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LEARNING VECTOR ANALYSIS WITH *COMPUTER ALGEBRAIC SYSTEM* (CAS) USING *SCILAB* AT THE MUHAMMADIYAH UNIVERSITY OF JEMBER

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Abstract

The ability to solve problems is the heart of mathematics, visualization is the core of mathematical problem solving. Visualization is the ability to see and understand the situation of the problem. Basically, students in need of interesting and innovative learning, therefore this research tries to makes learning interesting and innovative with the linking of learning with learning model analysis Vector Computer Algebraic System (CAS) using Scilab programming. Learning aims to maximize learning student. This course is given to Mathematics Education at the University of Muhammadiyah Jember sixth semester. This research is a development research, because in this study developed a learning tool Vector Analysis learning model Computer Algebraic System (CAS) using scilab. The results of us researches show that VIA semester students of the University of Muhammadiyah Jember able to receive learning vector analysis to go through three stages, namely CAS surprises, clarifications, and investigation by a computerized scilab program. While the results of the validation of SAP including both categories, validation modules included both categories, results of the validation test is good category, which means that learning is said to be effective, it shows that learning device Analysis Vectors learning model CAS using the program scilab can be categorized as a good device.

Keywords: *CAS (Computer Algebraic System), Scilab, Vector Analysis*

I. Introduction

Vector Analysis courses given in Mathematics Education Faculty of Teacher Training and Education University of muhammadiyah Jember in even semester. The method used in the analysis of learning is more likely vector for the centered learning. In addition a large part of vector analysis considers subjects including subjects that difficult, so it is certainly a bad impact on student learning outcomes.

The learning model to overcome this problem is a link between knowledge of mathematics and computer technology empowerment. One model that uses learning using computer tools is the Computer Algebra sistems (CAS).

Computer Algebra sistems (CAS) is a system that uses software that can perform numeric and symbolic calculations in accordance with the rules on covering mathematics such as algebra number theory, calculus, polynomial function, and others. The researchers hope that learning using CAS models can improve analytical skills of the students because of this learning model focuses on early learning in college and never applied in Algebra.

II. Method

Research question

Based on the background, the formulation of research questions in the study is "How's the development of learning tools Vector Analysis using Computer Algebra sistems (CAS) using scilab in Mathematics Education Faculty of Teacher Training and Education UNMUH Jember?"

Research purposes

The purpose of this study was to "describe the results of the development of learning tools Vector Analysis using Computer Algebra sistems (CAS) using scilab in UNMUH Jember ".

Term Limits

This study focused on the limits i stilah the following, among others:

1. Computer Algebraic System (CAS) is a software that will be used in study of vector analysis specifically for vector algebra problems.
2. Learning directly (direct interaction) is a learning model that will be used researchers to explain a concept or skill to students and test the skills of the students through exercises under the guidance and direction of lecturer.
3. The development of learning tools is the process of making the learning device according deng's theory of the development of the device.

Understanding Teaching and Learning

Fontana (in Suherman, 2001: 8) argues that learning is a process of changing the behavior of individuals who are relatively fixed as a result of the experience. While learning is an effort to organize the neighborhood to give the feel that the program learns to grow and develop optimally.

Learning Direct

Direct Instruction or directive instruction in Indonesian known as direct instruction. There are five (5) steps in a direct learning, namely:

a. Introduction (introduction);
b. Presentation (presentation);
c. Practice guidance (guided practice);
d. Practice free (independent practice); and

e. Special Review (special review).

Model Learning CAS (Computer Algebraic System)

Computer Algebraic Systems (CAS) is a learning system directly using the software, the learning model CAS can perform calculations in numeric and symbolic in accordance with the rules on mathematics like algebra that includes number theory, calculus, functions polynomial, and others. CAS developed by Joel Hillel when programming the computer started introducing the symbols used in mathematics.

Scilab

Scilab is a programming language (high-performance) for high performance technical computing problems. Scilab integrates computation, visualization, and programming in a model that is very easy to use where problems and solutions are expressed in mathematical notation frequently used.

Type and Research Approach

Based on the statement on the background research and the formulation of research questions that have been described previously, this research is categorized as research and development, because in this study developed a learning tool using model CAS (Computer Algebraic System).

Research procedure

The procedures in this study were as follows:

a. Preparation phase
b. The implementation stage
c. The data collection phase
d. Data analysis stage
e. Report writing stage

The step learning model research with CAS comprising there are Surprises, Clarifications and Investigation can be explained as follows:

Surprises

At this stage begins with the definition of a vector A computer and see success in performing the operations of addition, subtraction, multiplication, and

division of vector. This activity is one of a set of activities that have CAS main goal is to make learning more interesting.

Clarifications

Activities at this stage is clarification (explaining, outlines). One example solve the matter with the operating vector dot product and cross product in scilab software. All students are asked to use the CAS application using scilab software for it, and begin by completing the operation dot product and cross product vector. At this stage lecturers provide an explanation regarding the logic that should be used to run the operation.

Stage Examination (Investigation)

The purpose of this activity is an investigation (examination). This activity is a learning process advanced vector analysis, for example, assign students to work in eigenspace The same vector.

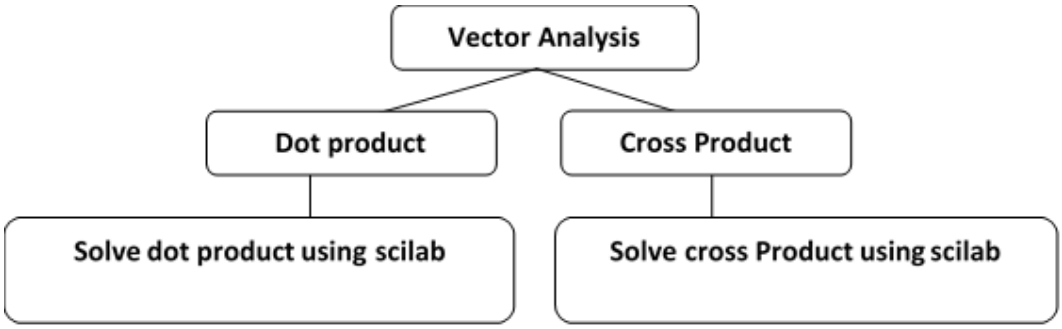
III. Discussion

Software development process consists of four stages, but were conducted in this study only focused on three stages, namely: 1) the definition phase; 2) the design stage; 3) the development stage of the device.

Phase Description Definition (Define)

Phase definition (define) aims to determine the underlying problems that need to be addressed in the development of learning tools.

a) Preliminary Analysis of the End: The activities include observation and discussion with the lecturer Vector Analysis 2012 UNMUH Jember forces obtained information that the learning is done conventionally.
b) Material analysis. The results of the analysis of material Vector Analysis can be seen in the following figure:



Gambar 1: Material of vector Analysis

c) Task analysis

Based on the analysis of the material as well as indicators of success that has been set in the curriculum, then conducted the analysis tasks. Analysis of the task to formulate the expected skill, namely:

a. Analyze problems dot product manually,
b. Resolving problems using scilab dot produt,
c. Comparing analytics solution using manually and using scilab program.
d. Specifications Learning Objectives

Formulation of learning objectives as a reference in designing a learning device, such as units of lecture events (SAP), module, and test course on Vector Analysis. In detail, according to the standard learning objectives and basic competencies presented below.

Competency standards: Students are able to understand the vector and scalar; Inter-vector multiplication; Differentiation vector functions; Gradient, divergent and curl; Integration of the vector; Integral transformation; and coordinates KurIVlinear. As well as mastering the concepts of vector and can use it to help own problems in various fields, both in mathematics, other sciences and the problems of everyday life.

Basic competencies : Perform multiplication on a vector

Indicator : College student Able to master and solve problems relating to Perform -soal multiplication of the vector.

Description Stage Design (Design)

Based on the results of the definition of the problems found in Mathematics Education Prodi FKIP UNMUH Jember in learning Vector Analysis, researchers began doing the preliminary design of learning tools that will be used in carrying out the research study Vector Analysis with Computer Algebra learning model Sistems (CAS). The initial design is done to design a learning device that involves students and faculty activities, ranging from the preparation of the test, models, methods to be used in preparing a learning tool. The device in question in the form of event lecture units (SAP), module, and test . In general the results of the initial design is as follows.

Events Unit Class (SAP)

Lesson plan developed consists of two materials for the two meetings. Allocation of time spent on each SAP is 2 × 120 minutes for each meeting.

Module

The module is a student guide arranged to facilitate students in conducting the investigation or problem solving.

Test

Test is a device used to determine student results after participating in learning and to measure the student's ability.

Description Development Phase (Develop)

The result of this research is the study of mathematics according to the standard of competence Students are able to explain the role of Vector Analysis in the field of mathematics. Basic competence to be achieved are Doing the multiplication of the vector. Indicators of success in this study is most students may

be able to master and solve problems relating to Perform -soal multiplication of the **vector.**

Results Validation Learning Tool

Learning tools that have been created by researchers validated by three (four) the validator. Each validator validates learning device consisting of Events Unit Class (SAP), module, and test . Validation results are then analyzed by looking at the average of each category to obtain valid devices. The results of the validation of SAP, module, and Test are described as follows:

The results of SAP validation

The results of the SAP validation including both categories. The average grade given by the validator to the category of format, language and content. From the above it can be concluded that the format of SAP were both categories, languages that are in either category, and the contents are in the very good category. Overall SAP are in either category, so that the learning can be valid and fit for use.

Results of Module Validation

The results of the module validation include both categories. The average grade given by the validator to the category of format, language and content

The results of the validation test

The results of the validation test including both categories. The average grade given by validator to content categories, language and writing about and conclusions.

From the above data it can be concluded that the format Quis were both categories, languages that are in either category, and the contents are in both categories. Overall SAP are in either category, so that the learning can be valid and fit for use.

Reliability Test Results

Reability test conducted before the pilot activities. The readability test to find out which devices have been created and revised based on feedback from the validator can be read clearly and be understood by the students. The device being tested Test. Legibility test was conducted on 6 students consisting of two high-ability students, two students capable of being, and two low-ability students.

Test results showed that the learning device clearly legible and understandable to students. Revision of the results of the test that is readability; Test that have been made should not be too difficult.

Test Development Kit

The trial phase of this development is implemented in class forces VIA Mathematics Education FKIP UNMUH Jember. The trial devices starting with the implementation of the pre-test. Then continued implementation of the SAP 1, 2 and giving Module. After the implementation of SAP to -2 given posttest .. Further analysis of the results of pretest and posttest to acquire validity, reliability and sensitivity in order to obtain a good learning tool.

The trial phase of this development is presented based on the results of the pretest, observation lecturer activities, observation of student activities, posttest, analysis items, and analysis of student responses. The trial results under development are:

Pre Test

Pretest carried out during the development stage in Class VIA force on 25 students.

Analysis of Observations Student Activity

The calculation result reliability coefficient of student activity observation sheet during the learning is said to be effective. The observation of student activity

in any implementing an SAP can be said to be effective**.** This is because the percentage of time spent on the activity of the students in conducting every aspect observed in each unit of event unit class is the percentage of time the ideal contained in SAP with a tolerance of 10%. In general, student activities can be categorized either so according to defined criteria , an effective instrument of this activity and can be used.

Post test

Post test carried out during the development stage in Class VIA force on 25 students.

Validity test

The results of the analysis of the validity of test items students will be presented in table below.

Table 1 **Results Validation Test Item Problem**

ITEM PROBLEM	validity coefficients	Interpretation
1a	0.64	High
1b	0.60	High
2a	0.64	High
2b	0.81	Very high
3a	0.72	High
3b	0.82	Very high
4a	0.60	High
4b	0.65	High
4c	0:59	moderate

Question 2b and 3b has a validity test very high, being about numbers 1a, 1b, 2a, 3a, 4a, and 4b have high test validity, and about 4c has a moderate value validity. Based on the test results, items already included categories valid for the product moment correlation coefficient is in the interval $0.40 < r_{xy} \leq 1.00$.

Test Reliability

The results of the analysis of reliability test items students will be presented in table 4.8 below.

Table 2 Reliability Test Results Item Problem

items	Varian per item	Varian total	The coefficient of reliability	reliability
1a	5:10	322.62	0.77	High
1b	12:05			
2a	13:58			
2b	4:07			
3a	10:12			
3b	2.60			
4a	27.25			
4b	10.95			
4c	15:43			

The test results can already said to be reliable because its High category or have a reliable criterion of $0.60 < r_{11} \leq 0.80$. Value $r \geq 0.60$

Sensitivity test

The results of the sensitivity test analysis test items students obtained that test (Quis can be said that the items in this study may be called sensitive towards learning, as included in the category of value ≥ 0.30.

Analysis of Student Response

Asiswa mah response data obtained through a questionnaire. The response is positive if the answer student student is greater than or equal to 75%. The results of the analysis of student responses showed positive results. Average Respo n positive students towards learning vector analysisusing direct learning model with scilab program is above 75%. The response of students to learning by showing a good response.

Based on the observation of the activities of lecturers with excellent category is said to be effective means of learning, observation of student activities with effective category, posttest, analysis items with categories including categories reliable so high, and student response analysis showed a good response, it can be known that the tools discrete mathematics can be considered a good device.

IV. Conclusion

Based on the discussion of the learning device exposure can be concluded that the development process of the device includes:

1. definition phase
2. Stage Design Tool
3. Device Development Phase

While the results were analyzed descriptively device development. Data from the study and discussion of the discussion of the results showed that the learning device Vector Analysis with Computer Algebra Learning model sistems (CAS) met both criteria. It can be seen from:

1. The results of the validation study by experts and practitioners meet tance pen in both categories and fit for use. Validation of TNI learning device consists of SA P, module, and test .
2. Learning Keterlakasanaan Vector Analysis with Computer Algebra learning model sistems (CAS) showed good results. lecturers have done different stages of learning in accordance with the syntax in the Events Unit Class (SAP).
3. Activities of students in learning activities with learning model Vector Analysis Computer Algebra sistems (CAS) is generally effective.
4. Test results in the learning of Vector Analysis with Computer Algebra learning model sistems (CAS) meets the criteria for a valid, reliable, and sensitive.
5. The response of students to instructional Vector Analysis with Computer Algebra learning model sistems (CAS) meet either category, can make students interested and motivated in the following study.

Based on the results obtained learning device in the form of units of Events Unit Class (SAP), module, and Test are in a Good criterion.

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