

Need Analysis for Developing a Natural Science Learning Website with the Theme of Biotechnology in Improving Digital Literacy

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Abstract: The development of technological rapidly changes the learning process more broadly. Demands for students or prospective science teachers to improve their digital literacy skills with the help of website-based media are needed in the learning process so that it can take place optimally. The development of biotechnology has also developed rapidly in the last few years, thus demanding that students or prospective science teachers be more responsive to information and be able to present this information interactively. Unfortunately, many students or prospective science teachers are not able to understand biotechnology because it is considered that the concept of biotechnology is difficult to understand. For this reason, it is necessary to have a needs analysis to find out the aspects needed and develop the learning and learning resources needed to improve digital literacy skills and understand the concept of biotechnology. The aim of this study is to analyze the needs of learning media based on a biotechnology theme website that would be developed, so that it can improve the digital literacy skills of students or prospective science teachers. The needs analysis was carried out as a preliminary study on Borg & Gall's research and development methods, which are included in the research and information collecting stage. The analysis of the needs for developing learning tools includes student analysis, concept analysis, task analysis, and learning objectives analysis. This needs analysis is accompanied by a literature review and observation results. The results obtained are a thorough and real needs analysis on the development of a biotechnology theme website to improve the digital literacy abilities of science teacher candidates, which can be applied at the next research and development stage.

Keywords: Biotechnology; Digital Literacy Ability; Needs Analysis; Website

Introduction

Currently the world is in the 21st century which is the era of information and communication technology that is developing very rapidly. Science and technology is very influential for all areas of life, one of which is the learning paradigm which is characterized by changes in curriculum, media, and technology (Syefrinando et al., 2022). The development of learning innovations in the classroom during the adaptation period from new habits during a pandemic can use the concept of blended learning, which in the learning process combines 3 main aspects namely online, virtual-digital and offline while still having to pay attention to health protocols (Arisa et al., 2021).

Developments in technology, information and communication in the world of education provide convenience, especially in conveying material during learning activities by using the media as an intermediary to obtain maximum learning outcomes (Haka & Suhandha, 2020). This is in line with (Fadila et al., 2021) which states that one of the determining factors for successful learning is the ability to find the information needed on digital networks/the internet. But in reality, not all students get the expected learning outcomes. Sometimes in carrying out learning activities it is not always successful, often there are things that result in failure or difficulties when learning. The occurrence of difficulties in learning is due to the inability to link new

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knowledge with old knowledge, causing a lack of understanding of a lesson (Caryono et al., 2012).

Likewise with the theme of biotechnology. Biotechnology is one of the subjects in Science Education. In this case, there are symptoms of difficulty, including when most of the science teacher candidates still have difficulty understanding this biotechnology theme, because students consider the biotechnology theme too hard to learn so that in the end it is difficult to understand because to get a good understanding, an understanding of the basic sciences is needed. Most of which are abstract. Due to the difficulty in understanding the theme, it ultimately causes students to no longer be able to concentrate, resulting in a low score.

Biotechnology discusses the process of using organisms and their components to produce products or services for the needs of living organisms on earth (Orhan & Sahin, 2018). Biotechnology is a discipline that is relatively difficult but is also a science that is developing very complexly (Tood & Murphy, 2003). To be able to understand concepts that continue to develop, students' abilities need to be improved in finding and managing new information so that misunderstandings do not occur during the learning process. A prospective teacher is also required to be able to convey information systematically to the students.

The rapid development of science and technology has made biotechnology a field of science that must be mastered and is considered very necessary, especially for science teacher candidates. Because as a knowledge to provide understanding to students at school later. This is in line with research (Orhan & Sahin, 2018) showing that at present, biotechnology is very important. Furthermore, explained by (Dewi, Kusuma, et al., 2022), students' attitudes towards online platforms show that they prefer learning through Google Classroom compared to learning non-online or conventional learning platforms. Therefore, applying Google Classroom to online learning is effective in increasing student information literacy. Biotechnology is the process of using organisms, components of organisms or biological systems to produce a product or biological agent to carry out a certain process.

The use of media in learning the theme of biotechnology is very necessary. According to (Sudjana, 2011) in his book entitled Teaching and learning strategies using media in the learning process is not an additional function. But it functions as a tool in demonstrating a more effective teaching and learning situation, especially in science subjects on the theme of Biotechnology. Learning media that can help the science learning process on the theme of biotechnology is website-based learning media. The website is one of the results of technological developments that can be used

as appropriate and appropriate media in learning. Besides that, the website is an innovation in education that can help teachers, lecturers, and prospective teachers in the learning process. The ability to utilize information and technology in jobs that are constantly changing will be the basis for developing multiculturalism skills and awareness of the importance of technology (Rohmawati et al., 2014).

Website-based learning can present learning that is more enjoyable, has a high element of interactivity, provides flexibility in accessing learning materials, makes it easier to obtain information and visualization in the learning process (Rusman et al., 2012). Website-based learning will become meaningful learning because students can interact with learning resources and media. Website-based learning media are learning media and learning resources that have a broad scope, allowing students to learn independently even though there is no teacher. In this way, this media will stimulate brain performance to be more optimal, so that in the end it will create online-based learning websites (Fajarisman et al., 2020).

The presence of website-based learning media provides an innovation that has a major contribution to changing the learning process, in this case making the learning process more innovative and encouraging students to be able to carry out other activities such as observing, doing, demonstrating, and so on (Januarisman & Ghufro, 2016). In addition, website-based learning media is not limited by space and time. Where, website-based learning media can create an interesting, interactive, effective learning process, and arouse students' enthusiasm in learning activities (Darussalam, 2017). Web-based learning media or e-learning which is now very popular because of its flexibility and effectiveness in accessing learning.

Learning media using the website is the most important part that needs to be developed to improve digital literacy skills. Because in learning it is important to understand the context of information literacy, communication and also media literacy in order to be able to use digital literacy wisely. Digital literacy is a key word in efforts to build civilized communication in the digital era (Nash, 2020). The concept of digital literacy can be defined as the abilities needed by every individual to be able to live, learn and work in a digital community environment.

Digital literacy in the era of the industrial revolution 4.0 has led to increasingly close boundaries between humans, industrial machines, information technology and communication which has an impact on all aspects of life (Fomunyan, 2019). Digital literacy is the main key in efforts to build civilized communication in a digital era society (Nash, 2020). Digital literacy requires close interaction and understanding with

technology (Coffin Murray & Pérez, 2014). Literacy in 21st century learning has become an inseparable part of today's life. Digital literacy is very crucial because in the 21st century, it is necessary to acquire skills to understand, access, evaluate, integrate, communicate, use, manage, add to the wealth of information safely and precisely, and use media according to their needs (Law et al, 2018).

Digital literacy is one of the abilities that prospective teachers must have to access, manage, understand, integrate, communicate, evaluate, and create information safely through digital devices (Ilhami et al., 2021). Referring to learning practices, digital media provides opportunities to transfer information and data so that they can be accessed more quickly over long distances (Prasanti & Indriani, 2017). So, prospective teachers must be able to master digital literacy skills so that when they do the learning process can take place more optimally. Students with good digital literacy skills are believed to be able to search, find, apply, evaluate digital information to support the implementation of their learning. (Dewi et al., 2021) described that digital literacy is very important in chemistry learning. It can be focused on the needs of Z Generation students in internet's acces as a medium that promises easy community connectivity. It can be started from how to communicate, how to collaborate, how to be creative, how to solve problems, how to make decisions, and how to utilize information.

Prospective science teachers must have good digital literacy skills to face learning in the new era Rachmawati et al. (2020) because they are prospective teachers who will transfer their knowledge in the future. In implementing science learning, digital literacy has a strategic role because it can present science learning material contextually, visually, and audio that is interesting and interactive (Rusydiyah et al., 2020) besides that it also provides various learning resources such as materials, teaching materials, media , virtual practicums, and so on which are widely available in digital form, and can also be accessed widely via the internet (Wijaya & Supadmini, 2020).

Based on the explanation above, the author feels it is important to conduct research related to the analysis of needs for the development of website-based learning media in science learning with the theme of biotechnology in improving digital literacy skills. The aim is to make it easier for writers to build systems that are developed with the real needs of users.

Method

This study uses the Borg Gall (1983) development research (R&D) model which aims to produce

application products and test product effectiveness. According to Borg and Gall, there are 10 stages of development stages, namely (1) information data collection; (2) preparation related to planning (defining skills, specifying objectives, and determining learning rules); (3) developing initial media (preparing teaching materials and evaluation equipment); (4) testing the initial field; (5) make improvements from the trial results; (6) test the main field; (7) improvement of products or media from the results of field trials; (8) testing the operational field; (9) improve the results of the final product or media; (10) disseminate and implement the product.

This research is limited to needs analysis, namely at the stage of gathering information from initial observations in the field and accompanied by a literature review. Needs analysis in this study was carried out at the Science Education Study Program, Faculty of Teacher Training and Education, Sultan Ageng Tirtayasa University, Indonesia.

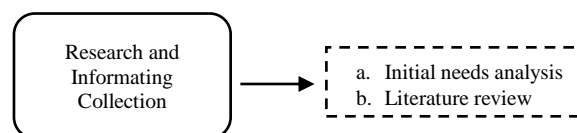


Figure 1. Design of the modified Borg and gall model into 1 stage

Data was collected through survey techniques with instruments in the form of questionnaires. The questionnaire was used to find out student opinions related to the needs of the developed website-based learning media. The questionnaire questionnaire was calculated using the formula for the level of achievement of the respondents.

$$TPR = \frac{\text{Average Score}}{\text{Maximum Ideal Score}} \times 100\% \quad (1)$$

(Modification of Riduwan, 2013)

The need for learning media will be developed through a questionnaire instrument which then obtains data in the form of an analysis of student needs, concepts, assignments, and learning objectives. In the next stage the data is analyzed by interpreting the results of the problem analysis and then drawing conclusions.

Result and Discussion

Needs analysis is an early stage in design and development research. This analysis was carried out with the aim of obtaining the information needed before carrying out the research. The results of the needs analysis include student analysis, concept analysis, task

analysis, and learning objectives analysis as important information which is used as the basis for designing instructional media is presented in the following description.

Student Analysis

Student analysis is about student characteristics. In order for students' needs to be met in lectures, it is necessary to analyze student needs. This needs analysis has an important role in helping the learning process. According to (Thiagarajan et al., 1974), student analysis is a study of the characteristics of students in accordance with the design of developing learning tools. These characteristics include background academic ability (knowledge), cognitive development, and skills possessed by individuals related to learning topics, media, formats, and the language chosen. This student analysis was carried out to get an overview of student characteristics besides the analysis carried out in this study included student cognitive development, media, and teaching and learning activities.

Students are generally seen as having a higher level of maturity than students, this is because the average age of students is 18 years and over, according to (Piaget, 1952) ages ranging from 11-15 are included in the formal operational stage which is the final stage in cognitive development theory. In this case the demand for mastery of cognitive abilities at this stage is definitely greater than that of students. When they are still the students, their cognitive domain is still in basic development, whereas when they are a student, this domain is considered to have mastered abilities that can be developed and applied.

Students belong to the adolescent category, so their cognitive development is at the formal operational stage because students are able to think abstractly and more logically. This is in line with Piaget's theory (1952) which states that at this formal pre-operational stage individuals have started to think about experiences beyond concrete experiences, besides that they can think about them in a more abstract, idealistic, and logical way. So that in this case students whose cognitive development is already at this operational stage, in studying this biotechnology theme can be designed through exploratory activities. Where in this exploratory activity students are expected to be able to think abstractly and obtain an answer or solution to a problem by using a systematic process. Supported by the characteristics of these students as Z generation. Z generation is known as the generation that is connected through digital social media networks and via the internet. Most of this generation is used to taking advantage of technological advances in daily life. In addition, the ease of accessing the internet makes the

internet the main reference in finding sources of information (Shmul Cohen, 2020).

The characteristics of generation Z are the characters possessed by those born in 1995-2010 or often also called the Net Generation. This includes students who are in their sixth semester. With the existence of technology that is so rapidly influencing students in participating in the learning process. Because generation Z uses a lot of technological developments, one of which is to find learning resources. Therefore, with the rapid development of internet technology, it has a big impact on generation Z students. (Natsir et al., 2022) showed that learning multimedia was declared feasible based on a content validity value of 100%, and the Gen-Z digital literacy index obtained a score of 3.30 or is in the medium category. It can be concluded that interactive learning multimedia can be an alternative in increasing students' digital literacy in substance pressure material. This study shows that science learning can contribute for accelerating digital transformation by increasing students' capacity in digital literacy. (Aini & Mufit, 2022) explained that interactive multimedia designs using Adobe Animate CC software can be used on student cell phones. This interactive multimedia is structured based on the syntax of a cognitive conflict-based learning model. Product validity was obtained from the assessment of experts, the average value of the product was 0.81 in the valid category. Interactive multimedia is proven to be valid in terms of material substance, learning design, visual communication display, and software usage.

One of the technologies that has a big influence on generation Z students in the learning process is the use of website-based learning media. The use of this website in the learning process can make students more innovative, besides that also interested students digital technology has a much higher digital literacy score compared to students who are less interested in digital technology (Brata et al., 2022).

Digital literacy becomes the main key in the effort to build communication civilized society in the digital age society (Nash, 2020). Because basically digital iteration requires interaction and understanding closely related to technology (Murray & Perez, 2014). The aim of digital literacy is to help students become competent, critical and literate in the form of web-based digital media because they need to interpret what they see or hear and prevent that interpretation from controlling them. Therefore, students' perceptions of digital literacy are needed to support the learning process using website-based media (Akçayoglu & Daggo, 2019).

Concept Analysis

The aims of concept analysis are to find out the main concepts to be conveyed, then arrange them in a

structured manner, and relate one concept to another, so that concepts are formulated that are relevant and fit for learning objectives (Thiagarajan et al., 1974). This analysis was carried out by analyzing the concepts on the theme of biotechnology which are adapted to the learning outcomes of biotechnology courses and the content of Middle School Science subjects. This was conducted because it was considered very necessary, especially for science teacher candidates as a knowledge to provide understanding to students at school later. This concept analysis will later be used in learning media to improve the digital literacy skills of prospective science teachers. (Dewi, Awaliyah, et al., 2022) indicated a significant increase in digital literacy scores before and after using an android-based e-module treatment. Thus, it can be concluded that significantly enhances students' digital literacy on chemical bond.

The results of the concept analysis based on the biotechnology theme were obtained based on knowledge of the concepts, development and use of biotechnology in daily life, as well as having skills in presenting knowledge to students. This course was developed in 2019. The concept of learning Biotechnology consists of 8 aspects based on CPMK including the Basic Principles of Biotechnology, Conventional Biotechnology, Modern Biotechnology, Food Biotechnology, Agricultural Biotechnology, Health Biotechnology, Environmental Biotechnology, and Reproductive Biotechnology and Genetic Engineering.

Task Analysis

The aims of task analysis is to identify the main or additional tasks or skills to be developed (Thiagarajan et al., 1974). In this analysis, it examines in detail the assignments that will later be given to prospective science teachers through biotechnology concepts that have been determined in the previous analysis, namely concept analysis. Ilhami et al. (2021) showed that the digital literacy of pre-service science teachers was in the medium category with a score of 61.8%. (Dewi, Awaliyah, et al, 2022) described that the digital module which has been developed using kvisoft flipbook on atomic structure material obtained percentages feasibility of 86 with a feasible category and practical test of the use of digital modules provide a positive response in growing students' digital literacy.

Analysis of Learning Objectives

The aims of learning objectives analysis is to formulate the results of concept analysis with task analysis into a goal that is stated with the expected behavior that appears after development (Thiagarajan et al., 1974). The expected behavior will be used as a reference in developing learning tools, especially website-based media. Because basically the

characteristics of students in generation Z are accustomed to using technological devices to find various information and become supporting materials in learning. So that website development can facilitate increasing digital literacy skills. Anggraeni et al. (2022), explained that the increase in the average percentage value for measuring interest in learning was 22.24% and the average percentage value for measuring digital literacy skills was 80.90%.

Table 1. Learning Objectives for Biotechnology Courses

No	Learning Objectives
1	Students can explain the basic principles of biotechnology and are able to apply the basic principles of biotechnology in daily life.
2	Students can differentiate conventional biotechnology from modern biotechnology, can determine conventional biotechnology products and can describe the role of microorganisms in the manufacture of conventional biotechnology products.
3	Students can describe prospective conventional biotechnology products in the food sector that will be made.
4	Students can make and explain the results of conventional biotechnology products in agriculture that have been made.
5	Students can analyze modern biotechnology and its components.
6	Students can describe examples of the application of modern biotechnology in the health sector.
7	Students can identify biotechnology as an environmentally friendly technology and its application in energy supply.
8	Students can identify the use of biotechnology in efforts to improve the environment.
9	Students can identify the use of biotechnology in the production process and genetic engineering in an effort to obtain superior varieties.

Based on the results of the study it can be concluded that the integrated QR code in the physics learning module is effective for increasing interest in learning and students have high digital literacy skills because they are able to utilize digital media for the learning process. (Dewi, Awaliyah, et al., 2022) described a significant increase in digital literacy scores before and after using an android-based e-module treatment on the chemical bond concept. As a result, it can be concluded that using an android-based e-module treatment significantly improves students' digital literacy. The results of the analysis of learning objectives on the concept of biotechnology are presented in Table 1.

Conclusion

From the data analysis, it can be concluded that students still have difficulty understanding, finding

sources of learning on the theme of biotechnology independently, and processing information. From these problems, it is necessary to create a learning resource that helps students prepare an initial understanding structurally and assists students in improving digital literacy skills, especially on the theme of biotechnology. Biotechnology content that needs to be studied is in the form of basic biotechnology concepts, biotechnology developments, and biotechnology applications in daily life. From the existing studies, can be created website-based media as a learning media and learning resources that have a wide scope, enabling students to study independently and improve their digital literacy skills in the concept of biotechnology.

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The roles of the authors in this research are divided into executor and advisor in this research.

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Conflicts of Interest

The author declares no conflict of interest.

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