JISAE
Online ISSN : 2597-8942
Print ISSN : 2442-4919
Journal of Indonesian Student Assessment and Evaluation

THE APPLICATION OF E-LEARNING MATHEMATICS USING MOODLEIN IMPROVING STUDENTS' PROBLEM SOLVING ABILITY

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ABSTRACT

E-learning is an online-based learning process that cannot replace conventional learning models in the classroom, but can support that model through the enrichment of content and development of educational technology. The use of e-learning is very useful, because it can train students to be more independent in gaining knowledge, high learning flexibility in accessing learning materials at all times and repeatedly, saving educational costs, and facilitating the renewal of learning materials and models in accordance with the demands of scientific development that happened. Problem solving is a high level cognitive ability that is complex, because when solving a problem, students need to think critically to be able to see a problem and think creatively to be able to solve the problem. Therefore, teachers are required to be able to shape students to have innovative, creative, and critical thinking abilities. For this reason, efforts are needed to improve teacher performance so that they can carry out their duties as one of the determining factors in achieving the quality of learning and improving student learning outcomes, especially in developing learning media based on e-learning. Based on these assumptions a problem arises in this study, namely: "What is the strategy of developing a prototype e-learning Mathematics learning tool using Moodle in order to improve students' problem solving abilities?". Specific targets in this study are: prototype e-learning Mathematics learning tools using Moodle. This research is a Research and Development that was carried out for seven months in the Computer Laboratory of PTIK FT UNJ.

Keywords: electronic learning, mathematics, moodle, problem solving

INTRODUCTION

Education is part of an effort to develop self-potential in order to grow into a strong human character and a healthy social life. In the 1945 Constitution Article 31 on Education, it was also stated that to achieve a moral and prosperous nation a good and appropriate quality of education is needed. Education is very much needed to meet the need for high human resources in Indonesia, with the aim of being able to compete in the future.One part of education is a lifelong and continuous learning process. The main components in the learning process are Teachers, Students, and Teaching Materials. Teachers are the spearhead of all educational policies and are crucial in shaping the face of education in Indonesia.It is the teacher who will shape the character and soul of the nation, so that the good

and bad of this nation is very dependent on the teacher. Because the teacher's role is so large, it requires teachers who are professional, creative, innovative, have a high willingness to continue learning, and are literate in information technology, so that they are able to keep abreast of the times (Raddana, 2013).The teacher has the task to shape students to have innovative, creative, and critical thinking abilities. In carrying out his profession, a teacher must have special abilities, among others, the ability to design and implement a variety of learning strategies in accordance with the level of student development, including utilizing a variety of sources and learning media to ensure the effectiveness of learning.The effectiveness of learning lies on the shoulders of the teacher. Therefore, the success of the learning process is largely determined by the quality and performance of the teacher, likewise, the success of the implementation of a learning strategy will depend on the teacher's skills in using models, approaches, strategies, methods, media, techniques, and tactics of learning.

Many strategies can be carried out by the teacher to train students to have innovative, creative, and critical thinking abilities, including through the development of learning models that lead to students' thinking processes, and one model that is considered appropriate is the problem solving model.With problem solving students are expected to be able to solve mathematical problems, apply and adapt various strategies, and build their own knowledge. Problem solving is a type of learning that is the highest level and complex compared to other types of learning.Problem solving is also inseparable from one's knowledge of the substance of the problem, starting from how the understanding of the core problem, what procedures or steps will be used, and which formula rules are appropriate for use in solving the problem.

Problem solving learning model is part of problem based learning. In problem-based learning students are required to solve the problems presented by the teacher by digging up as much information as possible, then analyzing the information and finding the best solution of the existing problems.Problem solving should be central in learning mathematics because it can involve the process of thinking optimally.With this method the teacher does not provide information in advance to students, but information is obtained by students after solving the problem. Anderson (1985) revealed that"problem solving by analogy involves using the structure of the solution to one problem to guide the solution to another problem".Meanwhile according to Polya (1981)"Solving a problem means finding way out a difficulty". In problem solving students are required to conduct authentic investigations to find solutions to problems that are given. Students are asked to identify problems, develop hypotheses, collect and analyze information, and make conclusions.

The development of Information and Communication Technology has an impact on the increasing need for concepts and mechanisms in learning systems based on Information and Communication Technology, known as e-learning.In the world of education this concept carries an influence on the process of transformation of conventional education into digital form through internet technology. E-learning cannot replace conventional learning models in the classroom, but strengthen these learning models through enriching content and developing educational technology.

The use of e-learning in the learning process provides many benefits for students, teachers, and in the whole learning process.The benefits gained in using e-learning

include: being able to train students to be more independent in gaining knowledge, high learning flexibility in accessing learning materials at any time and repeatedly, saving time in the learning process, being able to interact with learning resources when anywhere and anywhere, saving overall education costs,facilitate the renewal of material and learning models in accordance with the demands of scientific development that occurs, can also efficiently control student activities, and various other benefits.As a professional educator, teachers should be able to increase their competence to be more skilled in providing assistance and guidance to students through the learning process in the classroom.

Furthermore, by exploring and paying attention to the description, it is necessary to have research on efforts to improve the quality of the learning process through the development of learning tools based on e-learning so that it can contribute to the problem solving abilities of students in Mathematics subjects.In this study the assessment was carried out on efforts to develop prototype of e-learning based learning devices using Moodle software.

METHODS AND EQUIPMENT

This research is a Research and Development, namely: a systematic assessment of the design, development, and evaluation of programs, processes, and learning products that must meet the criteria of validity, practicality, and effectiveness (Seals and Richey, 1994), and can show added value (Plomp, 1994).Gay (1991) said development research is an effort or activity to develop an effective product for school use, and not to test theory.Akker (1999) describes development research based on two objectives, namely: as the development of a product prototype and as the formulation of methodological suggestions for the design and evaluation of a product prototype.Meanwhile, according to Borg and Gall (1983) development research is a process used to develop and validate educational products.Specifically, in this study the study focused on developing prototypes of e-learning based Mathematics learning device products using Moodle and the formulation of methodological suggestions for designing prototype products.

This study aims to improve the productivity, effectiveness, and efficiency of the learning process through planning and developing strategies and utilizing Information and Communication Technology through developing a prototype e-learning Mathematics learning tool using Moodle.This development research was carried out in the Computer Laboratory of the Informatics and Computer Engineering Education Study Program at the Faculty of Engineering, Jakarta State University, involving three competent students in the field of Computer Programming.The process of developing a prototype e-learning Mathematics learning tool in this research study lasted for seven months, starting from May 2019 to November 2019.

At the data collection stage two things are done, namely: literature study and field study.Literature study is used to find concepts or theoretical foundations that strengthen a product, examine the scope of the product, the extent of use, supporting conditions, and to find out the most appropriate steps to develop a

product.Next, a field study is conducted as a gauge of needs and research on a small scale. Product development is based on measuring needs.

Development research in the field of education begins with the identification of learning problems encountered in the classroom and related to learning tools, such as: syllabus, teaching materials, student worksheets, instructional media, as well as learning achievement test.Learning tools are considered to be a problem because they do not yet exist, or exist but do not meet learning needs, or they exist but need to be improved.Next, a theoretical study is conducted on the development of learning tools that are relevant to what will be developed. The next step is to develop a draft of learning tools based on relevant theory. After completion of the draft, the draft was repeatedly reviewed by the researcher himself and assisted by peers (peer review).After what was expected, the draft was given to the relevant experts (expert validation) to get input. Input from experts is the basis for improvement of the draft.After the draft was revised based on expert input, the next step was to test the draft. From the results of the trial, some parts may require revision. The last activity is the revision of the draft into the final draft of the learning kit.

Development research methods are focused on two stages, namely: the preliminary stage and the formative evaluation stage (Tessmer, 1998). At the Preliminary stage, researchers determine the place and subject of research by contacting the principal and subject teachers at the school that will be the location of the study.Furthermore, the researcher will make other preparations, such as arranging the research schedule and the procedure of collaboration with the class teacher used as the research site. Formative Evaluation Phase, includes: (1) Self Evaluation, namely: the analysis phase and the design stage.The design results that have been obtained are validated using data triangulation techniques, namely: the design is validated by experts (experts) and colleagues. The results of this design are referred to as the first prototype. (2) Prototyping, the results of the first prototype are given to experts (expert review) and students (one-to-one) in parallel. From the results of both of them used as revised material.The results of the revision of the first prototype are called the second prototype. At the expert review stage, the products that have been designed were examined, assessed, and evaluated by experts in terms of content, construct, and language. In the one-to-one stage, researchers try out designs that have been developed to students/teachers who become testers.The results of this implementation are used to revise the designs that have been made. The results of the revision of the expert and the difficulties experienced during trials on the first prototype were used as the basis for revising the prototype and named the second prototype then the results were tested on a small group.The results of this implementation are used for revision before being trialled at the field test stage. The results of the question revision are based on students' suggestions / comments on the small group and the results of the analysis of this item are called the third prototype. (3) Field Test, the revised results are tested on research subjects in this case as a field test. Products that have been tested in the field test must be products that have met the quality criteria, namely: validity, practicality, and effectiveness.

RESULTS

Based on the description in the previous study and given that in the learning process there are three important variables that are interrelated, namely: teachers, students, and learning media, it can be concluded that efforts to improve teacher performance in contributing to students' problem solving abilities in Mathematics can grouped into three variables,namely: improving the quality of teachers, improving cognitive abilities of students, and improving the quality of instructional media developed by teachers. Therefore, efforts to improve students' problem solving skills cannot be separated from these three variables.

The steps taken to improve the quality of teachers are to shape the character of teachers so that they are sensitive to the environment, highly motivated in finding information, critical of existing problems and creative in finding solutions to problems. The next step is to provide training regarding the steps of problem solving. The teacher can follow the problem solving steps proposed by David Johnson and Johnson (Gulo, 2002) with the following sequence of steps:(1) Define the problem in the classroom by expressing the problematic events, both through written and oral material, then asking students to formulate the problem in one simple sentence (brain stroming). Collect each student's opinion by writing it on the board without questioning whether or not it is right, as well as the right or wrong opinion.Each opinion is reviewed by asking for an explanation from the student concerned. Thus it can cross out some formulas that are less relevant, and choose the right formula to be reformulated (rephrase, restate) until finally one formula is chosen that is most appropriate for all students,(2) Diagnosing the problem, after successfully formulating the problem, the next step is to form a small group that will discuss the causes of the problem,(3) Formulate alternative problem solving strategies. At this stage the group searches for and finds various alternatives on how to solve the problem. For that the group must be creative, divergent thinking, understand the conflict between ideas, and have a high degree of meeting power,(4) Determine and implement a strategy. After various alternatives have been found by the group, then which alternative will be used. In this stage the group uses fairly critical and selective considerations with convergent thinking,and (5) Evaluate the success of the strategy. In this final step the group learns: Whether the strategy was successful (process evaluation) and what was the result of implementing the strategy (evaluation of results).

Steps taken to improve students 'cognitive abilities are by: (1) Increasing students' sensitivity to information that develops around them. This increased sensitivity will also be associated with an increase in the ability to think critically, because to think critically requires attention to details of what ishappening,(2) Improve students' ability to recognize information related to problems, (3) Improve critical thinking skills. Critical thinking is characterized by the ability to think reflective, productive, and evaluative of the available evidence. A critical person will always question the things around him until he gets the answer sought.In addition to being able to think critically, an individual must be open and accept all possibilities for the explanation of a problem, and (4) Increase creativity. Creative individuals have the characteristics of being able to be flexible, have intrinsic motivation, are willing to face risks and can make objective assessments.Some ways that can be

used to improve the ability to think creatively include always trying to be interested and enthusiastic about something, happy with surprises and giving surprises, always have targets and goals every day, and engage in activities that stimulate creativity, such as artistic activities or skills. (Miwa Patnani, 2013).

Steps taken to improve the quality of instructional media are to develop learning media based on Information and Communication Technology through Web Based training methods, which are often also identified with the term e-learning.In the Web-based training method, in addition to using a computer as an educational tool, it also utilizes the internet network, so students who will learn can access their subject matter anywhere and anytime, while connected to the Internet network.Thus the learning process can run more interactive and help the realization of independent learning. Although it cannot replace the conventional learning model in the classroom, e-learning can strengthen the learning model through enriching the content and development of educational technology.As it is known that learning media is a tool that can help the teaching and learning process to clarify the meaning of the message conveyed, so that it can achieve the objectives of learning effectively and efficiently.

Some research results that show the positive impact of using media as an integral part of learning in the classroom, are as follows: (1) the delivery of non-rigid lessons, (2) learning can be more interesting, (3) learning becomes more interactive by applying learning theories and principles psychological principles accepted in terms of student participation, feedback, and reinforcement,(4) the length of learning time can be shortened, because most media only require a short amount of time to deliver a large number of messages, and the possibility of being absorbed by students is greater, (5) the quality of learning outcomes can be improved if word integration and pictures as learning media can communicate elements of knowledge in a way that is well organized, specific, and clear, (6) the learning process can be given whenever and wherever desired or needed, especially if instructional media are designed for individual use, and (7) students' positive attitudes towards what they learn and towards the learning process can be improved, and (8) the role of the teacher can change in a more positive direction.
The results of this study are prototypes of e-learning based Mathematics learning media using Moodle, for one subcompetency. This media consists of the front page (Cover), preface, table of contents, limiting modules, and parts of the module. The module parts are: Moodle preparation and installation, creating user accounts in the Moodle application, creating categories, sub categories, courses, and assigning roles, creating topics, entering teaching materials, and testing materials, checking, rating, commenting on assignments students, see online and export exam results in Excel format.

DISCUSSION

Problemsolvinga high level of cognitive ability thatcomplex, because when solving problems, students need to think critically toable to see a problem and think creatively toable to solve the problem. However, in reality, therestill many students who experience difficulties in solving problems, especially in mathematics subjects, because they do not understand well the problems theyface. As a computer technician, he did not know what damagehappening to his customer's

computer, so of course, he also did not know how to repair the damage to the computer. Therefore, special abilitiesneeded to understand how to solve a problem better.

According to the Content Standards in Permendiknas Number 22 of 2006, mathematics subjectsgave to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to cooperate. The competencyneeded so that students can have the ability to obtain, manage, and utilize information to survive in a situation thatalways changing, uncertain, and competitive. Efforts to develop the creativity of students optimally, especially about the learning process in schoolthe duties and responsibilities of a teacher.

Teachers as facilitators in educationrequired toable to form students who have innovative and creative abilities. A teacher needs to have special abilities, abilities thatnot owned by people whonot teachers. Thatwhy teachersprofessional work. By Law Number 14 of 2005 concerning teachers and lecturers in article 10, a teacherrequired to have competencies that include pedagogical competence, personal competence, social competence, and professional competence, where the four competenciesinterrelated to form professional teachers. Pedagogical competencies that mustpossessed by professional teachers include the ability to master subject matter, teaching methods and learning strategies, and how to assess student learning outcomes.

CONCLUSION

The main study in this research is how to develop a prototype strategy for e-learning Mathematics learning tools using Moodle in order to improve students' problem solving abilities. Problem solving is a skill that includes the ability to find information, analyze situations, and identify problems with the aim of producing alternatives so that they can take a decision to achieve the goal. Problem solving in Mathematics subjects needs to be cultivated, because it can improve student learning creativity.

Mathematics which means knowledge, thought, assessment, learning and is a science that studies things such as quantity, structure, space, and change needs to be studied more deeply. Mathematics can be seen as a series of ever-increasing abstractions. Lots of mathematical ideas are very abstract and previously unknown relevance, and the language of mathematics that seems difficult for beginners. To facilitate students' understanding in learning mathematics, various strategies are needed, one of which is through the development of learning media based on e-learning using Moodle.

The teacher plays a very strategic role in the effort to create quality graduates in order to meet the needs of professional human resources, because the teacher is the party most in direct contact with students in the school. This means that teacher performance is one of the determining factors in achieving the quality of learning and improving student learning outcomes. Teacher performance can improve the quality of education and will be able to produce graduates who are superior and have high competitiveness in this globalization era. Teacher performance must always be considered and managed properly in order to

experience improvement, especially in developing learning media based on e-learning along with the rapid development of Information and Communication Technology.

Discussion on improving teacher performance through the use of e-learning based learning media is very important, because the learning process will always be related to learning media and teacher performance to provide optimal learning outcomes. In addition, teachers have a very big role in educating the next generation of the nation. While problem solving in learning mathematics is very necessary, because it can involve students 'thinking processes optimally, so students are able to solve mathematical problems, apply and adapt various strategies, and build their own knowledge, and it is undeniable that to improve students' problem solving abilities competent teacher.

Based on the studies described above, the conclusions from this study can be drawn as follows: to improve students' problem solving abilities in Mathematics, it is necessary to develop learning media based on e-learning and improve the quality of learning methods. Thus it is hoped that students will become better prepared when faced with problems, especially if they have been directly involved in the community.

Based on the results of research, studies, and conclusions that have been described in the previous discussion, the suggestions put forward in efforts to utilize the results of this study are as follows: (1) This study limits its study to the strategy of developing a prototype e-learning Mathematics learning tool using Moodle in order to improve students' problem solving skills. This gives an indication that the generalization of research results is limited, only applies to Mathematics subjects, so it is advisable to conduct further research in the implementation of other subjects as well as other variables that might be able to improve students' problem solving abilities, (2) Continuous training is needed for all teachers so that the process of developing learning media based on e-learning can provide maximum results, and (3) Further development research needs to be conducted on the use of e-learning in learning media using Moodle, in order to improve the quality learning.

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FUNDING

This researchfunded by the fund of the Public Service Agency (BLU) Faculty of Engineering, Jakarta State University Based on the Rector's Decree.

ACKNOWLEDGMENT

The authors would like to thank their colleague for their contribution and support to the research. Theyalso thankful to all the reviewers who gave their valuable inputs to the manuscript and helped in completing the paper.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.