Design Of MOODLE-Based Mathematics Learning To Improve Spatial Ability For Class XII High School Students

Isnaepi, Suparman

Abstract: Geometry is one of the essential ingredients taken in class XII. The problem is the compilation of three-dimensional real-life objects in two dimensions, this is related to spatial ability. Spatial capabilities can be drilled through GeoGebra-assisted MOODLE-based multimedia. Designed using MOODLE-based multimedia learning to improve the spatial ability of class XII students. The subjects in this study were teachers and students of class XII Yogyakarta 5 SMA. Data collection instruments used are observation guidelines, interview guidelines, and questionnaires. The development phase uses the ADDIE model. But in this study only on paper analysis and design. The analysis phase is divided into two parts, namely needs analysis and system analysis. In the design section, this section reviews, the part of the house, the content section, and the evaluation section. E-learning developed has advantages as a source of independent learning for students, to improve spatial abilities in three-dimensional material, as well as the ability to solve problems in statistical and opportunity material. Then in the next research is to develop compulsory MOODLE-based mathematics learning multimedia for class XII.

Index Terms: Design, E-Learning, MOODLE, Spatial Ability, ADDIE, Geometry.

1. INTRODUCTION

The success of learning can be realized if the learning process is held effectively, meaning that the learning process can run smoothly according to the duration of time available, directed and achieving the learning objectives. Several factors influence the learning process, both from internal factors, namely the learner itself and from external factors such as educators, teachers, facilities, environment, and learning media used. Students who are actively and creatively supported by facilities and teachers who master the material and effective delivery strategies will increase the success of learning. However, to achieve maximum results, there are still many factors that are still obstacles.

So far the parameters of the success of mathematics learning still use a single quantitative standard that applies nationally. In fact, there are still very many students in Indonesia who are categorized as laggards, namely students who are very difficult to understand the subject matter at the time available. This is seen in terms of the process of learning geometry in compulsory three-dimensional mathematics subjects. This material has an important role, especially for students of class XII high school, namely to develop spatial abilities in the real world and support the learning of other subjects.

Geometry is one of the mathematical material that is often problematic because it requires spatial reasoning skills [1]. Spatial reasoning refers to the ability to produce, maintain, retrieve, and change visual images so that they are well structured [2]. This capability involves the rotation, retention, and transformation of visual information in involving linking 2D views with 3D [3]. Not all students have spatial skills, namely the innate ability level that describes a person's holistic capacity in spatial ability, where no education or training specifically designed to develop spatial abilities has occurred. In contrast to spatial skills, spatial abilities can be trained to improve student learning outcomes [4-6]. According to Buckley, Seery, and Canty, the spatial ability is the current level of ability that describes a person's holistic capacity in the domain of spatial abilities, after education or training specifically designed to develop spatial abilities has occurred [7]. The problem occurs when three-dimensional real-life objects are represented in two dimensions, so the role of the media in learning mathematics is very important to help students practice spatial abilities in three-dimensional material. The attractiveness of the media will provide a real experience for students in the three-dimensional learning process. The media can also improve students to think concrete and can develop psychomotor skills in the learning process. Based on the results of field observations in Yogyakarta 5 Public High School, teachers have never developed online learning media that can practice spatial abilities in three-dimensional material. The age factor is one of the reasons expressed by the teacher. Besides, time constraints are also a reason because teachers are busy preparing school administration. On the other hand, the plurality of conditions that occur in the field is that the teacher is still preoccupied with "chasing" the syllabus so that the achievement of holistic learning in mathematics is neglected. The reason is that class XII students have accepted mathematical concepts during class X and XI. So that in class XII the learning process is only carried out in odd semester, whereas in the even semester students are only trained to prepare themselves in facing the national exam with the method of giving assignments. This condition requires students of class XII to have independent learning resources that can be used anytime and anywhere. Along with the development of technology that is increasing very rapidly making it easier for everyone to get information anytime and anywhere. This provides an opportunity for educators to develop interactive learning media. One of the learning media is website-based multimedia. Learning by using multimedia is expected to motivate students to learn independently, creatively, effectively and efficiently. On the other hand, the development of information technology currently available has

- Isnaepi is currently pursuing master’s degree program in mathematics education in University Ahmad Dahlan, Indonesia
- Suparman is an associate professor in mathematics education at University Ahmad Dahlan, Indonesia, E-mail: suparman@pmat.uad.ac.id
a very important role in the education system and its effects on learning outcomes, performance, and student satisfaction [8], [9]. From the perspective of presentation of content in learning, multimedia and network technology have helped transform traditional media, such as books, tables, drawings, and blackboard writing, into online and interactive forms [10]. Also, multimedia technology can facilitate the presentation of learning materials adaptively and in various suitable forms, such as video, audio or text. One system that can be utilized in website-based learning is e-learning. E-learning refers to an internet-based learning platform, where students and teachers can interact or collaborate. E-learning is defined as instructions delivered on digital devices (such as desktop computers, laptops, tablets or smartphones) intended to support learning [11]. Implementation of e-learning can lead to the administration of teaching and learning processes automatically through software known as Learning Management Systems (LMS) [12]. One of the popular LMS used in creating e-learning is Moodle (Modular Object-Oriented Dynamic Learning Environment) [11], [13-15]. Therefore, it allows researchers to develop MOODLE-based multimedia learning designs and conduct research with the title "MOODLE-Based Mathematics Learning Multimedia Design to Improve Spatial Ability for Class XII Senior High School ".

2 METHOD
This research is classified into research and development. While the development model used in this study is the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). "[16] Visually the stages of the ADDIE development model are shown in Fig. 1.

![Fig. 1. ADDIE model [17].](image)

But in this study only covers the analysis and design stages. Analyze phase (analysis), carried out to see conditions related to the compulsory mathematics learning process related to multimedia needs of MOODLE-based learning, curriculum analysis, analysis of student characteristics, problem analysis. At the analysis stage, data collection techniques through observation and interviews use observation guidelines and interview guidelines. The type of data produced is qualitative data related to the curriculum used, student characteristics, problems in learning. The subjects in this study were students of class XII Yogyakarta 5 SMA. The collection technique used in analyzing data is the Miles and Huberman model. Then the design phase was carried out, the researcher designed MOODLE-based multimedia learning tailored to the needs of students based on the results of the initial analysis. The data collection instrument used to test the design feasibility of e-learning development in the form of questionnaires. The type of data generated is in the form of quantitative data in the form of design feasibility test scores.

3 RESEARCH RESULT
This research was conducted by designing MOODLE compulsory mathematics learning multimedia for high school students of class XII. The following are the results of the module development design through the analysis and design stages in ADDIE.

3.1 Analyze
At the analysis stage, there are two stages of needs analysis and system analysis. Analysis of e-learning needs based on:

3.1.1 Curriculum Analysis
The results of interviews with mathematics teachers must be obtained that the curriculum used in the learning process is a revised 2013 curriculum. The scope of compulsory mathematics material in high school class XII in the revised 2013 curriculum consists of three dimensions, statistics, and opportunities.

3.1.2 Student Characteristics Analysis
It is known that students prefer online learning resources, with the reason that they are more accessible anytime and anywhere, free, and more variety in problem-solving and problem-solving. Seeing this condition, e-learning is an alternative for students as a source of independent learning. So that e-learning can help students understand and as a source of independent learning.

3.1.3 Problem Analysis
Problems encountered by students are difficult in visualizing the distance in space in three-dimensional material, such as when students determine the projection of a point to a line that represents the distance of a point to a line or determines a line perpendicular to 2 lines. Such abilities are included in spatial abilities and can be trained to improve students' abilities in the third dimension. In addition, the results of interviews with students, students said they did not know what GeoGebra was and had never used it. According to him if learning using GeoGebra can help in visualizing the building of space will be preferred and more easily understood, especially three-dimensional material. Because with GeoGebra it can facilitate the understanding of concepts and facilitate the construction of the right image in terms of geometric construction [18-21]. While the system analysis is done to find out the supporting programs that will be used in designing e-learning. The results of the analysis are obtained, supporting programs include, CorelDraw Suite X7, GeoGebra 5.0, www.geogebra.org, www.yumpu.com, dan www.youtube.com.

3.2 Design
In the design stage, e-learning that is be designed in the form of MOODLE-based compulsory mathematics learning multimedia with the website address, http://mathgeometry.gnomio.com. Based on the results of the analysis above, MOODLE-based multimedia learning has been made as follows:

3.2.1 Main Section
In the main section, there are menus and footers. The menu section contains menus available on the website to make it easier for users to access e-learning. The menus are in the form of Material, Evaluation, Home, and Final Evaluation. Figure 2 below shows the display menu on the website.
At the bottom of the website or also called a footer containing information related to descriptions, references used in compiling material, quick links to access supporting websites, and contacts from researchers. Figure 3 below shows the display footer on the website.

On the left side of the website, there is a block containing home, dashboard, calendar, and private files. Figure 4 below shows the display block on the website.

3.2.2 Homepage Section
On the Homepage or Home section, there is a slider and course. The slider section consists of three sliders containing information about geometry, statistics, and opportunities. Slider 1 contains a description of geometry used in the concept of distance in space, and there is a "know more" button for more information. The following Figure 5 shows the slider. In addition to the slider, the home view provides a course or button display to access material, evaluation, and even final evaluation which includes all three materials in class XII. The following Figure 6 shows the course view.

3.2.3 Content Section
In the contents section, present a description of the material including the sample questions and their solutions. The following Figure 7 shows the display of distance materials, and Figure 8 shows the display of angle materials.

3.2.4 Evaluation Section
The evaluation section presents multiple-choice questions that can be done directly by students on the website on each material. Besides that, there are also short description questions.

3.3 Develop Phase
The existence of e-learning as students' teaching materials must be useful in terms of appearance, content, and practicality. The evaluation results from the e-learning by experts are presented in Table 1.

4 CONCLUSION
Spatial ability is not shared by all students, but this ability can be improved through exercises designed to improve spatial abilities. So that the MOODLE-based multimedia design was developed to improve students' spatial abilities. The results obtained indicate that the analysis phase is divided into two parts, namely needs analysis and system analysis. The needs analysis carried out to obtain results related to the curriculum used is the revised 2013 curriculum, the characteristics of students who use online learning resources more, and the problems encountered in the teaching and learning process namely class XII students are required to have independent
learning resources. System analysis produces the supporting devices needed to design and develop websites such as CorelDraw Suite X7, GeoGebra 5.0, www.geogebra.org, www.yumpu.com, and www.youtube.com. In the design section, the researcher designed four parts including the main section, the home section, the content section, and the evaluation section. E-learning developed has the advantage of being a source of independent learning for students to improve the spatial ability of material in the third dimension. Then in the next research is to develop compulsory MOODLE-based mathematics learning multimedia for class XII.

ACKNOWLEDGMENT
We thank the Master of Mathematics Education Study Program at Ahmad Dahlan University and Yogyakarta 5 Public High School for supporting this research. And we also thank Mr. Suparman as chairman of the Mathematics Education Master's study program who has been very helpful in guiding research. Besides, we thank Mr. Sapto Nugroho, and Ms. Diah Muslihah as a teacher of SMA Negeri 5 Yogyakarta for providing comments and suggestions on the designs developed.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The Evaluation Results From the E-Learning by Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Expert</td>
</tr>
<tr>
<td>1</td>
<td>Sapto Nugroho</td>
</tr>
<tr>
<td>2</td>
<td>Diah Muslihah</td>
</tr>
</tbody>
</table>

REFERENCES