

Development Of Module Linear Program Based Problem Solving Assisted Qsb Application

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Abstract

The purpose of this study is to obtain a linear program module based on problem solving with the help of QSB applications that meet the valid, effective and practical criteria. Type of research is a method of research and development (Research and Development) with the design model of ADDIE (Analyze, Designed, Development, Implementation, and Evaluation). The subjects of the study were Grade X students of SMK I Tanah Miring Merauke Regency, Papua Province. Module trials are carried out with stages of expert trials, legibility testing, and field trials. Experienced trials and legibility testing used a questionnaire, while field trials used the experimental one group pretest post-test design. The research instruments used were validation sheets, practical sheets, and learning achievement test sheets. The steps in this development are researching and gathering information, selecting and developing teaching materials, initial trials, revisions, main trials, and final product revisions. Product validation was validated by experts using a validation sheet. The practicality of the product is assessed by the product user, that is, the student who gets the treatment. The effectiveness of the product was tested using inferential statistical tests by looking at differences in the percentage of students' mastery learning from this cores pre-test and post-test. The results obtained by the results of validation in the category of very valid average score of student response questionnaire was 3.66 in the practical category and the percentage of percentage post-test of students 70.9% of students completed so it can be said to be effective.

Keywords: module; linear program; Problem Solving; QSB application

Introduction

Mathematics is the science of logic about the form, composition, quantity and concepts with a large number which is divided into three fields, namely algebra, analysis and geometry. Mathematics can also change one's mindset into a mathematical, systematic, logical, critical, and careful mindset. Mathematics is used in various fields of science including natural sciences, social sciences, medical science, and commerce. This illustrates that mathematics is a science that is useful for life so mathematics is important to learn. However, mathematical objects that are abstract and loaded with symbols and mathematical terms often make students find it difficult to learn mathematics. It is not uncommon for students to be able to understand the material well but not be able to apply the material to more complex problems. This is in line with the results of PISA 2012, a math score of 379 puts Indonesia at the bottom of the list. In general, Indonesian students are weak in all aspects of content and cognitive, both for mathematics and science (Khikmiyah & Midjan, 2017).

There are indirect objects that can be obtained by students in learning mathematics, such as the ability to solve problems, the ability to think, be independent, and be respectful of mathematics. Thus, mathematics not only teaches knowledge about mathematics, but also as a mindset and tool in everyday life (Kurnia, Lati, Fauziah, & Trihanton, 2019). The purpose of learning mathematics is that students have the ability to: 1) understand mathematical concepts; 2) use reasoning on patterns and properties; 3) solve problems; 4) communicating; 5) has an attitude of appreciating the usefulness of mathematics in life (Nindy Citroesmi, Sugiatno, 2016).

Students must be able to understand, apply, analyze, and evaluate knowledge at the technical, specific, detailed, and complex levels in science related to the cause of phenomena or events in specific fields of work to solve problems. Students must become *problem* that are adaptive to various field problems, solver problem solvers are not only applying knowledge that has been mastered, but also able to find something new (Ariskasari & Pratiwi, 2019).

Mathematics as a compulsory subject in schools has the role of developing students' logical, systematic, and analytical thinking principles in problem solving (Antok, 2018). All basic competencies taught in mathematics in schools focus on achieving these, including basic competencies on the subject of linear programming. Linear programs are material that is *problem solving* due to the concept of learning using case examples in everyday life.

Problem solving is part of a very important mathematics curriculum because in the learning process and its completion, students are allowed to gain experience using the knowledge and skills they have to apply to problem solving (Nurhayati, E. Meirista, 2019). Problems in learning mathematics are divided into two groups, namely routine and non-routine problems. Non-routine problems require more than just translating problems into mathematical sentences and using known procedures. Non-routine problems require problem solvers to create their own solving strategies (Khomsiatun, 2015). But for students it is considered the most difficult part of learning, because the teacher has not used learning media that is able to stimulate students to think critically and creatively in problem solving (Pixyoriza, Netriwati, 2019).

Based on the facts found in the field, the process of learning mathematics in vocational schools is not yet holistic in nature and is still predictable with the respective vocational context (E. Nurrohman, S. Zubaidah, 2017). Mathematics textbooks taught at SMK contain the same contents as those taught at high school even though the purpose of learning mathematics at SMK and SMA is different. Students become less motivated to learn mathematics due to the lack of integration in the vocational fields taken. The development of mathematics learning tools in vocational high schools is a necessity so that students can learn the right concepts with their vocational fields. Learning tools that can be developed are modules. Through the use of modules that are integrated with the vocational field can provide learning experiences for students to be ready to face the world of work. Students become more focused and deepen the concepts given so that they can become problem solvers.

Modules are teaching materials that are arranged systematically in a language that is easily understood by students, according to their age and level of knowledge, so that they can learn independently with minimal guidance from the teacher. The material in the module should include the knowledge, skills and attitudes that students must master in terms of achieving the desired competencies. Modules can also be equipped with the use of technology as a means of understanding material, so that students can more easily learn and solve complex problems when done manually. Especially for linear program material that requires a lot of reasoning and creative thinking in its completion.

Linear programs taught in schools are limited by two variables and the maximum number of constraint functions. Whereas in actual context the number of variables and function constraints can be more than two. This requires an application that can help students understand the linear program comprehensively. The application that can be used is computer software, namely Quantitative systems for Business (QSB). QSB is very effective in helping to solve linear program problems in a broader context (Ujianto, Anwar, Bisri, & Anggaran, 2014). QSB is software that contains algorithm problem solving for operational research. Student mastery of the QSB application is an effective and efficient means to solve various daily problems quickly with better analysis.

Based on the description above, this study aims to produce a-based linear programming module problem solving with the help of a valid, practical and effective QSB application, so that it can be used as teaching material in schools.

Research Methods

Research conducted aims to develop learning media in the form of-based module problem solving in linear program material with the help of QSB applications. This type of research is development research with the development research design that is used adapted from the ADDIE model (Analyze, Design, Development, Implementation, Evaluation) (Dian, 2015). 1) in the phase

analyze , the things done are analyzing the needs and problems in the form of relevant material, textbooks, and learning conditions; (2) at the stage *design* , several activities are carried out including formulating learning objectives, determining the material or subject matter to be studied, then compiling teaching materials systematically that have been adapted to the needs of students; (3)stage *development* (development), the preparation of teaching material that is tailored to the needs of students in conducting learning activities; (4)phase *implementation* is the use of development products in the form of teaching materials in learning activities; (5) and the stage is *evaluation* carried out formatively at the product development stage in accordance with the model used.

The subject of this study consisted of several elements, namely (1) Media experts and material experts as validators or suggestions or comments about the quality of content, linguistic, presentation and suitability regarding module development with problem solving, content quality, language and appearance of the media. (2) Grade X students of SMK Negeri 1 Tanah Miring majoring in computer network engineering class A odd semester 2019/2020 academic year selected by random sampling amounted to 24 students. Data collection techniques in this study using test techniques, and non-tests. Data collection instruments in the form of an assessment sheet in the form of a questionnaire to assess the validity and practicality of the resulting modules and learning achievement test sheets to meet the effectiveness criteria.

Categorizing the percentage results completeness of students based on academic skills assessment criteria are presented in the following table 4:

Table 4. Guidelines for Academic Skills Assessment Category

Percentage of Completeness	Criteria
$x > 80$	Very Effective
$60 < x \leq 80$	Effective
$40 < x \leq 60$	Fairly Effective
$20 < x \leq 40$	Less Effective
$x \leq 20$	Very Less Effective

Results And Discussion

This development study uses the ADDIE model, while the stages are carried out based on the ADDIE model, namely the analysis stage, the results of the Lysis was obtained based on observations and interviews with subject teachers and students related to linear program material. Competencies that must be mastered after learning linear programs are also the basis for consideration in preparing this module. The content of the material based on the textbook is the linear inequality of two variables, the linear program, determines the optimum value with a search line (maximum and minimum values). At SMK Tanah Miring leaning yet available modules that can help students in learning to use computer applications and problems which train problem solving skills(problem solving).

The design stage, based on the results of the analysis, is then carried out with the module design including the cover, the contents of the material, sample questions and evaluation. In the preparation of the material is equipped with appropriate pictures so that it can provide interest in reading for students to be interested in learning linear programming material. The sentences used are made simpler to make it easier for students to understand the material. Evaluation is given in the form of descriptive questions to measure student understanding after learning linear program material. Furthermore, at this stage the researcher also prepares a questionnaire or questionnaire as a validation tool and measures students' responses to determine the practicality of the resulting module.

Development phase, the activities carried out in this stage, namely writing a draft of learning tools based on the module preparation framework by taking into account specifications such as print media, materials compiled by linking various daily problems and solving them using the QSB application, and displayed with the *layout* (display) according with a module display design that has been determined at the design stage. After that it validates the modules conducted by mathematics teachers and peer lecturers supporting mathematics learning media courses. The validation of teaching materials by media experts and material experts aims to see the contents of the initial product before carrying out a trial. Validation aims to improve teaching materials so that they are suitable for testing. Product improvement based on comments and suggestions from the validator, both in the form of

written suggestions on the text and validation sheets as well as oral suggestions obtained by discussing the modules developed. Validation activities are carried out by providing a module script along with a validation sheet to the expert validator. Validation results from experts are presented in the following Table 5.

Table 5. Expert Validation Score Material

No	Assessment aspects	Total score	Average	Classification
1	Didactic	19	3.6	Very valid
2	Construction	30	4.3	Very valid
3	Technique	9	4	Very valid
4	Material quality	47	4.5	Very valid
5	Conformity with activity problem solving	21	4.1	Very valid
Total		126	4.1	Very

Validation The validation score obtained shows that the module developed is categorized as very valid. This gives an explanation that the module is suitable for use in learning in schools.

Evaluation of module validity in addition to reviewing the module evaluation in general is also seen from the module display. The assessment is carried out by the media validator on aspects of module size, design cover module, and module design. The results of the assessment can be seen in the following table:

Table 6. Questionnaire Results of the Media Expert Rating

No.	Aspect of Assessment	Total Score	Average	Classification
1.	Module Size	8	4	Very Valid
2.	Skin Design (Cover)	27	3.8	Very Valid
3.	Design Content Module	50	4.2	Very Valid
Total		85	4	Very Valid

Average score obtained based on the assessment criteria table shows that the module has a very valid validity. This means that the module development meets the graphic design aspects, design cover module, and module content design.

The assessment of practicality quality can be seen from the student response questionnaire. The results of student responses to the developed module can be seen in the following exposure:

Table 7. Questionnaire Results Student Response

Aspects assessed	Average	Categories
Cognitive Competency	3.3	Practical enough
Affective Competencies	3.60	Practical
Competencies Psychomotor	3.68	Practical
Confidence	3.36	Sufficient Practical
Introspection	3,62	Practical
Objectivity	3,38	Practical enough
Conclusion	3.49	Fairly practical

The average actual student score is 3.49. Based on the practicality criteria of the student response questionnaire, it shows that this module learning device has a practical enough value to continue the field trials.

During the implementation phase, the module is tested to determine its effectiveness. This trial is to find out the level of understanding of the subject of the module being developed. Students who were involved in this trial were 24th grade students of SMK Negeri 1 Tanah Miring. The developed

module was tested in schools using experimental research one group pretest-posttest design. Face-to-face learning is done in two meetings, before learning the initial test (pre-test) and at the end of the study the final test (conducted post-test) is. Supporting modules in the form of the QSB application was previously installed on school computers so that the use of the modules can function properly and students are more interested in learning them. The test is given to students in the form of a written description, then analyzed to find out the difference or an increase in the results of the two tests. Assessment results for each test are as follows:

Table 8. Results of Analysis of Students Completion

Test results	Many students		Percentage	
	Pre-test	Post-test	Pre-test	Post-test
Students complete	6	17	25%	70.9%
Students incomplete	18	7	75%	29.1%
Total	24	24	100%	100%

Based on these results it appears that there are differences in the number of students who complete, where in the *pre-test* only amounted to 6 students increased to 17 students in the *post-test*. This shows that the linear program module based on *problem solving* with the help of the QSB application is quite effective to be used in learning mathematics in schools.

Evaluation phase, at this stage the researcher conducts the final module evaluation and revision based on comments or input from the validator and students. At this stage anis carried out evaluation from the analysis stage to the implementation phase. Improvements were made based on the results of the validator, educator responses and student responses. All suggestions and improvements made to teaching materials developed are revised properly.

The development of based modules *problem solving* has a positive influence on student achievement, this is in line with the results of the study (Anggoro, 2015) because students are trained to use their thinking skills in order to solve problems related to daily life, where students observe and analyze each problem and try to do the right solution and in accordance with applicable rules and concepts. The development of valid, practical and effective modules proves that the module is appropriate for use in learning in schools as teaching material that is able to provide different nuances for both students and teachers because of the added value of using information and communication technology so that students become more interested in learning it as required expressed by (I M. Suarsana, 2013) that the use of technology is able to provide critical thinking skills in problem solving.

Conclusions And Suggestions

Conclusions

This study refers to the ADDIE development model, that is analysis , design , development , implementation , and evaluation . This module is equipped with a tutorial on the use of the QSB application as a supporting tool so that students get a good understanding of linear program material while being able to provide stimuli in analyzing every problem related to linear programs that require more complex problem solving.

Modules are arranged based on ADDIE stages, which at each stage give positive values based on the assessment of validators and student responses. Based on the description above, the linear program module with the help of QSB applications that have been compiled meets valid, practical and effective criteria obtained from data processing in the form of questionnaires and achievement tests. Validity is obtained through the validation process by the teacher and lecturer as material experts and media experts with 4.1 and 4 in the very valid category. Practicality is obtained by filling in the student response questionnaire with the results of 3.49 in the practical category, while the effectiveness of the students' learning completeness results with 70.9% of students completing.

Suggestions

Development of modules for school levels is needed as a supporting part of learning to improve student understanding in learning mathematics. The use of applications in learning mathematics in schools is also very necessary to facilitate teachers' teaching and learning activities, so it is necessary to have similar modules for other subject matter.

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