3IMPROVING UNDERSTANDING OF SIMPLEX OPERATIONS THROUGH DEVELOPING THE SIMPLEX SOLVER APPLICATION IN LINEAR PROGRAM COURSES

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IMPROVING UNDERSTANDING OF SIMPLEX OPERATIONS THROUGH DEVELOPING THE SIMPLEX SOLVER APPLICATION IN LINEAR PROGRAM COURSES

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Abstract. Based on the researcher's experience, in Linear Program lectures there is a tendency for students to be less active so that the spirit in the learning process seems to be absent. In solving problems, students tend to follow the completion steps outlined by the lecturer. This may be due to the low ability of students to make mathematical models. One of the factors causing the low ability to make mathematical models is the limited teaching materials according to student abilities. One of the efforts that can be made to increase the ability to make mathematical models in the Linear Program course is to develop a Simplex Solver application that is suitable for student conditions. The purpose of developing the Simplex Solver application is for students to feel the convenience of studying Linear Programming courses so that the objectives of this course can be achieved. This type of research is development research. Data collection used by means of validation, observation, questionnaires, interviews and tests. Validation is carried out to determine the validity of the Simplex Solver application development. Observations, questionnaires and interviews were conducted to find out the practicality of developing the Simplex Solver application. The test was conducted to find out whether the development of the Simplex Solver application could improve the mathematical representation skills of Mathematics Education students at Pancasakti University, Tegal.

Keywords: Linear Programming, Simplex, Applications

INTRODUCTION

The Linear Program is one of the mandatory courses taught to students of the Mathematics Education Study Program at Pancasakti University, Tegal, with a weight of 3 credits. Based on the researcher's experience, in Linear Program lectures there is a tendency for students to be less active or passive so that the spirit of the learning process does not seem to exist. When solving problems, students tend to follow the solution steps outlined by the lecturer. One of the efforts made to increase the ability to understand mathematics in the Linear Programming course is to develop a Simplex Solver application. The aim of developing this application is for students to feel ease in studying the Linear Programming course so that the objectives of this course can be achieved. Based on these problems, the researcher was interested in conducting research entitled "Development of the Simplex Solver Application to Improve Understanding of Simplex Operations in Linear Programming Courses".

The aims of this research are (a) to find out whether the development of the Simplex Solver application meets content standards, and (b) to find out whether the development of the Simplex Solver application is effective in improving the perception of Linear Program learning.

1.1 Development

Al-Bahra Bin Ladjmudin (2005: 3-6) defines system development as an activity to develop a new system to completely replace the old system or improve an existing system. The old system needs to be repaired or replaced because a new system needs to be developed to solve problems that arise, fulfill instructions given, or seize existing opportunities. With the new system, it is hoped that the following improvements will occur:

a. Improvement of the quality of information presented.

b. Improvement of system performance so that it becomes more effective.

c. Improvements to operational efficiency.

From the opinions of the experts above, it can be concluded that development is a structured activity with comprehensive planning to create and/or improve a system so that it becomes a new system in accordance with the required functional requirements and of better quality. Development is carried out to add improvements that are needed by the results.

According to Sudarsono, et al (2013: 186) Research and Development or what is usually called Research and Development (R&D) is research that aims to produce products. In order to produce standard products/systems in an integrated and systematic manner, developers need system development methods. Extracted from Ian Sommerville (2015: 19) software development is a professional activity where software is developed for a specific purpose, to be implemented in a device, or as a software product such as an information system.

According to M. N. Hoda, et al (2018: 340) every software developer, without exception, must go through the stages: requirements, analysis, design, implementation, and testing cycles,

during software development. Apart from that, in his book Roger S. Pressman (2010:31) states that project tracking and control, risk management, quality assurance, configuration management, technical review, etc. are applied throughout the process. Every software development process can use these stages, but each stage has a different emphasis, so the flow of stages must be defined according to the development model. The development models or so-called Software Development Life Cycles (SDLC) that are often used are: waterfall, iterative, iterative and incremental, evolutionary prototyping, and ad-hoc or code-and-fix SDLC.

The Waterfall development model is the most common and longest used development model, the waterfall model is also often called the classic life cycle. Roger S. Pressman (2010: 31) states that the waterfall model takes a systematic and sequential approach to software development starting from requirements specifications then developed through planning, modeling, construction and deployment, culminating in ongoing support of the completed software. made, as can be seen in Figure 1.

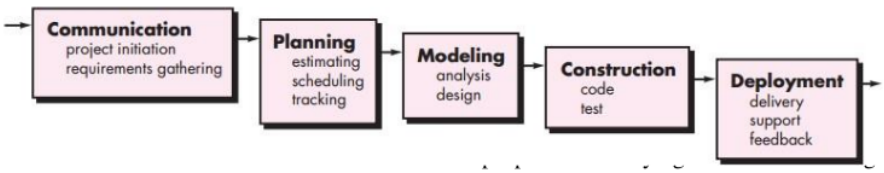

Figure 1. Waterfall Models

1. Communication

Roger S. Pressman (2012: 36) states that to understand the nature of the program being built, software engineering must understand the information domain, behavior, performance and interface required. At this stage, a needs analysis is carried out to understand by communicating all component requirements such as services, constraints and system objectives through observation or consultation with users. Then it is defined in detail so that software system specifications are obtained according to needs. The requirements of the software system are documented, analyzed and determined in detail and clearly so that results are obtained that can help determine the features and functions of the software to be used as a guide at the next stage (Ian Sommerville, 2015: 49-50).

2. Planning

Extracted from Roger S. Pressman (2010: 15), this planning stage defines software engineering work by explaining the technical tasks that will be carried out, the resources that will be needed, the risks that may occur, the work schedule, and the work products that will be produced.

stage is to facilitate software development in meeting the needs that have been analyzed so that it will be very easy to carry out the next development

stage. This stage builds the overall system architecture. Software modeling describes and identifies fundamental software system abstractions and their relationships, including: data structure, software architecture, programming procedures, and interface representation (Roger S. Pressman, 2010: 31).

From Norman (1988) in Roth (2017: 3) states that humans use interfaces, but they experience interactions, and it is the experience that determines the success of an interactive product. Interfaces are tools, and for digital mapping this tool allows users to manipulate the map and underlying geographic information. Interaction is broader than interface, which describes a two-way inquiry or query-result dialogue between a human user and a digital object mediated through a computing device (Roth, 2017: 3).

From Garrett (2010) in Roth (2017: 3) UI (User Interfaces)/UX (User Experience) explains a series of concepts, guidelines and workflows for thinking critically about the design and use of interactive products. Heonsik Joo (2017: 1) stated that UI refers to a system and users interacting with each other through commands or techniques to operate the system, enter data, and use content. UX refers to the overall experience related to the perceptions (emotions and thoughts), reactions, and behaviors that users feel and think through direct or indirect use of a system, product, content, or service.

1.2 Mobile Applications

Application according to HM Jogiyanto (1999: 12) is the use in a computer of statements or instructions arranged in such a way that the computer can process input into output. While mobile in the Oxford English Dictionary means being able to move easily and freely anytime and anywhere, mobile is often associated with mobile phones and other technology.

Vijay Kumar Velu (2016: 3) explains that one of the exciting future technologies in the mobile application space is the development of mobile applications that run on Android devices, where applications can listen for signals from beacons in the physical world and react accordingly. Vijay (2016: 3) also states that applications are broadly categorized into types, namely:

1. Nativeapps

Native apps on mobile operating systems are installed through their respective app stores. This application is designed for a specific platform and can take advantage of all device features, such as the use of the camera, GPS, phone contact list, and so on, which are advantages of native apps. Another advantage according to Jeff Mc Wherter and Scott Gowell (2012:22) is that native apps can access content offline. Even when storing data locally, the application can use background services to see if the device has access to the Internet, and prompt the user if it wants to obtain an updated data set.

2. Mobile webapps

Mobile web apps are non-native applications. Users access it like they would access any other web page, but optimized for mobile. The application runs under a web browser. This kind of application appears to work within the

browser, but without a visible browser window. This application has high compatibility because it can be accessed on all platforms, but to access it you must be connected to the internet so it cannot save data offline.

3. Hybrid apps

Hybrid apps try to combine the best of both approaches. the application uses server-side computing power but does not treat the device as just a front end. These apps have native components that reside on a device and can use local features as if they were native apps. The advantage is that developing these applications is easier and more cost-effective, but the APIs regarding device-specific features are limited compared to native apps.

Gartner in Mahesh Panhale (2016: 1) said that Companies are finding that they need to support multiple platforms, especially as the BYOD (bring your own device) trend is gaining momentum. In addition, the app-only trend also supports this BYOD trend. App-only means that applications, which used to be available via desktop web browsers as well as mobile devices, stop operating web applications, thereby forcing customers to access applications via mobile applications only.

From this definition, it can be concluded that a mobile application is an application that can be accessed on a mobile device and can be connected to the internet, so that when used, the mobile application can be used anywhere and at any time.

RESEARCH METHODOLOGY

The validation team (assessing) the suitability of the instruments and products (prototypes) in this research are experts in applications and mathematics education, as well as Linear Program lecturers. The subjects to determine the validity and practicality of the instruments and products were semester II A mathematics education students at UPS Tegal.

According to Borg and Gall (1981: 775) in Emzir (2007: 270) the steps in research and development are shown in the following table:

Table 2. Research and Development Steps

Borg and Gall's main move	**10 steps of Borg and Gall**
Research and information collecting	1. Research and information gathering
Planning	2. Planning
develop preliminary form of product	3. Development of the initial form of the product
Field testing and product revision	4. Initial field test
	5. Product revision
	6. Primary field test
	7. Revision of operational products
	8. Operational field test
Final product revision	9. Revise the final product

Dissemination and implementation	10. Dissemination and implementation

Based on these steps, the research design that will be developed is as follows.

1. Information Collection

This stage was carried out to see an overview of conditions in the field related to the Linear Program teaching and learning process at Pancasakti University Tegal, then analyze the problems.

2. Design stage

The next stage after analyzing the existing information continues with the design stage. Namely designing teaching materials in the form of a Simplex Solver Application which consists of 6 chapters. Each chapter contains competency standards, basic competencies, learning objectives, learning activities (descriptions and examples, exercises, summaries, formative tests, feedback), answer keys.

3. Initial Product Form Development Stage

After the design is complete, the validation stage is carried out. There are 2 types of validation used in the Simplex Solver Application, namely:

a. Content validity, namely whether the Simplex Solver Application has been designed in accordance with the course syllabus.

b. Construct validity, namely the suitability of the components of the Simplex Solver application with the indicators that have been determined. The Simplex Solver application that has been designed was consulted and discussed with Linear Program and education experts, as well as Linear Program lecturers. Forms of consultation and discussion can be carried out by filling out the Simplex Solver Application validation sheet. The validation sheet is used to obtain the validity and feasibility of the Simplex Solver Application so that it can be used properly according to competency standards and basic competencies.

4. Field test and product revision stage

After the validation stage was carried out, the Simplex Solver Application was revised and then tested, to determine the level of practicality and effectiveness. The trial was carried out in the Linear Program learning for second semester mathematics education students at Pancasakti University, Tegal. In this trial, student activities and learning outcomes will be observed to determine the level of effectiveness of the product that has been developed. During the lesson, a practicality questionnaire was given to determine the level of practicality of the Simplex Solver Application.

5. Revise the final product

After being tested to obtain effectiveness and practicality, activities are focused on evaluating or revising the product (trial version) so that it can be used according to expectations. If not, make revisions to the parts that are still considered lacking. This revision is used as a benchmark in improving the product being developed.

RESULTS

1. Information Collection

From the results of the questionnaire given to students, the following information was obtained:

1. The teaching materials used in the Linear Program learning process rely on the availability of books in the library, and lecturers do not provide Simplex Solver or dictation programs.
2. The material and examples of learning descriptions presented in teaching materials have not changed much from year to year so there is an impression that there has been no revision to adapt to current developments.
3. The available Linear Program teaching materials are difficult for students to understand

2. Planning

This stage designs the Simplex Solver program tool

3. Early Form Development

The next step is to carry out the validation stages of the Simplex Solver Program Linear program where there are two types of validation used, namely:

a. Content validation, which will assess whether the Simplex Solver program has been designed in accordance with the course syllabus

b. Construct validation, which assesses the suitability of the Simplex Solver program components with predetermined indicators. Next, the Simplex Solver program that has been designed is consulted and discussed with colleagues (permanent lecturers in the UPS Tegal Mathematics Education study program) who are competent in Linear Program equations or related materials. The form of consultation and discussion is carried out by filling out the Simplex Solver program validation sheet, where colleagues are asked to provide an assessment of the initial product of the Simplex Solver program and provide suggestions for improvements that need to be made.

The results of the assessment via validation sheets by colleagues are presented in summary form in Table 5.

Table 5. Summary of Simplex Solver Program validation results

No	Indicator
1.	Identity
2.	Competency standards and basic competencies
3.	Conformity of learning objectives with competency standards and basic competencies
4.	Learning objectives support competency standards and basic competencies
5.	The explanation of goals fulfills the elements of problem solving
6.	Indicators of achievement of competency standards and basic competencies
7.	Load material that corresponds to competency standards and basic competencies

8.	The concept map has been explained well	3	2	2	2,33	Quite Valid
9.	Conformity of content to learning objectives	3	4	3	3,33	Valid
10.	Concept truth	3	4	2	3	Valid
11.	Concept sequence	4	3	3	3,33	Valid
12.	Readability or Language of the Simplex Solver program	4	3	3	3,33	Valid
13.	Graphic components in the Simplex Solver program	3	2	2	2,33	Quite Valid
14.	Effective use of language and Efficient	4	3	3	3,33	Valid
15.	Completeness of the Simplex Solver program as teaching material	3	2	3	2,67	Quite Valid

From this table it can be seen that the validators generally gave a rating above 2 for all indicators so that of the three validators, all fifteen indicators for the Simplex Solver Program stated that the criteria were quite valid to valid. The average of 3 validators' assessments of the Simplex Solver program is 3.23, where this value meets the valid category.

4. Field testing and product revision

In this phase, the Simplex Solver program which has received assessments and suggestions from the validator team is revised based on these input and suggestions, so that a revised Simplex Solver program is obtained which is ready to be tested in the field. This trial is intended to obtain the level of practicality and effectiveness.

1. Practicality Test of the Simplex Solver Program

The student response questionnaire was filled in by 25 students. In general, based on the distribution of the questionnaire, student responses regarding the practicality of using the Simplex Solver program were 84. This value means that the Simplex Solver Linear Program used in learning meets the practicality criteria. The results of the questionnaire data analysis on the practicality of using the Simplex Solver program indicate that there are several shortcomings of the Simplex Solver program, namely that the sample question indicators do not clarify students' concepts of the material. Apart from that, the concept indicators used are still not well understood by students so they are not able to base students' problem solving abilities.

2. Effectiveness Test Results for Using the Simplex Solver Program

Test the effectiveness of learning using the Realistic-Based Simplex Solver program, namely testing whether learning using the Realistic-based Simplex Solver Program is effective for students' mathematical representation abilities. Previously, the analysis prerequisite tests were carried out, namely the normality test and homogeneity test

a. Normality Test Results

The analysis prerequisite tests carried out gave the result that the data from the mathematical representation capability test followed a normal distribution and had homogeneous diversity. The

Normality Test is carried out with the help of SPSS 17, where H_0 and H_1 are written as follows.

H_0 : Data distribution follows a Normal distribution (The sample comes from a population with a Normal distribution)

H_1 : Data distribution does not follow a Normal distribution (The sample does not come from a population with a Normal distribution)

With the significance level set at 1-α = 95% or error level α = 5%, the analysis results are then summarized as in the Kolmogorov-Smirnov test summary table from the SPSS 17 output which can be seen in Table 6 below.

Tabel 6. *One Sample Kolmogorov Smirnov Test*

		Kelas Eksperimen
N		25
Normal Parameters	Rata rata(*Mean*)	72,8
	Simpangan Baku	15,882
Most Extreme Differences	Mutlak (*Absolute*)	0,15
(Perbedaan Paling Ekstrem)	Positip	0,15
	Negatip	-0,141
Kolmogorov-Smirnov Z		0,749
Asymp.Sig. (2-taled)		0,628
Test distributions is Normal		
(Hasil uji sebaran data Normal)		

Based on this table, the Asymp value can be seen. Sig. (2-tailed) or the real error level value of the analysis results is 0.628 or 62.8%, where this value is greater than the specified error level, namely α = 5% so that the null hypothesis in this test is not rejected. It can also be seen from the Kolmogorov-Smirnov calculated statistical value = 0.794, which is greater than the difference in the largest (most extreme) absolute value = 0.15 which is interpreted as acceptance of H0. Thus, the results of the Normality test conclude that the data comes from a normally distributed population.

b. Homogeneity Test

The homogeneity test is carried out using the Levene's Test, which is a test package with the t-test for independent samples (Independent Sample t Test). In this homogeneity test, the statistical hypothesis is.

H_0 : There is no difference in variance between the 2 samples being compared (The diversity of the data for both samples is homogeneous)

H_1 : There is a difference in variance between the 2 samples being compared (The diversity of the data for both samples is not homogeneous)

With the significance level set at 1-α = 95% or error level α = 5%, the analysis results are then summarized as in the Kolmogorov-Smirnov test summary table from the SPSS 17 output which can be seen in Table 7 below.

Tabel 7. *Levenes Test for Equality of Variances*

		F	Sig
Test Results Ability Troubleshooting Problems	Equal Variances Assumed	2,67	0,109

Based on the table above, you can see the Sig value. or the real error level value of the analysis results is 0.109 or 10.9%, where this value is greater than the specified error level, namely α = 5% so that the null hypothesis in this test is not rejected. So it can be concluded that the diversity of the data for the two samples is homogeneous.

c. Mathematical Representation Ability Completion Test

In this study, the completeness of the mathematical representation ability measured was the completeness of the classical mathematical representation ability with a proportion of 75%. The purpose of carrying out this completeness test is to obtain an answer to one of the indicators of the effectiveness of the Realistic-Based Linear Program Simplex Solver program on students' mathematical representation abilities, namely achieving completeness of mathematical representation abilities with a minimum completeness score of 55. The statistical hypothesis for this test can be written as follows.

H_0 : The proportion of students who get a score ≤ 59 is not more than 75%

H_1 : The proportion of students who get a score ≤ 59 is more than 75%

With the significance level set at 1-α = 95% or error level α = 5%, the following analysis results are obtained:

From the data on the mathematical representation ability scores of 25 students, it is known that there are 4 students whose scores are ≤ 59, so it can be stated that x = 21 and n = 25 so that the calculated z value can be obtained using the formula

$$z = \frac{\frac{x}{n} - \pi_0}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}}$$

The calculation results obtained the z value

$$z = \frac{\frac{21}{25} - 0{,}75}{\sqrt{\frac{0{,}75(1-0{,}75)}{25}}} =$$

0,090,0075 = 1,039

For α = 5%, z table = 1.96, so that the value of zcount < ztable means the null hypothesis is accepted, meaning that the proportion of students' classical mathematical representation ability is 75%.

d. Test of Equality of Two Means

The equality test of two means was carried out to compare the average value of the mathematical representation ability of the class whose learning used the Simplex Solver program (experiment) and the class which did not use the Simplex Solver program (control). In this test the statistical hypothesis is.

H_0 : There is no difference in average between the 2 samples being compared

H_1 : There is a difference in average between the 2 samples being compared

With the significance level set at 1-α = 95% or error level α = 5%, the analysis results are then summarized as in the Kolmogorov-Smirnov test summary table from the SPSS 17 output which can be seen in Table 4 below.

Tabel 5. *Independent Sample Test*

		F	Sig	t
Hasil Tes	Equal	2,67	0,109	3,97
Kemampuan	Variances			
Pemec Masalah	Assumed			

From this table it can be seen that the sig. or the statistical test error level is very small, 0.000 and less than the specified error level, namely α = 5%. it can also be seen from the value of t = 3.97 which is greater than the t table value for α = 5% degrees of freedom 23 two-sided test, namely t = 2.069, so it can be stated that H0 is rejected, meaning there is difference in the average between the experimental class and the control class . If we look at the average score for each class, it can be concluded that the value of the mathematical representation ability of the class whose learning uses the Realistic-Based Simplex Solver program is better than the value of the mathematical representation ability of students whose learning does not use the Simplex Solver program.

DISCUSSION

1. Validity of the Results of Realistic-Based Linear Program Simplex Solver Program Development

The Simplex Solver program developed in this research already contains elements that are characteristics of learning that are considered good by several competent experts on this issue. One of these experts is Surahman, who in his book Prastowo (2011; 113) states that a good Simplex Solver program is a Simplex Solver program which is prepared by paying attention to the title of the Simplex Solver program, general instructions, Simplex Solver program material and semester evaluation. In connection with this statement, research on the development of the Realistic-Based Linear Simplex Solver program already contains elements of identity, general instructions, namely basic competencies, subject matter, achievement indicators, references, learning strategies, learning activity sheets, instructions for students, and evaluation, then the content of the Simplex program Solver or Simplex Solver program material that is in accordance with basic competencies, concept maps that are explained very well. Apart from that, in terms of language, the Simplex Solver program can be said to be effective and efficient and the completeness of the Simplex Solver program is in accordance with the research objectives for developing the Simplex Solver program. Realistic-Based Linear Program.

The statement above is in line with the assessment carried out by the validator team, where the total average score of the validator team for each aspect of the Simplex Solver program is 3.23. This value shows that overall the Simplex Solver program has quite valid criteria, so it is quite suitable for use in learning in a lecture program.

Looking at each aspect, starting from the identity aspect, an average score of 3.67 was obtained, which means that looking at the identity aspect, the Simplex Solver program is valid. Even though it is valid for this aspect, the writing is still revised according to suggestions from the Validator Team.

The Competency Standards and Basic Competencies received a score of 3. According to the criteria, this number shows that it is valid, however, based on the advice of the Validator Team, several sentences in the Competency Standards and Basic Competencies which were considered less operational were revised so that they became sentences indicating operational.

Not all indicators were revised, only a few parts received the attention of the Validator Team. The discussion of the example question which students feel is not easy to understand because there are several calculation steps that have been missed, is revised by completing the steps for completing it so that students can understand the solution of the example question even though the lecturer does not explain the discussion of this example question again. Another input related to the questions is the practice questions, because the Realistic Based Linear

Program Simplex Solver program is expected to improve mathematical representation abilities, the example questions in the Simplex Solver program should also be questions based on mathematical representation. Based on this input, there are additional examples of questions based on mathematical representation. Apart from that, the practice questions also contain mathematical representation questions.

Other revisions related to the Validator Team's input were due to writing errors due to typing errors. Even though many revisions have been carried out, due to the limited number of Validator Teams, it is very possible that along the way there will be shortcomings that will only be discovered later, but in general it can be said that the Simplex Solver program is quite valid because it meets the criteria for a good Simplex Solver program.

2. Practicality of the Simplex Solver Program Development Results

Student responses via a questionnaire represented by 25 students regarding the practicality of using the Simplex Solver program obtained a questionnaire score of 81.2. This figure means that the Simplex Solver Linear Program program used in learning meets practical criteria. As a result of the analysis of questionnaires from students, information was obtained that the Simplex Solver program still had shortcomings in terms of discussing example questions, namely the presence of jumping solutions so that one could understand them.

In general, students can benefit from the Simplex Solver program, because they no longer concentrate on taking notes on what the lecturer explains because the explanations in the Simplex Solver program can be directly understood by students. Formally, students provide assessments through questionnaires with quite good scores, so it can be said that the Realistic-Based Linear Program Simplex Solver program meets the practicality criteria.

3. Effectiveness of the Simplex Solver Program Development Results on Mathematical Representation Ability

The results of the mathematical representation ability test for 25 students who studied using the Simplex Solver program exceeded the standard score set, namely 59. Even though there were 4 students whose scores were less than 50, the results of the proportion test actually showed that 75% of the students the score is not less than 59. In other words, it can be said that 75% of students have achieved classical completion. This condition is in line with conditions in the field when learning is carried out.

The results of the independent t-test, namely a statistical test carried out to compare the mathematical representation ability of the class whose learning uses the Realistic-Based Simplex Solver program with the class whose learning does not use the Realistic-Based Simplex Solver program, concludes that the

mathematical representation ability of the class whose learning uses the Realistic-Based Simplex Solver program better than classes whose learning does not use the Realistic-Based Simplex Solver program.

Students who use the Simplex Solver program are greatly helped in concentrating when studying, because with the Simplex Solver program students can study lecture material first at home, so they will only concentrate on topics that they cannot understand from the Simplex Solver program. In contrast to the condition of students who do not use the Simplex Solver program, although there are some students who have studied at home, what they learn is not focused on the material that the lecturer will discuss in lectures. Students who use the Simplex Solver program in learning are more active and understand the material more easily, discussions can run well, some students can become tutors for other students who cannot understand the material or example questions, as well as practice questions given in lectures. The opposite condition occurs for students whose learning does not use the Simplex Solver program.

Based on the results of the proportion test and t-test, it can be concluded that the Realistic-Based Linear Program Simplex Solver program developed in this research can be said to be effective in students' mathematical representation abilities.

CONCLUSION

From the research results, the following can be concluded:

1. The development of the Simplex Solver application has met content standards
2. The development of the Simplex Solver application is effective in improving the perception of Linear Program learning.

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BIBLIOGRAPHY

Deniz, Omer. 2016. Students Mathematization Process of the Concept of Slope Within the Realistic Mathematics Education. *Hacettepe University Journal of Education* 10 : 1 - 5

Emzir. 2011. *Metodologi Penelitian Pendidikan Kuantitatif dan Kualitatif*. Jakarta: PT. Rajagrafindo Persada.

Hamalik, O. 2001. *Proses Belajar Mengajar*. Bandung: Bumi Aksara

Hough, Sue. 2007. Realistic Mathematics Education. *Mathematics Teaching* 203 : 34 - 38

Prastowo, A. 2011. *Panduan kreatif membuat bahan ajar inovatif*. Yogyakarta: Diva Press.

Makong, Judah P. 2014. Teaching Functions Using a Realistic Mathematics Education Approach : A Theoretical Perspective. *International Journal of Educational Science* 7 : 653 - 662

Mandur, K., I Wayan Sadra dan I Nengah Suprata. 2013. Kontribusi Kemampuan Koneksi, Kemampuan Representasi, dan Disposisi Matematis Terhadap Prestasi Belajar Matematika Siswa SMA Swasta di kabupaten Manggarai. *E-journal Program pascasarjana universitas Pendidikan Ganesha Volume 2*.

Samsudi. 2005. *Desain Penelitian Pendidikan*. Semarang: UNNES.

Sudjana. 2002. *Metode Statistika*. Bandung: Tarsito

Sugandi, A. 2004. *Teori Pembelajaran*. Semarang: UPT MK UNNES.

Sugiyono, 2009. *Metode Penelitian Pendidikan pendekatan Kuantitatif, Kualitatif, dan R & D*. Bandung: Alfabeta

Van Den Heuvel-Panhuizen, Marja. 2003. The Didactical Use of Models in Realistic Mathematics Education : An Example From a Longitudinal Trajectory on Percentage. *Educational Studies in Mathematics* 54 : 9 -35

Yazid, A. 2012. Pengembangan Perangkat pembelajaran Matematika Model Kooperatif dengan Strategi TTW (*Think-Talk-Write*) Pada Materi Volume Bangun Ruang Sisi Datar. *Journal of Primary Educational volume 1 No 1 halaman 32 – 37*.

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Cakrawala: Jurnal Pendidikan, 2015
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