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The e-guidebook feasibility phytoplankton in the bongkok river as learning media for plant-like protists

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ABSTRACT

The sub-topic of plant-like protists is one of the biology subjects that students still struggle to learn. Therefore, there is a need for learning media that meets these requirements and the e-guidebook. This study aims to determine the feasibility of the e-guidebook learning media based on the abundance of phytoplankton found in the Bongkok River, Tanjung Harapan Village, Kubu Raya Regency. The research method used is descriptive quantitative. The media development process involves three stages: pre-production, production, and post-production. After the media was created, the instruments and media were validated. The media validation questionnaire consists of 4 aspects (format, content, language, and practicality) with 19 criteria. The media validation was conducted by 5 validators, including 2 biology education lecturers from FKIP Untan and 3 biology teachers from grade 10 of senior high school or equivalent. The validation results were calculated using the Lawshe formula. The validation assessment received a CVI value of 1.00, thus being declared valid or feasible for further testing and can be used as a learning medium for the sub-topic of Plant-like Protists for grade 10 of senior high school or equivalent.

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INTRODUCTION

Learning media facilitates the interaction between teachers and students during the learning process (Hapidin, 2015). With the use of learning media, teachers can deliver the material more effectively and capture students' attention (Dianto, 2023). Learning media can also assist and ease students in independent learning, allowing them to set their learning pace according to their abilities. Learning media can be divided into two types: printed and non-printed media (Nurdiansyah, Fahyuni, and Fariyatul, 2016). Printed learning media refers to instructional tools

based on print technology, such as modules, books, and handouts. Non-printed learning media, on the other hand, refers to instructional tools that are not printed, typically in the form of audio, audio-visual, and electronic formats, such as audio teaching materials, videos, PowerPoint presentations, electronic modules, and multimedia (Naim and Safa, 2011). Selecting the right type of learning media is essential for teachers to achieve learning objectives and help students understand the lesson material more easily (Huda and Purwowidodo, 2013). Electronic media, using mobile devices such as phones, laptops, and tablets for communication, allows information and messages to be more portable and enables people to access learning media anytime, anywhere. Additionally, electronic learning media is more environmentally friendly than traditional learning media as it reduces paper use and other resources (Kristanto, 2016).

The e-guidebook is considered environmentally friendly among all electronic learning media and can inspire readers to adopt a paperless lifestyle (Widyawati et al., 2022). In line with Arief (2021), the use of e-guidebooks places great emphasis on sustainability. This e-guidebook learning media can be used in various learning materials, such as in the topic of protists in Basic Competence (KD) 3.5 of the 2013 Curriculum Syllabus. One of the protist topics is plant-like protists or phytoplankton. Phytoplankton are a type of plankton that resemble plants and are capable of photosynthesis to produce their food (Aryawati & Thoha, 2011). A healthy phytoplankton community structure supports the survival of aquatic organisms by transferring energy to the next trophic level (Handayani and Patria, 2005). Therefore, students need to learn about phytoplankton.

Students often face difficulties in understanding the material on plant-like protists due to time constraints and the learning media used. This is supported by the results of an interview with a grade 10 teacher at Al-Fityan Islamic High School in Kubu Raya, who stated that 30-40% of students still struggle with learning the sub-topic of plant-like protists because the scope of protist material is too broad, preventing the teacher from explaining plant-like protists in detail. Additionally, the teacher only uses PowerPoint presentations to deliver the material, so there is a need for supplementary media.

The phytoplankton information included in the e-guidebook learning media was obtained from various sources and observations of the phytoplankton community structure conducted in the Bongkok River, Tanjung Harapan Village, Batu Ampar District, Kubu Raya Regency. The use of field observations of phytoplankton provides contextual examples of phytoplankton in real-world situations. Previous research has stated that learning media in the form of guidebooks can enhance readers' understanding and skills. Printed guidebooks have been extensively studied. A guidebook, also known as a manual, according to Komalasari, Nurhenti, Adhe, and Maulidia (2021), contains facts, events, or processes in a specific field and can be used as a reference book for a particular area of knowledge. Additionally, guidebooks can be used as laboratory manuals. According to Telaumbanua (2022), the advantage of a guidebook is that it provides information and guidance to the reader on how to carry out what is conveyed in the media. However, the use of technology for guidebooks has not been widely adopted. In line with technological advancements, electronic guidebooks (e-guidebooks) have been developed. Therefore, the use of guidebooks can provide benefits in understanding the material.

The creation of electronic guidebooks also aligns with the demands of 21st-century education, where education involves technology in the learning process. The use of e-guidebooks can be utilized to explain images that are not visible to the naked eye, especially if laboratory facilities do not support the learning or practical process. Plant-like protists, also known as phytoplankton, are topics studied in high school. Phytoplankton are microscopic organisms that float in water (Samudra, Widyaningsih, and Suryono, 2021), making it difficult for students to see the types and forms of these organisms without the aid of a microscope. Moreover, the role of

phytoplankton as the primary producer in aquatic ecosystems is crucial. Therefore, the purpose of this research is to develop e-guidebook learning media for the sub-topic of Plant-like Protists for grade 10 of high school or equivalent, which can enhance students' knowledge of phytoplankton based on direct research on phytoplankton abundance in the Bongkok River.

RESEARCH METHODS

Research Design

The creation and validation of the e-guidebook learning media were conducted from February to October 2023. The research used a descriptive quantitative method with three stages, according to Suryani, Nunuk, and Aditin (2018): pre-production, production, and post-production. The validation of instruments and media was carried out by validators based on the assessment of the Content Validity Ratio (CVR) and Content Validity Index (CVI) for each criterion.

Population and Samples

The population in this study includes educational media targeted for teaching the topic "Plant-Like Protists" to Grade 10 high school students. The sample in this study consists of an educational medium in the form of a guidebook on phytoplankton, specifically designed for teaching "Plant-Like Protists" to Grade 10 students. Additionally, the population in this study includes educators teaching Biology at both the university and high school levels, while the sample consists of lecturers in the Biology Education program and high school teachers with experience in developing Biology educational media.

Instruments

The instruments used to collect data were the instrument validation sheet and the phytoplankton e-guidebook media questionnaire. The instrument validation assessment sheet used a Guttman scale (Yes/No) and was considered valid (Yes) if all aspects assessed by both validators, who were Biology Education lecturers from the Faculty of Teacher Training and Education (FKIP) at Tanjungpura University, were deemed appropriate. The validation of the Phytoplankton E-guidebook media covered four assessment aspects (format, content, language, and practicality) and was carried out by two Biology Education lecturers from FKIP Tanjungpura University and three grade 10 biology teachers from high schools or equivalent (SMA IT Al-Fityan, SMA Negeri 09 Pontianak, and SMA Negeri 02 Sungai Raya). The validation of the e-guidebook media used a Likert scale with four aspects and 19 assessment criteria (Table 1).

Table 1. Assessment Criteria Used to Check the Feasibility of the Media

Aspects	Assessment Criteria
Format	1. Completeness of the e-guidebook media components
	2. Attractiveness of the e-guidebook cover design
	3. Readability of font type and size
	4. Balanced, varied, and engaging placement of titles, text, and images
	5. Clarity of the quality of images/illustrations in the e-guidebook
Content	6. Alignment between learning objectives and the content of the e-guidebook
	7. Completeness of the material presentation within the e-guidebook
	8. Research findings in the e-guidebook support understanding of the material

Aspects	Assessment Criteria
	9. Accuracy of the content and concepts explained in the e-guidebook
	10. The e-guidebook guides readers to recognize phytoplankton species based on their characteristics
	11. Research findings provide factual examples of the material discussed
Language	12. The language used conforms to the Enhanced Spelling System (EYD)
	13. The sentences used are easy to understand
	14. All scientific names are written according to the rules of binomial nomenclature
Practicality	15. Ease of use of the e-guidebook
	16. Flexibility of using the e-guidebook for individuals, groups, or classes
	17. The e-guidebook is easily accessible using various free applications that support offline opening of .pdf files and online access to anyflip.com links
	18. The e-guidebook can be used repeatedly as long as the file does not have errors
	19. The e-guidebook file does not require much storage space

Procedures

The steps in creating the e-guidebook learning media follow the process outlined by Suryani, Nunuk, and Aditin (2018), which consists of three main phases. The first phase, pre-production, involves conducting a needs analysis through interviews, defining instructional goals by analyzing the Basic Competencies (Kompetensi Dasar or KD) in the syllabus, and determining the material to be included in the learning media. The second phase, production, includes selecting the media format (such as structure, content, theme, and color), drafting the script format, creating a flowchart, developing a storyboard, and designing detailed content. The final phase, post-production, involves editing to review the content and design of the e-guidebook, conducting validation (instrument and media validation), making revisions, and analyzing the collected data.

Data Analysis

The validation of the media was analyzed using the Content Validity Ratio (CVR). After that, the Content Validity Index (CVI) for each criterion was calculated. The formulas for CVR and CVI used in this analysis are based on Lawshe's (1975) method. The CVR formula measures the agreement among experts on whether a particular criterion is essential. It is calculated as follows:

$$CVR = \frac{Ne - \frac{N}{2}}{\frac{N}{2}}$$

Where:

- N_e is the number of experts who rate the item as essential.
- N is the total number of experts.

The CVI aggregates the CVR values for multiple items to assess the overall content validity of the instrument. It is a proportion of items that have a positive CVR value, indicating they are deemed valid by experts.

$$CVI = \frac{\sum CVR}{\sum n}$$

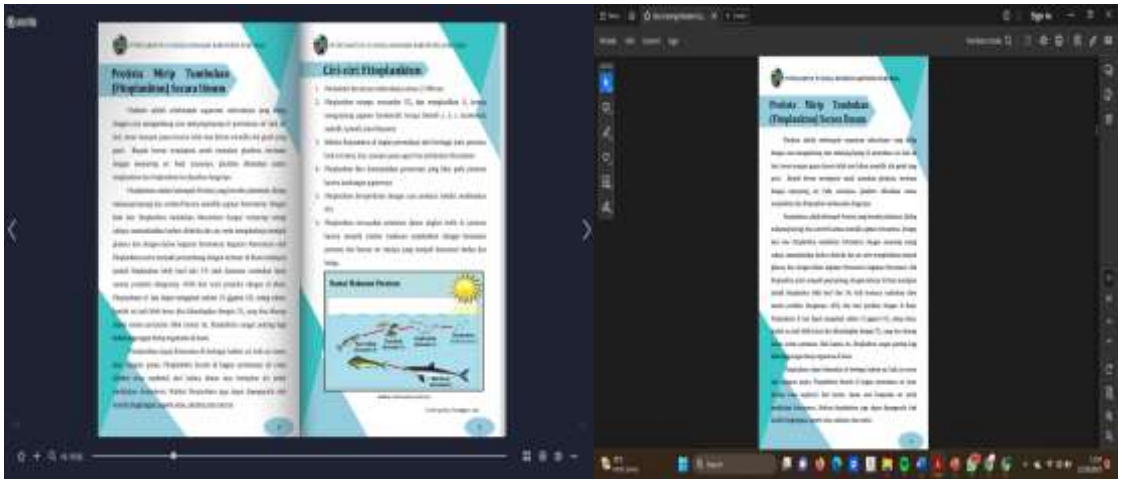
These measures help ensure that the media being evaluated has a valid content structure that is aligned with its instructional goals and materials.

RESULTS

The e-guidebook was created using free tools such as Canva, Microsoft PowerPoint, and the Anyflip website. The e-guidebook has a size of 21 x 29.7 cm (A4) in portrait orientation and consists of 49 pages. The content components include a front cover, usage instructions, material content, and a back cover (Figure 1). The cover features the Tanjungpura University logo, title, author's name, illustration, and target audience. The usage instructions provide steps for both teachers and students on how to utilize the e-guidebook effectively. The material section covers various topics: an introduction to Bongkok River, and an explanation of plant-like Protists, which includes a general overview of Protists, the diversity of phytoplankton in Bongkok River, and detailed descriptions of six classes of phytoplankton found in the river. Each species example includes classifications, morphological characteristics, locomotion mechanisms, reproductive systems, habitats, and comparison images from literature. The final section discusses the ecological importance of phytoplankton in Bongkok River, focusing on the benefits and impacts of certain phytoplankton classes. The e-guidebook concludes with references, a glossary, and an author profile.

Figure 1. The e-guidebook preview includes key components such as the cover, usage instructions, and various sections of the content. The guidebook is written in Indonesian.

The e-guidebook created in this study can be accessed both online and offline, as shown in Figure 2a and 2b. The online version is available through a provided link, while the offline version can be shared via PDF files. These files can be transferred using Bluetooth between electronic devices or through a data cable from smartphones to laptops and vice versa. The offline accessibility of the e-guidebook is especially beneficial for students or readers who may encounter internet connectivity issues, ensuring they can still access the learning materials without relying on a stable network connection.



(a) (b)

Figure 2. The Display of The E-Guidebook When Accessed Online (a) and Offline (b).

The initial version of the e-guidebook was validated to assess its feasibility before being tested as a learning tool in the classroom. The evaluation covered four main aspects: format, content, language, and practicality, encompassing 19 criteria (Yamasari, 2010; Monika, Yeni, & Aryati, 2014). The results of the e-guidebook validation are presented in Table 2. This process ensures that the e-guidebook is suitable for educational use, providing a structured and reliable tool for both students and teachers.

Table 2. The Validation Results of The E-Guidebook Media

Aspect	Assessment Criteria	CVR	Category
Format	1. Completeness of the e-guidebook media components	1,00	Valid
	2. Attractiveness of the e-guidebook cover design	1,00	Valid
	3. Readability of font type and size	1,00	Valid
	4. Balanced, varied, and engaging placement of titles, text, and images	1,00	Valid
	5. Clarity of the quality of images/illustrations in the e-guidebook	1,00	Valid
Content	6. Alignment between learning objectives and the content of the e-guidebook	1,00	Valid
	7. Completeness of the material presentation within the e-guidebook	1,00	Valid
	8. Research findings in the e-guidebook support understanding of the material	1,00	Valid
	9. Accuracy of the content and concepts explained in the e-guidebook	1,00	Valid
	10. The e-guidebook guides readers to recognize phytoplankton species based on their characteristics	1,00	Valid
	11. Research findings provide factual examples of the material discussed	1,00	Valid
Language	12. The language used conforms to the Enhanced Spelling System (EYD)	1,00	Valid
	13. The sentences used are easy to understand	1,00	Valid
	14. All scientific names are written according to the rules of binomial nomenclature	1,00	Valid
Practicality	15. Ease of use of the e-guidebook	1,00	Valid
	16. Flexibility of using the e-guidebook for individuals, groups, or classes	1,00	Valid
	17. The e-guidebook is easily accessible using various free applications that support offline opening of .pdf files and online access to anyflip.com links	1,00	Valid
	18. The e-guidebook can be used repeatedly as long as the file does not have errors	1,00	Valid
	19. The e-guidebook file does not require much storage space	1,00	Valid
	CVR	1,00	Valid

The validation of the e-guidebook media resulted in a CVR (Content Validity Ratio) and CVI (Content Validity Index) score of 1.00, indicating that the e-guidebook is valid. This score exceeds the minimum threshold value of 0.99 as per Lawshe's (1975) criteria. A CVI score of 1.00 reflects that all the indicators align with the expected criteria, confirming that the e-guidebook meets all aspects of evaluation, including format, content, language, and practicality. Thus, the media can be considered fully valid and suitable for use in an educational setting.

Although the e-guidebook successfully met all the indicators from the four aspects of evaluation, the validators provided suggestions and comments, as listed in Table 3. These comments focused on two areas: language, from three validators, and practicality, from one validator. The language aspect required attention to the use of punctuation, capitalization, and the correct writing of scientific names. In terms of practicality, the e-guidebook was considered more suitable for individual use rather than group settings. These recommendations highlight areas for minor improvement to ensure the e-guidebook's clarity and usability across different learning environments.

Table 3. Comments and Suggestions for Phytoplankton E-Guidebook Media in Sungai Bongkok from The Validators

Aspect	Validator Identity	Komentar dan Saran
Language	Dr. Afandi, M.Pd. Lecturer	Pay attention to the use of capital letters again.
	Tuti Kusumadewi, S. Si. Teacher	Punctuation should be more consistent.
	Laili Fitri Yeni, M.Si. Lecturer	Double-checking for each scientific name
Practicality	Laili Fitri Yeni, M.Si. Lecturer	E-guidebooks are more suitable for individuals

DISCUSSION

The e-guidebook created contains information about Bongkok River, explanations of plant-like Protists (phytoplankton), their characteristics, and classifications. Additionally, it includes the diversity of phytoplankton species found in Bongkok River across six classes, along with a guide for recognizing species based on body shape, size, locomotion mechanisms, color, and habitat. The media also explains the ecological significance of several phytoplankton classes identified in Bongkok River. The electronic guidebook (e-guidebook) is a digital version of a traditional guidebook that can be accessed and read on computers or mobile devices. Users can download it from the internet and save it on their devices for offline access. The designed e-guidebook aims to meet educational needs and facilitate the learning process in Biology, specifically for the subtopic of plant-like Protists.

The feasibility of the e-guidebook for educational purposes can be detailed according to its evaluation items. The description of each criterion for assessing the e-guidebook's feasibility consists of four aspects: format, content, language, and practicality.

Format Aspect: This aspect includes five criteria. The validation results for the format aspect received a CVR (Content Validity Ratio) score of 1.00 from five validators, indicating that the e-guidebook on phytoplankton in Bongkok River is valid. The e-guidebook was evaluated based on five criteria, each achieving a CVR score of 1.00, indicating their validity. Criterion 1 assessed the completeness of the e-guidebook components, which include a cover, preface, learning objectives, table of contents, main content, conclusion, glossary, bibliography, and author profile, based on modifications from Disparbud Garut (2022) and Sidik et al. (2018). Criterion 2 focused on the

attractiveness of the cover design, with a well-proportioned layout and suitable color combinations that enhance visual appeal, helping to engage students (Mehic, 2022). Criterion 3 examined the readability of font type and size, confirming that their consistency facilitates easy reading for students (Niagara, Daningsih, & Titin, 2018). Criterion 4 evaluated the balanced and varied placement of titles, text content, and images, which enhances the overall appeal of the e-guidebook (Astharianty & Lesmana, 2018). Criterion 5 addressed the clarity of images and illustrations, emphasizing the importance of quality visuals in educational media to support effective learning, as noted by Arsyad (2017). Overall, the format aspect of the e-guidebook is validated and meets the necessary criteria for effective educational media.

Content Aspect: The second aspect is the content, which comprises six criteria. The e-guidebook achieved a CVR (Content Validity Ratio) score of 1.00 in this aspect, indicating its validity. Six key criteria were used to evaluate the e-guidebook content, all receiving a CVR score of 1.00, which validates their effectiveness. Criterion 1 evaluated the alignment between the learning objectives and the e-guidebook content. It was deemed valid as the content aligns with the curriculum, ensuring learning outcomes are met (Saparina, Suratman, & Nursangaji, 2020; Sadiman, 2011). Criterion 2 assessed the completeness of material presentation, confirming that the e-guidebook is comprehensive and supports student engagement and motivation (Harfian & Fadillah, 2021). Criterion 3 validated that research findings in the media help support the comprehension of material, particularly about phytoplankton diversity in the Bongkok River (Oktaningtyas, 2018). Criterion 4 verified the accuracy of content and concepts, affirming that the media contains factual, current, and relevant information from research, based on clear sources (Supit & Paputungan, 2018; Oktaningtyas, 2018). Criterion 5 confirmed that the guidebook effectively helps readers identify phytoplankton species by their characteristics. Lastly, Criterion 6 demonstrated that the research findings provide factual examples of the phytoplankton species diversity in the Bongkok River. The e-guidebook on phytoplankton in Bongkok River is deemed valid and effective as it meets all content evaluation criteria, including alignment with learning objectives, completeness, accuracy, and the ability to guide species identification, achieving a perfect CVR score of 1.00 across all aspects.

Language Aspect: The third aspect is the language, which encompasses three criteria. The phytoplankton e-guidebook is considered valid in this aspect because the CVR value obtained meets the minimum standard set by Lawshe (1975), which is 1.00. Criterion 1 assessed the compliance of word usage with the Enhanced Spelling System (*Ejaan yang Disempurnakan*, EYD). The CVR score achieved was 1.00, indicating that the word usage in the media adheres to EYD standards. Proper sentence construction according to EYD facilitates students' understanding of the media content. Asyhar (2017) states that educational media must consider the rules of language use, especially in word or sentence construction, to avoid creating ambiguous meanings for students. Criterion 2 confirmed the clarity and comprehensibility of the sentences used. This criterion achieved a CVR score of 1.00, indicating validity. According to Nurita (2018), students can easily understand material when the sentences in the media are straightforward. Appropriate sentence construction allows students to analyze the material through educational media in line with the theory being studied (Simamora & Mukhtar, 2015). Criterion 3 ensured all scientific names are correctly formatted according to the rules of binomial nomenclature. This criterion received a CVR score of 1.00, indicating validity. Standardizing the names of living organisms globally requires scientific names; therefore, competency in understanding scientific nomenclature is important for students in biology (Aseptinova, Niskon, & Prasetyo, 2012). Overall, the language aspect is considered valid indicating that the spelling, sentence clarity, and proper use of scientific nomenclature meet educational standards, facilitating student comprehension and ensuring scientific accuracy.

The fourth aspect is practicality, with the e-guidebook media rated valid for this aspect (CVR 1.00). It includes five criteria. Criterion 1, ease of use, is valid with a CVR of 1.00. The e-guidebook can be easily used on various devices (smartphones, laptops, tablets). It can be accessed anytime, and students can navigate directly to desired pages using the "search" and "view all pages" features. Criterion 2, suitability for different group sizes is considered practical for individual, small, and large group use (CVR 1.00). According to Badriyah (2015), teachers should consider students' diversity and group sizes for efficient, productive learning (Miftah, 2015). Criterion 3 is the accessibility via free applications. With a CVR of 1.00, the e-guidebook is easily accessible through free applications, supporting both offline PDF and online access via anyflip.com. Free apps ease access and improve learning quality (Sabariah, 2023; Aini et al., 2022). Criterion 4 is the reusability. Valid with a CVR of 1.00, the e-guidebook can be reused multiple times, allowing continuous learning (Hasan et al., 2021). Lastly, Criterion 5 is low storage requirements. With a CVR of 1.00, the media requires minimal storage, making it convenient for accessing learning materials on various devices without needing to store many physical books (Hasan et al., 2021). Overall, the e-guidebook media demonstrates high practicality, with all five criteria rated valid (CVR 1.00). Its ease of use, adaptability to different group sizes, accessibility via free applications, reusability, and low storage requirements make it an effective and flexible learning tool. This practicality ensures that both students and teachers can access and utilize the e-guidebook efficiently, promoting a more accessible and resource-efficient learning experience.

Although the CVR and CVI values met the minimum requirements for all aspects and evaluation criteria, there were suggestions and comments regarding revisions to the e-guidebook. These suggestions focused on language aspects, including the consistent use of capitalization, punctuation, and the accuracy of scientific names. The capitalization has been corrected following the Indonesian Spelling System (EYD), punctuation consistency has been ensured, and the scientific names have been rechecked to align with the binomial nomenclature.

The e-guidebook on phytoplankton in Bongkok River presents a comprehensive and valid resource for biology education, effectively meeting the necessary criteria across all evaluated aspects: format, content, language, and practicality. Its high CVR scores reflect its alignment with educational objectives, user-friendliness, and accessibility, ensuring that it serves as a valuable tool for both students and teachers. While it has received positive evaluations, the feedback for revisions highlights the importance of refining language elements to enhance clarity and accuracy further. By addressing these suggestions, the e-guidebook can be continually improved, ultimately enriching the learning experience and deepening the understanding of plant-like Protists within the ecological context of Bongkok River.

CONCLUSION

The e-guidebook learning media was created to address students' needs, particularly those facing limitations due to insufficient biology laboratory facilities for understanding phytoplankton material. Additionally, the e-guidebook is tailored to students' preferences, as they tend to be more interested in learning through gadgets rather than printed books, given its accessibility anywhere and at no cost. Consequently, this e-guidebook allows students to access phytoplankton material more easily and to tailor their learning pace according to their individual needs.

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