JPBIO (Jurnal Pendidikan Biologi)
Vol. 9, No. 2, November 2024, 213 – 223 //e-ISSN 2540-802X
http://jurnal.stkippersada.ac.id/jurnal/index.php/JBIO/index

The development of website-based encyclopedia media on laboratory equipment material for laboratory engineering courses

Nurfitri AR*, Jamilah, Syahriani, Syamsul

Biology Education Study, Universitas Islam Negeri Alauddin Makassar, Indonesia

*Corresponding author: nurfitriar12@gmail.com

Article Info

Article History:
Received 09 September 2024
Revised 15 October 2024
Accepted 25 October 2024
Published 30 November 2024

Keywords:
Encyclopedia
Laboratory Equipment
Website

ABSTRACT

The importance of mastering laboratory equipment for Biology Education students encourages the development of a website-based encyclopedia as an interactive and easily accessible learning resource. This study aims to determine the characteristics of the media, the level of validity, and the level of practicality of the website-based encyclopedia on the material of introduction to laboratory equipment as support for laboratory engineering courses in the Biology Education Study Program, UIN Alauddin Makassar. The study was a research and development (R&D) based on the ADDIE development model, which included five steps: analyze, design, develop, implement, and evaluate. The results showed that the website-based encyclopedia media on laboratory equipment introduction material for the laboratory engineering course in the Biology Education Study Program UIN Alauddin Makassar has first-rate characteristics with an average expert validator rating of 100%. The media has a validity level of 3.66 means a very valid category. The media's level of practicality, as assessed by both students and lecturers, fell into the very high criteria, with a rating of 3.57 from students and 3.62 from lecturers. Therefore, the website-based encyclopedia media for introducing laboratory equipment is suitable and recommended for integration into the learning process.

Citation: Nurfitri AR, Jamilah, Syahriani, & Syamsul. (2024). The development of website-based encyclopedia media on laboratory equipment material for laboratory engineering courses. *JPBIO (Jurnal Pendidikan Biologi), 9*(2), 213-223. DOI: https://doi.org/10.31932/jpbio.v9i2.3847

INTRODUCTION

Technology has become important, especially in the 21st century. Technology has entered all fields, including education. In education, technology is a channel for transferring knowledge everywhere. The influx of technology that continues to develop causes changes in people's lives, including perspectives, dynamics, and lifestyles (Grabe, 2007; Ghavifekr & Rosdy, 2015). With the existence of technology in education, of course, all institutions must support the use of

technology in learning. In addition to innovations that continue to develop, generations need to be skilled in using them to keep up with learning progress.

(Khusnah et al., 2020) stated that the use of mobile phones in learning has been rife. This indicates that teachers must work hard regarding learning materials. That shows how technology has made learning more dynamic, demanding innovation and creativity. Carpenter et al. (2020) said educators, through professional development university programs, are responsible for providing qualified teachers to help students reach their potential. (Bingimlas, 2009) also emphasized that technological innovation can improve teachers' pedagogical competence and facilitate students' learning. (Carpenter et al., 2020) said teachers ought to be able to use technology. Professional teacher programs at higher education institutions should take the availability of teachers with these skills into consideration. Students can succeed at their highest potential with the help of their teacher. (Bingimlas, 2009) Similarly technology can facilitate student learning and increase teacher pedagogical skills.

Learning media can help students achieve learning goals. This shows the role of the media as an effective messenger. Learning media can make learning productive (Shafira et al., 2018). Therefore, the media must be adapted to the characteristics of students, achieve learning goals, be simple, according to learning methods, and be motivated (Rasyid et al., 2016). Recognizing laboratory equipment, of course, requires appropriate media. Introduction to laboratory equipment is one of the basic materials in laboratory engineering courses. It said in (Gökmen et al., 2021) that laboratories are important in accomplishing educational objectives and improving learners' retention of subject matter. They extend beyond merely imparting scientific knowledge by promoting essential skills such as scientific research, discussion, and critical thinking. Actively participating in laboratory work not only deepens students' comprehension of scientific concepts but also nurtures essential abilities for both academic and personal growth. (Restiana & Djukri, 2021), said that Laboratory equipment represents a technological advancement aimed at enhancing skills and addressing the demands of the modern era. Consequently, students are required to be familiar with the proper utilization of this equipment. Apart from skill development, familiarity with laboratory equipment and chemicals also aids in grasping the underlying learning theories. This ensures the effective execution of subject-specific practical exercises and facilitates students' comprehension of the theoretical concepts previously taught in the classroom.

Encyclopedias, as a form of learning media, are a valuable resource for easy-to-understand information enriched with colorful pictures, keeping readers engaged and interested (Handayani et al., 2021). The Encyclopedia serves as a valuable reference source commonly utilized for explanatory purposes. It encompasses two main types: general encyclopedias and special encyclopedias, both offering a wealth of knowledge on various subjects. Whether seeking comprehensive overviews or in-depth information on specific topics, these encyclopedias stand as essential tools for individuals seeking to expand their understanding and knowledge across a diverse range of subjects. Based on the type of media there are print, digital, and electronic encyclopedias (Hermanto et al., 2021).

Web-based encyclopedias allow users to actively construct knowledge through exploration and interaction with various sources of information. Several studies have shown that the use of online encyclopedias can improve students' learning motivation, conceptual understanding, and learning outcomes.

Nevertheless, findings from interviews with Biology Education students at UIN Alauddin Makassar have brought to light a concerning issue - the scarcity of resources for laboratory equipment introduction. The limited availability of relevant materials in the library makes it arduous for students to access essential information, leading them to resort to Internet sources that often lack appropriateness and adequacy. In light of this predicament, there arises a pressing need

for an open-access manual that comprehensively presents clear descriptions, accompanied by pictures and detailed explanations of laboratory equipment. Such a resource would undoubtedly prove invaluable in bridging the knowledge gap and empowering students to engage effectively in their academic pursuits.

Several studies regarding the introduction of laboratory equipment have been carried out. These studies focused on chemical laboratory equipment (Priyambodo et al., 2017) and the Digital Encyclopedia of Electrical Technology in the field of physics (Nurhatmi, Rusdi, et al., 2015). Studies on biology laboratory equipment have been conducted by (Huda et al., 2018) and (Supriyadi & Lismawati, 2018), who developed printed encyclopedias for high and junior high schools. (Ferastia, 2022), has also created mobile learning-based encyclopedias for junior high school students. One study about encyclopedias for laboratory engineering courses at the university level was done by Sitti Nur Ramadhanty. Unfortunately, It took the shape of printed material on A4-sized Art Paper. In this research, laboratory equipment, especially for laboratory engineering courses, was developed in a website-based encyclopedia. This website-based encyclopedia includes images, functions, and usage instructions for laboratory tools. The study uses Figma for prototype design and implements it into the Laravel Framework as the website medium, with data input via XAMPP and Visual Studio Code applications. The Canva Pro application is utilized for image and icon editing, ensuring the design incorporates graphic elements.

The use of encyclopedias contributes significantly to an enriched learning experience, promoting a deeper understanding of subjects and fostering a thirst for knowledge in students. This development of a biology laboratory equipment encyclopedia aims to familiarize students with lab tools, enabling them to become independent and active in practicum activities. This development of a biology laboratory equipment encyclopedia aims to familiarize students with lab tools, enabling them to become independent and active in practicum activities. Supriyadi & Lismawati, (2018), stated that utilizing the encyclopedia would improve comprehension of laboratory tool names and functions among students.

RESEARCH METHODS

Research Design

This type of research is called research and development abbreviated as R&D (Haka et al., 2021). The main purpose of this research is to create new products or improve existing products based on previous iterations (Saputro, 2017). Research and development can be tested according to the level of testing that can produce valid, practical, and effective results. The learning media in this study were compiled and developed using the ADDIE development model. The ADDIE development model has simple, structured, and systematic stages. The ADDIE development model consists of five stages, namely Analyze, Design, Develop, Implement, and Evaluate.

Population and Samples

The sample consists of 19 students from class B in Biology Education 2022. Validation was carried out by 2 validators, namely lecturers from the Biology Education Study Program. The validators consisted of media experts who provided assessments of the specifications of the media developed and material expert validators who provided assessments of the content of the media.

Instruments

The research instruments comprised media characteristic sheets, validation sheets, and questionnaires. The characteristic sheet served as a valuable reference for discerning the distinctions between previously developed media, media created by researchers, and other learning media. Expert assessors or validators directly evaluate the validation sheet to determine the validity of the

media. Furthermore, a questionnaire was given to the lecturer and students containing a list of questions or statements used to see the level of practicality of the media developed and to collect feedback from the learning process after using the media created by the researcher.

Procedures

The analysis stage begins with an analysis of student needs related to the learning media used. The design and development stage is carried out by designing and developing laboratory tools in web form through a validation process by expert validators. The results of product development were implemented with class B Biology Education students to see the effectiveness of media. After that, the product is evaluated based on input from students and lecturers.

Data Analysis

The data obtained were then analyzed descriptively. The data obtained from the results of the validation sheet and the response questionnaire were arranged in a table to facilitate identification. Instrument data were obtained from the recapitulation of the results of the expert validator assessment and the student and lecturer response questionnaire. The average obtained was then interpreted, the media characteristic category in Table 1, the validity level criteria in Table 2, and the practicality level criteria in Table 3.

Table 1. Media Characteristics Categories

Persentase	Characteristics Category
76% - 100%	Very good
56% - 75%	Quite good
40% - 55%	Not good
< 40%	Not good

Table 2. The Validity Category

Mean	Criteria
$3,5 \leq M \leq 4$	Very valid
$2,5 \leq M < 3,5$	Valid
$1,5 \leq M < 2,5$	Quite valid
$M < 1,5$	Not valid

Table 3. The Practicality Category

Mean	Criteria
$3,5 \leq Xi < 4$	Very Practical
$2,5 \leq Xi < 3,5$	Practical
$1,5 \leq Xi < 2,5$	Quite Practical
$0 \leq Xi < 1,5$	Not Practical

RESULTS

Characteristics of Website-Based Media Encyclopedia

Characteristics are something distinctive or striking that is found in a person or an object or thing. Based on the results of the analysis of assessment data by expert validators using the Guttman scale, the characteristics of website-based encyclopedia learning media obtained an average assessment value of all aspects, namely 100%, which is included in the very good category. This is supported by Dessyta Gumanti's theory (2021) that if the results of the analysis of learning interest

assessment data by respondents using the Guttman scale are at a percentage of 76% - 100%, it is categorized as very good. So it can be concluded that the characteristics of website-based encyclopedia media are very good for use in learning.

Website-Based Encyclopedia Media Validity Level

Based on the results of the analysis of the media validity level test that has been carried out by researchers, the website-based encyclopedia media obtained an average value of all aspects of 3.66 or is in a very valid category (Table 4). So, it can be concluded that the website-based media encyclopedia on laboratory equipment introduction material is feasible to use in the learning process. This is by the theory which states that if the average value of the media validity test results is $3.5 \leq M < 4$ then the media is in the very valid category (Ridwan: 2003).

Table 4. Validator Assessment Results

Assessment Aspect	Rating Result	Category
Appearance	3,5	Very Valid
Media Contents	3.75	Very Valid
Technical Quality	3,33	Very Valid
Size	4	Very Valid
Appropriate Use of Terms	3.75	Very Valid
Average	3,6	Very Valid

Level of Practicality of Website-Based Encyclopedia Media

The practicality level was assessed using two research instruments: a student response questionnaire and a lecturer response questionnaire. After analyzing the practicality test results, the student response questionnaire yielded a score of 3.57, while the lecturer response questionnaire scored 3.68. The overall average response, calculated as 3.62, falls within the "very practical" category (Table 5). Thus, it can be concluded that website-based encyclopedia media is highly practical for implementation in the learning process. This conclusion aligns with the theory that categorizes media with an average practicality test score between 3.5 and 4 as "very practical" (Fairuz et al., 2020).

Table 5. Results of the Response Questionnaire Analysis of Supporting Lecturers and Students

No.	Types of Research	Average	Assessment Criteria
1	Lecturer's Response	3.68	Very Practical
2	Student Response	3.57	Very Practical
	Average Number	3,62	Very Practical

DISCUSSION

Characteristics of Website-Based Media Encyclopedia

Characteristics are inherent attributes or features that distinguish and make a person or object unique or remarkable (Kadir et al., 2021). The analysis of assessment data by expert validators, utilizing the Guttman scale, revealed that the website-based encyclopedia learning media exhibited exceptional characteristics, obtaining an average score of 100% in all aspects, falling within the "very good" category. This finding aligns with (Gumanti & Teza, 2021) theory, which stipulates that when the assessment data using the Guttman scale reaches a percentage range of 76% to 100%, it is classified as "very good" (Gumanti & Teza, 2021).

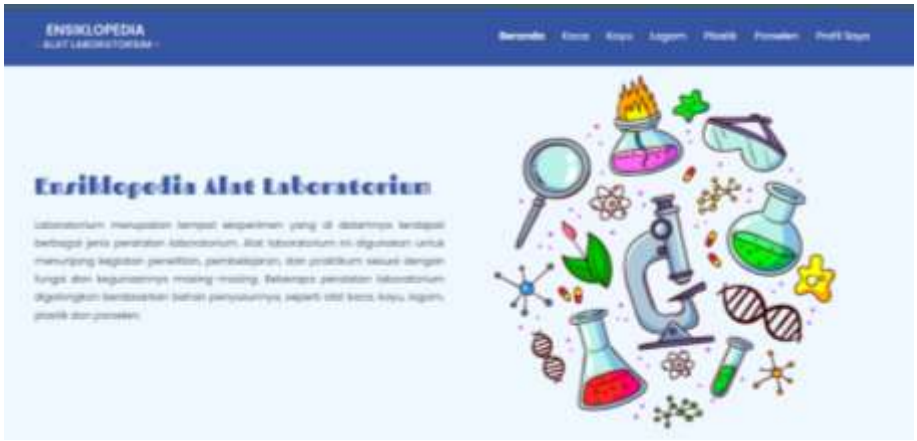

Figure 1. Development of Website-Based Encyclopedia

In appearance aspect, this medium boasts a clear and orderly layout, complemented by a pleasing color combination and an array of captivating features. The website-based encyclopedia media employs a well-proportioned arrangement of fonts and colors that seamlessly blend with the typography (Figure 1). Additionally, it incorporates intriguing features housing relevant learning materials, accompanied by illustrative icons representing each laboratory tool.

Moving on to the content aspect, this medium encompasses lucid learning materials sourced from reputable books, journals, and researchers' laboratory observations. It ensures that the content aligns cohesively with the required competencies. In terms of language, the medium utilizes easily understandable language, catering to the needs of its users and ensuring a user-friendly experience. Furthermore, from a technical perspective, this medium's usability requires no specialized skills, thereby eliminating potential hindrances for students during its usage. According to (Sunarto et al., 2020), creating a successful learning application demands a user-centric approach, prioritizing the needs and requirements of the application's users over the preferences of the creator. The application's relevance to the cultural context in which it will be implemented is of utmost importance, ensuring its effectiveness and resonance with the target audience. To achieve excellence in a learning application, careful consideration must be given to aligning it with the characteristics, technology, and context of the learning system. By adhering to these principles, a well-designed and culturally relevant learning application can pave the way for a truly impactful and successful educational experience.

The results of this study find support in the research by (Cahdriyana & Richardo, 2016), which delineates various characteristics of effective learning media. These include having clear learning objectives, relevant and accurate content, a coherent learning flow, unambiguous usage instructions, and provision of perceptions, conclusions, examples, and exercises with accompanying feedback. Effective media also stimulates student learning motivation, includes evaluations with results and discussions, engages students with interesting intros, incorporates harmonious and proportional visual elements like images, animations, texts, and colors, offers interactivity, features easy navigation, and employs language that is easily comprehensible to students (Cahdriyana & Richardo, 2016).

Website-Based Encyclopedia Media Validity Level

The validity of learning media includes aspects of format, content, and language obtained from the validator's lecturer validation results (Saniriati et al., 2021). The developed medium is determined by its validity level. If the validity level of the learning medium falls below the required standard, revisions are essential to ensure it achieves a valid validation level (Simanjuntak, 2019).

The display aspect in terms of fonts uses the Fascinate Inline font type in the title section on the homepage and Poppins in the features, descriptions of tools, functions, how to use, sources, and other elements. The use of Poppins as the main typeface on website-based encyclopedia media because Poppins is a San serif typeface classified in a geometric San serif form, with characters that represent the impression you want to make, namely dynamic and easier to read (Adi, 2020).

The right colors in multimedia learning can generate motivation, feelings, attention, and interest in student learning. Therefore, a good understanding of color selection is needed for the development of learning multimedia, including website-based media encyclopedias (Purnama, 2010). The choice of background color on the dominant website is white to match the color of the writing. The white color reflects a positive, bright, and assertive character (Langga et al., 2020). The blue color is used in tools made of glass and porcelain. Using blue as a product indicator gives the impression of a cool taste. Thus, the use of blue will make students comfortable with the learning media being developed (Masturah et al., 2018). The brown color on the wooden tool part characterizes the material that makes up the wooden tool itself. Brown means natural, warm, grounded, and more stable (Nurdini et al., 2018). Plastic and metal tools are denoted in gray according to the color of the laboratory equipment where they were made. Gray is associated with neutral colors. The color gray means balance, safety, natural, classic, simple, mature, intellectual, and justice (Monica & Luzar, 2011).

According to Zakiya, Sinaga & Hamidah, 2017; and Yulianti et al., 2021, the diverse range of representation modes in this learning content is genuine, contributing to the enrichment of knowledge insights and the enhancement of student comprehension of the material. This means the significance of using multiple representation modes in learning content. "Representation modes" refer to different ways of presenting information, such as text, images, videos, diagrams, and interactive elements. By incorporating a variety of representation modes, the learning content becomes more diverse and authentic, closely mirroring real-world scenarios. The various representation modes in learning content bring real-life context, enrich knowledge insights, and bolster student understanding, making the learning experience more comprehensive.

Level of Practicality of Website-Based Encyclopedia Media

Appropriate use of technology can serve the regular education classroom by motivating students in all disciplines. The research conducted by Asare & Parker (2022), demonstrates the significant positive impact of web-based instruction on students' understanding of biology concepts as well as their engagement and critical thinking abilities. Notably, the study revealed that students easily adapted to web-based software, finding it neither boring nor time-consuming. Moreover, web-based instruction effectively catered to individualized learning needs, further enhancing the learning experience for students. While a minority of students expressed some reservations, the overall findings highlight the immense potential of web-based technology as a valuable tool for biology instruction, fostering a more interactive, efficient, and engaging educational journey.

The results of this study are also supported by a theory that states that practicality refers to the condition of learning media that is developed so that it is easy to use by users, both students and teachers so that learning is carried out in meaningful, interesting, fun, and useful ways for students, as well as increasing creativity in learning. This is in line with the study of (Astuti et al., 2020), which states that students have expressed excitement and appreciation for this website, as it has been instrumental in enhancing their understanding. Thus, students stay engaged in their lessons by exploring the menus on the web, which is interesting.

Several things must be considered related to the media created. The format must be considered first, as it will determine how the media will be presented and how much time and

money will be required. The second is the suitability of students, namely the suitability of media content with the development and experience of students, and the third is the suitability of educators, namely the suitability of media with the learning carried out by educators and being able to facilitate students and understand the material through the developed media (Milala et al., 2022).

Based on the result, the practicality of media for students and teachers refers to the extent to which the media is useful, functional, and effective in supporting the teaching and learning process. The lecturers' responses to the website-based encyclopedia media are assessed based on appearance, convenience, desire for learning objectives, and usage. In terms of appearance, the media effectively captures students' attention through attractive displays, including easy-to-understand images and appropriate color and font choices for introducing laboratory tools. As for convenience, the website-based encyclopedia proves accessible on various devices (Windows, Android, and iOS) without requiring special skills. Its presentation of interconnected material aids students in understanding the functions and usage of laboratory equipment, making it a valuable learning resource. Student responses align with the lecturers', emphasizing the website-based encyclopedia's role in facilitating learning objectives. The media contributes to students' understanding of laboratory equipment introduction, thereby aiding in the achievement of learning goals. Additionally, the website's ease of use further enhances its effectiveness as a learning tool for students.

Overall, both the lecturers and students recognize the significance of the website-based encyclopedia media in supporting the learning process. Its visually appealing and user-friendly features, along with its alignment with learning objectives, make it a valuable asset for enhancing students' understanding and application of laboratory equipment concepts. This positive reception can increase the likelihood of achieving the desired learning outcomes. Sayan & Mertoğlu, (2020), argued that the incorporation of equipment in Biology education proves highly effective in facilitating students' cognitive, affective, and psychomotor development. During laboratory work, the impact on affective and psychomotor aspects becomes more pronounced. The presence of various experimental tools in laboratory settings, plays a significant role in motivating students and instilling a passion for scientific exploration. This statement emphasizes the importance of a high level of validity and practicality in the media. Choosing the right medium with good validity and practicality shows effective and interesting material content (laboratory introduction). Under these conditions, content is presented in a form that is easy to understand, accessible, and ultimately leads to satisfying learning outcomes. Puspitarini & Hanif (2019) said that technology-based media is very valuable. If this type of media is used properly, it can improve learning outcomes. This type of media that utilizes the internet can encourage effectiveness, liveliness, dynamics, and independence in learning.

Apart from the positive results of the validity and practicality tests, this study has limitations. In this study, no effectiveness test was carried out, and the practicality test was only carried out on one expert lecturer, so there is a possibility of subjectivity. Further studies should carry out a more extensive evaluation.

CONCLUSION

Based on the research and discussion, the developed website-based encyclopedia media exhibits an appealing appearance with well-combined colors. It offers user-friendly features, making it accessible to all users without the need for special skills. The validity level of the website-based encyclopedia media used to introduce laboratory tools for the Biology Education Study Program at UIN Alauddin Makassar is highly commendable, with an average value of 3.66, classifying it as a very valid resource. The practicality level of the website-based encyclopedia media, utilized in

introducing laboratory equipment for the Biology Education Study Program at UIN Alauddin Makassar, receives accolades from both students and supervising lecturers. Based on the student response questionnaire, achieves an impressive average score of 3.57, while the supervising lecturer's questionnaire yields an even higher average score of 3.68, placing it firmly in the very practical category. The results of this study are expected to improve students' knowledge and understanding, especially in the introduction to laboratory equipment, and contribute to the development of science and technology.

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