MEASUREMENT OF EFFECTIVENESS OF A LECTURER IN TRANSFERRING ALGEBRA KNOWLEDGE THROUGH OF MULTIMEDIA FACILITIES BY USING CERTAINTY FACTOR-FORMATIVE-SUMMATIVE MODEL

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ABSTRACT

Algebra courses are probably difficult enough for most students in a college. This is because most students have not understood their basic concepts. To understand the basic concepts of algebra, the students are required to spend more time in learning the courses and in doing the exercises. In addition, they also have to be brave to ask the lecturers if they find problems. It is in this context that a lecturer has to be ready to transfer his knowledge to the students, either using conventional teaching materials or multimedia facilities, so that they can understand the knowledge given to them. This research aims to know the use of evaluation model through mobile technology in measurement of effectiveness of a lecturer in transferring Algebra knowledge through of multimedia facilities. In order to realize these objectives, the lecturer has to give an evaluation. In addition to giving the evaluation to the students, the lecturer also needs to give questionnaire to the students to know the students' response to/view about the lecturer's method in transferring his knowledge. The evaluation model used in this study to determine the degree of effectiveness of a lecturer in transferring his or her knowledge to the students was the formative-summative model combined with certainty factor method. The technology used to measurement of effectiveness is a mobile technology, specifically Android application.

Keywords: *Transfer of Knowledge, Multimedia, Evaluation, Formative –Summative, Certainty Factor.*

1. INTRODUCTION

Understand about basic concepts in Algebra requires the students to spend more time in learning the courses and in doing exercises. In addition, they also have to be brave to ask questions to the lecturers if they find problems. The students' success in understanding the basic concepts of Algebra is largely dependent on the degree of effectiveness of a lecturer in transferring his or her knowledge to the students using multimedia facilities.

To find out the degree of effectiveness of a lecturer in transferring his or her Algebra knowledge to the students using multimedia facilities, he or she has to give an evaluation in the form of tasks, quizzes, middle test and final test. In addition to giving the evaluation to the students, he or she also has to give questionnaire to the students to know their response to/view about the method

that he or she used in transferring his or her Algebra knowledge.

A questionnaire that evaluates the lecturer's method of teaching is a good way of finding out the degree of his or her success in transferring his or her Algebra knowledge. However, the fact shows that the questionnaire that is filled in by the students is not effective. This is due to many things. The students will give a good evaluation to their lecturer if the lecturer is really good in giving and transferring his or her knowledge; the students will give a bad evaluation to the lecturer if the lecturer does not master the course he or she teaches; or on the contrary, the students will give a good evaluation to the lecturer who gives good grades to the students, although the fact is that he or she can't transfer his or her knowledge well and the students will give a bad evaluation to the lecturer who is a "killer" who gives bad grades to the

students while in fact he or she has been very good in transferring his or her knowledge.

Realities that are often encountered, then it is better application of information technology is used to help solve problems that occur. In the current era of globalization, information technology has a very important role in supporting the activities carried out by the community [1].

Therefore, an evaluation questionnaire on the method used by the lecturer to transfer knowledge should be given to the students and to the lecturer cum coordinator of the course. In addition, the evaluation of the transfer of knowledge by the lecturer to the students should use a computerized system that uses mobile technology which becomes the current trend, that's Android application. If one still uses a manual system, it will take a considerable amount of time in processing the data and in computing them. The computerized system used should include expert elements, so that the user does not have problems in determining the result of the computation and the result will be more valid.

In principle to find a good learning process, it would require the evaluation process. That statement in accordance with the opinion in [2] which states that good class is not only supported by innovative learning model but also need better assessment or evaluation ability through student's competence attainment.

Evaluation is an activity that consists of the process of gathering, describing, and explaining various pieces of information about the effectiveness of something that can be used later as the consideration for making a decision   and a recommendation [3]. The evaluation is an activity for data collecting, data analyzing and data presenting into information about a particular object under study so that the results can be used to take a decision [4].

Evaluation is an activity in collecting, analyzing, and presenting information about an object of research and the results can be used to take a decision [5].

In line with the previous definitions, evaluation is an activity for collecting, analyzing, and presenting information about a particular object being evaluated to be used as the consideration in making a decision [6].

Evaluation is an activity for collecting, analyzing, and presenting information about a

particular object being evaluated and the result can be used for making a decision [7].

Evaluation is an activity for collecting, understanding, and reporting the result of analysis of a particular program/object in such a way that the result can be used as the consideration in making a decision as to whether the program will be continued or stopped [8].

Based on some opinions above, it then can be concluded that in general, evaluation is an activity for collecting, analyzing, and explaining comprehensively information about a particular object/program/policy being studied and the results of an evaluation can be used for the consideration in making a decision to continue or to stop the object/program/ policy.

The evaluation model that was used in this study to determine the degree of effectiveness of a lecturer in transferring his knowledge to the students was a formative-summative model which is combined with expert method. The expert method used in this computerization system was the method of certainty factor which is one of the methods of expert system used to show the extent or degree of certainty of a fact. This method is very suitable for the problem of this study, since it is the measurement of confidence in the lecturer's success in transferring his or her knowledge. The basis used to determine the degree of success of a lecturer in transferring the materials consists of the students' own ability, the meaningfulness of the teaching, attitude, and effort made by the students and the method of teaching used by the lecturer.

Based on the above explanation, it can be the formulation of the problem, namely: 1) How the use of Android application in measurement of effectiveness of a lecturer in transferring algebra knowledge through of multimedia facilities?, 2) Is the use of formative-summative models combined with the expertise method was appropriate to do measurement of effectiveness of a lecturer in transferring algebra knowledge through of multimedia facilities?

There is some research that underlies this study conducted starting from 2015 do research about "An Expert System-Based Evaluation of Civics Education as a Means of Character Education Based on Local Culture in the Universities in Buleleng" by Sanjaya and Divayana with research merits that is able to show that [4]: 1) Using the CIPP model in evaluating Civics Education processes in all public and private universities in Buleleng regency makes the evaluation more

objective, especially in proving local culture in developing character education. 2) Using certainty factor method in determining the extent or degree of certainty of a component that is being evaluated in Civics Education process will produce a more objective and optimal evaluation. The weakness of this study is not able to show the results of the evaluation before the activity/program running and results evaluation after the activity/program is completed.

Research in 2016 conducted by Divayana and Dessy [8] about "program evaluation of computer certification at Universitas Teknologi Indonesia using a *CSE-UCLA* model" with the advantages of research results that could indicate that the average level of effective implementation of the program on the system assessment components amounted to 84.73%, program planning amounted to 83.87%, program implementation amounted to 85.24%, program improvement amounted to 84.17% and program certification amounted to 84.75%. By looking at the average results of the evaluation of computer certification program at Universitas Teknologi Indonesia as a whole amounted to 84.55%, the effectiveness level of the implementation of the program belong to good category. The weakness of this study is not able to show the results of the evaluation calculation accurately based on the certainty factors that determine the success of an activity/program running.

In addition, there is also some research results related to this research, including research in 2012 conducted by Purwanta [9] about "Evaluation of Content Textbooks History in the New Order" have similarities in terms of approach to evaluative research, while the difference namely the focus of his research. Purwanta research emphasis is focused on the analysis of the content of history textbooks by using "Sartono" criteria in writing national history, while the focus of this study is the degree of effectiveness of Algebra knowledge transfer.

Research in 2011 conducted by Mukminan [10] about "Evaluation of the Implementation of KTSP on Geography Lesson School in Yogyakarta" has much in common in terms of the type of evaluative research, while the difference is that the model of evaluation used in the research. The model of evaluation used by Mukminan in his research that the Stake model, whereas this study used a *formative-summative* evaluation model modified with *certainty factor* method. As well as research in 2010 conducted by Nursa'ban [11] about "Evaluation of Geography Learning Assessment in

High School in Bantul" also have similarities in terms of the type of evaluative research, while the difference is that the model of evaluation used in the research. The model of evaluation used by Nursa'ban in his research that the model Stake, whereas this study used *formative- summative* evaluation model modified with *certainty factor* method.

Research in 2017 conducted by Divayana [12] about "the evaluation of blended learning at SMK TI Udayana used *CSE-UCLA* model" has similarities in terms of objective in this study, that is was to determine the level of effectiveness of a program and similarities in terms of the type of research, that is the evaluative research. Meanwhile, the difference lies in the model of evaluation used. The model of evaluation used by Divayana in his research that the *CSE-UCLA* model, whereas this study uses *formative-summative* evaluation model modified with *certainty factor* method.

From some of the problems revealed and review some of the results of previous studies and relevant background of this study, the researchers are interested in doing research about measurement of effectiveness degree of a lecturer in transferring Algebra knowledge through of multimedia facilities by using certainty factor method combined with formative-summative model.

2. LITERATURE REVIEW

2.1 Learning and Transfer Knowledge

Learning is a process performed or an effort made by an individual to make a change into a new behavior in a comprehensive way, as the result of his or her experience in interacting with the environment [13].

Success in learning is a learning process performed by a student in the teaching and learning interaction [14].

Transfer of knowledge is the effect of learning which has been obtained in the past concerning the process and result of learning that is undertaken later [13]. There are some conditions/ factors which facilitate transfer of knowledge and some of these factors are: a) the student's own ability, b) meaningfulness of teaching, c) attitude and effort of the student, d) method of teaching.

2.2 Formative-Summative Evaluation Model

Formative-Summative Evaluation Model is a model that shows stages and scope of the object being evaluated, which include: an evaluation conducted at the time the program is in progress

(called formative evaluation) and an evaluation conducted at the end of the program (called summative evaluation). The aim of formative evaluation is to know to what extent the program that has been designed can run well, and at the same time to identify the problems. While the aim of summative evaluation is to measure the achievement of the program [15].

Formative Summative Evaluation Model is a model of evaluation whose process lasts continuously during the course of teaching and learning activities, which consists of formative and summative evaluations [16]. Formative evaluation is aimed at improving the program, while summative evaluation, to monitor the use of the program [17].

From some opinions above it can be concluded that in general, formative and summative evaluations are evaluations conducted from the beginning to the end of the program to know to what extent the program that has been designed can run successfully.

2.3 Certainty Factor

Certainty factor is one of the methods being used in an expert system. In [18], Expert systems is an artificial intelligence system that combines knowledge base with inference engine so that it can adopt the ability of the experts into a computer, so the computer can solve problems such as the often performed by experts.

Certainty Factor is a method used to show the measure of certainty about a fact or regulation [19]. The notation of certainty factor caused by a fact is as follows [20]:

$$CF[H,E] = MB[H,E]–MD[H,E] \qquad (1)$$

Notes:
$CF[H,E]$ = certainty/confidence factor of hypothesis H in fact E (between -1 and 1)
$MB[H,E]$ = measure of confidence of hypothesis H with fact E (between 0 and 1)
$MB[H,E]$ = measure of no confidence in hypothesis H with fact E (between 0 and 1)

While the notation of certainty factor caused by more than one fact is as follows:

$$CF[H,E1^E2] = MB[H,E1^E2]–MD[H,E1^E2] \quad (2)$$

Where:

$MB[H,E1^E2]$ = $MB[H,E1]+MB[H,E2]*(1-MB[H,E1])$
$MD[H,E1^E2]$ = $MD[H,E1]+MD[H,E2]*(1-MD[H,E1])$

Notes:
$CF[H,E1^E2]$ = certainty/confidence factor of hypothesis H in facts E1 and E2 (between -1 and 1)
$MB[H,E1^E2]$ = measure of confidence in hypothesis H with facts E1 and E2 (between 0 and 1)
$MB[H,E1^E2]$ = measure of no confidence in hypothesis H with facts E1 and E2 (between 0 and 1)

3. RESEARCH METHODOLOGY

3.1 Object of Study

The object of this study was the degree of success of transferring Algebra knowledge. The reason this object studied because researchers want to assess the success of a lecturer in transferring Algebra knowledge which is measured through the use of evaluation model based of mobile technology that is Android application.

3.2 Subject of Study

The subjects of this study were the students and lecturers cum coordinators Algebra courses. The reasons for selection of research subjects is based on the concept of purposive sampling in the selection of the study sample, where the study subjects were involved directly related to the object under study. The number of students involved in providing an assessment of the questionnaire as many as 20 students and 1 lecturer coordinator Algebra courses.

3.3 Location of Study

The locations of this study were Department of Informatics, Universitas Teknologi Indonesia, Bali. The reasons for selecting this location for research because there are still many lecturers who have not been able to properly transfer of Algebra knowledge to students. Through this study was expected later discovered constraints cause it to happen.

3.4 Methods of Data Collection

The data in this study were collected by distributing questionnaire doing observations and collecting documents. Questionnaires were distributed to students and coordinator of Algebra courses. Researchers conducted observations using the observation sheet for some multimedia facilities used in transferring Algebra knowledge.

Documentation may include research data and pictures of multimedia facilities display.

3.5   Design of the Study

The design of this study used *Formative-Summative Model* and combined with *Certainty Factor*. In this design consists of two dimensions, they are: the *formative* dimensions and *summative* dimensions. In formative dimensions, consist of 3 success factors in transferring Algebra knowledge, such as: 1) the students' own ability of the students, 2) meaningfulness of the course, and 3) attitude effort of students. In summative dimensions, just 1 success factors in transferring Algebra knowledge, that factor is teaching method.
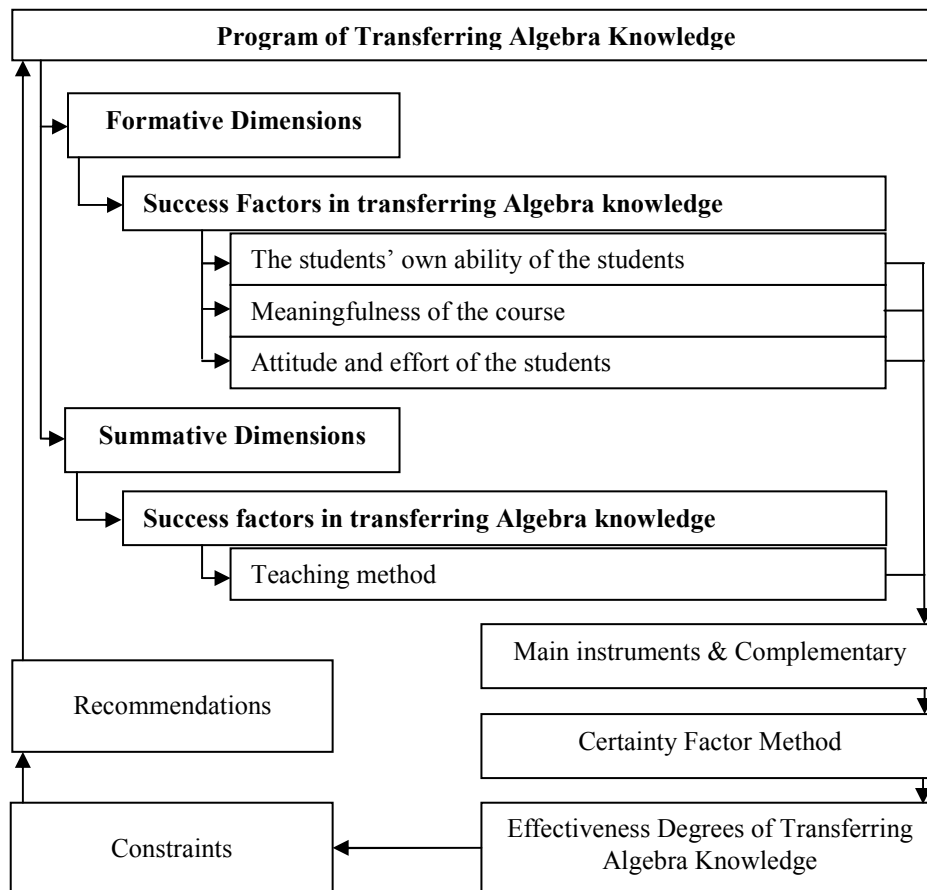
The intended design can be seen in the following figure 1.

Figure 1: Formative-Summative Model and Combined with *Certainty Factor*

3.6   Technique of Data Analysis

The data in this study were analyzed by quantitative descriptive analysis technique. Data analysis is done by comparing the value of the evaluation results with values of standard effectiveness of the successful transfer of Algebra knowledge to students. Values obtained from the results of the evaluation questionnaire distributed to students and lecturers cum coordinators of Algebra courses, was calculated using the method of *certainty factor* so resulting a value of effectiveness of the successful transfer of Algebra knowledge. If the effectiveness results of the successful transfer of Algebra knowledge exceed the standards of effectiveness, then the transfer of Algebra knowledge to students can be said to be optimal. But if not, can be said to fail.

4.   RESULTS AND DISCUSSION

4.1   Results

4.1.1   Standard of Effectiveness Degree of successes in transferring Algebra knowledge from dimensional of formative-summative evaluation model

The standard of effectiveness degree of the lecturers' successes in transferring Algebra knowledge to the students by using dimensional of formative-summative evaluation model can be shown in Table 1 as follows.

Table 1: Standard of Effectiveness Degree in the Lecturers' Successes in Transferring Algebra Knowledge to the Students by Formative-Summative Evaluation Model

No	Code	Dimensions	Factor in the success in transferring knowledge	Values of Effectiveness Standard	
				Dec	%
1	X1	Formative	The students' own ability of the students	0.75	75
2	X2	Formative	Meaningfulness of the course	0.76	76
3	X3	Formative	Attitude and effort of the students	0.76	76
4	X4	Summative	Teaching method	0.78	78
			Average	0.7625	76.25

4.1.2   Results of the measurement of the degree of effectiveness

The results of the measurement of the degrees of effectiveness in the lecturers' successes in transferring Algebra knowledge to the students by using certainty factor can be shown in Table 2 as follows.

Table 2: Degree of Effectiveness in the Lecturers' Successes in Transferring Algebra Knowledge to the Students by Using Certainty Factor

No	Lecturers Name	X1 (%)		X2 (%)		X3 (%)		X4 (%)		CF Value	
		B	N	B	N	B	N	B	N	Dec	%
1	I Gede Nurjaya	87	13	92	2	94	5	96	2	0.79	79
2	Nyoman Risnawati	85	15	87	13	90	10	92	8	0.61	61
3	Kadek Sukma	97	3	90	10	82	18	91	9	0.65	65
4	Putu Kurnia Saputra	94	6	94	6	88	12	84	16	0.65	65
5	Made Dwi Aryasa	93	7	98	2	92	8	86	14	0.72	72

Notes :
B   : Degree of confidence in facts
N   : Degree of No confidence in facts
X1   : one's own ability of the students
X2   : Meaningfulness of courses
X3   : Attitude and effort of the students
X4   : Method of teaching
CF   : Certainty factor

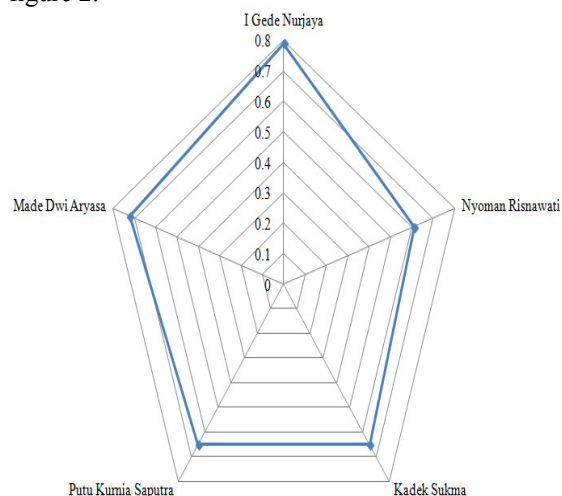The CF value of each lecturer has been shown in Table 2 can also be seen in the following figure 2.

Figure 2: Display of CF Value of Each Lecturer

4.1.3   Display of Multimedia Facilities

The display of multimedia facilities in Universitas Teknologi Indonesia for transfer Algebra knowledge can be seen in the following figures 3.
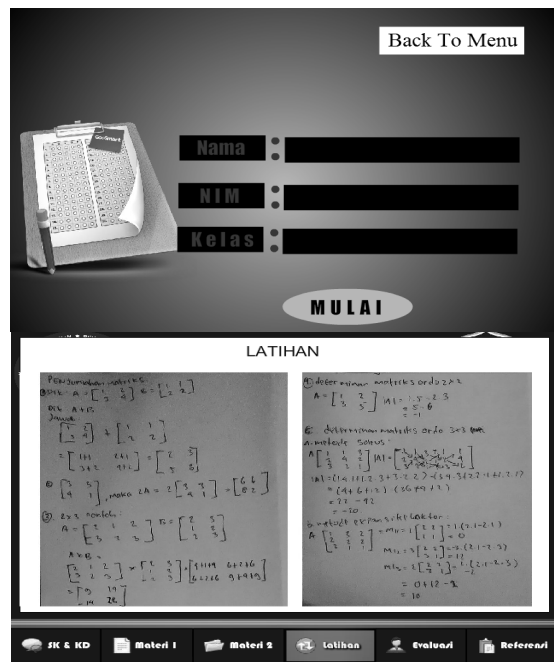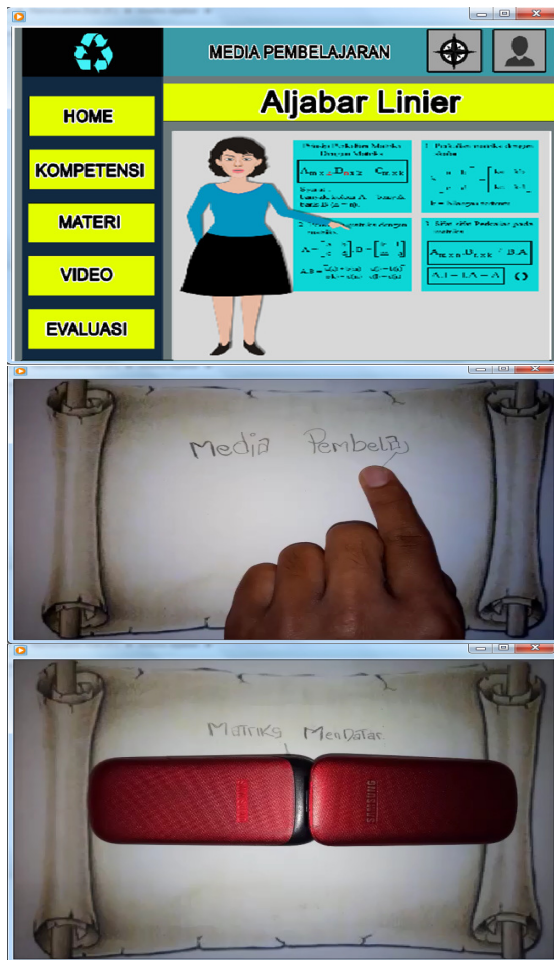
4.1.4   Display of Effectiveness Measurement Application

The display of the application for computing the degrees of the lecturers' effectiveness in the successes in transferring Algebra knowledge to the students by using Android can be seen in the following figures 4-7.
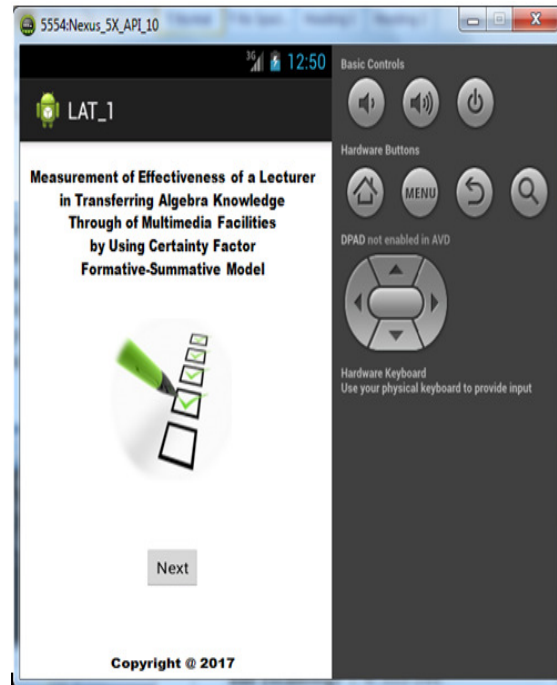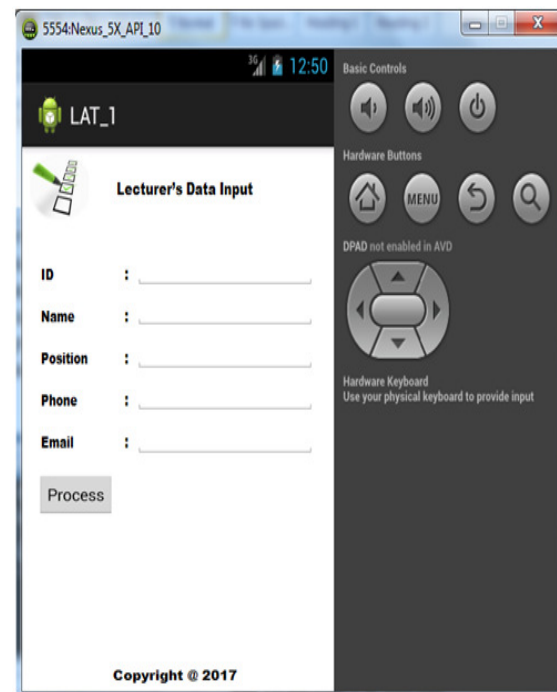

Figure 4: *Display of the Main Menu*

Figure 3: *Display of Multimedia Facilities in Universitas Teknologi Indonesia*

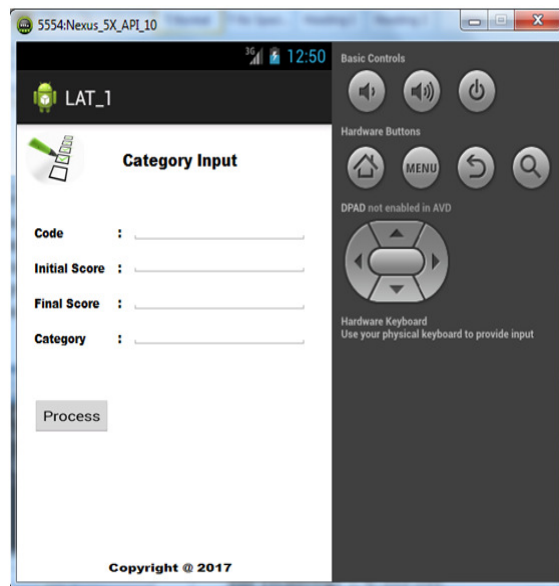*Figure 5*: *Display of Lecturers' Data Input*
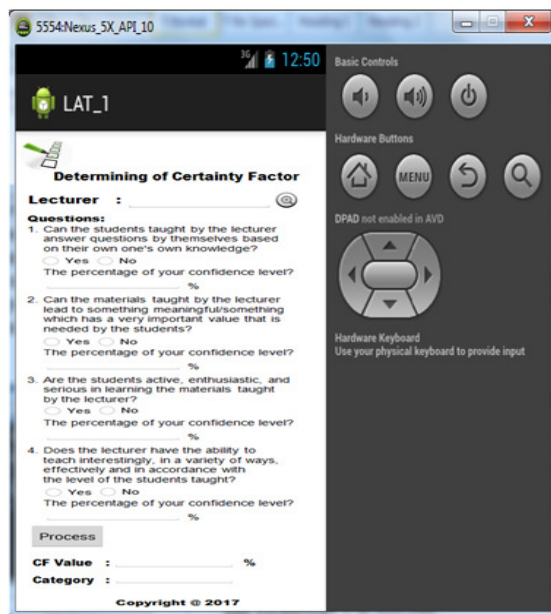
Figure 6: Display of Categories Input

Figure 7: Display of Determining of Certainty Factor

4.2 Discussion

Based on the results described above there are some points that need to be discussed such as:

4.2.1 Analysis of the results of the comparison between the effectiveness standard (shown in Table 1) with the evaluation results (shown in Table 2)

Based on the results obtained can be seen that the results of evaluations of lecturer called "I Gede Nurjaya" obtain effectiveness score of 79% has surpassed the average standard value stipulated in the initial effectiveness is 76.25%. This means that

"I Gede Nurjaya" was optimized to transfer Algebra knowledge to students. Whereas, if seen from the results obtained by the lecturer named "Nyoman Risnawati" obtain effectiveness score of 61% who was not exceeded the average standard value set in the initial effectiveness is 76.25%. This means that "Nyoman Risnawati" not optimal to transfer Algebra knowledge to students.

When comparing the results of the evaluation and the effectiveness standards can be seen merits and demerits in this section. The merits found in accurate calculation by using the of certainty factor method used in determining the results of the effectiveness of Algebra knowledge transfer. Demerits have not been able to optimally demonstrate significant changes in value, when added new criteria into the existing dimensions.

4.2.2 Basic Knowledge

The basic knowledge used in determining the degree of a lecturer's success in transferring knowledge can be shown in table 3 as follows.

Table 3: The Bases of Knowledge Based on Formative-Summative Evaluation Model

Code	Dimension	Factor in the success in transferring knowledge	Type of Questions
X1.	Formative	The students' own ability of the students	Can the students taught by the lecturer answer questions by themselves based on their own one's own knowledge?
X2.	Formative	Meaningfulness of the course	Can the materials taught by the lecturer lead to something meaningful/ something which has a very important value that is needed by the students?
X3.	Formative	Attitude and effort of the students	Are the students active, enthusiastic, and serious in learning the materials taught by the lecturer?

Code	Dimension	Factor in the success in transferring knowledge	Type of Questions
X4.	Summative	Teaching method	Does the lecturer have the ability to teach interestingly, in a variety of ways, effectively and in accordance with the level of the students taught?

4.2.3   Rule

The rule used in determining the degree of a lecturer's success in transferring his or her knowledge can be shown in table 4 as follows [21].

Table 4: The Rule Used in Determining the Degree of a Lecturers' Success in Transferring His or Her Knowledge

Code	Evidence				Hypothesis
	X_1	X_2	X_3	X_4	
RL.01	-	-	-	-	F
RL.02	√	-	-	-	T
RL.03	-	√	-	-	T
RL.04	-	-	√	-	T
RL.05	-	-	-	√	T
RL.06	√	√	-	-	T
RL.07	√	-	√	-	T
RL.08	√	-	-	√	T
RL.09	-	√	√	-	T
RL.10	-	√	-	√	T
RL.11	-	-	√	√	T
RL.12	√	√	√	√	T

4.2.4   Analysis of the Data by Using *Certainty Factor* Method

a) *Certainty Factor (CF)* Procedure

C*ertainty factor* (CF) is computed by subtracting no confidence value from hypothesis H with fact E (MB[H,E]) in confidence measure in hypothesis H with fact E (MD[H,E]).

In addition there is also a procedure for computing *certainty factor* (CF) which is used to determine a hypothesis based on some evidence, that is by subtracting no confidence in hypothesis H with

facts E1 and E2 (MB[H,E1^E2]) in confidence in hypothesis H with facts E1 and E2 (MD[H,E1^E2]).

b) Procedure for computing *Certainty Factor* (CF) in this study

Referring to the result shown in table 1 above, the Certainty Factor for lecturer "I Gede Nurjaya" can be computed as follows:

1) Determining Certainty Factor (CF) of the hypothesis of success in transferring knowledge caused by the students' own knowledge

   CF [H,E] = MB[H,E] – MD[H,E]
   CF [H,E] = 0.87-0.13 = 0.740

2) Determining Certainty Factor (CF) of the hypothesis of success in transferring knowledge caused by the students' own knowledge and the meaningfulness of the course

   CF [H,E1^E2]   = MB[H,E1^E2] - MD[H,E1^E2]
   MB[H,E1^E2]   = MB[H,E1]+MB[H,E2]*
     (1-MB[H,E1])
   MB[H,E1^E2]   = 0.87+0.92*(1-0.87) = 0.990
   MD[H,E1^E2]   = MD[H,E1] + MD[H,E2]*(1-
     MD[H,E1])
   MD[H,E1^E2]   = 0.13+0.02*(1-0.13) = 0.147
   CF [H,E1^E2]   = 0.990 – 0.147 = 0.842

3) Determining Certainty Factor (CF) of the hypothesis of success in transferring knowledge caused by the students' own knowledge, the meaningfulness of the course and the students attitude and effort.

   CF [H,E1^E2^E3] = MB[H,E1^E2^E3] –
     MD[H,E1^E2^E3]
   MB[H,E1^E2^E3] = MB[H,E1^E2] + MB[H,E3]*(1-
     MB[H,E1^E2])
   MB[H,E1^E2^E3] = 0.990+0.94*(1-0.990) = 0.999
   MD[H,E1^E2^E3] = MD[H,E1^E2] + MD[H,E3]*(1-
     MD[H,E1^E2])
   MD[H,E1^E2^E3] = 0.147+0.05*(1-0.147) = 0.190
   CF [H,E1^E2^E3] = 0.999 – 0.190 = 0.809

4) Determining Certainty Factor (CF) of the hypothesis of success in transferring knowledge caused by the students' own knowledge, the meaningfulness of the course, the students' attitude and effort, and teaching method

   CF [H,E1^E2^E3^E4] = MB[H,E1^E2^E3^E4] –
     MD[H,E1^E2^E3^E4]
   MB[H,E1^E2^E3^E4] = MB[H,E1^E2^E3] +
     MB[H,E4] * (1-
     MB[H,E1^E2^E3])
   MB[H,E1^E2^E3^E4] = 0.999+0.96*(1-0.999) =
     0.999
   MD[H,E1^E2^E3^E4] =MD[H,E1^E2^E3] +
     MD[H,E4] * (1-
     MD[H,E1^E2^E3])
   MD[H,E1^E2^E3^E4] = 0.190+0.02*(1-0.190) =
     0.206
   CF [H,E1^E2^E3^E4] = 0.999 – 0.206 = 0.79

From the computations above the degree of success of lecturer "I Gede Nurjaya" in transferring Algebra knowledge to the students = 0.79 or 79 %.

There are several advantages that have been shown as a result of this research, among others: the use of formative-summative evaluation model be effectively used in measuring the effectiveness of the success of a lecturer transfer Algebra knowledge and utilization certainty factor methods that precisely and accurately able to acquire and demonstrate the effectiveness calculation results of the success of knowledge transfer.

Besides some of these advantages, there are some limitations that are found in this study include: a) the difficulty in adding new criteria on dimensional of formative-summative model if later there factors as the new determinant of success of Algebra knowledge transfer because of the unavailability of the facility to add new data to this android application, b) the difficulty of making the rule automatically if later there are new factors as determinants of success of Algebra knowledge transfer.

5. CONCLUSIONS

In the light of the results of the study and discussion it can be concluded that: a) by using Android application as one of the mobile technology applications in measuring a lecturer's effectiveness in transferring Algebra knowledge, it becomes easier for the users (especially, lecturers cum coordinators of Algebra courses to evaluate their successes whenever and where ever they are; b) the use of Android application in measuring the effectiveness of the lecturers in transferring knowledge through the use of the formative-summative evaluation model is very appropriate and effective to know to what extent a program has been successfully been implemented; c) the use of Android application in measuring the effectiveness in the success of lecturers in transferring knowledge through the use of certainty factor method of the formative-summative evaluation is very appropriate if we are to obtain the result of computation of the degree of effectiveness in the success of transferring Algebra knowledge comprehensively, validly and accurately. This is evidenced by the acquisition of CF accurate value on one of the lecturer named "I Gede Nurjaya" by 79% using *certainty factor* method.

To overcome some of the limitations found in this study, it is suggested that future research is able to find a breakthrough to make this application more perfect with provide the new criteria input facility automatically and rule-making automatically.

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