SINOMICS JOURNAL
International Journal of Social Science, Education, Communication and Economics
ISSN (e): 2829-7350 | ISSN(p): 2963-9441

The Effectiveness and Practicality of the 3x3 Gauss Jordan Application

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Abstract

The purpose of developing an Android-based Gauss Jordan application is as an alternative in effective and practical Linear Algebra learning. The method for developing this research is R&D (Research and Development) research with the ADDIE development model. Data collection techniques used are material validation sheets and application display; practicality sheet; test sheets (pretest and posttest); and student opinion sheets. The application developed in application design is with figma.com and for software development using visual studio code. Questionnaire instruments and questions on systems of linear equations were given to 22 TI21A4 students in the Linear Algebra course. Based on the data that has been obtained and processed, the score for improving student learning outcomes is 0.71 which is considered effective. The improvement is classified as high and includes effective, and the average score of the practicality assessment is 4.2 which is included in the high category. This application also received a positive response from students who have used it, so the Gauss Jordan 3x3 application is suitable for use in learning and determining solutions to linear equations.

Keywords: ADDIE, Effective, Gauss-Jordan, Linear Equation, Practical

INTRODUCTION

The development of the world of information and technology is currently growing very rapidly. In everyday life, mobile-based technology is very reliable. One of the methods used is the use of smartphones to shorten the time. In the field of education, the use of smartphones is also widely used in the world of education. According to research (Nisa et al., 2020) that the use of smartphones in learning is 66.7% which shows that the use of smartphones during the COVID pandemic is very high.

The use of gadgets for learning is mostly used to find information and look for school assignments. According to (Rosiyanti & Muthmainnah, 2018)there is a significant and significant effect of using gadgets on learning outcomes of basic mathematics. This shows that the variable of mathematics learning outcomes of basic mathematics students is determined by the variable of using gadgets as a learning resource and the rest is determined by other variables. Therefore, learning media is one of the factors that determine the success of learning.

For this reason, it is necessary to use the right for students in using smartphones. The use of learning support applications, such as applications for calculating linear equations in the world of education, is very important. Some of the difficulties experienced by students, including students of Informatics Engineering class 2019 Faculty of Computer Science, Universitas Duta Bangsa Surakarta who take Linear Algebra courses in studying linear equations include: 1) difficulties in understanding concepts and definitions, 2) difficulties in applying a careful and thorough attitude and students in solving contextual problems of a three-variable linear equation system, 3) difficulties in drafting the SPLTV concept, 4) difficulties in solving contextual problems with a three-variable linear equation system using

the elimination and substitution method, 5) difficulties in drawing conclusions about the solution of contextual problems with a system of linear equations three variables (Group, 2017)This linear equation calculation application can solve linear equations with the order of 3x3. Computerized calculations are needed to get results quickly and accurately. In solving linear equations can use the Gauss Jordan method. The Gauss Jordan method is one of the mathematical methods devoted to programming linear equations (Azizah, 2021). This method can determine a linear equation that has one to nine variables.

Based on this analysis, a valid Android-based Gauss Jordan 3x3 application was built. The purpose of the Gauss-Jordan application is to determine the effective and practical solution of linear equation problems. This is in accordance with research (Sumarni, 2021) that misunderstandings, errors in the completion process and errors in drawing conclusions from linear equations system problems using the Gauss Jordan method manually. Based on the results (Fitri & Aprilla, 2021) of the study, it can be concluded that the ability to understand mathematical concepts and mathematical problem solving abilities of junior high school students on SPLDV material is still low, especially in applying it in everyday life. Therefore, we will see how effective and practical the Gauss-Jordan 3x3 application is.

This system of linear equations will be very useful in life and enterprise applications. The application of linear equations in everyday life is used to calculate income over time, calculate interest rates, or predict the profits of a company (Saputra, 2018). In addition, this research will produce a theoretical study and an android-based application.

The purpose of the android-based Gauss Jordan application research is to develop a mobile-based Gauss Jordan application product on a valid, effective, and practical system of linear equations. While the purpose of writing this article is to determine the effectiveness and practicality of the application. Effective is the use of gauss Jordan application can improve student learning outcomes. While practically the application is expected to get a positive response from students.

IMPLEMENTATION METHOD

This research is development research or R&D (Research and Development). Development research is research conducted to produce a particular product and test the effectiveness of that product (Oktaviani & Ayu, 2021). The product produced in this development research is the application of Gauss Jordan of the order of 3x3 to determine the solution of a system of linear equations.

The system development method used in making this software is ADDIE (Rokhim & Rohmah, 2020) which has 5 stages. The stages of the ADDIE development model consist of 1) Analysis which includes smartphone analysis; 2) Design which includes product plans to be developed; 3) Development, namely the development or process of making a Gauss Jordan 3x3 application based on android; 4) Implementation, namely the process of validation and application; 5) evaluation aims to make this Android-based 3x3 Gauss Jordan application feasible to be implemented.

Data collection techniques used are material validation sheets and application display; practicality sheet; test sheets (pretest and posttest); and student opinion sheets (Farida &

ISSN (e): 2829-7350 | ISSN(p): 2963-9441

Indah, 2019). The application design technique used is to use mobile programming with Android Studio to design software applications. Previously, a validation test was carried out on the appearance, practicality tests for lecturers and student opinions on the response from the application of this application. Each validation sheet is given to who are experts in their fields to validate Gauss-Jordan and applications the practicality sheet is given to the lecturer from the student who is the subject study. The data obtained were then analyzed with the following steps:

a. Validation sheet

Validation of application accuracy and application display results from the validator for all aspects assessed are presented in tabular form. Then find the average score using the formula:

$$R = \frac{\sum_{i=1}^{n} V_i}{n}$$

With:

R = the average of the assessment results from the validators

V_i = score of the i-th validator assessment results

n = many validators

Then the means obtained is confirmed with the specified criteria. How to get these criteria is as follows (Yolanda & Hasanah, 2022):

1. Score range from 0 to 4
2. The criteria are divided into five levels. The terms used are adapted to the relevant aspects.
3. The mean range is divided into five class intervals.

b. Observation

1. Observation of the practicality of the application

Observation results are separated according to data groups. To describe the data from the observations used descriptive techniques.

2. Observation of student activities

Observation data was obtained by counting the number of students who carried out activities as contained in the observation sheet. The data were analyzed by the percentage technique stated by (Sinollah & Wahyu, 2020) as follows

Description:

$$N\ Gain = \frac{post\ test\ - pretest}{maximum - pretest}$$

To determine the success rate of student learning activities, (Maskar & Dewi, 2020) provides the following criteria:

Table 1. Classification N Gain category

N Gain skor	Category
$G \geq 0{,}70$	Height increase

$0{,}30 \leq G < 0{,}70$	Moderate improvement
$G < 0{,}70$	Low increase

c. Questionnaire

Data from student responses through a collected questionnaire, then tabulated (Sinollah & Wahyu, 2020). The result of tabulation of each bill is searched for the percentage, with the formula:

$$P = \frac{\sum skor\ per\ item}{skor\ maks} x100\%$$

Based on the percentage results, each bill is categorized on:

Table 2. Practicality Category of Assessment Tool

(%)	Category
0-20	Not practical
21-40	Less practical
41-60	Quite practical
61-80	Practical
81-100	Very practical

d. Interview

Descriptive technique is used to describe the data from interviews with students regarding the practicality of the Gauss Jordan application.

RESULTS AND DISCUSSION

This Gauss Jordan 3x3 application has been applied as a solution for students in studying the system of linear equations in the Linear Algebra course. The instrument used to collect data is a list of student use of smartphones, application validation, material validation, pretest and post-test results, as well as student opinions about the Gauss Jordan application.

Effectiveness data analysis

The effectiveness of the Gauss-Jordan application is assessed from the results of the student opinion sheets as well as changes in the results of the initial and final tests. The results of the students' pretest and posttest are in table 3 below.

Table 3. student score data

pretest		*posttest*	
Total score	average	Total score	average
138	6,3	195	8,9

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The results of the analysis of the significance of increasing student learning outcomes with the following N-Gain formula.

$$N - Gain = \frac{8{,}9 - 6{,}3}{10 - 6{,}3} = 0{,}71$$

The increase in student learning outcomes is 0,71 .and is included in the category of high improvement. A significant increase after the use of the 3x3 gauss-jordan application was effective for TI21A4 students.

The data from the pre-test and post-test results that have been collected are then analyzed for the significance of the increase using the N-gain formula. Through the N-Gain formula, an increase in student learning outcomes was obtained by 0.71 and included in the classification of high improvement. There is a significant increase and the classification of high improvement in students who use the application, it can be said that the 3x3 gauss-jordan application is effective for students. According to the effectiveness research (Merdeka et al., 2022), it can be seen from the results of working on questions manually and with a matrix calculator, it appears that there is an increase in the average value of 3.12 or about 20%. This shows that the use of the application shows a significant difference in learning outcomes. Research (Rodiah & Koswara, 2022) also said that the use of applications or software Learning matrix with computer devices with maxima software version 16.04.2 can help students in solving problems and abstract matrix concepts. With Maxima software, this problem will be easily solved and for manuals students and teachers can use the Gauss-Jordan Elimination Method or OBE and so on. The results of the work provided by the Maxima Program will be the same as the results of manual work. Maxima program can help students understand the concept of inverse matrix material they are looking for.

Practical data analysis

The practicality of the 3x3 gauss-jordan application through observations on the implementation of lectures and the results of interviews with students. The results of the student opinion sheet show that the appearance of the 3x3 gauss-jordan application is attractive and easy to use. The details of working on the questions are also easy for students to understand, every detail of the work has a description of each step, and it is clear to read and understand. This 3x3 gauss-jordan application makes it easy for students to determine the solution of solving a system of linear equations. In addition, based on the collected questionnaires, 58% of results were obtained and included in the practical category.

The practicality of this gauss-jordan application was assessed based on the results of practicality data analysis using the application practicality instrument sheet. Based on the student opinion sheet (practical sheet) it was found that the Gauss-Jordan 3x3 application has a valid working accuracy and an attractive appearance and is easy for students to use. Students stated that this application was interesting because the application was easy to use by converting a system of linear equations into an augmentation matrix. The details of the work are also easy for students to read and understand because they show the details of each step of the work. The existence of the Gauss-Jordan 3x3 application makes it easier for

students to understand the material on systems of linear equations and determine solutions. Students can also learn and determine settlement solutions without being limited by space and time because they can be accessed through their respective Android smartphones. Students agree and agree that the 3x3 gauss-jordan application makes it easier for students to determine solutions to solve systems of linear equations. The conclusion from the data is that the application of gauss-jordan 3x3 is effective and can be used as a tool in learning linear algebra.

Respondents of the practicality of this application are lecturers of linear algebra. Based on the practicality data analysis, 58% of the results were included in the practical category. The research (Kurniawati et al., 2021) also stated that the practicality of the module or application was obtained from the opinions of students. The results of testing the practicality and effectiveness of teaching materials in research (Maskar & Dewi, 2020) shows that the practicality and effectiveness of these teaching materials are included in the good category with a test value of 3.36 for practicality and 72.75 for effectiveness. This means that online-based calculus teaching materials are assisted GeoGebra can be implemented by users as an alternative to calculus-based learning online. According to research (Arends et al., 2017) various teacher classroom practices significantly affect student performance in Mathematics and that these practices should be identified and mechanisms implemented to support teachers in these practices.

CONCLUSION

Based on the results of the research and discussion described above, Based on the data that has been obtained and processed, the score for improving student learning outcomes is 0.71 which is considered effective. The improvement is classified as high and includes effective, and the average score of the practicality assessment is 4.2 which is included in the high category. Based on the results of practitioner testing to test the practicality and effectiveness of the gauss-jordan application, shows that the application belongs to the practical and effective category, in other words the developed application can be implemented as an alternative learning media in linear algebra courses.

ACKNOWLEDGEMENTS

The authors would like to thank Duta Bangsa University, Surakarta, Indonesia for funding this research in the academic year of 2022.

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