Development of matemathic media games education based on e-learning in the Planting of Basic Concepts in Numeracy

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Abstract. The purpose of this research is to design and create an educational game based on e-learning Matemathic on the Basic Concept of Counting. The method of this research is research and development. This research was conducted in DKI Jakarta Elementary School class V and the object of research was an educational game based on e-learning Matemathic in the Counting of Basic Concepts as a medium of mathematics learning. The method used in data collection is observation and documentation, and the method of data analysis is quantitative descriptive analysis techniques. The results of this study are in the form of an educational game based on e-learning Matemathic in the Numeracy Basic Concept Planting as a learning media for class V. Material expert validation of learning media material based on the quality of the material and the usefulness of the material gets a percentage of eligibility of 76, 56%. The assessment of media experts on the quality of instructional media is based on the characteristics of the media in learning multimedia gets a percentage of eligibility of 86, 68%. The results of the assessment on product trials are divided into three aspects, namely aspects of screen display design, program operation, navigation, and expediency. Overall assessment results of 68 grade V students obtained a percentage of eligibility of 92,94 % so that this learning media is appropriate to be used as grade V mathematics learning.

1. Introduction
Mathematics education in Indonesia is currently undergoing a paradigm shift. There is a strong awareness, especially among policy makers, to renew mathematics education. The aim is that mathematics learning is more meaningful for students and can provide sufficient competence, both for further study and entering the workforce. This cannot be separated from the main problem in learning in formal education (schools) is the low absorption of students. Likewise in learning mathematics. Reports in studies conducted PISA (Program for International Student Assesment) in 2015 stated that the ability of students in Indonesia in mathematics had a low average score. Out of 70 countries, Indonesia ranks 62. Relevant to the statement, TIMSS (Trends in International Mathematics and Science Study) in 2015 stated that the average mathematics score of students in Indonesia was below the average international score and ranked 45th out of 50 countries. This could be caused because until now mathematics was one of the lessons that was a frightening specter for some students. The assumptions of difficult math students have become the most excited rumors compared to other subjects. In reality mathematics cannot be blamed entirely because there are many other things that make the process of
learning mathematics less than optimal so mathematics is considered difficult. Some of these include the lack of practice questions and maximizing the use of various learning media in fulfilling student learning.

The learning process at this time still gives dominance to the teacher and does not provide access for students to develop independently through discovery in their thought processes. The process of learning mathematics in class is almost always carried out conventionally with a sequence of offerings: (1) taught theory / definition / theorem through notice, (2) given and discussed examples, then (3) given practice questions. As a result, until now the quality of learning in Indonesia is still low. Another thing that causes difficulties in learning mathematics is that mathematics is generally presented as an abstract science, because mathematics involves abstract things. This is contrary to the conditions of development of elementary school age students who are still at the stage of concrete operations. As stated by Jean Piaget quoted that children aged 7 to 11 years are at a concrete operational stage [1]. To be able to understand and like abstract mathematics, the process of learning mathematics in particular the subject matter of the arithmetic operations is actually conveyed meaningfully and pleasantly, and must be able to demonstrate the benefits of mathematics in solving various problems in life.

The difficulty faced by students in learning mathematics is their difficulty in learning arithmetic operations, especially the basic arithmetic of addition, multiplication, subtraction and division. Though these materials are very important concepts to learn other mathematical concepts. The difficulty of students in performing multiplication operations is the key to the success of other mathematical concepts, because almost all mathematical concepts that will be studied at the next level will be closely related to multiplication calculation operations, such as division, FPB and KPK, geometry, statistics, etc.

The very basic problem above, alternative solutions must be sought. One alternative is to apply games education mathematics. This is in line with the age of development of elementary school students who are in a concrete operational phase, and really like the game. The game will make students relaxed, and feel happy, do not feel forced and afraid, even though they are following the learning. The game that will be developed and implemented in this study is a game to find pairs of numbers, a game that puts forward fun and extraordinary elements in the acquisition of mathematics learning information. This game acts as a context to help elementary school students understand the concepts of arithmetic operations of addition, multiplication, subtraction, and division.

The use of mathematical education games based on e-learning in a learning process is expected to be an alternative to overcome the problem of teacher difficulties in learning mathematics in elementary schools that are often found, because the use of media games education mathematics based on e-learning allows teaching students to learn while playing so students can have fun on learning mathematics especially material on planting basic concepts of forest [2]. In addition, learning e-learning based mathematics learning games is also expected to be able to improve student cognitive towards learning outcomes that can be easily achieved [3].

At present, the use of e-learning based education games is not only used as a means of playing, but also as a learning medium. E-learning based education games that are used as educational media that are educative are commonly referred to as education games. According to Barr [7] and Yong, Gates and Chan [8] the game can be presented as an addition to strengthen the material in mastering abilities. For children who need help in learning, games can function as a new and effective training tool in learning. Furthermore, the key characteristics of the educational game are four characteristics: (a) Challenge Challenges are designed with clear objectives, (b) Curiosity can come in two different forms. (c) Control is self-determination carried out in the game. (d) Fantasy includes emotions and thought processes [9,10].

Hainey, Connolly, Boyle, Wilson and Razak Explaining e-learning based education games is one of the learning methods that uses game technology [11]. According to Brom, Šisler and Slavík explained, education education based on e-learning is a software application used to support learning by utilizing games [12]. Any digital game product can be considered as a medium if there is an element of learning in it. A game demo that contains new product introduction material and how to use it and its benefits
can be considered as a medium that can help in the learning process. Sekleves, Cosmas and Aggoun explained that e-learning based education proved to have the potential to help every problem in learning, especially mathematics learning [13]. All the potential possessed by the game as a medium is very possible to be used as a motivational learning media for students. Its ability to affect the cognitive and emotional aspects of the user can simultaneously become a strength as a medium of learning [14,15].

2. Methods
The method used in this research is to use research and development methods. Development research includes the process of finding novelty and excellence in the context of effectiveness, efficiency and productivity. Development research is research oriented to develop and validate products used in education [16]. In this study focuses on the Development of Mathematical Education Games Based on e-learning on the Planting of Basic Concepts of Numeracy for Grade V students in Primary Schools.

The model used in the development of interactive multimedia based on a scientific approach is to use the Dick and Carey model [17]. E-learning Based Education Games Mathematic Development Test on Numeracy Basic Concept Planting for fifth grade students in elementary schools using a research design “One Groups Pretest-Posttest Design”, namely the research design that contained pretest before being given treatment and posttest after being treated.

Data collection techniques and data analysis techniques used are qualitative descriptive statistics. Qualitative descriptive statistics are used to analyze data by describing or describing data that has been collected as is without intending to make conclusions that apply to the public or generalizations.

3. Results and discussion
The media expert test in this study was conducted by a team of instructional media experts. The media assessment questionnaire covers aspects of the quality of educational games based on the characteristics of the media in multimedia. Based on the data, a large percentage of the level of the feasibility of the media in the educational game learning media = (319: 368) x 100% = 86, 68%. Material expert test in this study was conducted by a team of learning material experts. The material evaluation questionnaire covers several aspects, namely the usefulness, relevance of the material, and appearance. Based on expert assessment of learning materials which are divided into 2 aspects, namely the quality and usefulness of the material. Based on the data, a large percentage of the level of material worthiness in educational game learning media = (112: 128) x 100% = 76, 56%.

The product trial is carried out after the product is revised and declared appropriate by media experts and material experts. The assessment data on this product test uses a questionnaire. Questionnaires were given to 68 Class V Students at the DKI Jakarta Elementary School. The results of the assessment on product trials are divided into four aspects, namely aspects of display design, program operation, navigation, and expediency. Overall student assessment results obtained a percentage of 92, 94 %.

4. Conclusion
Based on the results of research and discussion, the following conclusions can be drawn:

- Designing an educational game based on e-learning Matemathic in Basic Concept Counting by analyzing potentials and problems, collecting data, making product designs, validating designs, and revising designs by experts.
- This educational game was developed using Adobe Flash Professional CS5 software using ActionScript 2.0 and supporting software such as CorelDraw X5, notepad, dan XML marker. In making content material in educational games, the data storage format used is XML (Extensible Markup Language).
- The results of the assessment of material experts on educational game materials are based on the quality of the material and the usefulness of the material in learning the basic concepts of calculating with a percentage of worthiness 76, 56%. The assessment of media experts on the quality of educational games based on the characteristics of the media in multimedia learning gets a percentage of feasibility 86, 68%. The results of the assessment in the product trial are
divided into four aspects, namely aspects of display design, program operation, navigation, and expediency. Overall results of the feasibility percentage of 92, 94%.

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