

DEVELOPMENT OF PROBLEM-BASED ENGLISH MATHEMATICS WORKSHEETS FOR INFORMATICS STUDENTS

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Abstract: *Mathematics and English can collaborate so that the students in practice on computers are also familiar with mathematical terms in English. This will help the ability of informatics students to understand other materials in the informatics study program. The fact that occurs in learning mathematics and English at Technology Institute of Asian Business Malang is that students are still less enthusiastic in pursuing these subjects so that the majority of students have not achieved optimal learning outcomes. In collaborating the English and Math course in learning, the instructional needs learning tools. One of the learning tools needed is teaching materials such as worksheets. The worksheet which was developed used a Problem Based Learning approach. The development model adopted was Plomp's development model which consists of 3 stages, namely preliminary research, prototyping, and assessment phase. The developed math worksheets met the criteria of validity, practicality, and effectiveness. Based on the validation test, the score obtained showed that the mathematics worksheet was in the proper category. Meanwhile, the results of the effectiveness test and the results of student responses showed a score of 80.35 and 76.76 or in the effective category and quite feasible.*

Keywords: *Worksheet, Mathematics, Problem Based Learning.*

INTRODUCTION

Mathematics is one of the compulsory subjects at Technology Institute of Asian Business Malang. For certain study programs, mathematics is a basic science that supports understanding of some of the material in the study program. As in

the informatics study program which requires an understanding of mathematics because several methods in making a decision support system, expert system, artificial intelligence, and so on require an understanding of mathematics. Informatics techniques are more practical activities using

computers. As we know, that computers use English them. So besides mathematics, English is also a compulsory subject which is quite essential in the Informatics study program.

The two courses, namely Mathematics and English, can be collaborated so that students in practice on computers are also familiar with mathematical terms in English. This will support the ability of informatics students to understand other materials in the informatics study program. In collaborating the two courses in learning, supporting learning tools are needed. One of the learning tools needed is teaching materials.

Parmin and Peniati (Fajriah & Suryaningsih: 2020) stated that teaching material is materials or contents that must be mastered by students through learning activities in accordance with the desired curriculum, arranged systematically, both written and not so as to create an environment or atmosphere that allows students to learn and as a medium used by lecturers in carrying out teaching and learning activities in class. The absence of teaching materials causes

students to become dominant in listening and taking notes so that it becomes one of the factors causing learning that does not actively involve students. In this case, it means that in compiling lecture material it is necessary to refer to the curriculum, in this case, it is necessary to have a semester learning plan, and a learning implementation plan. In addition, in the preparation of good material, it is necessary to create an atmosphere that makes students learn through class activities and can make students involved in the class.

To improve the quality of the learning process, universities need to creatively develop new educational concepts that are more comprehensive and competitive. Based on the Law of the Republic of Indonesia Number 12 of 2012 concerning Higher Education, good learning needs to be held student-centered. Student-Centered Learning provides opportunities for students to build deeper knowledge and understanding. Meanwhile, student-centered learning provides opportunities for students to develop the knowledge and skills learned, students are actively involved in managing knowledge, not only

focusing on mastering the material, but also developing learning attitudes, and the function of lecturers as motivators, facilitators, and evaluators. In addition, problem-solving skills are also important to improve to produce students with problem solver characteristics. Therefore, it is needed to develop Problem-Based English Mathematics worksheets for Informatics students at Technology Institute and Asian Business Malang.

The learning method that can be adapted to improve problem-solving skills is problem-based learning. Savery and Duffy in (Savery: 2006) state that students' motivation increases when they are given the responsibility to solve a problem. According to Arends (2008), Problem Based Learning is designed to help students develop thinking skills, solve problems. The problem based learning method is expected to train students to work hard to solve problems in this case related to statistics and probability courses and teach accuracy in understanding problems.

Based on the background of the problem, the authors have a research objective to develop a valid,

practical, and effective problem-based English math worksheet for students of the Informatics Engineering Study Program at the Technology Institute and Asian Business Malang.

REVIEW OF RELATED LITERATURE

Wutsqo (2010) has developed an English student worksheet with a constructivism and problem solving approach. The subjects of his research were bilingual/international junior high school students. Not all topics in junior high school are the focus of research, but only a few. From the results of the study, it can be concluded that the English-language student worksheets in mathematics lessons at the junior high school level are based on constructivism and the problem-solving approach that has been prepared has a very good quality. In this case, it was revealed that even though the English worksheet was not a problem for students.

Problem-based learning is innovative learning because students' thinking skills are honed and optimized so that students are able to empower, hone, test, and develop their thinking skills (Rusman: 2014). Students who experience problem-

based learning experience an increase in their mathematical argumentation skills compared to students in conventional learning (Soekisno: 2015).

In other words, the use of Problem Based Learning can improve students' understanding and ability to think about what they are learning so that they are expected to be able to apply it in real conditions in everyday life.

METHODOLOGY OF STUDY

This type of research is Research and Development. The purpose of this research was to develop problem-based math worksheets in English for students of informatics. The development model used was the Plomp development model (2010). The development process according to (Plom: 2013) includes (1) preliminary research, (2) the development phase (prototyping phase), and (3) the assessment phase (assessment phase).

The research location is carried out in classrooms or laboratories at Institut Teknologi dan Bisnis Asia Malang with the object of research being students who take mathematics

courses in the odd semester of the 2020/2021 academic year.

The Plomp development model can be described in the diagram below:

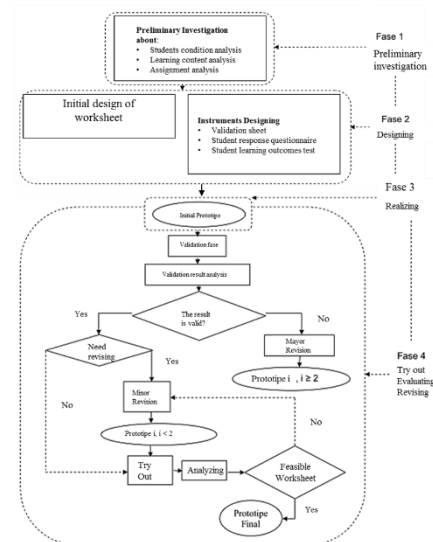


Figure 1. Flowchart of the Math Worksheet Development Phase

The research instrument which is a measuring instrument for the achievement of research objectives is to measure the validity, practicality, and effectiveness of mathematical worksheets. The instruments used in this study were the Validation Questionnaire for the Mathematics Worksheet, the Student Response Questionnaire, and the Mathematics Worksheet. The next stage after the data is obtained is the data analysis stage.

The data were analyzed to determine the level of validity,

practicality, and effectiveness of the math worksheets. The data obtained is then processed by determining the percentage of the total score of each respondent's answer to the maximum score of each item. The formula for analyzing data was adapted from (Sudjana, 2011) as follows:

$$p = \frac{x}{x_i} \times 100\%$$

Explanation:

p : percentage

x_i : one item respondent's answer score

x : maximum score of one item

Data analysis techniques for the overall score was

$$p = \frac{\sum x_i}{\sum x} \times 100\%$$

Explanation:

p : percentage

$\sum x_i$: the number of respondents' answer scores of one item

$\sum x$: maximum score of one item.

RESULT AND DISCUSSION

Result

In this development research, the product produced was a student worksheet with a problem-based learning approach for English-speaking informatics students. At the

initial stage, the researcher analyzed the student situation, curriculum, and student abilities. The analysis of student situations found that students needed mathematics courses to support Informatics courses, while students did not like mathematics because they did not know concretely the application of mathematics. Students are more challenged if a course is faced directly with a case.

Early Research Stage

At the initial research stage, observations were made of student needs analysis, material analysis based on semester learning plans, and assignment analysis. The instrument used in this step was an observation sheet. For the applicable curriculum, basic mathematics has an initial course on the real number system. In the real number system subsection, students will find useful terms in learning programming. However, the language used by the computer in English. For this reason, the development of this student worksheet was developed using English.

Prototyping Stage

At the prototype stage, initially, the student worksheets were paper-based. With the covid pandemic

situation, the worksheet is in the form of a google form. The English math worksheets show the goals students need to achieve and begin with the initial problem. The following is an initial overview of the student worksheets.

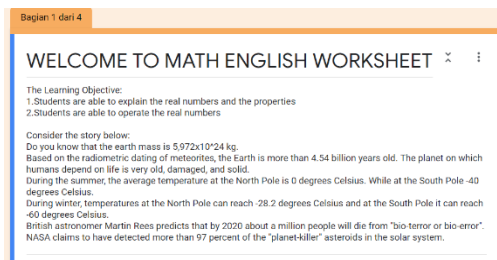


Figure 2. The Beginning of the Student Worksheet

Based on the problems presented, the lecturer leads students to discuss the real number system. After the case is provided, the students are asked to work on some questions about the real number system.

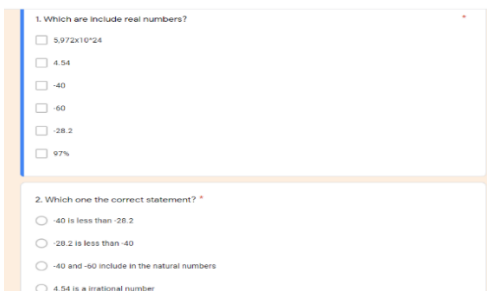


Figure 3. Question Section with Multiple Choice and Correct Tick

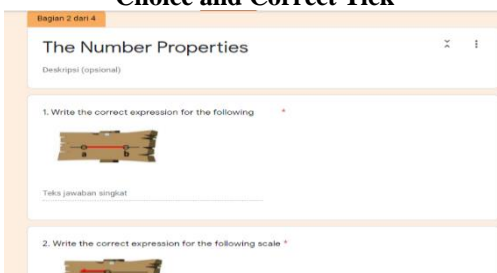


Figure 4. Essay

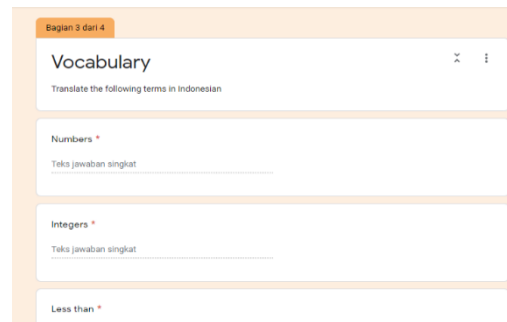


Figure 5. Vocabulary Section

The research subjects were first-semester students of the 2020/2021 academic year which consisted of 27 students.

Assessment Stage

Validation Test Results

Table 1. Expert Validation Results

No	Validation Aspect	Score	Maximal Score	Score Percentage
1	Content	46	52	88,46%
2	Language	18	20	90 %
Total Score		64	72	88,89%
Average of Score Percentage				89,23%

By analyzing the results of the validation with the percentage of the average acquisition score, it can be said that the mathematical worksheet developed in the category is feasible and does not need revision.

Effectiveness Test Results

The test of the effectiveness of math worksheets was based on the results of the answers to math problems was 80.34567901 indicating the value of the LKM was effective in supporting English learning mathematics. Meanwhile, in terms of

vocabulary mastery, students had various perceptions.

Practicality Test Results

The practicality test was carried out by measuring student responses. The student response test resulted in an average answer worth 76,75925926 which indicates the criteria are quite feasible and do not need revision.

Table 1. Expert Validation Results

No	Item	Option 1	Option 2	Option 3	Option 4	Score
1	This Worksheet arouses my curiosity about the topic being studied	1	5	8	13	80,56
2	The language used in the worksheet is easy to understand	3	6	13	5	68,52
3	The language used in the worksheet is unambiguous, clear, and easy to understand	3	6	12	6	69,44
4	The problems presented in the worksheet are according to my development	2	7	10	8	72,22
5	This worksheet motivates me to learn English	0	1	12	14	87,04
6	This worksheet adds to my vocabulary in English	1	2	12	12	82,41
7	The terms in the worksheet are useful to support me in learning information technology	0	5	11	11	80,56
8	The sentences used use English grammar that is easy to understand	2	3	14	8	75,93
9	I love learning basic math with this worksheet	1	4	14	8	76,85
10	I support if mathematics is in Indonesian and English	1	7	11	8	74,07
Average						76,76

The practicality of the product was obtained from the student response after working on the Student Worksheet. The student response test resulted in an average answer of 76.76 which indicated the criteria were quite feasible and did not need revision.

Discussion

The developed math worksheet showed valid results. The materials were based on the curriculum run at the Technology Institute of Asian Business Malang. The language used was quite easy to understand and does

not cause ambiguity. The problems presented at the beginning also lead students to be more motivated to answer the following questions. Because by known the usefulness of a subject in mathematics, the students will be more motivated to learn that material. This was also expressed by (Rahmawati: 2013) that problem-based learning can increase students' learning motivation.

The student response questionnaire also showed that students' responses indicate that this worksheet has criteria that are quite feasible and do not need revision. From the students' response questionnaire, it showed that the worksheet was able to generate motivation to learn English which was obtained with a score of 87.04, increased English vocabulary with a score of 82.407, aroused student curiosity with a score of 80.55, and could be a reference for learning about terms.

Mathematical terms with a score of 80.55. This was supported by research (Yandhari et al: 2019) that the Problem Based Learning (PBL) Model was able to arouse students' curiosity and motivation to learn.

The score obtained by students in completing the worksheets was 80.345 which indicated that the mathematics worksheets had effective criteria. These results support previous research that student learning outcomes before and after receiving learning using a problem-based learning approach have increased (Hasana: 2016). Learning with a problem-based learning approach also supports the improvement of mathematical communication (Hidayat et al: 2020).

CONCLUSION AND SUGGESTION

Conclusions

In this development research, the resulting product was a student worksheet with a problem-based learning approach for English-speaking informatics students. In the validation test, by analyzing the results of the validation with the percentage of the average acquisition score, it can be said that the mathematical worksheet developed in the category was feasible and did not need revision. LKM effectiveness test 80.34567901 showed the value of LKM is effective in supporting English learning mathematics. And the students'

response test resulted in an average answer worth 76,75925926 which indicated the criteria were quite feasible and did not need revision.

Suggestion

It is hoped that the product in the form of student worksheets can help students understand the material independently and can use this student worksheet as reference material in determining strategies or approaches and learning models that can be used in the learning process in the classroom. This Problem Based Learning-based student worksheet can be used in institutions that are the object of research or other educational institutions of the same level. The distribution of this product must still pay attention to the characteristics of students so that the distribution is right on target and useful. Research and development are carried out not only by developing Problem Based Learning learning models, but can try to use other learning strategies and methods, while still paying attention to student characteristics.

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