Moodle-based e-learning development based on mathematical solving of high school students

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Abstract. This study aims to design Moodle-based e-learning based on mathematical solving of high school students and to determine the level of feasibility and effectiveness of Moodle-based e-learning based on solving high school students' problems. This research is included in research and development with steps, as follows: potential and problem, gathering information, product design, design validation, design improvements, product trials, product revisions, and the final result. The subjects of the study were six references. Data collection techniques used in this research is the form of literature studies. The results of the study based on the literature study shows that the average score of media experts is 88.67% included in the good category, the average score of material experts is 80.67% included in the sufficient category, while the average score of mathematics learning outcomes is 83% is included in the high category with the results of the t group test in one group design being 11.510. Based on data analysis, it can be concluded that the use of e-learning based on Moodle is based on proper problem solving and is effectively used in high school.

1. Introduction

The development of technology every year will experience rapid progress. This is marked by the emergence of technological sophistication in mobile phones and laptops/computers as internet services. Based on the survey results of the Indonesian Internet Service Providers Association (APJII) in 2017, there was an increase in internet use in Indonesia from 132.7 million in 2016, now surging to 143.26 million from the total of 262 million Indonesians [1]. Meanwhile, according to the Ministry of Communication and Information of the Republic of Indonesia (2014) funded by UNICEF, the latest data is found, about 30 million children and adolescents in Indonesia are internet users and digital media are the main choices in the way they communicate [2].

Along with the technological developments, the learning process requires the support of internet-based learning media. This internet-based media that is able to make students to adapt to technological developments in the IT field. One of the media that can support the learning process is media in the form of e-learning. E-learning is a learning system that is carried out online, where students do not need to meet face to face with the teacher during the learning process and the media used can facilitate the learning process between both teachers and students.

The types of e-learning, for example Moodle, Blended Learning, ditLRN and others. However, not all schools apply e-learning based learning processes especially in the use of Moodle. Darmawan
(2014) said that Moodle is a Course Content Management (CMS), which was first introduced by Martin Dougiamas, a computer scientist and educator who spent part of his time developing a learning management system in a university in Perth, Australia [3].

The use of Moodle-based e-learning can help students to follow the "digital classroom" used in accessing learning materials. Whereas, Nuriyanti (2013), said there were several advantages of Moodle, among others as a place of learning without having to meet face to face between teachers and students, as a place to make teaching materials, to make quizzes, there are also discussion forums that were accessed online. In the use of Moodle-based e-learning media this can be expected to help students in understanding the material especially in mathematics learning [4].

Mathematics is a study that some students might consider as a study that is felt to be quite difficult, even mathematics is a study that most students don’t favor it. Therefore, the existence of e-learning based on Moodle in the learning process of mathematics makes it possible to help and improve student motivation in mathematics learning.

The use of moodle-based e-learning applications in mathematics learning can facilitate students to study, not only studying at school, but outside the school. So, this application can be used and accessed at anytime and anywhere. The use of e-learning in mathematics learning also provides experience to students, because not all students use this e-learning application as a learning process especially the Moodle-based e-learning application.

One of the advantages of Moodle is making quizzes and forums for discussions between teachers and students. In quizzes making, researchers try to make mathematical questions related to problem solving. Problem solving can be in the form of creating new ideas, finding new techniques and even solving these problems have different interpretations [5]. This aims to make students able to create new ideas in math problems solving, in addition to being able to create new techniques that have not been taught by the teacher. Whereas, for discussion forums here is used as a place of discussion between teachers and students, and teachers can monitor the students who have completed mathematical questions given by the teacher correctly or wrong.

Based on the results of the literature conducted by several researchers that are relevant to my research, there are several problems that need to be developed, including 1) students feel bored in the learning process; 2) the use of learning media that is less varied; 3) schools have not implemented e-learning based learning processes; 4) lack of innovative and creative learning.

Based on the description above, the problem can be formulated as how is the level of feasibility and effectiveness of e-learning based on Moodle based on solving high school students' problems. The research objectives to determine the level of feasibility and effectiveness of e-learning based on Moodle based on solving high school students' problems.

2. Methods
This type of research is included in research and development. According to Hesty [6] said that development research is a process used to develop and validate new or existing products in education and learning. In this research developed in the form of e-learning website based on Moodle. The research design used in this development research is the R & D model, where the product is in the form of e-learning based on Moodle. In Sugiyono’s book (2015) [7], the development procedures used in the R & D model are as follows:
The research subject is the source of the data to be obtained. Meanwhile, the research subject in this study is six references. Data collection technique is literature study. The research instrument consisted of observations, questionnaires for media experts, questionnaires for material and learning experts, test after study taken.

3. Result and Discussion

The use of moodle-based e-learning in mathematics learning needs to be applied in schools with the aim that students can add a knowledge in the IT field and as a media that can increase students learning motivation. Moodle-based e-learning is very common for teachers, even though this application is good if it is implemented in schools, so that information needs to be shared about the application as a learning process.

This application is also useful for teachers and students, because the learning process can be done out of the lesson hours by re-accessing the material provided by the teacher through the application. With this application, it is expected to attract attention and make the atmosphere of teaching and learning more enjoyable and not boring. The purpose of this study is to design Moodle-based e-learning based on mathematical solving of high school students' problems.

Data obtained based on literature studies on previous research, then the data was analyzed by taking the results obtained as an average in the expert media questionnaire, material and learning, and the test results of learning. The data that has been obtained, then the calculation is done by looking for the average of the results of previous studies and looking for the value of t one group design on the test results of learning. After the calculation, the results of the analysis appears as ideas in conducting the research and as a final result in obtaining a conclusion. Therefore, the results of calculations performed by the researcher were obtained by taking some results from previous research, namely:

| Source | Arya B P 2015 [8], Nopita S Ika K Joko P TT [9] and Amalia I N 2015 [10] |

Table 1 shows that the minimum value of the above data is 0.84, while the maximum value is 0.91. The average of these data is 0.8867 and the standard deviation is 0.04. From the results of these calculations, the criteria for the ideal assessment category were obtained on the questionnaire for media experts, namely good.
Table 2. The Results of The Questionnaire Analysis for Material and Learning Experts

| Data | Minimal | Maximal | Mean   | Standard Deviation | Category Criteria for Ideal Assessment |
|------|---------|---------|--------|--------------------|----------------------------------------|
| 1    | 0.71    | 0.71    | 0.8067 | 0.08067 > 0.86     | (Very Good)                            |
| 2    | 0.90    | 0.90    | 0.8067 | 0.79 < 0.8067 ≤ 0.82 | (Enough)                               |
| 3    | 0.81    |         |        | 0.8067 ≤ 0.75      | (Poor)                                 |

Source: Arya B P 2015 [8], Nopita S, Ika K and Joko P TT [9] and Amalia I N 2015 [10]

Table 2 shows that the minimum value of the above data is 0.71, while the maximum value is 0.90. The average of the data is 0.8067 and the standard deviation is 0.10. From the results of these calculations, the criteria for the ideal assessment category are obtained on the questionnaire for material and learning experts, that is enough.

Table 3. The Results of Test Analysis from The Results of Learning mathematics

| Data | Minimal | Maximal | Mean   | Standard Deviation | Category Criteria for Ideal Assessment |
|------|---------|---------|--------|--------------------|----------------------------------------|
| 1    | 0.73    | 0.73    | 0.8300 | 0.8300 > 0.7        | (High)                                 |
| 2    | 0.97    | 0.79    | 0.8300 | 0.3 < 0.8300 ≤ 0.7  | (Enough)                               |
| 3    | 0.79    |         |        | 0.8300 < 0.3        | (Low)                                  |

Source: Siti M Hana A 2015 [11], Tri W Sri K TT [12] and Silfi Z S Ekasatya A A 2017 [13]

Table 3 shows that the minimum value of the above data is 0.73, while the maximum value is 0.97. The average of these data is 0.8300 and the standard deviation is 0.13. From the results of these calculations, then the criteria for the ideal assessment category were obtained on the test of mathematics learning outcomes, namely high.

Figure 2. The Results of Test Analysis from T-Test One Group Design

Figure 2 shows that t-test calculations are carried out on one group design with the result of 11.510.

Based on the results of the above analysis, it can be concluded that the results of the expert media analysis are categorized in good categories with an average value of 0.8867, the results of the expert material analysis and the learning done are categorized in the category with an average value of 0.8067, while the test results on the ability the problem is classified as a high category with an average value of 0.8300 and t-test calculations are carried out on one group design with the result of 11.510. From these results it can be explained that the use of moodle-based E-learning media is feasible and
effective in the learning process. Although the data obtained using literature studies by taking some data that has been done by several previous researchers.

4. Conclusion
Based on the description above, the results of the research based on literature studies show that the average score of media experts is 0.8867 or 88.67% included in the good category, the average score of material experts is 0.8067 or 80.67% included in sufficient category, while the average score of mathematics learning outcomes is 0.8300 or 83% included in the high category with the results of the t test in one group design is 11.510. Based on the analysis of the data, it can be concluded that the use of e-learning based on Moodle is based on problem solving that is feasible and effectively used in high school.

5. Reference
[1] Jamalul I 2019 Growth of Internet Users 33 5
[2] __________ 2014 Communication and Information Research and UNICEF Regarding the Behavior of Children and Youth in Using The Internet
[3] Deni D 2014 Development of E-Learning Theory and Design (Bandung: PT. Remaja Rosdakarya)
[4] Nuriyanti D D and Utami N R 2013 Pengembangan E-Learning Berbasis Moodle Sebagai Media Pembelajaran Sistem Gerak di SMA Journal of Biology Education 2 3
[5] Heris H et al 2017 Hard Skills and Student Mathematical Soft Skills (Bandung: PT Refika Aditama)
[6] Hesty M W 2017 Development of Macromedia Flash 8 Based Interactive Multimedia Math Learning on Line and Corner Material for Junior / Secondary Students
[7] Sugiyono 2017 Educational Research Methods approach, quantitative, qualitative and R & D (Bandung : Alfabeta)
[8] Arya B P 2015 Development of The Practice of Mathematics National Examination Questions for High School Level Online Web Based Using Drupal CMS 79
[9] Nopita S, Ika K and Joko P T T Mobile E-Learning (M-Learning) Development Based Moodle as The Supporting Capacity of Physics Learning in High School 178
[10] Amalia I N 2015 Development of Android-Based Mathematics Learning Multimedia for Class 3 Elementary Students 73-74
[11] Siti M and Hana A 2015 Ability to Solve Students Mathematical Problems in Learning Mathematics by Using Generative Learning Models in Middle School 3 2 172
[12] Tri W and Sri K T T Based Order Thingking Based on Troubleshooting to Increase Oriented Establishment From Student Character 161
[13] Silfi Z S and Ekasatya A A 2017 Students Difficulties Analysis in Problem Solving Process of Geometry Based on Van Hiele Thinking Stages 6 2 287

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