E-Learning Model Based on the Ability Test to Creating Community of Inquiry

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Abstract—**E-learning method have the advantages that are not limited to space and time. But this learning method also has weaknesses that are the students are difficult to understand the material because the same material is given to students without importance their abilities. Therefore, we need to create community of inquiry (CoI) based on the ability of students, so that different materials are given according to ability. CoI can be grouped into advances, intermediate, and beginner. The method used is experimental research that is directly conducting ability tests. The student ability test is implemented through the WhatsApp application by give a minute for each question, and all students must be online simultaneously. Student ability is tested with psychological test consisting of 30 questions. Calculation of test assessment using Microsoft Excel. One class was tested by 30 students, that is created six CoI with each CoI consisting of five students. Classification based on assessment analyzed by Rasch Model. One advance CoI has the ability log > 2 and can solve all difficult questions, and one advance CoI has the ability log of 1.6 – 1.87 and can solve several difficult questions. Two intermediate CoI have the ability log of 0.13 – 1.18 and can solve a few difficult questions. Two beginners CoI are identified only guessing difficult questions because the ability log <= 0 and two students identified cheating on each other because they have the same answer. The six CoI that already formed will be put in six e-learning groups via WhatsApp.**

Keywords: Rasch, ability, e-learning, question, test

I. INTRODUCTION

The World Wide Web, a system of interlinked hypertext documents accessible via the Internet, has become the great multimodal medium of information that ensures messages are disseminated and read all over the world [1]. The plan emphasises the importance of improving the quality of the national education curriculum and enhancing teaching and learning experience [2]. E-learning is a distance learning tool to facilitate the provision of material. Nowadays, with the latest technology, learners are being able to learn anything, at any place and any time they needed the knowledge [3]. E-learning has become a platform flexible learning today because of this its advantages that allow virtual communication applies between the teacher and student and student [4]. But e-learning also has shortcomings, namely many students who cannot understand because giving the same material and there is no explanation from the teacher. E-learning can be done via video, conference, hybrid training, SMS and others. A meaningful hybrid e-training experience provides a logical purpose for strategic educational change

through lifetime education and creation of a knowledge society [5]. The learners' perceptions in SMS-learning may provide some information related to the factors in the use of SMS learning [6].

In this study, e-learning begins with testing the ability of students based on psychological scores calculated using the Rasch Model. This Rasch model uses a mathematical formula that is roughly the same as measurement of one parameter in Item Response Theory (IRT) or also known as Latent Trait Theory [7]. IRT measurement does not focus only on the person but it also includes the item. [8]. IRT can provide adaptive online assessments for e-learning application. These adaptive online assessments start with items of moderate difficulty, and then change item difficulty according to a test taker's performance [9]. Items of IRT related to the level of difficulty of the questions that can be answered by a student.

Rasch model can be used for Predicting Academic Achievement Using Machine Learning. In the present paper we showed the Rasch scores of the tests and scales used significantly differentiated the high achievement from the low achievement 10th grade students [10]. The Rasch model can also be used for the analysis of learners' perceptions of instructor feedback in e-learning courses. Our results indicate that systematic collection and analysis of learners' feedback comments have a strong potential to enhance feedback competencies of course facilitators, as well as provide a common platform for both learners and course facilitators vis-à-vis the diverse objectives of instructor feedback [11].

E-learning used in this research is via WhatsApp. Besides WhatsApp, e-learning can also use other media such as learning with Facebook in English. It is hoped that through making English sentences on Facebook, the engineering students could not only share their ideas, but also increase their English vocabulary acquisition [12]. Rasch models can be used in assessment measures through Moodle. Their voluntary participation in the study was through the e-learning Moodle platform where tests and assessment were administered online [13].

The fundamental problem of this research is how to design an e-learning model with material according to students' abilities? The solution found and researched was the design of e-learning models by creating several Community of Inquiry (CoI) according to the abilities of students, based on the results of the ability tests with the Rasch Model.

II. METHOD

The study was a design research because it was to design/develop an intervention that took the form of strategy and learning material for solving the problems in education [14]. The first stage for the post test is to test the students' abilities with psychological tests and is measured by the Rasch Model. Measurements with the Rasch Model are carried out in order to detect students who are smart and answer many questions correctly and can answer difficult questions. A researcher must begin by defining the single variable to be measured [15].

Samples taken were 30 students from STIKOM CKI (Cipta Karya Informatika) Jakarta who were studying in the 5th semester. The instruments used in data collection are tests. Psychological tests totaled 30 questions and took the form of multiple choice. Questions and gathering of answers are done via WhatsApp. Students must be online at the same time working on this psychological test problem, because only given 30 minutes to complete it.

III. RESULTS AND DISCUSSION

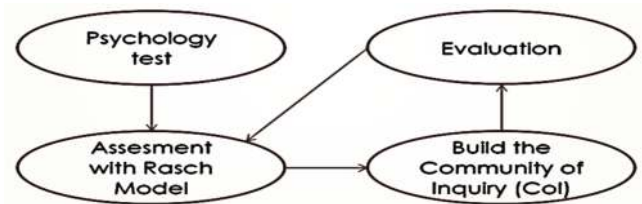The e-learning model created from this study can be seen in figure 1.

Fig.1. E-Learning Model

The stages of e-learning model will be explained below:

A. Psychology Test

Psychological testing held amounted to 30 questions. The questions consisted of 10 verbal questions, 10 arithmetic questions, and 10 question reasoning. As many as 30 students of STIKOM CKI (Cipta Karya Informatika) worked on the psychology test. All students must be online simultaneously because the work time given is only 30 minutes in WhatsApp.

B. Assessment with Rasch Model

Assessment is not only based on the number of correct answers but also based on the level of the difficulty questions that can be answered by students. A list of student grades for the psychology test (psychology test value data) can be seen in figure 2.

Fig.2. Psychology Test Value Data

In figure 2 above contains student answer data. If the answer is correct then it has a value of 1 and if false then it has a value of 0. Yellow and pink are advanced level CoI, purple and gray are intermediate level CoI, maroon and white are beginner level CoI, blue are high difficulty questions.

Data on students' psychological test scores is processed using the Rasch Model calculation so that an ability log is obtained that shows the ability of each student in Figure 3.
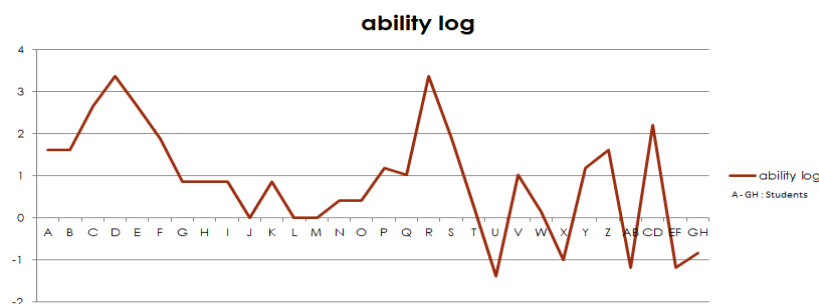
Fig.3. Ability Log

Ability log describes the person ability. R and D have the highest ability log with a value of 3.367. U has the lowest ability log with a value of -1,39.

The Rasch Model calculation can also detect difficult questions. In figure 4 you can see some easy questions and some difficult questions. Generally students have perceived the items as quite easy to understand as the item mean logit is lower than the person mean logit [16].
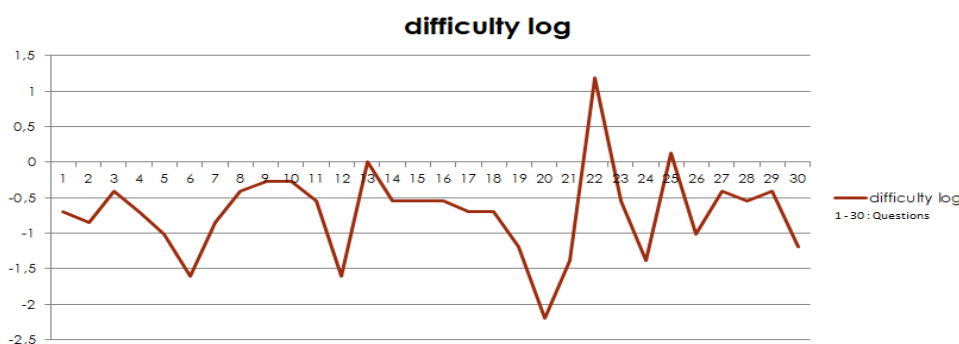

Fig. 4. Difficulty Log

Difficulty log describes the item difficulty. Question number 22 is the most difficult question with difficulty log 1,1896. Questions number 12 and 20 are easy questions with difficulty log -2,1972.

In figure 2 it can be concluded that students who can answer all the most difficult questions are C, D and R. It can be seen in figure 2 that students C, D and E get a score of 1 on a difficult question indicated by a blue square. Students N and O are indicated cheating because they have the same answer on the whole answer and it can be seen in figure 2. Student GH is indicated guessing because there are many wrong answers for easy questions can be seen in figure 2. In Figure 2, GH student answers are dominated by the value 0, which is the value for the wrong answer.

C. Build the Community of Inquiry

There were 3 groups of CoI formed in figure 2, namely advance level consisting of grup 1 are students D, R, C, E, CD and grup 2 are students F, S, A, B, Z. Intermediate level consisting of grup 1 are students P, Y, Q, V, K and grup 2 are G, H, I, T, W. Beginner level consisting of grup 1 are N, O, J, L, M and grup 2 are GH, X, AB, EF, U. Each group is further divided into 2 groups consisting of 5 students. The division of groups is based on the score of the ability log and the ability of students to answer difficult questions that have a large number of difficulty logs.

D. Evaluation

Post test value data or evaluation after testing the data in the form of multiple choice items and totalling 30 questions. Datawarehouse testing also uses the Rasch Model calculation with the final results which can be seen in Figure 5.

Number	Name	Before CoI	After CoI
1	D	96,667	100
	R	96,667	100
	C	93,333	95
	E	93,333	95
	CD	90	90
2	F	86,667	95
	S	86,667	95
	A	83,333	85
	B	83,333	90
	Z	83,333	95
3	P	76,667	80
	Y	76,667	80
	Q	73,333	80
	V	73,333	75
	K	70	70
4	G	70	75
	H	70	70
	I	70	70
	T	60	75
	W	60	75
5	N	56,667	75
	O	53,333	75
	J	50	50
	L	50	50
	M	50	70
6	GH	30	70
	X	26,667	65
	AB	23,333	60
	EF	23,333	65
	U	20	60

Figure 5. Evaluation Value Data

In Figure 5, about 80% of students have increased grades. This was because the improvement in the outcome were small despite the fact that the lecturers have invested a lot of work and time in adopting the changes [17]. Students who have a fixed grade are CD, K, H, I, J and L are marked with a brown box. After evaluating (post test) with the Rasch Model calculation, CoI will be formed again according to the student's post test score. This stage will continue to be repeated to determine the ability of each student to understand the e-learning material provided.

The use of learning aids can also improve students' thinking skills, particular-ly towards high-level thinking skills [18]. The Rasch model could provide linear measures of student abilities on both tests on the same scale, and the difference in ability measures on pretest and posttest could be used as the direct measure of student gain [19]. Learners less practice work on the problems. That is one of the reasons students have poor skills [20].

IV. CONCLUSION

The Rasch model is suitable for assessment on multiple choice tests because it analyzes the ability of students and forms it into 3 CoI's, advance (1,609 - 3,367), intermediate (0,847 - 1,189) and beginner (-1,386 - 0,405) level, also analyze questions based on the degree of difficulty. The questions with the highest level of difficulty are questions with numbers 22, 25, 13, 9, 10.

Rasch model can also detect students who can answer the most difficult questions, namely C, D and R. Students who are indicated cheating are N and O because they have the same answer. Students who are indicated guessing the answer, that is GH, because there are many wrong answers for easy questions.

The evaluation phase results are an 80% increase in value in the data warehouse subject. This increase shows that the e-learning model that was created has been successful for teaching process based on data warehouse subject.

In further research, it is expected that this e-learning model can be developed in a web or android application with an assessment based on the Rasch model calculation. It is also hoped that this e-learning model can do an examination of questions that are not qualified so that they can be corrected for the next testing.

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