# *Data Analysis Techniques for Problem-Based Learning Model Development and Rewarding Elementary Linear Algebra*

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***Abstract***

The problem in this research is how the data analysis techniques are used in developing problem-based learning models and giving elementary linear algebra rewards. The purpose of this study was to describe the results of data analysis in the research conducted. The type of research used is the type of R&D research with qualitative and quantitative methods. The stages of data collection carried out are: Preliminary Phase, Prototyping Phase and Assessment Phase. The Preliminary stage is processed descriptively, by clearly describing the results of the preliminary analysis in the form of needs analysis, curriculum analysis, concept analysis, and student characteristics analysis, each resulting analysis is equipped with conclusions. The prototyping stage uses instrument data that has been given to experts or validators to see the errors and accuracy of the instruments presented in the form of numbers. For the Assessment Phase, validity tests were carried out on the validity of the RPS and SAP instruments, model books, lecturer books, LKM, students' mathematical ability tests, attitude questionnaires and student learning interests. Product reliability tests were carried out on RPS and SAP instruments, model books, lecturer books, LKM, students' mathematical ability tests, attitude questionnaires and student learning interests. The product effectiveness test was obtained from the student's mathematical ability test data, attitude questionnaire and student learning interest questionnaire. Based on the analysis of the data used, it can be concluded that the product validity test results obtained high validity criteria. The results of the practicality test obtained high validity. The results of the effectiveness test are that the problem-based learning model and the provision of rewards can improve students' mathematical abilities and can encourage increased understanding of a concept and solve problems that are legitimate, efficient, and effective.

***Keywords:*** *Data Analysis; Learning Model; Linear Algebra.*

**Abstrak**

Masalah dalam penelitian ini, yaitu bagaimana teknik analisis data yang digunakan dalam pengembangan model pembelajaran berbasis masalah dan pemberian reward aljabar linear elementer. Tujuan penelitian ini adalah untuk mendeskripsikan hasil analisis data dalam penelitian yang dilakukan. Jenis penelitian yang digunakan adalah jenis penelitian R&D dengan metode kualitatif dan kuantitatif. Adapun tahapan pengumpulan data yang dilakukan yaitu: Preliminary Phase, Prototyping Phase dan Assessment Phase. Tahap Preliminary diolah secara deskriptif, dengan menggambarkan secara jelas hasil

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analisis pendahuluan yang berupa analisis kebutuhan, menganalisis kurikulum, analisis konsep, dan analisis karakteristik mahasiswa, setiap analisis yang dihasilkan dilengkapi dengan kesimpulan. Tahap prototyping menggunakan data instumen yang telah diberikan ke ahli atau validator untuk dilihat kesalahan dan ketepatan instrumen yang disajikan dalam bentuk angka. Untuk Asesment Phase dilakukan Uji validitas terhadap instrumen validitas RPS dan SAP, buku model, buku dosen, LKM, tes kemampuan matematis mahasiswa, angket sikap dan minat belajar mahasiswa. Uji reliabilitas produk dilakukan terhadap instrumen RPS dan SAP, buku model, buku dosen, LKM, tes kemampuan matematis mahasiswa, angket sikap dan minat belajar mahasiswa. Uji Efektivitas produk diperoleh dari data tes kemampuan matematis mahasiswa, angket sikap dan angket minat belajar mahasiswa. Berdasarkan analisis data yang digunakan maka dapat disimpulkan Hasil uji validitas produk diperoleh kriteria validitas tinggi. Hasil uji praktikalitas diperoleh validitas tinggi. Hasil uji efektivitas adalah model pembelajaran berasaskan permasalahan dan pemberian reward dapat meningkatkan kemampuan matematis mahasiswa dan dapat mendorong meningkatnya kepahaman suatu konsep dan memecahkan permasalahan yang sah, berdaya guna, dan efektif.

**Kata Kunci:** *Analisis Data; Model Pembelajaran; Aljabar Linear.*

## INTRODUCTION

The research developed in this activity is development research that focuses on problem-based learning models and rewarding. Development research is research that develops a product and tests a theory. According to Gay (1990) development research is an effort or activity to develop an effective product for use in the world of education, and not to test theories. Whereas Borg and Gall (1983:772) define development research as the process used to develop and validate educational products. This development research can be carried out in the field of education, so this study discusses data analysis related to problem-based learning models and rewarding.

The problem-based learning model is a learning concept that can make it easier for lecturers to realize learning conditions based on problems that are appropriate and important for students and allow direct involvement. The problem-based learning process includes students actively, able to work well together, student-centered. This process can independently cultivate learners' skills in solving a problem, this needs to be possessed by learners to face obstacles in real life and in the world of work that increasingly has complex problems. The PBL learning process can be started by carrying out work in groups of fellow

students, and researchers, the process of detecting a problem, then looking for a solution to the problem through the help of instructions from lecturers. The research presented by Lee, Chien I, (2017) his research adopts the Polya method with problem solving to provide students with a basis for diversification for problem solving. Furthermore, students are given direct feedback in the form of hints and help them to find answers on their own so as to help them learn more effectively. Li Hui-Chuan (2012) explained that the PBL process in this study is generally followed by three stages. The preliminary stage is to start the problem. The second stage is to solve the problem through group/discussion paired. The third step is to have a whole class discussion on the matter under investigation. PBL stands under the auspices of social constructivism in a study there are several parts that must be explained according to the type of research carried out.

## RESEARCH METHODS

This type of research adopts the type of research for the development of the Plom model (Plom & Nieveen, 2013) which consists of three phases, namely prelimanary research, phase prototype and phase assessment. The three stages are preliminary research, model design and assessment stages. In addition to the stages of development based on Wayan (2009) there are 4 characteristics of development research that must be considered, including: (1) the problem to be solved is a real problem, (2) The model, approach, media or method developed must support the effectiveness of achieving student competencies, (3) The product development process, validated through expert testing, and limited field trials need to be carried out so that the resulting product is useful for improving quality Learning. And (4) The process of developing models, approaches, modules, methods, and learning media needs to be neatly documented and reported systematically in accordance with research rules that reflect originality. So that the research that will be carried out can really be useful in developing a learning model. The learning model referred to in this study is a learning model that can streamline learner learning.

Data analysis is an important thing to do in quantitative research or development research. The data in this study were analyzed quantitatively and qualitatively. According to Emzir (2009: 28), a quantitative approach is an approach that basically uses postpositivist in developing science (such as related to causation, reduction to variables, hypotheses and specific questions with measurements, observations, and theoretical tests), using research strategies such as surveys and experiments that require statistical data. Meanwhile, Sugiyono (2009: 14) explained that quantitative methods are research methods based on the philosophy of positivism, which is used to examine certain populations or samples, which are generally random sampling, and data collected using research instruments, then analyzed quantitatively / statistically with the aim of testing the hypothesis that has been determined. Creswell (2012: 13), explaining quantitative research requires a researcher to explain how one variable affects another.

## RESULTS AND DISCUSSION

In this activity, there are stages that are passed in order to obtain data related to research instruments. The explanation of the data presented is a way of data analysis carried out through qualitative and quantitative analysis. An overview of the stages of data analysis is presented in the following table;

**Table 1. Data Collection Analysis**

| No | Stages | Analysis | Instrument | Purpose of Data Collection |
|---|---|---|---|---|
| 1 | Pleriminary Phase | Necessity | Lecturer and student interview guidelines | For analsisis the needs of lecturers and students in elementary linear algebra lectures. |
| | | Curriculum | Curriculum documentation study guidelines | For the analysis of the elementary linear algebra curriculum in the RPS and SAP writing guidelines |
| | | Concept | Concept Documentation study guidelines | For concept analysis in accordance with the subject of elementary |

| | | | | |
|---|---|---|---|---|
| | | | | linear algebra |
| | | Student character | Student character questionnaire | For the analysis of student character in elementary linear algebra courses. |
| 2 | Prototyping Phase | Self Evaluationt | RPS and SAP | To check the accuracy and suitability of the RPS and SAP instrument designs. |
| | | | Model books, lecturer books and LKM | To check the accuracy and suitability of the instrument design Model book, lecturer's book and LKM. |
| | | | Mathematical ability test, attitude questionnaire, interest questionnaire | To check the accuracy and suitability of the instrument design Mathematical ability test, attitude questionnaire, interest questionnaire. |
| | | Expert Evaluation | Validation of RPS, SAP, Model books, lecturer books, LKM, Mathematical ability tests, attitude questionnaires, and interest questionnaires | To check the validity of rps instrument design, SAP, model book, lecturer book, LKM, Mathematical ability test, attitude questionnaire, and interest questionnaire |
| | | | RPS, SAP, Model books, lecturer books, LKM, Mathematical ability tests, attitude questionnaires, | To see the reliable value of rps instrument design, SAP, model books, lecturer books, LKM, mathematical ability tests, attitude questionnaires, and interest questionnaires |

| | | | | |
|---|---|---|---|---|
| | | | and interest questionnaires | |
| | | | RPS, SAP, Model books, lecturer books, LKM, Mathematical ability tests, attitude questionnaires, and interest questionnaires | To see the ICC value of RPS instruments, SAP, Model books, lecturer books, LKM, Mathematical ability tests, attitude questionnaires, and interest questionnaires |
| 3 | Assessment Phase | Praktikalitas | Mathematical ability test, attitude questionnaire, interest questionnaire | To know the level of practicality of the product |
| | | Different test | Mathematical ability tests | To know the mathematical abilities of students |
| | | | Attitude questionnaire, interest questionnaire | Reward. To find out the interests and attitudes of students before and after using problem-based learning models and rewarding. |

Data analysis from this study will be described as follows.

1. **Preliminary Phase Data Analysis**

Preliminary phase data analysis is processed descriptively, by clearly describing the results of the preliminary analysis in the form of needs analysis, analyzing the curriculum, analyzing concepts, and anlyzing student characteristics, each analysis produced is equipped with conclusions, the conclusions obtained will be used as revision material to improve or revise product instruments (model books, lecturer books and LKM).

**2. Phase Prototyping Data Analysis**

Data analysis of the prototyping stage uses instrumental data that has been given to an expert or validator to see the error and accuracy of the instrument presented in the form of numbers. The figures obtained will be processed to obtain the validity value, reliability and level of trust of the validator to the instrument that has been made. Instruments that have been revised according to validator suggestions will be a tool in looking at research objectives for the next stage.

**3. Phase Assessment Data Analysis**

**a. Validity Test**

Validity tests carried out on RPS and SAP validity instruments, model books, lecturer books, LKM, student mathematical ability tests, questionnaires of student attitudes and interest in learning. Validity tests are analyzed to obtain the validity value of each instrument that has been designed. Before the learning product is used, first validate the validity sheet. To see the implementation of problem-based learning models and the provision of rewards, practicality tests are carried out. Practicality testing of this development model includes the implementation of problem-based learning models and rewarding, the practicality of elementary linear algebraic models.

Validity and practicality data were analyzed using the Kappa Cohen Moment, which is expressed by the Kappa Moment (κ) as follows;

$\kappa = (\rho_0 - \rho_e / (1 - \rho_e)$

information:

$\kappa$ = The kappa moment indicates the validity and pakticality of the product.

$\rho_0$ = The realized proportion, calculated by means of the number of values given validators divided by the maximum amount.

$\rho_e$ = Unrealized proportions, calculated by means of the number of maximum values reduced by the number of total values given by validators divided by the maximum amount.

Decision making on the value of data analysis of the validity and practicality of the product can be categorized according to the following table coefficients;

**Table 2. Categories of Validity and Practicality by Kappa Moment**

| No. | Interal | Category |
|---|---|---|
| 1 | 0,81 — 1,00 | Very High |
| 2 | 0,61 — 0,80 | High |
| 3 | 0,41 — 0,60 | Medium |
| 4 | 0,21 — 0,40 | low |
| 5 | 0,01 — 0,20 | very low |
| 6 | < 0,00 | less |

Source: Boslaug (2008)

**b. Product Reliability Test**

Product reliability tests are carried out on RPS and SAP instruments, model books, lecturer books, LKM, student mathematical ability tests, questionnaires of student attitudes and interest in learning. Reliability tests were analyzed using the SPPS 22 program to obtain reliability for the instruments that have been designed.

**c. Product Intracclass Correlationt Coefficient (ICC) Test**

Product ICC tests are carried out on RPS and SAP instruments, model books, lecturer books, LKM, student mathematical ability tests, questionnaires of student attitudes and interest in learning. Intra-class correlation test or ICC was analyzed using the SPPS 22 program to gain the confidence of all validators or experts in the instruments that had been designed.

**d. Product Effectiveness Test**

The effectiveness of the product is obtained from data on student mathematical ability tests, attitude questionnaires and student learning interest questionnaires. Data on student activity in the learning process were analyzed using the percentage formula from ridwan (2011: 89), namely:

$$P = \frac{\Sigma \text{ score}}{\Sigma \text{ ideal score}} \text{ x } 100\ \%.$$

To find out the level of effectiveness of a product, you can see the interpretation of assessment data from Riduan (2015: 89), namely:

**Table 3. Riduan Effectiveness Test Criteria (2015: 89)**

| No. | Range of Percentage | Level of Effectiveness |
|---|---|---|
| 1 | 0-20 | Ineffective |
| 2 | 21-40 | Less Effective |
| 3 | 41-60 | Quite Effective |
| 4 | 61 – 80 | Effective |
| 5 | 81-100 | Very Effective |

Experimental data were obtained from field tests through the stages of testing the effectiveness of the product. The effectiveness data measured are in the form of tests and non-tests. The test instruments are divided at the ability stage, namely the test instruments for the ability to understand mathematical concepts and the ability to solve mathematical problems, while the non-tests measured are in the form of student attitudes and interest in learning.

**1. Student Mathematical Ability Test**

Mathematical ability data is obtained by giving tests to students of IAIN Padangsidimpuan, before the test is carried out, the test questions are first tested and then analyzed the validity of the question items, the level of difficulty, differentiability, reliability, so that question items are obtained that can really be used to measure students' mathematical abilities.

**a) The Validity Of The Question Item**

The validity of the question item is a tool to measure the accuracy, truth or validity/reliability of the question item. The validity of the question items can be calculated using the SPSS sofwer and the manual calculation of product moment correlation by Pearson as follows:

$$r_{XY} = \frac{N\sum XY - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left\{N\sum X^2 - \left(\sum X\right)^2\right\} \times \left\{N\sum Y^2 - \left(\sum Y\right)^2\right\}}}$$

Where:

$r_{XY}$ = Correlation coefficient between item score and total score

X = item score

Y = total score

N = Large of students

Matching the validity coefficient of the test with the modified benchmark criteria of Guilford (in Rusefendi, 198a:144) as follows:

0,80 < R < 1,00 (Very High Validity )

0,60 < R < 0,80 (High Validity)

0,40 < R < 0,60 (Sufficient Validity)

0,20 < R < 0,40 (Low Validity )

0,00 < R < 0,20 (Very Low Validity)

The results of the trial calculation Validity of 10 points of concept understanding questions, which were given to 32 students outside the sample with a significant 5%, obtained $r_{table}$ = 0.361 will be presented in the following table:

**Table 4. Validity of Items about the Results of the Concept Understanding Trial**

| Number of Question | $R_{xy}$ | $r_{table}$ | Interpretation of Validity |
|---|---|---|---|
| 1 | 0,617 | 0,361 | Valid |
| 2 | 0,615 | 0,361 | Valid |
| 3 | 0,649 | 0,361 | Valid |
| 4 | 0,770 | 0,361 | Valid |
| 5 | 0,779 | 0,361 | Valid |
| 6 | 0,656 | 0,361 | Valid |
| 7 | 0,703 | 0,361 | Valid |
| 8 | 0, 652 | 0,361 | Valid |
| 9 | 0, 703 | 0,61 | Valid |
| 10 | 0, 649 | 0,361 | Valid |

For the Validity Trial, problem solving was given 5 questions in 32 students with a significant 5%, obtained $r_{table}$ = 0.361 will be presented in the following table:

**Table 5. Validity of Problem Solving Trial Results**

| Number of Question | $R_{xy}$ | $r_{table}$ | Interpretation of Validity |
|---|---|---|---|
| 1 | 0,771 | 0,361 | Valid |
| 2 | 0,651 | 0,361 | Valid |
| 3 | 0,618 | 0,361 | Valid |
| 4 | 0,778 | 0,361 | Valid |
| 5 | 0,619 | 0,361 | Valid |

**b) Realibility Test**

Reliability is a series of measurements or a series of measuring instruments that have consistency if the measurements made with the measuring instrument are carried out repeatedly. A measuring instrument is said to have high reliability if the instrument provides consistent measurement results or provisions. To test the reliability of the test the form of description is as follows:

Determining the reliability coefficient of the test using Crobacch's Alpha formula.

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum \sigma_i^{\,2}}{\sigma_t^{\,2}}\right)$$

Information:

$r_{11}$ = Reliability that in search

n = Lots of test items

$\sum \sigma_i^{\,2}$ = The number of variances of each grain

$\sigma_t^{\,2}$ = total variance

Total variance : $\sigma_t^{\,2} = \dfrac{N\sum Y^2 - \left(\sum Y\right)^2}{N(N-1)}$

Variance each of the question items: $\sigma_i^2 = \dfrac{N\sum X^2 - \left(\sum X\right)^2}{N(N-1)}$

Information:

N = Large number of samples

$\sum Y$ = Total number of score items

Determining the $t_{count}$ by substituting $r_{11}$ to the formula:

$$t_{count} = r_{11}\sqrt{\frac{N-2}{1-r_{11}^2}}$$ (Sudjana, 1992:380)

Determining the significance of the test reliability coefficient is a criterion that must be met so that the test reliability coefficient is significant with the condition that if $t_{count} > t_{table}$ with $t_{table} = t(1-\alpha)(dk)$ for $\alpha$ is the level of significance and dk = N-2.

Matching the reliability coefficient of the test with the modified benchmark criteria of Guilford (in Rusefendi, 198a:144) as follows:

| | |
|---|---|
| $r_{11} \leq 0{,}20$ | reliability : very low |
| $0{,}20 < r_{11} \leq 0{,}40$ | reliability : low |
| $0{,}40 < r_{11} \leq 0{,}70$ | reliability : medium |
| $0{,}70 < r_{11} \leq 0{,}90$ | reliability : high |
| $0{,}90 < r_{11} \leq 1{,}00$ | reliability : very high |

**Table 6. SPSS Output Reliability Test Concept Understanding Test**

| Cronbach's Alpha | N of Items | Conclusion |
|---|---|---|
| .871 | 10 | Reliable |

**Table 7. SPSS Output Test Reliability Test Troubleshooting**

| Cronbach's Alpha | N of Items | Conclusion |
|---|---|---|
| .714 | 5 | reliable |

The results of the calculation of the reliability of the test for understanding concepts using SPSS 22 of 0.871 and problem solving of 0.714 showed that the reliability value of the question item was classified as very high and high.

**c). The Differentiating Power of The Question Item**

The differentiating power of the question is the ability of a question item to distinguish between student learning residents who have mastered the material being asked and student learning residents who do not / less / have not mastered the material being asked. According to Sudijono (2008) The differentiator of the question item depends on the size of the discrimination index value. In this connection, if a question item has a discrimination index number with a positive sign ($D > 0$), then it can be said that the question item already has differentiating power and can be interpreted as the upper value group that answers a lot more correctly when compared to the lower group that did not answer correctly. Arikunto explained that if a question item has $D = 0$, so it can be said that the item of the question already has a differentiating power and can be interpreted as the upper value group that answers a lot more correctly when compared to the lower group that does not answer correctly. Arikunto explained that if a question item has $D = 0$, then it shows that the question item has no differentiating power at all. This means that the number of Upper group trainees who answered correctly is equal to the number of Lower group trainees who answered correctly. So the question item cannot distinguish the abilities of the two groups of trainees.

The differentiating power is used formula (Arikunto, 2009) namely:

$$DP = \frac{meanKA - meanKB}{skor \max}$$

Information:

DP = Differentiation

Mean KA = the average score of the upper group on the processed question item

Mean KB = the average score of the lower group on the processed question item

Max score = maximum score (highest score)

The criteria for the level of differentiating power according to (Arikunto: 2006) are as follows:

| | | |
|---|---|---|
| Negatif | - 9% | very bad |
| 10% | - 19% | bad |
| 20% | - 29% | enough |
| 30% | - 49% | good |
| 50% | - to the top | very good |

The results of the calculation of the differentiating power of the items regarding the ability to understand mathematical concepts are as follows:

**Table 8. Results of Calculating the Different Power of Concept Understanding Test Items**

| Question | Power index Difference Problem | Interpretation |
|---|---|---|
| question 1 | 0,23 | enough |
| question 2 | 0.27 | enough |
| question 3 | 0.25 | enough |
| question 4 | 0.41 | good |
| question 5 | 0.34 | enough |
| question 6 | 0.27 | enough |
| question 7 | 0.31 | enough |
| question 8 | 0.26 | enough |
| question 9 | 0.32 | enough |
| question 10 | 0.33 | enough |

The results of the calculation of the distinguishing power of the questions from the trial of the concept understanding instrument obtained the conclusion that 9 categories are sufficient and 1 category question is good.

**Table 9. Calculation Results of Different Power of Troubleshooting Test Items**

| Power Index Difference Question | | Interpretation |
|---|---|---|
| question 1 | 0.25 | enough |
| question 2 | 0.33 | enough |
| question 3 | 0.22 | enough |
| question 4 | 0.22 | enough |
| question 5 | 0.25 | enough |

The results of the calculation of the differentiating power of the problem-solving trial results obtained the conclusion that 5 questions were categorized as enough.

**d). Difficulty Level of Question Items**

Analyzing the difficulty of the questions means reviewing the test questions in terms of difficulty so that questions can be obtained which are easy, medium and difficult. Azis (2016:18) mentioned that the level of difficulty is how easy or difficult a question item is for a group of students. In general, it can be said that the level of difficulty is the level of ease or not of a question given to a group of students. According to (Arikunto: 2009) The way to conduct an analysis to determine the level of difficulty of the problem is to use the following formula:

Information:

TK = Difficulty Level

$S_A$ = The number of scores students achieved in the upper group

$S_B$ = The number of scores students achieved in the lower group

N = Number of students in the upper group and the lower group

The results of the calculation of the difficulty level are interpreted using the criteria for the difficulty index of the question item (Arikunto, 2009) as follows:

TK = 0,00 too difficult (TS)

0,00 < TK < 0,30 difficult (SK)

0,30 < TK < 0,70 medium (SD)

0,70 < TK < 1,00 easy (MD)

TK = 1,00 too easy (TM)

The result of calculating the difficulty level of the question item,

**Table 10. Results of Calculating the Difficulty Level of Concept Understanding Test Items**

| Problem Difficulty Level Index | | Interpretation |
|---|---|---|
| question 1 | 0.59 | medium |
| question 2 | 0.65 | medium |
| question 3 | 0.63 | medium |
| question 4 | 0.66 | medium |
| question 5 | 0.66 | medium |
| question 6 | 0.65 | medium |
| question 7 | 0.64 | medium |
| question 8 | 0.67 | medium |
| question 9 | 0.68 | medium |
| question 10 | 0.71 | easy |

The results of the calculation of the level of difficulty in understanding the concept were obtained 9 questions with the interpretation of medium questions ranging in values 0.59 — 0.68 and 1 question with easy question interpretations ranging in value from 0.70.

**Table 11. Results of Calculating the Difficulty Level of Solving Test Items**

| Problem difficulty level index | | Interpretation |
|---|---|---|
| question 1 | 0.59 | medium |
| question 2 | 0.66 | medium |
| question 3 | 0.65 | medium |
| question 4 | 0.50 | medium |
| question 5 | 0.60 | medium |

The result of calculating the difficulty level of the problem Solving questions obtained 5 questions with the interpretation of medium questions ranging in value from 0.59 to 060

**2) Data Analysis of Student Learning Interest Questionnaire**

The data from the questionnaire results are non-test- to measure the learning interest of experimental class students with the control class. The questionnaire was given to 32 students using a liket scale of 1-5, with details of 5 strongly agreed, 4 agreed, 3 hesitated, 2 disagreed, 1 strongly disagreed, Statistical testing was first carried out testing the requirements of analysis using the SPSS 22 sofwer, then for hypothesis testing, the formulation of the statistical hypothesis of his research, namely:

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 > \mu_2$

Before the statistical test was carried out, the validity of the questionnaire item was checked and seen reliably using the help of the SPSS 22 sopwer, among others;

a. Validity of Items Questionnaire Interest Items in Learning Elementary Linear Algebra

**Table 12. validity of questionare interest items**

| Item | $r_{count}$ | $r_{table}$ | Interpretation | Item | $r_{count}$ | $r_{table}$ | Interpretation |
|---|---|---|---|---|---|---|---|
| 1 | 0,495 | 0,361 | Valid | 13 | 0,686 | 0,361 | Valid |
| 2 | 0,583 | 0,361 | Valid | 14 | 0,897 | 0,361 | Valid |
| 3 | 0,748 | 0,361 | Valid | 15 | 0,596 | 0,361 | Valid |
| 4 | 0,490 | 0,361 | Valid | 16 | 0,577 | 0,361 | Valid |
| 5 | 0,844 | 0,361 | Valid | 17 | 0,514 | 0,361 | Valid |
| 6 | 0,540 | 0,361 | Valid | 18 | 0,797 | 0,361 | Valid |
| 7 | 0,683 | 0,361 | Valid | 19 | 0,471 | 0,361 | Valid |
| 8 | 0,620 | 0,361 | Valid | 20 | 0,698 | 0,361 | Valid |
| 9 | 0,753 | 0,361 | Valid | 21 | 0,728 | 0,361 | Valid |
| 10 | 0,776 | 0,361 | Valid | 22 | 0,785 | 0,361 | Valid |
| 11 | 0,486 | 0,361 | Valid | 23 | 0,609 | 0,361 | Valid |
| 12 | 0,682 | 0,361 | Valid | 24 | 0,617 | 0,361 | Valid |

The results of the validity of 24 items of interest questionnaires tested on 32 students with a significant value of 5% obtained a table r value of 0.361 when compared to the r-count obtained, the value of r -count is greater than the value of r -table, according to the correlation

product moment the item of the questionnaire item is declared valid and can be used, to check the value of the level of reliability of the interest questionnaire can be seen by looking for the reliability value.

b. Reliability of Interest Questionnaires

The results of the calculation of the reliability of the interest questionnaire obtained a value of 0.937 showed that the level of trust in the attitude questionnaire item was relatively high.

**Table 13. Results of calculating the reliability of the Student Learning Interest Questionnaire**

| Cronbach'sAlpha | Nof Items | Interpretation |
|---|---|---|
| 0.937 | 24 | reliable |

**3). Data Analysis of Student Learning Attitude Questionnaire**

The data from the student learning attitude questionnaire are comparing the experimental class with the control class. Statistical tests were carried out to test the requirements of the analysis using the SPSS 22 sofwer, then for hypothesis testing, the formulation of statistical hypotheses of his research, namely:

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 > \mu_2$

Before conducting statistical tests, it is necessary to check the validity of the items of the attitude questionnaire item and look at the reliability using the help of the SPSS 22 software, among others;

a. Validity of Attitude Questionnaire Item

**Table 14. Validity of Student Learning Attitude Questionnaire Items**

| Items | $r_{count}$ | $r_{table}$ | Interpretation | Items | $r_{count}$ | $r_{table}$ | Interpretation |
|---|---|---|---|---|---|---|---|
| 1 | 0,453 | 0.361 | Valid | 6 | 0,451 | 0, 361 | Valid |
| 2 | 0, 506 | 0.361 | Valid | 7 | 0,561 | 0, 361 | Valid |
| 3 | 0, 599 | 0.361 | Valid | 8 | 0,552 | 0, 361 | Valid |
| 4 | 0, 605 | 0.361 | Valid | 9 | 0,555 | 0, 361 | Valid |
| 5 | 0, 568 | 0.361 | Valid | 10 | 0,456 | 0,361 | Valid |

The results of the validity of 10 items of attitude questionnaires tested on 32 students with a significant value of 5% obtained a rtabel value of 0.361 when compared to the r-count obtained, the r-count value was greater than the r-table value, according to the correlation produc moment the questionnaire item item was declared valid and could be used, to check the value of the level of reliability of the attitude questionnaire can be seen by looking for the reliability value.

b. Reliability of Student Learning Attitude Questionnaire

**Table 15. Results Calculation Reability of Attitude Questionnaire**

| Cronbach's Alpha | No Items | Interpretation |
|---|---|---|
| 0.711 | 10 | reliable |

The results of the calculation of the reliability of the attitude questionnaire obtained a value of 0.711 showed that the level of trust in the attitude questionnaire item was very high. The effectiveness test is carried out to see how much the reliability value of the use of the product developed in each instrument used, in this study examines the value of the benefits of developing problem-based learning models and providing rewards in improving students' mathematical abilities, improving attitudes and interests, for this reason, the following will be described the relationship between problems, hypotheses and hypothesis tests used;

**Table 16. Linkage of Problems, Hypotheses and Statistical Tests of Research**

| No | Researcher Problem | Hypothesis |
|---|---|---|
| 1 | Is the improvement of students' mathematical abilities through the use of problem-based learning models and rewarding higher than those who obtain conventional learning? | The improvement of students' mathematical abilities through the use of problem-based learning models and the provision of higher rewad than conventional learning. |
| 2 | Is the increase in interest in, and attitudes, learning mathematics of students who through the use of learning models are higher than those who acquire conventional learning? | Increased interest and attitude, learning student mathematics through the use of problem-based learning models and giving higher rewards than conventional learning |

The test results and non-tests carried out in the field test will first be carried out a requirement test, namely the normality test, the normality test is also called the Chi-square (chi-square) test Ruseffendi (1998: 294). Can also use the SPSS 22 software with kolmogrov smirnov and shaphiro wilk test. If the data is not normally distributed, a non-parametric wilxcolon test will be carried out, then the data homogeneity test is analyzed using a homogeneous test through a variance test;

$$F = \frac{S^2 big}{S^2 small}$$

(Russefendi : 1998)

F = variance homogeneity

$S^2$ big = big variance

$S^2$ small = small variance

Where the test criteria are, to a real degree of alpha significance, the sample variable is said to be homogeneous if $Fmak < Ftab$, with $Ftable = (1 - \alpha)\, Fk, n - 1$ (Sudjana, 2002), the homogeneity test can also be sought through the SPSS 22 sofwer with the Levene test.

## CONCLUSION

Based on the results of the above exposure, it can be concluded that the data analysis obtained in this research is Preliminary Phase, Prototyping Phase and Assessment Phase data. The Preliminary stage is processed descriptively, by clearly describing the results of the preliminary analysis. The prototyping stage uses instrumental data that has been given to an expert or validator to see the error and accuracy of the instrument presented in the form of numbers. For the Phase Assessment, a validity test of the instrument is carried out. Product reliability tests are carried out on RPS and SAP instruments, model books, lecturer books, LKM, student mathematical ability tests, questionnaires of student attitudes and interest in learning. The results of the product validity test obtained high validity criteria. The results of the practicality test obtained high validity. The results of the effectiveness test are problem-based learning models and the provision of rewards

can improve students' mathematical abilities and can encourage increased understanding of a concept and solve problems that are legitimate, effective, and effective.

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