Foundation of Mathematics Courses Using Virtual Learning

Masriyah¹, D K Fardah², A Wintarti³

e-mail: ¹masriyah@unesa.ac.id, ²dinifardah@unesa.ac.id, ³atikwintarti@unesa.ac.id

Mathematics Department of Universitas Negeri Surabaya

Abstract. This study aims to describe the learning outcomes and students’ responses after joining in the Foundation of Mathematics courses using virtual learning. The research subjects were Mathematics students who programmed the Foundation of Mathematics which consisted of 31 people. The method of data collection was carried out by test methods and questionnaires. This learning was said to be successful if the learning outcomes of students at least 70% get A, A-, B+, or B grades or at least 70% the scores obtained by students was more than or equal to 70, and students’ responses after joining in Foundation of Mathematics courses using virtual learning is positive category (the percentage of students positive responses was more than 70%). Based on the results of data analysis it can be stated that 90.03% of the final grades of students joining in the Foundation of Mathematics courses are B, B+, A- or A, and the percentage of positive responses of students after joining in Foundation of Mathematics courses was 80.0%. Thus it can be concluded that Foundation of Mathematics courses using virtual learning has been successful.

1. INTRODUCTION

In the current era, progress of science and technology is so rapid, especially information and communication technology (ICT). This progress certainly affects various fields of life, and education. In line with that, the autonomy of education and the globalization of education which emphasizes competition and quality began to take place. The success of the implementation of autonomy and globalization of education can only be achieved by utilizing information and communication technology in the education process. One effort in improving the quality of learning is through the use of ICT in learning, Internet-based learning or virtual learning is one example of the use of ICT in learning.

National education, Especially higher education must be in accordance with the current rapid development of Science and Technology. To adjust to the development of technological progress. The components of higher education such as curriculum, Lecture activities, facilities and infrastructure, and the campus environment are educational vehicles for students in an effort to master Science and Technology. Student mastery of Science and Technology will equip students with the ability to apply their knowledge in solving problems in various fields of life that are increasingly competitive and challenging.

The development of science and technology that is widely used in various aspects of life is Information and Communication Technology (ICT) with the internet as its mainstay, Likewise in education. The need for information cannot be fulfilled from learning without using the internet. But the basic concept of education that is not just teaching and learning still requires face-to-face activities. In addition, Unattended use of the internet can result in unwanted things. To overcome these problems there are efforts to combine learning strategies using face-to-face activities, offline learning, and online using the internet known as virtual [1]. This virtual learning system is expected to minimize deficiencies encountered in lectures on mathematics education that not only require mastery of material but also how to communicate material using ICT that is appropriate to the conditions of the students.
In addition, this research is also motivated by the low student learning outcomes in the Foundation of Mathematics which is one of the subjects that underlies all mathematics courses in mathematics Department. It discusses three topics, namely: (1) Logic (2) Actionatics and (3) Sets. This can be seen from the students’ learning outcomes for the three materials that have not been very satisfying. As an illustration, the results can be presented in the following table.

| Class | Average Students Learning Outcomes of Logic | Axiomatics | Set |
|-------|------------------------------------------|------------|-----|
| 1     | 68.2                                     | 51.1       | 69.2|
| 2     | 71.1                                     | 53.2       | 70.6|
| 3     | 69.3                                     | 55.3       | 68.2|

Based on the above, the researchers wished to try to improve student’s achievement in the Fundamentals of Mathematics courses, especially for the Axiom material which is much lower than other materials. The learning process of the Fundamentals of Mathematics courses will be focused on the ability and willingness of students to study independently who receive a large portion. Therefore, it is necessary to add additional forms of self-employment provided offline and online. This kind of combination of lectures is a virtual learning.

1.1 Research Objectives

The purpose of this study is to describe:
- Students’ learning outcomes in the Foundation of Mathematics courses using virtual learning.
- Students’ responses to Foundation of Mathematics courses using virtual learning.

1.2 Benefits of Research

This research is expected to be able to provide benefits in increasing students activity and creativity in the process of virtual learning of Foundation of Mathematics courses, as well as maximizing access to this learning wherever and whenever the students are.

2. VIRTUAL LEARNING

Virtual Learning is an education system that aims to streamline learning methods using the internet. Distance and time are no longer a problem in the learning process in this Virtual Learning concept. Philosophically, it can be explained that:
- Virtual learning is the delivery of information, communication, education, online training;
- Virtual learning provides a set of tools that can enrich the value of learning in a conventional manner, so that it can answer the challenges of the development of globalization;
- Virtual learning does not mean replacing conventional learning models in the classroom, but strengthens the learning model through enriching content and developing educational technology;
- Student capacity varies greatly depending on the form of content and delivery tools.

Maswan [2] explained that there are various notions of virtual learning that change according to the perspective in which it is carried out. It is often also associated with other terms and concepts such as e-learning, online learning (distance learning), web-based learning and so on.

The virtual learning model used in this research is computer-based learning and virtual schools, namely learning through computer media in the form of learning programs that present lecture materials in accordance with the applicable curriculum. This learning program can include aspects of the presentation of subject matter, practice, tutorials, simulations, and games, which students can learn anytime and anywhere they are.
2.1 The Importance of Using Virtual Learning

New ICT developments promise many benefits and advantages in education and training. The application of ICT in education provides a new learning environment and new ways of learning. In the beginning, ICT was used as a learning media. But along with its development, as stated earlier that ICT can be used to find a variety of learning resources, as a learning interaction aid, as a vehicle for the provision of learning materials, and for the development of professionalism of teachers or lecturers.

ICT-based learning media is very closely related to the creativity of students, and students who have creativity, of course, are able to solve problems well and do not want to dispute protracted and quickly resolved.

Creativity is a personal ability to actualize themselves in relationships and also in learning at school. This is expected so that with the ICT-based learning media, students can be creative.

Meanwhile Zakaria and Khalid [3] stated: "the advantages of a Virtual Learning Environment (VLE) are: increasing students' interest in learning mathematics, improving academic performance, promoting permanent learning, allowing positive interactive relations and supporting constructivist learning".

2.2 Characteristics of Virtual Learning

Virtual learning is a combination or combination of two or more components or learning methods to get the expected learning outcomes. The characteristics of virtual learning are [4]:

- Learning that combines various ways of explanation, teaching models, learning styles, as well as various diverse media-based media
- As a combination of direct (face-to-face) teaching, independent learning, and independent and offline learning.
- Learning is supported by an effective combination of ways of delivery, teaching methods and learning styles.

Rossett, Douglis & Frazee [5] suggested six things to consider when people organize Virtual learning:

- Submission of teaching materials and the communication of other messages (such as announcements) consistently.
- The implementation of learning through virtual learning must be held seriously.
- The instructional materials provided must always be updated either in the format, contents or availability of teaching materials that meet the rules of independent teaching materials.
- Time allocation can begin with formula 75: 25 in the sense that 75% for online learning and 25% for face-to-face learning (conventional).
- Allocation of tutorial time is 25% specifically for those who are left behind, but if it is not possible then the time can be used to resolve the difficulties of students in understanding learning problems.
- In virtual learning leadership is needed that has time and attention to continually strive to improve the quality of learning.

Meanwhile, Dhakal and Sharma [6] stated that virtual learning provides space to participate in school and education practices that are widely accepted by university education students, the use of virtual learning can improve learning habits, make students more active in learning, provide opportunities for learning and relearning to clarify concepts.

To carry out research on the application of online learning (virtual learning) in the subject matter of Mathematics Basics, there are several things that have been done, among others:

- Identify courses that need to be developed with virtual learning, namely the Fondation of mathematics subject matter.
• Identify the needs and students who program the Foundation of Mathematics courses in terms of the courses they have programmed to find out the readiness of students to attend virtual learning.
• Compile the Foundation of Mathematics Learning Plan using the concept of virtual learning.
• Create content output modules that are in accordance with the lesson plan.
• Designing a storyline that matches the output content.
• Create a multimedia package that is in accordance with the storyline.
• Applying Foundation of Mathematics learning with using what has been made.
• Conduct learning evaluations

3. METHOD
This is a descriptive research. It describes: (1) students learning outcomes of the Foundation of Mathematics using virtual learning, and (2) students responses to the of Foundation of Mathematics after joining in learning that applies virtual learning.

This research was conducted using instruments: items test and questionnaire. The test was used to obtain data of the ability of students after joining the foundation of mathematics learning that apply virtual learning. The questionnaire was used to obtain data about students responses to the foundation of mathematics learning that apply virtual learning.

To achieve the research objectives 1, the researchers processed and analyzed the test results with the following steps: (1) Supervise and assess the results of the test (=T) combined with the average of assignment scores (=A) and participation score (=P), which is used to determine the final grade of students. The Final Grade (= FG) is calculated using formula: FG = \frac{2xP + 3xA + 2xT}{7}.

Furthermore, the final grade of the students is converted according to the following table.

| FG Value Conversion  |
|----------------------|
| FG Value | Conversion |
| 0 ≤ FG < 40 | 0 or E |
| 40 ≤ FG < 59 | 1 or D |
| 59 ≤ FG < 65 | 2 or C |
| 65 ≤ FG < 70 | 2.5 or C+ |
| 70 ≤ FG < 75 | 3 or B |
| 75 ≤ FG < 80 | 3.25 or B+ |
| 80 ≤ FG < 85 | 3.5 or A |
| 85 ≤ FG ≤ 100 | 4 or A |

(2) Determine the percentage of the percentage of the final grade of students who get the final exam scores A, A-, B+, B-, C+, C, D or E. (3) Determine the final category of students in general. The criteria set are as follows. Students Learning Outcomes of Foundation of Mathematics that used virtual learning are said to be good, if at least 80% of students get the values A, A-, B+, or B.

To achieve the research objectives 2) the researchers processed and analyzed the results of the students response questionnaire with the following steps: (1) Calculate many students who give positive responses according to the aspects asked, (2) Calculate the percentage of activity 1), (3) Determine the students response category according to the aspects asked with the criteria that the researcher set, namely: student responses are said to be positive if at least 70% of students respond positively to at least 80% of the aspects asked.

This research activity was conducted using the steps that correspond to the following figure.
4. RESEARCH RESULT

The data obtained in this research are: (1) learning outcomes of Mathematics Education students who joined in Foundation of Mathematics courses, which are processed from the score of participation, average assignments, and the score of test, (2) the results of the Mathematics Education students response questionnaire after joining in Foundation of Mathematics courses using virtual learning.

In this research, students were given 3 (three) assignments, and one midterm test. The results of giving all three assignments, as well as the results of the test can be stated that the average results of the assignments of Mathematics Education students who joined in Foundation of Mathematics courses was equal to 85.0 while the average results of the midterm test was 77.5. If it was noticed to the final grade of students it can be stated that as many as 9 people (29.03%) obtained A grade, as many as 8 people (25.81%) obtained A- grade, 9 people (29.03%) obtained B+ grade, as many as 2 people (3.23%) got C+ grade, and as many as 2 people (6.45%) got C grade.

At the end of the Foundation of Mathematics learning the students were given response questionnaire to lectures on the Foundation of Mathematics using virtual learning. The results of the student response questionnaire can be stated that the foundation of mathematics learning using virtual learning got a positive response from students, because 80% of students responses were positive. In addition to the results of the questionnaire, the students also wrote down some of the advantages and disadvantages of Foundation of mathematics learning, which can be summarized as follows.

The advantages are: (1) Encouraging the spirit of learning (2) Students are more active. so challenged to learn, in order to be able to answer questions given during virtual learning, (3) I and my friends became more active in the question and answer session in the discussion, lectures also become more exciting (4) Easy to understand, (5) Can ask more questions from the lecturer, and there is 2-way communication. Besides that, you can also discuss with other friends, (6) Challenging can be remote discussion, (7) I read the book first before virtual learning, (8) More actively participate and discuss, (9) Can discuss with friends and lecturers, (10) feel challenged and must be more creative, (11) We can find out some of our friends' answers.

While the weakness are: (1) Interactions between lecturers and students are less controlled, (2) Not effective, if learning always uses vi-learning. Because sometimes the wifi used is error and a little slow, (3) Cannot distinguish between students, where is the lecturer, (4) There is no notification when the lecturer gives the next question, (5) If the material is difficult to understand, hence the possibility that students will find it increasingly difficult to understand the material, (6) Sometimes new questions

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are given a random order, so hard to find, (7) Questions from lecturers are based on student answers, (8) If the lecturer uploads the discussion of questions and comments, and no special notification, then we will miss the discussion, so you have to check it more often so you don't miss it, (9) Not all materials can use vi-learning, because if the material is difficult later it is not easy to understand, (10) Lack of symbols when you want to answer a question, besides that sometimes we have to look for one by one because sometimes the questions asked are buried by the answers of other friends, (11) Confused when answering and reading the questions given by the lecturer because the answers and questions become one, so stacked up.

5. CONCLUSIONS AND RECOMMENDATIONS
Based on the analysis results, it can be concluded that: (1) students learning outcomes in the foundation of mathematics learning that applies virtual learning is in the good category, (2) the students’ response to the foundation of mathematics learning that applied virtual learning is positive because 80% of the questionnaires given were responded positively by the students.

Based on the results of the research, it was suggested that the lecturers of mathematics should try to use virtual learning as an alternative in their learning process, so that students are more independent and students can follow the learning process whenever and anywhere. In addition, researchers who will carry out research using virtual learning should try to minimize the deficiencies in this research.

References
[1] Borba, M. Askar. P., Engelbrecht. J., Gadanidis. G., Lлинаres. S., & Aguilar, M. S. 2016. Virtual-learning, e-learning and mobile learning in mathematics education, ZDM Mathematics Education, 589-610.
[2] Maswan, S. “Virtual Learning”, Retrieved April 30, 2018 from http://www.sajadstudio.info/artikel/virtual_learning.pdf. p. 9
[3] Zakaria, N. A., & Khalid. F. 2016. The Benefits and Constraints of the Use of Information and Communication Technology (ICT) in Teaching Mathematics, Creative Education. 7. 1537-1544.
[4] Henrich, A., & Sieber, S. 2007. Workshop on Virtual Learning, pp. 150-161
[5] Rossett. A., Dougis. F., & Frazee, R. V. (2004. August 12). Strategies for Building Virtual Learning. Retrieved April 30, 2018, from Learning Circuits: https://admin.umt.edu.pk/Media/Site/UMT/SubSites/ctl
[6] Dhakal, Bed Prasad, Sharma, Lekhnath 2016 Educational journal 5 126-135.