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Development of ICT-Based Mathematical Learning Media on Linear Program Materials to Improve Students Achivement

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ABSTRACT

This research was inspired by the lack of ICT-based learning media in linear program material. Linear program material has the potential to be developed visually using computer devices to facilitate students in understanding the linear programs. The aim of the study was to develop ICT-based mathematics learning media that met the validity, practicality and effectiveness. The instruments used in this research were material validation sheets, media validation sheets, response questionnaires and student achievement test. Questionnaire sheets were analyzed quantitatively and qualitatively. Based on the results of data analysis and discussion, it can be concluded that the ICT-based media of mathematics learning is valid with an average score of 3.36 by the material validator and 3.42 by the media validator. This learning media also fulfills practical requirements with an average student response of 3.45 in small group trials and 3.18 in large group trials. Learning media also influence students achievement learning. Student achievements in this research are in sufficient criteria that is 65.21%.

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INTRODUCTION

Education is a conscious and systematic effort, which is carried out by people who are entrusted with the responsibility to influence students to have a character through education. In another sense, education is the maturing of students to develop their talents, potential, and skills in living life. Therefore education should be designed to provide understanding and skills to improve student achievement [1].

Understanding and visibility of students can be helped by using computers because with the help of computers the learning process runs more interactive and helps the realization of independent learning. In accordance with Government Regulation No. 19 of 2005 concerning National Education Standards, that the learning process in the education unit is carried out interactive, fun, challenging, motivating students to participate actively, as well as providing sufficient space for initiative, creativity, and independence in accordance with talents, interests, and physical and psychological development of students.

Such a learning process can be supported by the learning media. [2] said that learning media is one of the factors that support the success of the learning process in schools because it can help the process of delivering information from teachers to students or vice versa. The use of media creatively can facilitate and improve the efficiency of learning so that the learning goal is to obtain learning outcomes that achieve KKM can be achieved.

[3] states that computer-based learning is learning that uses computers as a tool. Through this learning, teaching material is presented using computer media so that teaching and learning activities become more interesting and challenging for students. [4] states that computers allow students to more easily understand a concept so that the use of computers to teach is better than

using books, films, or other traditional methods. According to Hick and Hyde (in Made Wena 2011) computer-based learning learners interact and deal directly with computers individually so that what is experienced by a student will be different from what is experienced by other students.

One model in computer-based learning is an interactive tutorial model. The tutorial model is a program designed to act as a tutor for students [5]. This means that this model is presented in a dialogue format with students. The tutorial model contains concepts, explanations, formulas, principles, charts, tables, definitions, terms and exercises (Padmanthara, 2007). Erik (2009) said that the tutorial in computer-based learning is intended as a substitute for humans whose learning is given through text or graphics on the screen that provides points of questions or problems.

The success of the developed media can be seen from the achievement of mathematical learning objectives, namely the success and completeness of mathematics learning outcomes obtained by students. The reality on the ground, there are still students who have not been able to achieve the objectives of learning mathematics. Based on the results of researchers' interviews with mathematics subjects in class X IT IT Al Pekanbaru in Ittihad, information was obtained that the percentage of mastery learning outcomes of students is still low. The minimum completeness criteria (KKM) set by schools for mathematics subjects is 78. On the subject matter of linear inequality, the two variables of the number of students who reach the KKM are 12 out of 23 people or around 52.17%. The percentage of students who reach the KKM can be classified as low. So with the development of learning media can also improve student learning outcomes because this media is developed interestingly and completely. Presentation of prerequisite materials, graphic examples of questions and exercises that can encourage students to be independent in solving problems related to linear program material.

Based on the description above, the researcher is interested in developing computer-based mathematics learning media on the subject matter of the Linear Program for grade X students. This study aims to develop a computer-based mathematics learning media that meet validity and practicality and is effective in improving student learning outcomes in subject matter linear program.

METHODOLOGY

The form of this research was Research and Development according to Borg & Gall which was modified by [6]. The subjects of this study were 24 grade students of Al Ittihad Pekanbaru IT High School as many as 24 people in a large scale trial and 10 people in a small scale trial and 18 students in the control class. Data collection techniques in this study were literature studies and interviews. While the data analysis techniques in this study were as follows:

1. Validity

Evaluation of product validity in the form of ICT-based learning media was carried out by a validator consisting of material validators and media validators. Assessment by the validator used a scale of 1 to 4 which is presented in table 1.

Table 1: Validator Rating Scale

Scoring scale	Criteria
4	Very good

3	Well
2	Less
1	Very less

Then the results of the validation questionnaire were analyzed with several steps, as follows.

a) Calculate the average score of each aspect with the formula:

$$\bar{x} = \frac{\sum x}{lot\ of\ validators}$$

Information :

$\bar{x}$= average score

$\sum$= the number of scores obtained by each aspect

b) Describing the average score of each aspect obtained becomes qualitative data according to the following assessment criteria in table 2.

Table 2: Qualitative Score Conversion Formulas

Score Range	**Criteria**
$\bar{x} > Mi + 1{,}8\ Sbi$	Very valid
$Mi + 0{,}6\ Sbi < \bar{x} \leq Mi + 1{,}8\ Sbi$	Valid
$Mi - 0{,}6\ Sbi < \bar{x} \leq Mi + 0{,}6\ Sbi$	Less alid
$\bar{x} \leq Mi - 0{,}6\ Sbi$	Very less valid

Information :

Mi = Ideal average (ideal maximum score + ideal minimum score)

Sbi = standard deviation (ideal maximum score - ideal minimum score)

Ideal maximum score = $\sum$ item indicator criteria for the highest score. The ideal minimum score = $\sum$ the lowest indicator score criteria × score. The ideal maximum score on the questionnaire validation by the validator is 4 (four), while the ideal minimum score is 1 (one). In this study, learning media is declared valid if it meets the minimum criteria of "Good".

2. Practicality

Practical assessment was used by teachers and students on computer-based learning media interactive tutorial models on the subject matter of the developed Linear Program. For teachers, the assessment sheet consists of two aspects, namely material aspects and media aspects. The assessment sheet used is in the form of a closed and open questionnaire. For closed questionnaires using a Likert scale with the answer choice criteria: very good, good, good enough, not good, very poor with values of 4, 3, 2, 1. An open questionnaire is used to find out suggestions from the teacher to be used as basic revision. For students, the assessment sheet was

made in the form of a closed response questionnaire for the media that has been used. The answer choice criteria were: strongly agree, agree, disagree, and strongly disagree with consecutive values 4, 3, 2, 1.Efektif

3. Effectivity

Analisis of student achievement tes is done by comparing the percentage of the number of students who achived criteria standard in the previous basic competencies with the number of students who achived criteria standard in mathematics learning achievement after using media. Siswa dikatakan mencapai KKM apabila skor hasil belajar siswa mencapai 78. Students are said to reach the standard if the students achievement score reaches 78. To find out the achievement of the standars score by students can use the following formula:

$$score = \frac{score\ obtained}{specified\ score} \times 100$$

Then the percentage of students who reach KKM will be determined using the following formula:

$$the\ percentage\ of\ students\ who\ reach\ the\ standard\ score = \frac{the\ number\ of\ students\ who\ reach\ KKM}{total\ number\ of\ students} \times 100\%$$

Student achievement increases if the percentage of students who reach the KKM after the action is higher than before the action. The following criteria for student achievement are stated by Sudijono (2005).

Tabel 3. Achievement Criteria

Persentase	**Kategori**
85%-100%	Very High
70%-84%	High
60%-69%	Sufficiently
51%-59%	Low
0-50%	Very Low

In this research, learning media are stated to increase achievement if they meet the category of at least "sufficiently" in the range of 60% -69%. The data processing steps taken are:

1. Normality Test

   Normality test aims to determine whether student achievement data has a normal distribution or not. The normality test was carried out with the help of a SPSS 24.0 with the Kolmogorov Smirnov Test with a significant level $\alpha = 0.05$ (Trihendradi, 2005). The hypothesis of the normality test are:

   H_0 = data is normally distributed

   H_1 = data is not normally distributed

   In this case, H_0 will be accepted if the significance value is more than > 0,05.

2. *One Sample t-test*

   This t test aims to test whether a certain score used as a comparison differs significantly or not with the average a sample. If the data normal, then the average similarity test uses the t-test with the help of SPSS 24.0. the t-test formula used is:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Information:

$\bar{x}$ = average learning achivement

μ_0 = hypothesized score

s = standard deviation

n = number of student

The significance level used is $\alpha = 0{,}05$. Decision criteria H_0 is rejected if the score of $t_{count} < -t_{table}$ atau $t_{count} < t_{table}$. If there is a range in the $70\% - 84\%$ then the formulation of the hypothesis is:

$H_0 : \mu_0 < 70\%$ computer based mathematics learning media interactive tutorial models are not effective in terms of student achievement.

$H_1 : \mu_0 \geq 70\%$ computer based mathematics learning media interactive tutorial models is effective in terms of student achievement.

If obtained not in the range above, the hypothesis adjusts the criteria in Table 3

RESULT AND DISCUSSION

In the design phase of the product, the design is done using a paper based design, where the Linear Program material is designed on paper, both in the form of text and images. This stage aims to get an idea of what will be displayed on the computer. The product design that has been made in paper based is then poured in a computer based form. The program used for the design of computer based products is Microsoft Power Point as shown in the Figure 1 and Figure 2.produk *computer based* ini adalah *microsoft power point* seperti yang ditampilkan pada gambar berikut.

Figure 1. The opening of the media

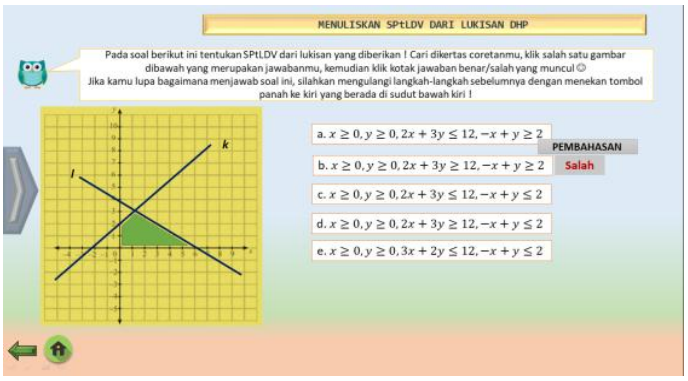

Figure 2. Display of the second meeting on the media

After the learning media was completed, validation was carried out by the material validator and the program validator and continued testing the implementation of media use.

1. Assessment of Material Validators
   Validation by material validators was used to assess the material that had been compiled in ICT-based learning media on the subject of the Linear Program for class X students of SMA. There are two aspects assessed, namely aspects of learning and aspects of the curriculum. Table 4 shows the result of validation of Material Validators.

Table 4. Results of Validation by Material Validators

No	Validator	Average		Overall average
		Aspects of Learning	Curriculum Aspects	
1	V1	3,6	3,6	3,6
2	V2	3,6	3,4	3,5
3	V3	3,2	3,14	3,17
		Overall Average		**3,42**

Based on the overall average o tained x = . the results of the evaluation from the material validator are stated to be very valid.

2. Media Validator Assessment
   Validation conducted by media validators was used to assess ICT-based learning media products on the subject of the Linear Program for class X students of SMA. Media validator is carried out by a mathematics lecturer. There are two aspects assessed, namely the aspect of appearance and aspects of the program (Table 5).

Tabel 5. Results of Validation by Media Validators

No	Validator	Average		Overall average
		Cosmetics Aspects	Program Aspects	
1	V1	3,52	3,69	3,6
2	V2	3,54	3,55	3,54
3	V3	2,83	3,05	2,94
		Overall Average		**3,36**

Based on the overall average obtained which is $\bar{x} = 3{,}36$ the results of the media validator's assessment can be said good and declared valid.

3. Small group trial results

The level of implementation of learning media was obtained from the results of the questionnaire responses of 10 students (Table 5).

Tabel 6. Questionnaire result of Small Scale Students

No	Aspect	Average
1	Artistics	3,39
2	Material Presentation	3,44
3	Program	3,52
	Overall Average	**3,45**

Based on the response questionnaire of small group students, it can be concluded that ICT-based mathematics learning media on the subject of the Linear Program for class X SMA students have very good levels of implementation with an average of 3,45.

4. Large group trial results

The level of implementation of learning media was obtained from the results of the questionnaire responses of 23 students (Table 6).

Tabel 6. Questionnaire result of Large Scale Students

No	Aspect	Average
1	Kosmetik	3,23
2	Penyajian Materi	3,21
3	Program	3,09
	Overall Average	3,18

Based on the responses of the large group students' responses, it can be concluded that ICT-based mathematics learning media on the subject of the Linear Program for class X students of SMA have a very good level of implementation with an average of 3.18. Respondents stated that students can operate this learning media well. The material description of the Linear Program on learning media is easy to learn, the display of button instructions on media and material is very clear and interesting and uses easy to understand

language. Students also feel motivation to learn and use this learning media. Respondents also stated that giving animations to visualize material in the Linear Program greatly helped them understand the material so that it was easier to understand. The existence of ICT-based mathematics learning media makes learning activities fun.

5. Analysis of the Effectiveness of Learning Outcomes Tests

a. Normality Test

The results of the normality test of student learning outcomes before and after the use of learning media using the Kolmogorov Smirnov test with SPSS 24.0 are presented in the following Table 7:

Tabel 7. Normality Test Data Learning Outcomes of Students

	N	**Mean**	**KS-Z**	***Sig.***	**H_0**	**Result Finding**
Learning outcomes	23	82,17	0,112	0,200	Accepted	Data learning outcomes of students with normal distribution

Based on Table 7, the significance level of 0.200 is obtained, then $p > \propto = 0.05$. This explains that the learning outcomes data after using learning media is normally distributed.

b. One Sample t-test Result

T-test results of student learning outcomes after the use of learning media using One Sample t-Test with SPSS 24.0 are presented in Table 8 below:

Table 8. Difference Tests in Student Learning Outcomes Data

	N	**Mean**	**Standard Deviation**	**T**	**Dk**	***Sig.***	**H_o**
Result	23	82,17	11,578	34,037	22	0,000	Rejected

Based on Table 8 the data obtained that the significance level is 0,000, then $p < \propto = 0.05$, the conclusion is that H_0 is rejected. Based on Table 4.10 obtained $t_{count} = 34.037 > t_{table} = 1.713$. It can be concluded that effective learning media in terms of learning outcomes.

Student learning outcomes in this study are insufficient criteria, which is 65.21%. Based on the results of the t-test and comparison of learning outcomes criteria, it was concluded that the instructional media was effective in improving student learning outcomes.

CONCLUSION AND SUGGESTION

Through this development research, the products with a computer-based mathematical learning media model interactive tutorial on the subject of Linear Program for learners SMA / MA. This media is considered to be valid and practicable after the validation process by experts and two stages of the trial to see the level of adherence to the media and effectively improve the learning outcomes of students.

Product development in the form of computer-based learning media model of interactive tutorials on the subject matter of this linear program has proven the feasibility so it is advisable to teachers of mathematics to use the product of this development as part of efforts to improve the learning outcomes of students.

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