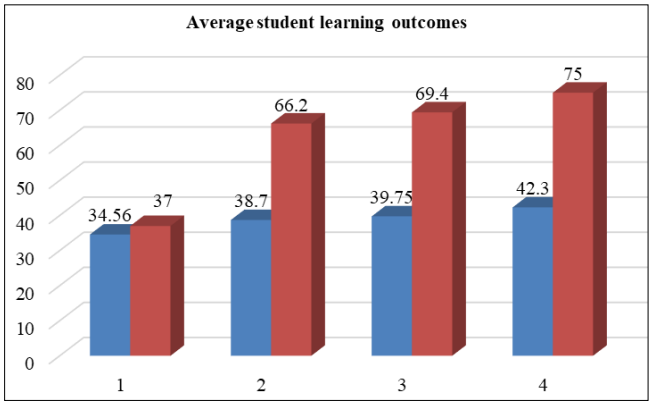

Fig 5: Average Student Learning Outcomes at each meeting.

The application of learning using the problem based learning model can help students to explore and find and solve their own problems from concepts related to subject matter. Finding and solving problems themselves will make the learning process more meaningful, meaningfulness will deepen the memory and understanding of the material being studied so that it will have a positive impact on student learning outcomes.
The results of this study are relevant to research conducted by previous researchers who used LKS based on problem based learning models. research conducted by (Heri Setyanto, 2015) [5] on the Development of Student Worksheets in Learning Based on Problem Based Learning. The results of this study indicate that PBL-based Science Student Worksheets that have been developed are declared feasible with a percentage of eligibility of 91.88%.
Pratiwi's research (2013) [8] on the development of Integrated Science Student Worksheets based on educational games on the theme of environmental pollution and health through Lesson Study. Research on Student Worksheets has also been conducted by Arafah *et al*. (2012) [1] which states that developing Worksheets Students based on critical thinking on animalia themes can improve student learning outcomes and activities. Similar research has also been carried out by Astuti & Setiawan (2013) [2], which is about developing Student Worksheets based on a guided inquiry approach in cooperative learning on heat. The study shows that the use of Student Worksheets based on inquiry approaches can improve student learning outcomes. Herlin Nur Hanifah (2012) [4], the research was carried out entitled "Development of Teaching Materials in the Form of Student Worksheets (Problem-Based) on Problem Solving in the Set Material for Class VII Middle School". Research carried out using the ADDIE development model with the aim of the

study was to describe the feasibility of Student Worksheets based on the opinions of experts, teachers and students. The results of this study are Student Worksheets that have good feasibility.

The results of research conducted by Felisitas Sayekti Purnama Utami (2013). The research was carried out entitled "Development of Learning Devices with Problem Based Learning Approach in Line and Angle Materials for Class VII Middle School Students". Research conducted using the ADDIE development model with the aim of research is to produce learning devices with Problem Based Learning approach in line and angle material and to determine the feasibility of products based on aspects of validity, practicality and effectiveness. The results of this study indicate that the learning devices developed are categorized as feasible.

The research they conducted showed an increase in learning outcomes using LKS based on problem based learning models. In line with these studies in an effort to improve student learning outcomes this study combines the development of student worksheets with problem based learning models. The results of this study produce products that can direct and guide students in the teaching and learning process so that they can improve student learning outcomes.

Revisions Based on Validation Results

After going through the stages of development and testing in small groups and large groups of learning products this has undergone revisions or improvements. This final product improvement is needed to perfect the device based on the input from reviewers and students.

Learning media focuses more on each learning step in the problem based learning model and emphasizes the purpose of the material used. The material in learning media is more related to the problems that occur in everyday life so that students will understand more about the digestive system in humans.

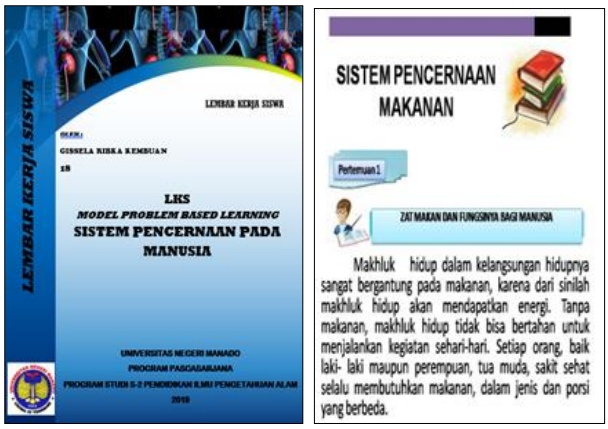

Fig 6: Final appearance of products and learning materials.

Product Desimination

The results of the development of this learning product are presented at a scientific meeting. This development product turned out to have a positive impact on the development of the quality of learning, among others: Implementation of product development can improve student learning outcomes, namely learning by using product development, there is an increase in learning outcomes before and after learning.

Helping teachers in implementing class learning and can encourage teachers to innovate in developing better learning tools.

Conclusion

Development of Student Worksheets based on problem based learning models is feasible and is well used in learning implementation and it turns out that it can improve the learning outcomes of Grade VIII students of 1 Poigar State Middle School.

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