Implementation of Linear Congruent Method in Learning Application Batak Toba Script with Game Model

Tonni Limbong, Sriadhi, Efendi Napitupulu

Abstract - When a process of teaching and learning activities by teachers is boring and uninteresting for students, so long as it can be ascertained that the message of values, morals, and knowledge from these lessons is difficult for students to understand and required a teaching method in the form of computer-based learning applications the game. Management of learning must describe efforts to plan or control teaching activities using teaching concepts and principles so that the objectives of teaching and learning activities are achieved more effectively, efficiently and productively and must be initiated from choosing strategies and plans, of course ending with assessment and can be used as consideration make further teaching improvements. Learning Batak Toba script by using the game model will increase students' enthusiasm and not be bored and train their memory to memorize or remember Batak Toba script and connect them to latin script because the questions that appear will never be the same and keep changing because they are randomized with linear congruent method (LCM). This learning model will add to the existing learning model in the form of multimedia-based applications.

Keywords : Linear Congruent Method, Batak Toba Script, Learning, Game.

I. INTRODUCTION

Learning that is good material and teaching techniques will be able to produce changes for students in their daily lives better. Teaching is an effort to change students so that students are knowledgeable and behave in a certain way. The process of changing the behavior of students is done correctly and in a measurable and controlled manner. In learning there are actions designed by a teacher through learning planning. Through planning, the learning is carried out using planned actions such as the method of discussion, question and answer, observation, and so on. This shows that learning that is arranged carefully and well will greatly affect the changes in attitudes and behavior of students, especially for the next future period [1].

Teaching is the creation of a system in a learning environment where learning will occur. Regions in a good learning environment generally have several interconnected components such as instructional goals, subject matter, educators or teachers and students as subjects who will participate in certain sociological relationships, forms of activities carried out and facilities and infrastructure for teaching and learning there is [2]. The components will interact as one system.

The students are allowed to play while learning with light games that are educational in learning during each activity but cannot exhaust them. If students are prohibited from playing in a monotonous manner of learning then their hearts are stressed and make the students bored, their intelligence will also be blunted and will feel pessimistic to do in their lives.

Teaching is a work that is unique and simple because it relates to people who learn, namely students, and teachers, and relates to humans in society because the teaching process is carried out occurs every day and in everyday life [3]. The principle of teaching is guiding students in teaching and learning activities or it can be interpreted that teaching is an activity of organizing the environment between students, teachers / educators and teaching materials..

II. LITERATURE REVIEW

A. Learning methods

Learning method is a component part that is in the learning strategy in delivering the contents of the subject matter to students who are being taught. Learning methods are also often referred to as ways that teachers use in carrying out interactions with students at the time of the occurrence of teaching [3], [4]. To create conducive learning activities, various approaches, strategies and learning methods can be used selectively, taking into account the character and nature of each learner and teaching material as the substance of the goal. The types of learning methods in general are the method of question and answer method, group work method, discussion method, lecture, recitation method, demonstration and experimental method, socio drama method of problem solving method, team system method, training method, field trip method, community survey method, also a simulation method [4]–[6]. Learning model or technique is how to convey the knowledge of education as a whole. This concept is present and growing rapidly by carrying out an experimental approach.

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The learning model has four characteristics, namely:
1. Rational theoretical logical compiled by the designer,
2. Competencies to be achieved,
3. Patterns and teaching techniques needed for the learning model to succeed
4. Learning Resources and Environment so that the benefits of learning are achieved well.

Along with the many learning models that exist in achieving learning objectives or competencies that must be mastered by students, the learning models are grouped into 4 major groups, namely: (1) Social learning model group; (2) information processing learning model group; (3) Person learning model group; (4) Behavioral learning model group[7].

B. The Meaning of the Game in Learning

Utilization of the game model in learning can provide a new atmosphere in more relaxed and enjoyable learning in order to create an interactive learning atmosphere, foster enthusiasm and learning motivation of students, foster a high sense of social solidarity, can increase students' insight, and improve learning achievement learners [8]. Basically every student really needs games and entertainment while studying. The learning class is quiet, tense, lonely, serious and full of conscience unconsciously making students feel exhausted, bored, tired and the like [3].

The game is an interaction activity between individuals or between groups to achieve a goal. Learning like this must have rules of the game that must be agreed either written or unwritten, and the technique of presenting lesson material should foster experience from learning while playing and achieving goals because the function of play in learning is to foster motivation and to increase students' curiosity and load understanding (concept), planting values and solving problems, besides that it can also foster cognitive, affective, and psychomotor [9], [10].

C. Batak Toba Script

Batak letters are names used to write Batak languages and Batak script still have a relationship with other characters in Indonesia. This script has several types and forms according to the variety of Batak tribes that exist and depend on the language and region. Currently there are five variants of Batak letters in North Sumatra, namely Toba, Karo, Simalungun, Mandailing and Dairi. This batak script must be understood and understood by elders or datu and people who are respected in the Batak community. This script can be found in the *pustaha batak*, which is the traditional book of the Batak tribe. The distinctive feature of a Batak letter is its type called abugida which means a combination of alphabet and syllabic alphabets. Each character contains both consonants and the basic vowel sounds [a]. But by using diacritical marks or so-called clauses *(anak ni surat)* in Batak language, then every sound from the vowels in the batak toba script can be changed. Vowels and consonants in the Toba Batak script are sorted according to tradition, namely: *a, ha, ka, ba, pa, na, wa, ga, da, da, ra, ma, ta, sa, yes, nga, la, the, ca, nda, mba, i, u*. Batak script was written on bark or bamboo [11]. Writing always starts from top to bottom, and lines are continued from left to right like writing letters / latin alphabet. In general the Batak Toba Script are arranged in 3 parts, namely:

a. *Ina ni Surat* (Parent Sentence).

Are the basic forming letters of the Batak script. During this time, this known letter consisted of: a, ha, ka, ba, pa, na, wa, ga, ja, da, ra, ma, ta, sa, ya, nga, la, ya, nya, ca, nda, mba, i, u. Nda and Mba are double consonants which are only found in Karo Batak variations, while His is only used in Mandailing but is also included in the Toba alfabat even though it is not used. The Ca script is only found in Karo while in Angkola-Mandailing the letter Ca is written using the letter Sa with a diacritic sign named tompi on it

Table I : Parent Sentences

Read	Script
A	ᯀ
HA	ᯂ
MA	ᯔ
NA	ᯉ
RA	ᯒ
TA	ᯖ
SA	ᯘ
PA	ᯇ
LA	ᯞ
GA	ᯎ
JA	ᯐ
BA	ᯅ
WA	ᯋ
DA	ᯓ
YA	ᯛ
NGA	ᯰ
U	ᯮ
CA	ᯌ
NYA	ᯜ
SA	ᯙ
VA	ᯝ
I	ᯪ
MBA	ᯘ
NDA	ᯉ
QA	ᯄ
FA	ᯕ

b. Sentence children

The letters in the Batak Toba alphabet consist of 7 pieces that are used to change the sound of the parent letter, for example sounds i, u, o, e / and add sound / ng / to the parent letter

Table II : Sentence Children

Name	Script	Read
Hatadingan	ᯩ	e
Singkora	ᯪ	i
Haluaon	ᯬ	o
Saringar	ᯰ	ng
Haborotan	ᯮ	u

c. *Pangolat* and Punctuation

Is a slash function to change the vowel sound into consonant sound or diacritical sign that removes the sound from the parent letter at the end of a syllable

"\ " =   Function to eliminate the vocal sound "a" in each parent sentence (Ina ni Surat).

Example:
AMAN = ᯞᯮᯤᯮ\

= Serves to end one sentence

d. Number

A number is a sign or symbol used to represent numbers

Table III: Numbers

Batak Script	Latin Script
━	1
≡	2
≣	3
△	4
≢	5
□	6
7	7
⋈	8
𝓎	9
━◇	10

D. Linear Congruent Method

Linear Congruent Method or commonly called LCM is a number randomization method by doing random number generation [12], [13]. The formulas of LCM are as follows:

$$X_{n+1} = (aX_n + c) \pmod{m} \qquad (1)$$

Where:
x_n = is a random number to n
a and c are LCM constants
m is the maximum limit of random numbers

The nature of LCM allows the repetition of numbers that appear for a certain period of time or after several times of generation, if the number of repetitions is equal to the number of modulus. Then determining the value of the LCM constant (a, c and m) will determine the results of randomization obtained in the sense that it will get a random number that does not occur [14]. Examples of the LCM randomization process can be seen below:

Formula :
$$X_{n+1} = (aX_n + c) \pmod{m} \qquad (2)$$

a = 6
c = 3
x_0 = 2
m = 11

$X(0) = 2$
$X(1) = (6(2)+3) \bmod 11 = 4$
$X(2) = (6(4)+3) \bmod 11 = 5$
$X(3) = (6(5)+3) \bmod 11 = 0$

$X(4) = (6(0)+3) \bmod 11 = 3$
$X(5) = (6(3)+3) \bmod 11 = 10$
$X(6) = (6(10)+3) \bmod 11 = 8$
$X(7) = (6(8)+3) \bmod 11 = 7$
$X(8) = (6(7)+3) \bmod 11 = 1$
$X(9) = (6(1)+3) \bmod 11 = 9$
$X(10) = (6(9)+3) \bmod 11 = 2$

Random numbers generated from numbers 1 to 10 do not show periodic repetitions. To be better in the results of randomization the amount of randomization <m:

III. RESULTS AND DISCUSSION

Before conducting research, it is necessary to design a research methodology as a reference so that research can be completed as expected. The design of the research methodology can be seen in the following, as shown in Figure 1 below
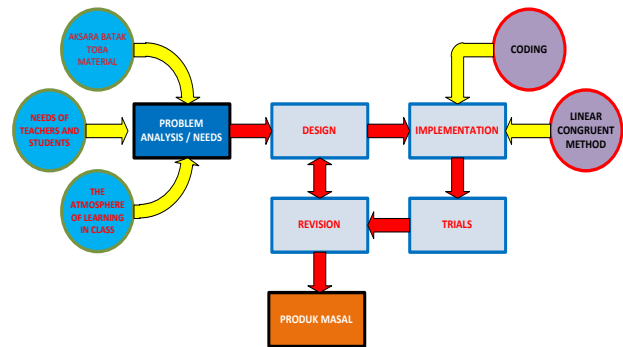

Fig 1. Research Methodology

Game-based learning models can provide a new atmosphere in learning activities because students are more relaxed and happy so that they can foster an interactive learning atmosphere, foster enthusiasm and increase student motivation, can add and strengthen the solidarity of social interaction among students, add insight, and improve learning achievement [15].

The description of the design flowchart from the design of this learning application using the LCM method can be seen in the following as shown in Figure 2 below:
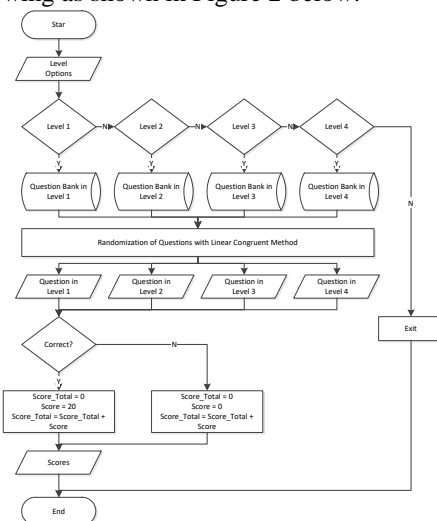

Fig 2. Implementation of LCM on Game-based Learning

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The learning model of this game is divided into 4 (four) levels, where each level is provided as many as 30 items to be randomized using the linear congruent method to display random questions of 5 (five questions) with each level also given a different keyboard input model.

The purpose of this randomization is to foster and improve the memory of each user, so that with this the user will be able to more quickly master the lesson

For the storyboard design of Learning Applications in this Game model can be seen in the following table:

Table IV : Storyboard Of Toba Batak Script Learning Application

Main Form	Number of questions	Time (Seconds)	Question Elements	Question content	Keyboard button	Audio		
						Main Game	Submit Button	Home /Exit Button
Splash Screeen	-	10	-	-	Batak Toba and Latin letters	gondang.midi	taganing.midi time : 5 second	gong1.midi time: 1 second
Level 1	5	25	Alphabet / Script	Letters		gondang1.midi		
Level 2	5	25	Alphabet / Script	1 Word		gondang2.midi		
Level 3	5	25	Alphabet / Script	2 Word	Batak script	gondang2.midi		
Level 4	5	25	Alphabet / Script	3 Word		gondang3.midi		

The question of each level is provided as many as 25 (twenty five) questions where each level is randomized to bring up a question of 5 (five) questions using the Linear Congruent Method.

The design of the learning application for batak toba Script based on multimedia game models in accordance with the results of the implementation is as follows:

Fig 3. Main page

Figure 3 above is the main view of the Toba Batak alphabet learning game application with a menu selection button, namely: Help button to see the procedures and rules for using the game, Play button is used to play starting from Level 1, Score Button is to see a list of scores for players who have used the game and the Exit Button to exit the application.

Fig 4. Level One and Two (Batak Toba and Latin characters)

Figure 4 above is a display for level 1 and level 2 games. At this level, questions or questions appear in the form of Latin characters, players answer questions using the buttons provided by using buttons consisting of Batak Toba and Latin characters

Fig 5. Level Three and Four (Batak Toba Script Button)

Figure 5 above is a display for level 3 games. At this level a question or question appears in the form of the Latin alphabet as in level 1 and level 2, the difference in this level 3 players answer questions using the buttons provided by using a button that consists of Batak Toba script.

IV. CONCLUSION

The application of the game model to the learning application of the Batak Toba script is an adaptation of the form of matchmaking and puzzle games that are often played or contested by children. Then the game is equipped with the LCM method to randomize the questions to be solved at each level, so that the questions that will appear will always be different for each level and useful in improving students' memory. This application is equipped with exam questions and answers for each level as many as 5 (five) times from the number of questions that will appear in each level, for example at level (1) one has 25 (twenty five) questions,

while those raised at that level only 5 (five) questions for each question given each score 20 (twenty) if correct and score 0 (zero) for each wrong answer. Each level is given 25 minutes. Besides that because this game is for learning for children, this level is not made continuous, so students can choose which level they like to play so that they get a new and meaningful but relaxed learning experience in learning Batak Toba Script.

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