PENGEMBANGAN LKS BERBASIS PENDEKATAN SAINTIFIK PADA MATERI PROGRAM LINIER UNTUK SMK KELAS X

THE DEVELOPMENT OF STUDENT WORKSHEET BASED ON SAINTIFIC APPROACH IN LINEAR PROGRAMMING FOR THE FIRST GRADE OF VOCATIONAL STUDENTS

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Abstrak

Penelitian ini bertujuan untuk mengembangkan LKS berbasis pendekatan saintifik pada materi program linier untuk siswa SMK Kelas X. Penelitian ini juga bertujuan untuk mengetahui kualitas LKS yang dikembangkan ditinjau dari tiga aspek kualitas yaitu kevalidan, kepraktisan, and keefektifan. Pengembangan LKS mengacu pada model pengembangan ADDIE yang terdiri dari lima tahap yaitu a*nalysis* (analisis), *design* (perancangan), *development* (pengembangan), *implementation* (implementasi), and *evaluation* (evaluasi). Hasil penelitian menunjukkan bahwa kualitas LKS ditinjau dari aspek kevalidan memperoleh kriteria valid. Hal tersebut terlihat dari perolehan rata-rata skor penilaian ahli materi sebesar 3,76 dengan kategori baik, perolehan rata-rata skor penilaian ahli media sebesar 4 dengan kategori baik, and perolehan rata-rata skor penilaian guru matematika sebesar 4,2 dengan kategori sangat baik. Kualitas LKS ditinjau dari aspek kepraktisan memperoleh kriteria praktis. Hal tersebut terlihat dari perolehan rata-rata skor angket respon siswa sebesar 2,92 dengan kategori baik, perolehan rata-rata skor angket respon guru sebesar 3,1 dengan kategori baik. Selain itu, kualitas LKS ditinjau dari aspek keefektifan memperoleh kriteria efektif. Hal tersebut terlihat dari perolehan rata-rata tes hasil belajar siswa sebesar 81,19 and persentase ketuntasan peserta didik sebesar 70,96%.

Kata kunci: LKS, pendekatan saintifik, program linier

Abstract

This research is aimed to develop student worksheet based on saintific approach on linear programming for first grade of vocational students. The objective of this research is to know the quality of developing student worksheet also, which is shown by three categories of its quality, that are validity, practicality, and effectivity. The development of this student worksheet is refered to ADDIE development model which is consist of five steps, that are analysis, design, development, implementation, and evaluation. The result of this research showed that quality of student worksheet which is shown by validity category that have gotten valid criteria. It could be seen by the average of competency practised valuation score is 3,76 with category good, the average of media practised valuation score is 4 with category good, and the average of mathematics teacher valuation score is 4,2 with category very good. The quality of student worksheet is shown by practicality category have gotten pratical criteria. It could be seen by the average score of students response questionnaire is 2,92 with category good, the average score of mathematics teacher response questionnaire is 3,1 with category good. Beside that, quality of student worksheet is shown by effectivity category that have gotten effective criteria. It could be seen by the average score of students learning result test is 81,19 and percentage of students achievement is 70,98%.

Keywords: student worksheet, saintific approach, linear programming

INTRODUCING

Linier programming is one of compulsory mathematics material isstudied by students in secondary school. Linier programming aims to improve problem solving ability that its important to vocational students. Problem solving ability is showed from required competencies to solve linier programming problems, that are problems identification and declaring the hypothesis, collecting data through comparing, grouping, and seeing a pattern, choosing and carry out the strategy to solving the problems, and checking the results. It was appropriate with problem solving steps by Abdul Majid (2006), David A. Jacobsen, et all. (2009) that was: 1) problem identification/hypothesis, 2) collecting data, 3) choosing strategy, 4) carry out the strategy to

solve the problems, and 5) checking the result/conclusion.

Students understanding in linier programming should well enough. In fact, it was far from which are expected. Based on the report of national test result of linier programming of Kabupaten Sleman vocational schools in 2014/2015 on Table 1 is shown that the level of linier programming mastery was still low.

Table 1. Linier Programming Mastery of Kabupaten Sleman Vocational School in 2014/2015

Competencies	City	Provi nce	Natio nal
Solving linier equality and linier inequality of two variables problems.	49,86	60,05	53,88
Determine the mathematical model of linier programming problems.	40,31	50,32	50,98
Determine the areas of completion of linier programming problems.	55,95	63,39	52,95
Determine the optimal value of linier programming problems.	42.53	49,76	45,26

Based on the observation and interview, mathematics teaching learning process in vocational school hadn't done well. It's because mathematics teaching learning process didn't focus on mastery concept and student activity. Learning material (lesson plan and student worksheet) didn't facilitate students to construct his own knowledge. Most of the presentations of the material in worksheet were simply presenting formulas related to the instant concept without knowing the process of finding the concept and it application to solving the problems. Learning process was teacher centered. Teacher using expository methods while students had just listen techer explanation, pay attention, take notes and answer when the teacher asked a question. Beside that, students had only memorized the steps and formulas to solve the problems presented. It's because many steps that should be done to solve linear programming problems. Therefore, we need an exact strategy so that could facilitate students to study easily the materials of the linear programming.

One of strategy which are able to facilitate students to mastery linier programming is saintific approach. Based on Permendikbud number 60 in 2014, Marsigit (2015), Ridwan Abdullah Sani (2014), and Imas Kurnianingsih & Berlin Sani (2014), saintitific approach actuate students to find, understand, apply and develop the rational thinking, active to construct his own knowledge by saintifik approach sintax, that are observing, questioning, trying/collecting data, associating, and communicating. Saintific approach is a learning approach designed to facilitate students to construct the concept or knowledge independently and/or with teacher guidance. The expectation of learning procces become more oriented to student learning (student centered) and students actively construct his own knowledge.

In fact, we need learning material in which are able to facilitate students to construct his own knowledge. Therefore, this research was focused on developing learning material that is student worksheet based on saintific approach in linier programming competency

Student worksheet is a printed material such as sheets of paper containing materials, summaries, and instructions of learning tasks that should be done by students, which refers to the basic competencies that should be achieved and is useful for actuate students active in the learning process (Andi Prastowo, 2011: 203-204). Menurut Marsigit (2015), student worksheet is not only consisting of collection of problems but consist of student activities to construct his own knowledge. Student worksheet could be a source of information, theories or guided discovery. Student worksheet is not necessarily one kind, but it could be developed a lot of variety also. Student worksheet must be able to facilitate students that is different needs, different times, different material, speed and ability of students that vary through observing, questioning, trying, asosiating, and communicating.

Student worksheet development was good quality if it required the criteria for validity, practicality, and effectiveness (Nieveen, 1999: 126-128). Student worksheet is valid if student worksheet was declared feasible to use in learning process by the validator. Validity was rated by five aspect of validity, that are 1) student worksheet appropriate to saintific approach, 2) content validity of linier programming, 3) student worksheet appropriate to didactic, 4) student worksheet appropriate to construct, and 5) student worksheet appropriate to technic. Student worksheet is practice if student worksheet was declared by teacher and students give positive respons to usefulness and easely. Student worksheet is efective if the average score of students were higher than or equal to minimum completeness criteria (KKM).

RESEARCH METHODS

Type of Research

Type of this reasearch is research and development (R&D).

Time and Place of Research

This research was conducted in 2016 on February until April in SMK Muhammadiyah 1 Sleman.

Research Subject

The subject of this research are two experts (material expert and media expert), a mathematics teacher, and thirty-one students of first grade in SMK Muhammadiyah 1 Sleman.

Prosedure

The research methods of this research is research and development with ADDIE development model which consists of five stages: analysis, design, development, implementation, and evaluation.

Data, Intruments, and Data Collection Techniques

Data of this research is quality data of student worksheet. Quality data of worksheet are seen from the aspect of validity, practicality, and effectiveness. Data of validity was gotten from assessment sheet of workseet by material expert, media expert, and mathematics teacher. Data practicality was gotten from teacher and students respon questionnaire. Data of effectiveness was gotten from student's test.

Data Analysis Technique

Data analysis technique is aims to know the quality of developing student worksheet, which is shown by three categories of its quality, that are validity, practicality, and effectiveness. The explanation of each data analysis are as follows.

1. Data analysis of student worksheet assessment result.

Data analysis of student worksheet assessment result by material expert, media expert, and mathematics teacher. Data of assessment result is used to know the validity of worksheet. Data of assessment result is analyzed with some steps, that are 1) change the qualitative data into quantitative data; 2) calculate the average of scores obtained; 3) convert the average value obtained into qualitative data. Based on these data, the following conversion guidelines are shown in Table 2.

Table 2. Validity Criteria of Student Worksheet

Average of scores	Criteria
$X > 4{,}2$	Very Good
$3{,}4 < X \leq 4{,}2$	God
$2{,}6 < X \leq 3{,}4$	Enough
$1{,}8 < X \leq 2{,}6$	Poor
$X \leq 1{,}8$	Very Poor

In this research, student worksheet is valid if student worksheet is required assessment criteria minimum is good.

2. Data analysis of respon questionnaire result.

Data result of teacher and student questionnaire respon used to know the practicality of student worksheet. Data of questionnaire respon result is analyzed with some steps, that are 1) change the qualitative data into quantitative data; 2) calculate the average of scores obtained; 3) convert the average value obtained into qualitative data. Based on these data, the following conversion guidelines are shown in Table 3.

Table 3. Practicality Criteria of Student Worksheet

Interval Rata-Rata Skor	Klasifikasi
$X > 3,4$	Sangat Baik
$2,8 < X \leq 3,4$	Baik
$2,2 < X \leq 2,8$	Cukup
$1,6 < X \leq 2,2$	Kurang
$X \leq 1,6$	Sangat Kurang

In this research, student worksheet is practice if student worksheet is required assessment criteria minimum is good.

3. Data analysis of student test

Data of test result is used to know the effectiveness of student worksheet. Student test resuls is analysed with some steps, that are: 1) calculate the average score of each competency assessment of students; 2) calculate the number of students who pass the KKM; and 3) analysis of student worksheet effectiveness. In this research, determining student mastery learning based on minimum completeness criteria (KKM) in school, that is 75. Student worksheet is practice if average class score of student test is required minimum 75 for student mastery learning.

RESULT AND DISCUSSION

Student worksheet based on saintific approach is a worksheet that are arranged by referring to learning activities in saintific approach. It consists of five learning activities that are observing, questioning, trying/collecting data, associating, and communicating. In addition, It's arranged of several components which are problems, solution, class activity, exercises and tests.

The research methods of this research is research and development with ADDIE model which consists of five stages: analysis, design, development, implementation, and evaluation. It's create student worksheet base on saintific approach in linier programming for first grade of Vocational School (SMK). Here is the explanation of each stage of development using ADDIE development model (Endang Mulyatiningsih, 2012: 182).

The first stage is analysis. Analysis stage is the stage where researchers analyzed the need of development and feasibility requirements. Analysis stage includes needs analysis, curriculum analysis, and analysis of the characteristics of students.

The second stage is design. At this stage, researchers are designed the worksheet such as a preliminary draft according to previous analysis. Creating preliminary design of worksheet is done step by step, that is determining the title of student worksheet and identificating basic competencies of linier programming. The design of student worksheet is design of good qualified by Endang Widjajanti (2008: 2-3), that is student worksheet is required didactic, construct, and technic. Beside that, student worksheet should have a suitability contents with saintific approach and appropriateness with the material content of the linear programming. In addition, researchers also create some instrument to assess the student worksheet. Instruments are established by considering three aspects of quality that are validity, practicality and effectiveness.

The third stage is development. Development stage is worksheet creating stage. Developing student worksheet is done according design of worksheet. After that, student worksheet is validated by material expert, media expert, and mathematics teacher to get validity of worksheet. The assessment result of validity of student worksheet is presented in Table 4 below.

Table 4. Data Analysis Result of Student Worksheet Validity.

Aspect	**Saintitific Approach**	**Linier Programming**	**Didactic**	**Construct**	**Technic**
Average scores	4,5	3,56	4,2	4	4
Criteria	Very Good	Good	Good	Good	Good
Average		4,05			
Validity		**VALID**			

Based on the result, the student worksheet is valid and it could be implemented in learning.

The forth stage is implementation. Student worksheet is implemented in school to thirty-one of first grade students in SMK Muhammadiyah 1 Sleman. In general, the learning process begins with preliminary activities that teacher opens and prepares students to start learning (apperception). Learning activities begins with a prayer. Then the teacher gives LKS to the students. It provides information about the subject matter to be learned, learning objectives, and activities to be followed by the students. In main activity, students are created some groups and dissucing problems in the worksheet. Main activity has done using saintific approach learning activities, that are observing, questioning, trying/collecting information, associating and communicating. In closing activity, teachers guided students to reflect on the activities that have been done and make a conclusion of material that have been learn, do the exercise and collecting worksheet, provided information about the next activity and prayed together and greeting.

Learning is conducted in seven meetings and one test. While the implementation in learning, students find a difficulty because they weren't usual by learning using saintific approach. Students prefer to use a quick/instant method to solving the problems. Students are not diligently to solve the problems saintific approach steps also. Some students are reluctanted to write questioning and communicating part in the worksheet. Eventually, by teacher guided, students could learn using saintific approach learning steps slowly. During the lesson, the students was very active to ask the teacher about the material that they were not understood yet. Besided that, students prefered to learn in groups rather than individually. Students were pleased after being able to solve the problem and took the initiative to teach their classmate. Students understand that to find the optimum value of linear programming problems, they could use a corner point method and line method. Test result are presented in Table 5 below.

Table 5. Data Analysis of Students Test Result

No.	Data	Result
1	Highers score	99
2	Lowers score	64
3	Average test scores	81,19
4	Standart deviation	8,95
5	Passing students	22
6	Not passing student	9
7	Percentance of mastery	70,96 %

Based on the test result, it shown that, student worksheet is categorized good with percentance of mastery is 70,96% and the average score is 81,19. In addition, standart deviation is 8,95, so that data in normal distribution. Therefore, the student worksheet is categorized effective.

In the end of learning, teacher and students completed the questionnaire. The results of the questionnaire response are used to obtain the practicability of student worksheet. Questionnaire result are presented in Table 6 below.

Table 6. Data Analysis Result of Student Worksheet Practically

Aspect	Type of Questionnaire		Total average
	Teacher	Students	
Average score of Usefulness	3,3	3,09	2,82
Average score of Easiness	2,9	2,75	3,19
Average of Questionnaire	3,1	2,92	4,02
Criteria	Good	Good	**PRACTICAL**

Based on the result, student worksheet is categorized practical. Overall, the process of learning is good with percentage of 88%.

The fifth stage is evaluation. In this stage, researchers revised the worksheet based on the suggestions and comments obtained from questionnaire or implementation notes. It's aims to make the worksheet exactly required to be implemented in schools.

CONCLUSION AND RECOMMENDATION

Conclusion

Based on the results of research described, it can be concluded: 1) development of student worksheet based on saintific approach in linier

programming for first grade of vocational school using ADDIE development model consist of five stage of development that are: analysis, design, development, implementation, and evaluation. Analysis stage consist of: a) needs analysis, b) curriculum analysis, c) the characteristics of student analysis. Design stage consists of designing student worksheet and create some instruments to assess the student worksheet. Development stage consist of developing student worksheet, validating student worksheet, and revising student worksheet. Implementation stage consist of implementing the student worksheet and analyzing implementation result data. Evaluation stage consist of revising the worksheet based on the suggestions and comments obtained from questionnaire or implememntation notes, 2) student worksheet based on saintific approach in linier programming for first grade of vocational school is required validity, practicality, and effectivity qualification.

Recomendation

Student worksheet based on saintific approach approach in linier programming for first grade of vocational school is required validity, practicality, and effectivity qualification. Therefore, it can be used for students or teachers to support learning activities in the classroom, and for other researchers can perform a similar learning material development in accordance with procedures similar to the procedure used in this research with another subject.

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