

# UTILIZATION OF E LEARNING IN LEARNING DISCRETE MATHEMATICS AT PERBANAS INSTITUTE

Pratiwi <sup>1\*</sup>, Robinson Situmorang <sup>2</sup> and Mochamad Sukardjo <sup>3</sup>

<sup>1</sup> Universitas Negri Jakarta IKPIA Perbanas Jakarta, Indonesia.

<sup>2,3</sup> Universitas Negeri Jakarta, Indonesia.

Email: <sup>1</sup>pratiwi@perbanas.id (\*Corresponding Author), <sup>2</sup>robinson@unj.ac.id, <sup>3</sup>sukadjo@unj.ac.id

DOI: [10.5281/zenodo.12198660](https://doi.org/10.5281/zenodo.12198660)

## Abstract

Discrete mathematics is one of the essential subjects at Perbanas Institute, especially for students majoring in Informatics Engineering and Information Systems. However, discrete mathematics learning often experiences obstacles, such as difficulty understanding concepts and lacking learning variety. This research aims to test the effectiveness of the e-learning based discrete mathematics learning model being developed. This research uses a qualitative research method with a case study approach. The data collection techniques in this research are literature study and observation. The data analysis techniques used in this research are data reduction, data presentation, and conclusion. The research results show that e-learning can be an effective tool for improving learning. This can be seen from the increasing results of students' discrete mathematics learning at the Perbanas Institute. E-learning can help students learn discrete mathematics by providing learning materials that are interactive and easy to understand, allowing students to study independently at their own pace, and facilitating interaction between students and lecturers, as well as between students. Factors that influence the effectiveness of e-learning in discrete mathematics learning include the quality of e-learning learning materials, the readiness of lecturers and students to use e-learning, and infrastructure and technology support.

**Keywords:** E-Learning, Learning, Discrete Mathematics, Perbanas Institute.

## 1. INTRODUCTION

Discrete Mathematics is a fundamental element in Informatics teaching because its essence is a collection of scientific and technical methods that process discrete entities. Discrete mathematics provides the mathematical foundation required in various subjects such as Algorithms, Data Structures, Databases, Computer Networks, Computer Security, and so on. Topics taught in this course include Set Theory, Relations and Functions, Graph Theory, and Hierarchical Data Structures (West, 2021).

Discrete mathematics is often faced with specific challenges, including difficulties in understanding concepts and limited variations in learning. Students often need help understanding abstract concepts taught in discrete mathematics because they are complex and not immediately visible (Alam, 2020). Apart from that, the lack of variety in learning methods can also cause boredom and a lack of motivation to learn for students. This shows the need to develop more innovative and exciting learning strategies to increase students' understanding and interest in this subject.

One way to develop this learning is by using e-learning. E-learning is a computer-based education system that allows students to learn anywhere and anytime. Thus, with e-learning, teachers can provide more flexible access for students to learning materials, assignments, and other supporting resources online (Hammoudy, 2021). E-learning is also used in discrete mathematics learning by the Perbanas Institute. Perbanas Institute is the first higher education institution to provide education in finance and banking. This institution began with the Perbanas Education Foundation, officially established as a legal entity on February 19, 1969, at Jalan Perbanas,

RT.6/RW.7, Kuningan, Karet Kuningan, Setiabudi District, South Jakarta City, Special Capital Region of Jakarta 12940.

Previous research (Mardiana & Faqih, 2019) found that students' Mathematical Ability and Application-Computer Self-Efficacy (ACSE) positively affected the quality of Discrete Mathematics learning outcomes using LMS as a supporting system. Meanwhile, other research by (Kurnia et al., 2022) found that online learning using Zoom was not proven to be effective in discrete mathematics courses. However, direct face-to-face learning could improve student learning outcomes and understanding. This is seen from the student's pretest and posttest. This research also found a significant difference between using the Zoom application and face-to-face in class.

The novelty of this research comes from the research object, namely the Perbanas Institute, which has never studied the effectiveness of e-learning based discrete mathematics learning models. This research contributes to understanding the effectiveness and application of e-learning in the context of discrete mathematics learning. These findings can strengthen the argument about the importance of technology integration in higher education and provide a foundation for developing more effective and innovative learning strategies. This research aims to test the effectiveness of the e-learning based discrete mathematics learning model being developed.

## 2. METHODS

This research uses a qualitative research method with a case study approach. The qualitative research method is a method or method of research that emphasizes analysis or descriptiveness. In a qualitative research process, things from the subject's perspective are emphasized more, and the researcher uses the theoretical basis as a guide so that the research process is in accordance with the facts encountered in the field when conducting research. Qualitative research methods aim to explain a phenomenon in depth and are carried out by collecting data as much as possible (Nasution, 2023). The data collection technique in this research is a literature study that explores journals, books, and other information relevant to research and observations on the discrete mathematics learning process using e-learning. The data analysis techniques used in this research are data reduction, data presentation, and concluding.

## 3. RESULT AND DISCUSSION

Universities in the future are faced with increasingly complex challenges, one of which is the pressure to produce graduates who can compete and excel in the globalization era. The success of a country in improving the quality of its human resources will be the key to competing fairly in global competition (Pucciarelli & Kaplan, 2016). Therefore, higher education institutions must demonstrate their ability to educate and produce highly qualified graduates to face the dynamics of globalization. Improving the quality of higher education as an educational institution must ensure that graduates have excellence in various aspects of life. Higher education is an integral part of the national education system, interrelated with other subsystems both inside and outside the education system (Ma et al., 2016).

To achieve these goals, universities must innovate in the learning process. The traditional literacy model that includes reading, writing, and mathematics needs to be

improved with new literacies that are in accordance with the demands of higher education in order to prepare competent human resources in the future (Muhali, 2018). Included in the context of discrete mathematics learning, discrete mathematics is a component of the mathematics curriculum, but not only that, discrete mathematics is also a core subject in engineering disciplines and the field of social sciences. Students usually take this course in semester 3, having previously obtained other basics in the previous semester (Farida & Indah, 2023).

Discrete mathematics is one of the essential courses taught in computer science colleges because it is a prerequisite for taking other courses, such as algorithms, data structures, databases, automata and formal language theory, computer networks, computer security, operating systems, compilation techniques, and so on. Discrete mathematics is typical of informatics, so this is an essential course in the Informatics Engineering study program (Hart & Martin, 2018). In discrete mathematics, students will be presented with various mathematical materials relevant to the field of Informatics. The material involves concepts such as logic, set theory, matrices, relations and functions, mathematical induction, algorithms, integer theory, series, group and ring theory, boolean algebra, combinatorics, discrete probability theory, generating functions, recurrent analysis, and graph theory. Some of these materials can also be taught separately in other courses, such as algorithms and programming materials, discrete probability theory in probability and statistics, computational modelling in automata and formal language theory, generating functions in models and simulations, and sequence in calculus (Farida & Indah, 2023).

Discrete mathematics is a part of mathematics that is mandatory and important for students to know because it can train abstract thinking, logical thinking, and train analysis of solving a problem so that they are accustomed to solving problems in the field of mathematics critically and rationally (Sandefur et al., 2022). However, there are obstacles to delivering discrete mathematics learning material to students. Two fundamental reasons cause many students to be less interested in discrete mathematics courses. First, they are still overshadowed by the classic assumption that discrete mathematics courses are challenging. Second, it is difficult for teachers to find methods that can create an active, creative, effective, and fun learning atmosphere, resulting in students feeling bored and unable to find ways to solve problems in learning discrete mathematics (García-Hernández & González-Ramírez, 2017).

Innovative efforts are needed in the learning approach based on the obstacles faced in delivering discrete mathematics material. Where education and innovation are interrelated, innovation is considered a process of change that can improve the development of a nation. Innovation not only includes the development of knowledge but also creating or significantly improving processes or systems. In education, innovation can be defined as a new concept or practice that aims to achieve a specific goal or solve an existing problem. Therefore, it should be recognized that innovation development strategies in education should comprehensively encapsulate various aspects. This includes good strategic planning and utilising existing potential, including technological advances (Serdyukov, 2017).

One of the innovations that can be applied to learning is adopting technology, such as e-learning. The definition of e-learning, according to (Bezovski & Poorani, 2016), explains e-learning as a form of learning and teaching that is procedurally supported electronically to influence knowledge construction. Therefore, interaction and

communication can be done directly or through a technology network. According to (Moubayed et al., 2018), e-learning is any form of teaching and learning that uses electronic circuits to access and share information. An interpretation also considers e-learning as a form of distance education conducted through internet media.

E-learning is also highlighted by the Deputy Director of Learning and Student Affairs of the Directorate General of Higher Education of the Ministry of Education and Culture (Kemendikbud), Ridwan Roy Tutupoho, who said that the government promotes e-learning-based education. According to him, if it only relies on regular learning, then the results can only support part of the gross enrollment rate (APK) of students in Indonesia. Thus, to meet the need to expand access, e-learning education is necessary. Because with e-learning, learning materials can be accessed anytime and anywhere, but with maintained quality (Nurati & Riyanto, 2023). In another view, it is emphasized that the application of e-learning is expected to improve the quality of education by adopting an e-learning approach. Therefore, universities must adapt to these changes (Arkorful & Abaidoo, 2015). This means that adaptation to e-learning technology is considered an important step to improve the quality of learning and provide wider accessibility to students.

According to (Mayer, 2017), the use of technology for e-learning offers convenience in the form of fast and unlimited access to information without space and time constraints. Learners can easily carry out learning activities anytime and anywhere that makes them comfortable. The limitations of space, distance and time are no longer a complex obstacle. In addition, e-learning can accelerate the achievement of learning time targets while reducing the costs incurred by educational programs. E-learning is considered a student-centred learning method, and hoping to motivate the improvement of education quality in Indonesia.

E-learning in discrete mathematics learning has been implemented at Perbanas Institute. Based on the observation, e-learning has become an effective tool in improving the quality of learning, mainly manifested through improving student learning outcomes in discrete mathematics courses at Perbanas Institute. The effectiveness of e-learning in learning discrete mathematics is reflected in several reasons. First, the use of e-learning helps students learn discrete mathematics by presenting learning materials that are interactive and easy to understand. The learning process has been transformed along with the times, and technology is now utilized as non-printing teaching materials. Interactive teaching materials allow interaction between media and learners, creating innovation in learning. However, this implementation requires particular expertise in the use of computers.

Obtained an overview of how students see the effectiveness of using e-learning in discrete mathematics learning at Perbanas Institute. The results of the poll are as follows:

### **Motivation through E-Learning**

70% agree (Strongly Agree + Agree): E-learning significantly boosts student motivation in discrete mathematics. 20% neutral, 10% disagree: A minority of students feel neutral or unmotivated.

### **Engagement through E-Learning**

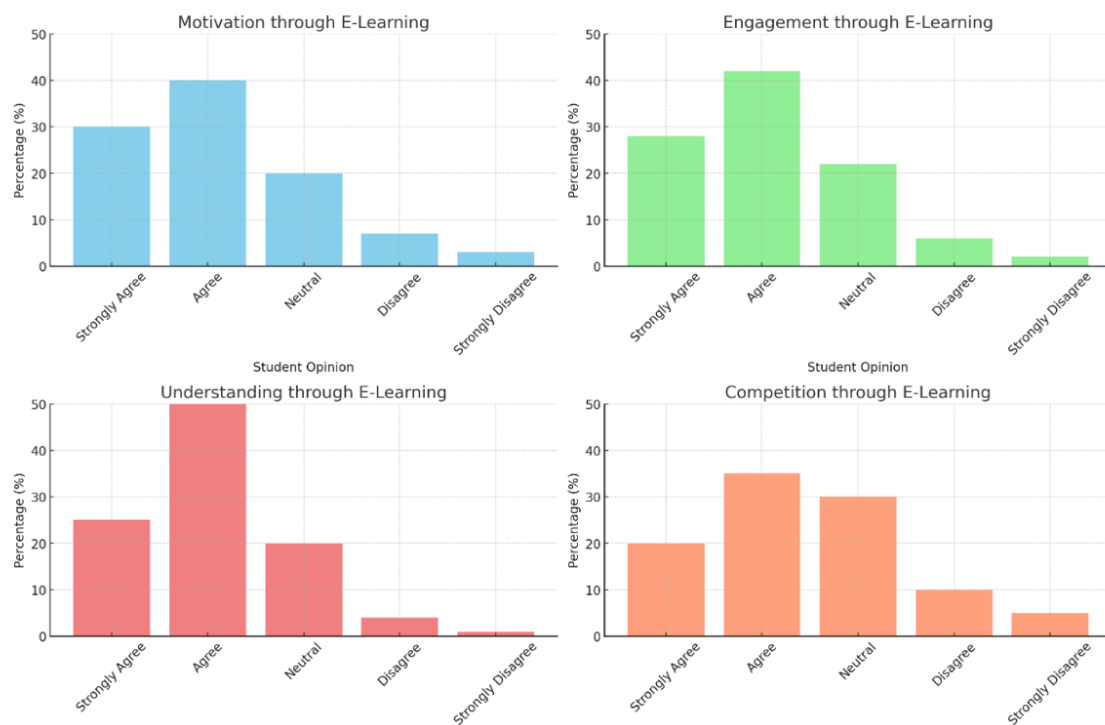
70% agree: E-learning increases student engagement. 22% neutral, 8% disagree: Some students feel neutral or less engaged.

## Understanding through E-Learning

75% agree: E-learning effectively aids understanding of discrete mathematics concepts. 20% neutral, 5% disagree: Few students feel it doesn't help.

## Competition through E-Learning

55% agree: Competition in e-learning is motivating. 30% neutral, 15% disagree: Significant portion is neutral or unmotivated by competition.



**Picture 1: Overview of how Students see the Effectiveness of using E-learning in Discrete Mathematics**

E-learning provides a variety of exciting and interactive learning media, such as videos, animations, simulations, and educational games. This aims to help students understand abstract and complex discrete math concepts more easily and enjoyably. The application of technology also allows the delivery of lessons with a quality that tends to be more consistent than classroom learning, which depends on the "mood" and physical condition of the instructor (Guragain, 2016). In addition, using technology in e-learning, learning can be presented dynamically and interestingly, increasing student involvement and facilitating understanding of material often considered problematic. The application of fun and not dull learning positively impacts the material and can be closer to students because the message to be conveyed can be received better. This situation increases students' learning motivation because they feel more involved and stimulated in the learning process (Aguti, 2015). This means that exciting e-learning media can connect student motivation and involvement in learning, especially discrete mathematics.

Furthermore, e-learning allows students to learn independently at their own pace. This is because the difference between traditional learning and e-learning lies in the focus. In a traditional classroom, lecturers or teachers are considered the source of knowledge who channel information to the learner. On the other hand, in e-learning,

the main focus is the students. They learn independently at set times and are responsible for their learning process. E-learning encourages students to play a more active role in their learning. Students make plans and search for materials independently with effort and initiative (Aguti, 2015).

Students experience a completely different sensation of learning compared to conventional classes. Students experience significantly increased access to information, allowing them to explore the material more deeply. In addition, the uniqueness of E-learning is the ability for students to choose a way of learning that suits their personality. In a conventional classroom, learning tends to be linear and limited to one teaching approach. However, with E-learning, students can decide how they want to learn. They can choose the learning method that best suits their learning style, thus improving the overall effectiveness of learning. In addition, students can access various learning resources from various platforms online, allowing them to gain a more comprehensive understanding of the material being studied. This flexibility allows learners to customize the time and place of learning according to their needs. Thus, it can be interpreted that e-learning provides a more dynamic learning experience, allowing learners to optimally develop their potential while customizing the learning process to their personal character and preferences.

Furthermore, the application of e-learning can facilitate interaction between students and lecturers and between students. This is in accordance with the view of (Jumrio, 2023), which recognizes the function of the internet in providing enrichment and facilitating communication between learners, teachers, fellow learners, group members, and other resource persons. Then, it is necessary to realize that the primary key in the learning process remains education, where interaction plays an important role. (Nortvig et al., 2018) Emphasizes that in education, there are interactions between teachers and students and between students and fellow students.

E-learning offers several features that support communication and collaboration, such as discussion forums, chat, and video conferencing. These features facilitate interaction between students and lecturers and between students. E-moderating facilities are also available, allowing teachers and students to communicate regularly over the internet quickly without being limited by distance, place, or time. Teachers and students can interact with many participants via the internet, thus increasing knowledge and broader insights (Garad et al., 2021).

Implementing an e-learning system demands careful preparation regarding its potential users' infrastructure and technical skills. Therefore, every school planning to adopt e-learning must ensure its readiness level is well met (Ali & Maksum, 2020). This step is crucial so that the benefits of implementing the e-learning system can be achieved.

In improving learning effectiveness through e-learning, support must be provided from various aspects, including human resources (HR) and infrastructure. The readiness of e-learning in schools can be assessed by assessing the preparation of educators, students, and the institution (Aldhafeeri & Khan, 2016). The success of e-learning can be reflected in the extent to which educators are ready to manage the quality of learning materials, the readiness of lecturers and students to use e-learning, and the availability of supporting infrastructure and technology. The determining factors affecting the effectiveness of e-learning in discrete mathematics learning can be explained as follows:

### 1. Quality of e-learning materials

The quality of e-learning materials in discrete mathematics is the main key. The materials should be clearly designed, in-depth, and in line with the needs of the discrete mathematics curriculum. The visualization aspect and the use of relevant examples are very important to understand complex concepts in discrete mathematics. With good quality materials, learners can gain a solid understanding of the topics taught.

### 2. Readiness of lecturers and students in using e-learning

Lecturers' readiness in teaching discrete mathematics through e-learning includes the ability to deliver material online clearly and interactively. Lecturers need to master the e-learning platform and utilize it to facilitate discussions, answer questions, and provide feedback. On the other hand, students need to have technical skills in using the e-learning platform, and motivation to actively participate in online learning.

### 3. Infrastructure and technology support.

Infrastructure and technology support are essential in online discrete mathematics learning. A stable internet connection, adequate hardware and a friendly e-learning platform provide a smooth learning experience. Visual aids such as digital whiteboards, math software, and online simulations can improve teaching effectiveness and understanding of discrete math concepts.

Ensuring the quality of learning materials, readiness of lecturers and students, as well as adequate infrastructure and technology support, encourage discrete mathematics learning through e-learning to be effective and provide the desired learning benefits. The results seen from the application of e-learning in discrete mathematics learning at Institut Perbanas show its effectiveness through the provision of interactive and easy-to-understand learning materials. In addition, e-learning provides opportunities for students to learn independently according to their own pace, while facilitating good interaction between students and lecturers, as well as among fellow students. Therefore, it can be concluded that e-learning has great potential to improve the quality of learning and student learning outcomes in discrete mathematics courses in the Perbanas Institute academic environment.

## 4. CONCLUSION

E-learning is an effective tool for improving learning, especially in discrete mathematics learning at the Perbanas Institute. E-learning has been proven to improve student learning outcomes in these courses. The effectiveness of e-learning in discrete mathematics learning is reflected in the provision of learning materials that are interactive and easy to understand, providing opportunities for students to learn independently at their pace, as well as facilitating interaction between students and lecturers as well as between fellow students. Factors that influence the effectiveness of e-learning in discrete mathematics learning include the quality of e-learning learning materials, the readiness of lecturers and students to use e-learning platforms, and adequate infrastructure and technology support. So, e-learning has excellent potential to improve the quality of learning and student learning outcomes in discrete mathematics courses in the Perbanas Institute academic environment.

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