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Electronic-Based Mathematics Learning for Students' Creative Thinking Ability

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Abstract

The learning process is one of the essential things in students' success in obtaining the material they get, especially during the Covid-19 pandemic. Many students cannot carry out face to face in class. Therefore educators must provide the right method. So, students can understand the material it provides. Educators have used various ways not to feel bored, using the e-learning method. The study aims to determine Electronic-Based Mathematics Learning (EBML) for students' creative thinking ability in Sekolah Tinggi Keguruan dan Ilmu Pendidikan (STKIP) Muhammadiyah Pagaralam. The method used is the quasi-experimental method in the one-shot case study category. The study population was all students of the Mathematics Education Study Program of STKIP Muhammadiyah Pagaralam. The study results because of the indicator creative thinking indicators: fluent review 69.44%, flexible thinking 71.76%, original thought 74.92%, and elaborative thinking 88.19%. It is obtaining an average value of students amounted to 76.08%, it is categorized as useful. EBML is designed to simplify and shorten the learning process. So, it becomes more efficient. It is also to train students to be more independent in gaining knowledge to reach a wider geographical area, both in discussions and references. The EBML is applied to students' creative think in understanding the material presented.

INTRODUCTION

The development of information technology has brought the world into a new era than previously imagined. This technological development brings changes in various areas of human life [1]. One of the results of the advances in technology is the resulting human-computer as a tool to do the job and the internet to communicate interface used by computer [2].

As technology users, humans must take advantage of existing technology and subsequent technological developments [3]. Human adaptation with new technologies that have developed to do through education. [4]**.** The next generation is not left behind in terms of new technology. That way, technology, and education can grow together with the new age as successors to the old generation. The primary vehicle for human resource development is education and training. However, when considering the circumstances of geography, socio-economic and cultural diversity of Indonesia, it is clear that it is no longer sufficient (not practical) if only relying on

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traditional ways of solving alone [5]. Therefore, various alternative strategies related to the problem need to be explored, studied, and implemented [6].

The introduction of new technology must be carried out in teaching and learning activities to become cadres ready to face the world's challenges in the technological era. The sudden outbreak of the Covid-19 pandemic demands all educational institutions to respond quickly by conducting face-to-face to online learning so that learning activities can continue as set out [7]–[10].

The quality of the teaching and learning process will affect the learning outcomes of students. One factor supporting students' learning outcomes is learning media availability. [11], [12]. One of the learning media that will be used electronic-based learning. E-learning or electronic learning is recognized increasingly to solve educational problems, both in developed countries and developing countries [13], [14]. Many people use different terms with e-learning. But in principle, e-learning uses electronic services as a tool [15].

Learning success is not only influenced by the learning method but also by students' creative thinking abilities [16]–[20]. Students who are creative in the teaching and learning process are likely to have high learning achievement because they can easily follow lessons. In contrast, passive students tend to have more difficulty following the readings. There are not a few high-achieving students who have low creative abilities. Many students achieve academic success, but only a few demonstrate creative skills in the teaching and learning process [21].

The research revealed the essence of creative thinking is a process in the brain and mind carried out by someone creative in solving a problem may come from various STKIP Muhammadiyah Pagaralam Lecturers. In the learning process still using interactions in class e-learning, in this study, the authors conducted a study entitled The Application of electronic-based mathematics learning (EBML) for students' creative thinking ability at STKIP Muhammadiyah Pagaralam.

RESEARCH METHODS

The study method used the quasi-experimental [22]–[24] in the one-short case study category [25]. With EBML, the researcher wants to know the effect of a change for the better or not on the students' creative thinking after treatment without affecting other factors [4]. Samples were taken from students' statistics mathematics education department STKIP Muhammadiyah Pagaralam. It has been done on the experimental class learning to use the medium of e-learning with 22 people. In this study, one practical class was carried out without a comparison class.

$$X \rightarrow O$$

X: The treatment given uses EBML

O: Observation during learning using EBML [26]

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RESEARCH RESULTS

Research on the application of electronic-based mathematics learning for students' creative thinking ability at STKIP Muhammadiyah Pagaralam. It begins with conducting material analysis based on the syllabus and semester lesson plan (RPS) of the Education Statistics. Subject by discussing with the head of the Mathematics Education Study Program to carry out e-learning and discussing with Mr. Fadila Kusuma, ST, a processor for the e-learning laboratory at STKIP Muhammadiyah Pagaralam.

Figure 1. E-learning Implementation Socialization

Furthermore, the researcher held a discussion again with Mr. Fadilah Kusuma, ST, to continue the research will be carried out. The researcher was assisted by the admin, Mr. Fadilah Kusuma, ST, to create a login for e-learning.

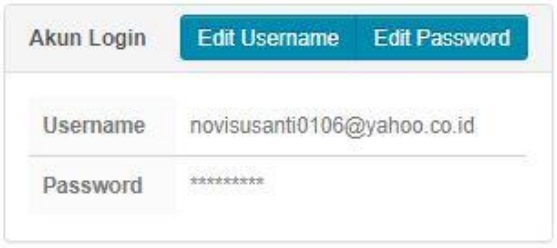

Figure 2. E-learning Account Creation

Researchers, doing e-learning in the system, determine the research class. Researchers carry out e-learning for the first meeting, which begins with data presentation material.

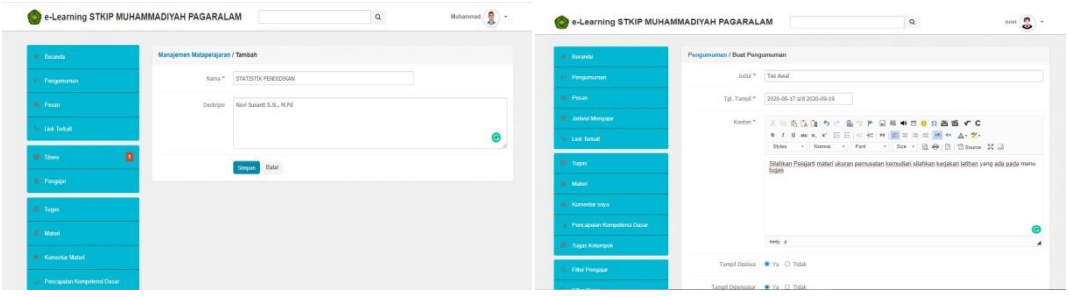

Figure 3. The E-learning system of STKIP Muhammadiyah Pagaralam

Researchers corrected the results of student answers after the final test. The final test results were conducted to determine the data analysis from the students' initial and final tests in e-learning to see the creative thinking of STKIP Muhammadiyah Pagaralam.

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The flow of the application of e-learning for STKIP Muhammadiyah Pagaralam students is as follows:

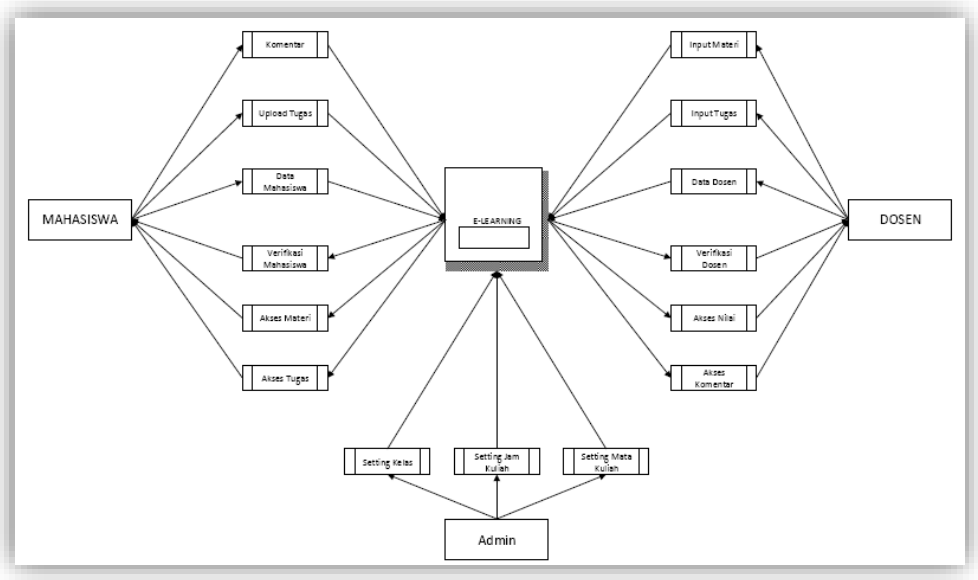

Figure 4. The flow of E-learning STKIP Muhammadiyah Pagaralam

Based on the student's creative thinking ability, test subjects statistics early pension in the right mathematics education department. It has been done on the experimental class by learning to use the medium of e-learning with the number of students 22 people, the value of post-test as follows:

Table 1. Percentage of First Test Creative Thinking Ability Each Indicator

Creative Thinking Indicators	total Score	Max Score x Number of Students	Percentage of Each Indicator
Fluent Think	205	264	69.44%
Flexible Thinking	177	352	71.76%
Original Thinking	218	352	74.92%
Elaborative Thinking	207	264	88.19%
Average		308	76.08 %

Based on the table. 1 above, the students' mathematical creative thinking ability scores are more dominated by elaborative thinking, which reach 88.19%. In contrast, original thinking in various forms of mathematical representation, Flexible Thinking, and Fluent in problem-solving, respectively, obtained a percentage of 74.92%, 71.76%, and 69.44%. it amounted to 76.08% categorized as useful. EBML is designed to simplify and shorten the learning process. So, it becomes more efficient. The EBML is applied to students' creative think in understanding the material presented.

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DISCUSSION

The development of information technology can improve performance and enable activities to be carried out quickly, precisely, and accurately, resulting in high productivity [27], [28]. E-learning, as an electronic medium, can have a changing impact on the learning process. The interaction between faculty and students, not just through direct face-to-face but also through electronic media as an intermediary, the lecture is more interesting, visual, and interactive [1], [27].

On the other hand, the rapid development of the internet or information technology has changed the way lecturers teach and how students learn. Learning is not only through lectures and books but also through the internet. Learning in this latter way has the advantage of being independent of time and space; learning can be done anywhere and anytime. Information can be obtained easily, from study materials to entertainment. One of the internet applications currently trending is Blog [25], [29]. Use of technology in the learning process which refers to the internet technology network thus use can be instant, easy to store and retrieve and share information with other users [30]. E-learning is the use of technology in the form of the internet or the web in learning so users can access learning anywhere and anytime[31].

The understanding above can be concluded that e-learning is a process that takes advantage of computer technology and information networks in the form of the internet or the web. In general, e-learning learning, of course, still requires learning media especially computers and other learning resources that can be accessed by teachers and learners. With e-learning, students can share information and can access the subject matter at any time.

The use of e-learning to collaborate can provide opportunities for broader distribution of knowledge at a relatively cheaper cost than holding tutorial classes [4]. E-learning will bridge managers of an educational institution or individuals and stakeholders and prospective learners to exchange information. Make it easy for all parties to access the latest news and knowledge and hold discussions on specific subjects to increase knowledge development.

EBML is designed to simplify and shorten the learning process. So, it becomes more efficient. It is also to train students to be more independent in gaining knowledge to reach a wider geographical area, both in discussions and references. So, the e-learning is applied leads students to think creatively in understanding the material presented [17], [32]–[34].

Besides, EBML can make learning easier and cheaper in the scope of campus and other areas. It can also train students to learn independently to find references to learning knowledge that is not only found in the classroom. This e-learning becomes a learning solution when lecturers and students cannot attend lectures but can still follow the learning delivered.

With e-learning allows students to have high flexibility of learning [7], [16]. It means that students can access lecture materials at any time and repeatedly. Students can also communicate with lecturers at any time. With these conditions, students can further strengthen their mastery of learning materials or lectures creatively. For lecturers, e-learning also has several benefits. For example, it will be easier to update teaching materials following scientific developments demands and develop themselves or research to increase their insights because they have relatively more free time.

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CONCLUSIONS AND SUGGESTIONS

Based on the research and discussion results above, it can be concluded that students' creative thinking skills increased after applying e-learning methods. Based on the test results, the students' creative thinking ability in the statistics department of education obtained 76.08%. It indicates a relatively good outcome. Suggestions for future research are to research larger samples and a relatively long time. It can also be done on other variables with this study to see more varied research results.

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