JPPIPA 10(9) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Effectiveness of Biology Learning to Improve Digital Literacy and Higher Order Thinking Skills on the Concept of Digestive System

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Received: August 18, 2023
Revised: June 23, 2024
Accepted: September 25, 2024
Published: September 30, 2024

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DOI: 10.29303/jppipa.v10i9.5018

Abstract: The use of HOTS skill-based e-learning can be used as one of the ways to provide HOTS skills and digital literacy skills. This study aims to determine the effectiveness of HOTS-based e-learning in improving HOTS skills and digital literacy skills of high school students. This study used a quasi-experimental method. The research design used was non-equivalent control group design. The samples in this study were XI Science class students consisting of 38 people determined by purposive sampling technique. This research was conducted on two classes, namely the experimental class (learning using HOTS-based e-learning) and the control class (learning using e-learning not based on HOTS). The results showed that there was a significant difference in the mean between the experimental and control classes on digital literacy and higher order thinking skills. T test on the value of digital literacy skills of HOTS skills shows the number (2-tailed = 0.000 < α (0.05), which means that there is a difference in the effectiveness of using HOTS-based e-learning with e-learning not based on HOTS to improve students' digital literacy skills. Then the results showed that there was a significant difference in the average high-level thinking skills of students between the experimental class and the control class. Showing the T-test number on the value of digital literacy skills shows the number (2-tailed = 0.000) < α (0.05), it means that there is a difference in the effectiveness of using HOTS-based e-learning with ordinary e-learning to improve students' digital literacy skills. The N-Gain score criteria for using HOTS-based e-learning to improve digital literacy skills fall into the medium category (N-gain = 0.56) and the use of HOTS-based e-learning to improve higher order thinking skills in the medium category (N-gain = 0.83).

Keywords: Digital literacy; High Order Thinking Skills; Hybrid learning

Introduction

The Industrial Revolution 4.0 phenomena not only produce impacts on the economic sector but also impacts on the human resources sector. The Industrial Revolution 4.0 has been assumed appearing some new problems such as the increasing numbers of the unemployment (Gamar et al., 2018). The development of information technology is part of the emergence of the digital revolution era in Indonesia. Its rapid development is able to have a major influence and dominate all sectors of people's lives, including in the world of education (Akbar & Anggaraeni, 2017). Advances in information technology and the internet have resulted in an abundance of digital information resources (Kurnianingsih et al., 2017). 21st Century Learning is combined with the development of digital information. Society is connected to each other. This is what many people say about the industrial revolution, especially the information industry (Handiyani & Abidin, 2023). Through digital intel- ligence teachers can cater children's digital skills which are on the brink of cyber risk into the educational opportunities to get success in future ventures especially in this pandemic where children are wholly dependent on online learning (Mishra et al., 2020). On the other hand, the development

How to Cite:
Ibrahim, N. M., Sanjaya, Y., & Nurjhani, M. (2024). Effectiveness of Biology Learning to Improve Digital Literacy and Higher Order Thinking Skills on the Concept of Digestive System. *Jurnal Penelitian Pendidikan IPA*, *10*(9), 7131–7137. https://doi.org/10.29303/jppipa.v10i9.5018

of information technology is likened to the two sides of a coin that gives positive and negative effects to society. Digital literacy learning is inevitable (Anggraini, 2011). All aspects of life, including education, are affected by technological advances and the internet. High order thinking skills (HOTS) can be trained in the learning process in the classroom. The learning carried out must provide space for students to find activity based and meaningful knowledge concepts. Talking about education certainly cannot be separated from educational institutions, namely schools. Schools as formal institutions are a means to achieve educational goals. At school, students learn various things, not only knowledge but also acquire skills and abilities (Indrawan et al., 2019).

Therefore, the revision of K13 emphasizes that HOTS must be integrated into learning (Hanifah, 2019). Modern learning emphasizes the ability of students to think critically, communicate, collaborate, and master information technology (Angraini & Sriyati, 2019). This demand then gave birth to a thought about the importance of digital literacy (Abdullah, 2018). Teachers need to make innovations that support the development of HOTS in the teaching and learning process. Starting from the methods of learning techniques, media, and teaching materials that can also other things that support. Student's teaching materials are made a choice because of the advantages in developing the ability of students to learn about the facts and capable of general principles and abstract using realistic arguments (Yennita et al., 2018). To support these high-level thinking skills, students need to have a careful attitude. This is because in examining a problem in the early stages of the critical thinking process (Paputungan et al., 2022).

E-learning is a type of internet media-based learning that has ease of access that can be accessed anywhere and anytime. E-learning as a learning innovation that utilizes information technology helps the learning process. Things that can be helped by e-learning are related to the delivery of learning materials, practice questions, online discussion forums, and task collection (Sari et al., 2020). E-learning systems and applications, E-learning systems and applications are often referred to as Learning Management Systems (LMS), which are software systems that virtualize conventional teaching and learning processes for administration, documentation, reports of a training program, classrooms and online events, e-learning programs, and training content, for example, all features related to the management of the teaching and learning process such as how to manage classes, create materials or content, discussion forums, assessment systems, and online exam systems, all of which are accessed via the internet (Hartanto, 2016). E-learning is indeed able to improve the learning experience, but face-to-face learning is also needed which is used as a control for students. The blended learning model is a model that is considered suitable for students. Blended learning is a mixture or combination of face to face and online learning (Abdullah, 2018). E-learning has grown significantly as an educational tool as technology has evolved and developed over the years. Interestingly, there is more effort in ad-vancing technology than trying to understand individual learning needs and styles and instructional design (Verawati, 2020).

Blended learning is proven to have differences in learning motivation and learning outcomes between students who are taught blended learning compared to students who are taught with conventional learning (Sudarman, 2014). The application of e-learning for online learning nowadays is very easy by utilizing Learning Management System modules that are easy to install and manage, such as Moodle (Hanum, 2013). Literacy as a soft skill that every individual must have is interpreted as a dynamic ability that continues to develop along with the progress of the times. Literacy is also interpreted as the knowledge and skills needed by students to access, understand, analyze, evaluate information, interpret information, express thoughts and emotions, present thoughts and opinions, interact with others and participate in activities inside and outside school (Hardiyanti & Alwi, 2022). Nowadays, teenagers, especially school learners, believe that digital literacy is very important. According to the Education Law No. 2 of 1989, a student is defined as a person who is in education; in various literatures, the term "pupil" is also used to refer to students. Digital literacy can be included in all subjects such as language, Social Sciences (IPS), Science, Mathematics and computers (Sriyanto, 2021).

Digital literacy is increasingly needed along with the rapid growth of internet users in the world from year to year. According to a survey by the Indonesian Internet Service Providers Association, the growth of internet users has reached 171.17 million people or 64.8% of the total population of Indonesia (Jati, 2021). Unfortunately, the high number of smartphone users among students is not followed by teachers' understanding in using smartphones. In fact, learning media applications such as biology, mathematics, physics have been widely circulated on the Playstore with an Android smartphone base. Given the increasing challenges for teachers in the era of the industrial revolution 4.0, the implementation of the use of m-learning in the learning process can be used as a basis for changing the education system that can be developed by education process actors (Hizhwati et al., 2022). Today's learning system is not only limited to teachers and learners. With today's technological advances, learners can access Nowadays, teenagers,

especially school learners, believe that digital literacy is very important. According to the Education Law No. 2 of 1989, a student is defined as a person who is in education; in various literatures, the term "pupil" is also used to refer to students. Today's learning system is not only limited to teachers and learners. With today's technological advancements, learners can access all kinds of information, including school lessons, through the internet.

There are journals, books, or even courses that are conducted online without the need to meet face-to-face and be hindered by all kinds of information, including school lessons, through the internet. There are journals, books, or even courses that are conducted online without the need for face-to-face meetings. As self-efficacy beliefs are thought to affect people's behavior, we hypothesized that differences in teachers' self-efficacy beliefs would affect their subsequent instructional quality—with higher levels of self-efficacy leading to more cognitively activating behavior, better classroom management, and more individual learning support (Holzberger et al., 2013). With e-learning, learning can be done anytime and anywhere, through any path and at any access speed so that the learning process takes place effectively and efficiently. With information technology, e-learning is able to provide teaching materials and store learning instructions that can be accessed anytime and from anywhere (Hutagalung et al., 2019). In 2004, the incidence of digestive tract disorders, especially diarrhea, had a high incidence rate compared to other diseases, namely 4620.4 million in the world (Pratiwi et al., 2018). Digestion of food in the human digestive system is a complex combination of versatile and multiple-scale physicochemical processes that steer the food intake, disintegration to suitable forms, absorption of the basic units, transportation to related organs, and purging the remaining waste (Sensoy, 2021).

Method

This research is included in the classification of research and development (Research and Development/ R&D) namely using the ADDIE model, namely Analyze, Design, Develop, Implement, Evaluate. The learning system that includes it is related to the processing and selection of content (learning resources), the preparation of learning strategies, and also includes the selection and development of media to be used, and evaluation of the achievement of objectives (Hayati et al., 2015). This research is a quantitative study using the experimental method. The design has a control class but not all external variables affect the implementation of the experiment (Sugiyono, 2017). The experimental design used in this study was Nonequivalent Control Group Design (Sugiyono, 2017). In this design there is a pretest and posttest. Before being treated, the control and experimental groups were given a pretest first to measure the initial condition of the students. The control group was not given the same treatment by not using E-Learning. While the experimental class was given treatment using E-Learning. Learning tools developed include syllabus, lesson plan, teaching materials and learning media. The questions used to measure higher order thinking skills and concept mastery used OSN questions and PISA questions. Blended learning incorporates a wide array of learning environments and approaches to teaching and learning such as, asynchronous learning networks, webenhanced teaching platforms, and digital online learning tools (Keengwe & Kidd, 2010).

Result and Discussion

Based on the results of the research that has been carried out, the following results are obtained. The many benefits of digital literacy provide digital literacy helps students learn better and save money and time, make safer, get the latest information, always be connected, make better choices, and increase happiness (Wright, 2018). This is in accordance with research conducted by Giovanni & Komariah (2020) which stated that there is a significant relationship between digital literacy and student learning achievement as measured by information competence, communication competence, content creation competence, security competence. Questions to test HOT are developed at levels C4-C6. Brookhart (2010) proposed several examples of types of questions to measure students' abilities at the analysis, evaluation, and creation levels. At the analysis level, there are three types of questions that can be used, namely determining the main idea or problem, analyzing arguments or theses, and comparing and contrasting. At the evaluation level, materials or tasks are needed that require students to criticize a value or goal, for example, students examine scientific articles and popular news in the mass media about global warming. At the creation level, tasks or problems are needed to be solved including generating various solutions, planning procedures to complete specific goals, or producing something new (Nikmah, 2017).

Based on the data listed in Figure 1, there are differences in pretest and posttest scores in the control class and experimental class. The mean pretest score in the experimental class was 77 while the mean pretest score in the control class was 65. The mean posttest score in the control class was 75 and the mean posttest score in the experimental class was 90. The control class received

different treatment from the experimental class. In the learning process, the control class was not given a stimulus to hone digital literacy skills. The e-learning used was still simple, namely in the school website which contained material and assignments from the teacher. The concept of digital literacy according to Bawden consists of four components, namely basic literacy skills (reading and writing), background knowledge of information (intellectual level), skills in the field of ICT, and attitudes and perspectives on information (Irhandayaningsih, 2020). The lack of stimulus provided by the teacher affected their digital literacy skills.

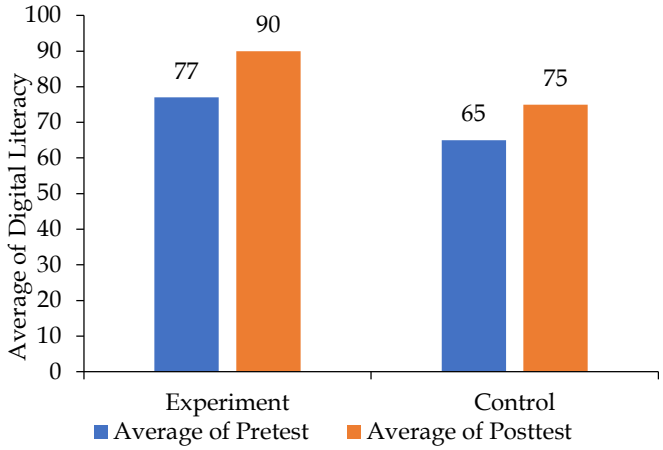

Figure 1. Pretest and posttest result for digital literacy

According to Spires & Bartlett (2012), students today do not have a complete understanding of digital literacy, even though they are digital natives (Eryansyah et al., 2019). They do not realize how the use of technology has affected their education. The strategy of using E-learning to support the implementation of the learning process, is expected to increase the absorption of students for the material being taught; increase active participation of students; improve students' independent learning abilities; improve the quality of educational and training materials, improve the ability to display information with information technology devices, expand the reach of the teaching and learning process using the internet, not limited to space and time (Husnussaadah, 2021). The grading rubric domains and descriptors were evaluated for clarity and design by the poster mentors, chairs of the college's curriculum and assessment committees, the college's associate dean for academic affairs, and the pharmacy practice department chair (Kelsch & Werremeyer, 2011). There are several activities that must be present in online learning, namely: 1) Increasing student attention, 2) Conveying learning objectives to students, 3) Encouraging students to recall information they have learned, 4) Presenting stimuli specifically, 5) Providing learning instructions, 6) Obtaining student performance, 7) Providing informative feedback, 8) Assessing student performance levels, 9) Increasing retention and transfer of learning (Mustofa et al., 2019).

Based on the findings of the pre-test and post-test given to students in the experimental class (XI MIPA 5), it can be seen that there is a difference in scores between the two tests. After the process of implementing E-learning in improving HOTS skills, the learning outcomes changed. Basically, e-learning-based learning requires preparation of devices that require a lot of money. That is why many schools or madrasas are not ready with the E-Learning model (Ika, 2023). All of the students Bakti Mulya 400 have their own Ipad. The results of the study showed that the average value of student learning outcomes using the Project Based Learning (PjBL) model was better in improving student learning outcomes (Kencana & Rifa'i, 2021). The table below displays the learning outcomes for the experimental class (XI MIPA 5). The pre-test and post-test results for the experimental class are shown in Table 1.

Table 1. The pre-test and post-test results for the experimental class

Data	High order thinking skills ability	
	Before	After
Highest score	75.00	93.00
Lowest score	50.00	75.00
Average score	63.89	84.16
Standard deviation	2.94	5.61

Based on Table 1 it is known that the average value before using HOTS-based e-learning is 63.89 and the average value after using HOTS-based e-learning is 84.16. The assessment of higher order thinking skills was carried out to obtain the results of the N-gain test. The results obtained were taken from the results of the initial and final tests in the experimental class with HOTS-based e-learning treatment in the experimental class and the control class with treatment in the control class by providing e-learning via google classroom that had been made by the teacher. After the N-gain calculation, the conclusion is obtained from the calculation of the initial test (pretest) and the final test (posttest). Determining how much the effectiveness of the use of E-Learning based on higher order thinking skills, the N-gain calculation is obtained, and the results are presented in Table 2.

Table 2. The effectiveness of the use of E-Learning

Class	N-gain score (%)	Information
Control	7.10	Ineffective
Experiment	56.00	Effective

Based on the results of the N-gain score test calculation in Table 2, it shows that the average N-gain score for the experimental class is 56%, including in the moderately effective category. With a minimum N-gain score of 20% and a maximum of 100%. Meanwhile, the average N-gain score for the control class is 7.1%, including in the ineffective category. With a minimum N-gain score of 33.3% and a maximum of 50%.

Based on the data processing of the final test (posttest) conducted after the treatment, it is known that the average final test of higher order thinking skills in the experimental class and control class as a whole has a significantly different value after being treated using e-learning. The difference in the results of the high-level thinking skills test between the experimental class and the control class was caused by different treatments in the two classes. The results of the increase in higher-order thinking skills in the experimental class can be caused by the use of e-learning based on higher-order thinking skills. The use of e-learning based on higher order thinking skills can be caused by several things. First, there is a "Let's Analyze" feature which contains a table to analyze the content of food containing carbohydrates, protein, fat, vitamins or minerals. Second, the e-learning also provides a discussion room to direct learners to conduct virtual discussion sessions. In the control class e-learning, the presentation is directly in the form of teaching materials and continued with questions that must be answered by students while in class. So that students are not given the space and opportunity to discuss with their friends before learning begins. With the character of e-learning like this, the opportunity for students to be able to analyze a phenomenon is less facilitated, besides that students are not challenged to find the data sources needed for them to develop complete analytical skills. The results of the study are also in accordance with the research of Maghfirah & Nurhaliayati (2020) which states that the use of e-learning is effective in improving students' higher order thinking skills.

In high-level thinking skills there are several aspects, namely analyzing, evaluating, and creating. With the features that can hone higher order thinking skills in e-learning, students will be trained with these aspects of argumentation, while the control class is not familiar with these aspects so that the average score of the experimental class is higher than the control class. This is in accordance with the opinion of Muhammad et al. (2022) which states that e-learning makes it easier for students to practice higher order thinking skills and is proven to improve higher order thinking skills. According to Poppy (2013) the use of e-learning can facilitate students in learning and also provide students with the ability to improve higher order thinking skills. For discussion-based conferences, it is more appropriate to use the Zoom platform because it is more communicative with teacher and between students. Meanwhile, to establish a more appropriate platform to use is WhatsApp Group or Google Classroom. Students feel progress in the college process. Lectures now seem more flexible and have more usability value (Jana et al., 2022).

Conclusion

The study reveals that using HOTS-based e-learning can enhance the digital literacy and higher order thinking skills of high school class XI students. The results show a significant difference in digital literacy skills between classes using HOTS-based e-learning and control classes using non-HOTS-based e-learning (google classroom). The experimental class showed a higher average improvement in digital literacy skills, while the control class had a lower improvement. The use of e-modules based on socio-scientific issues also showed a medium improvement in decision-making on environmental material, while the control class had a lower improvement. Higher order thinking skills like critical thinking, creative thinking and problem solving are considered necessary skills for 21st century individuals. On the other hand, technology competencies like using the Internet and its services effectively and learning in online environments are also skills required for the new generation (Kalelioglu & Gilbahar, 2013).

Acknowledgement
We would like to express our deepest gratitude to our supervising lecturer, teachers, and students who have significantly contributed to the successful completion of this research. Your support, guidance, and participation have been invaluable, and we truly appreciate your efforts and dedication. Thank you for your continuous encouragement and for making this study possible.

Author Contributions
N.M.I. contributed to the conceptualization, data collection process, data processing, and article writing; Y.S. contributed to review and the data processing; M.N. contributed to the data processing and article writing.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

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