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Research Article

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Development of web-based general biology content on the GEN-BIO platform

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ABSTRACT

The development of valid online learning media is currently very necessary in supporting the biology learning process. A high percentage of students had misconceptions about general biology material in biology education (75%), a high percentage of student responded that are difficult to get valid general biology material on the internet (40.2%), and a high percentage of student responded so that lecturers make valid general biology material (94,1%), and the high percentage of student responses so that general biology material can be in the form of a web app (70.6%). The research objective is to produce a web app-based general biology content form on the GEN-BIO platform that meets the valid criteria. The method used in this research is R&D with the Thiagarajan development model consisting of define, design, and develop. While the disseminate will be carried out in the next research using a quasi-experimental method. The research instrument used was a needs analysis sheet in the form of a G-form given to 100 respondents, a Semester Lecture Plan (SLP) analysis sheet, a material expert validation sheet given to one lecturer, a media expert validation sheet given to one expert, a practitioner validation sheet given to give to one lecturer, and the readability test sheet given to 43 students. All instruments used in this study have been declared valid by the evaluator. Research data is a score of validity in the form of quantitative data and complementary information in the form of qualitative data. The data analysis technique used is descriptive quantitative. The results showed that it has been produced general biology content based on the web app on the GEN-BIO platform has been declared valid from material elements (96.06%), media elements (94.47%), practitioners (95.33%) and student readability (34, 02% strongly agree, 57.93% agree). The research concludes that the general biology content based on the web app on the GEN-BIO platform is suitable for offline and online learning in general biology courses in Higher Education, especially in the Department of Biology Education and the Department of Biology.

Keywords: Biology; development; GEN-BIO; web app

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INTRODUCTION

The ideal biology learning in the new era is a learning process that includes teamwork discussion activities in the classroom or outside the classroom, practicum as proof of concept, solving life problems through problem-based learning and project-based learning activities, searching for reference sources through digital technology, processing data findings, and determining solutions as recommendations for problem-solving. Thus, learning biology in this new era is not just about transferring information on biological material and solving exam questions. Education today must immediately switch from traditional learning to modern learning so that students gain knowledge, learning and innovation skills, skills to use digital technology to obtain information, and life skills to face life's problems (Sipayung et al., 2018). Current learning must also support the characteristics of students who are present in the millennial generation because they have the nature of living always connected to mobile devices and social media, living to work, play, and have fun, live with a consumptive style, and live very collaboratively but are low-key attention (Hermana, 2019).

The results of a survey of internet users in the education sector in 2022 on the island of Java by the Indonesian Internet Service Providers Association is that the internet is used for distance learning in a network or online by 100%. Online learning is carried out using media such as Google Meet, Zoom Meeting, Whatsapp, Google Classroom, Microsoft Teams, platforms developed by the school, Telegram, Email, and Facebook Messenger (APJII, 2022). Based on the data above, educators must have the awareness and skills to combine information and communication technology with learning media in their place of work to support learning (Martinez-Cerda et al., 2015); Syamsuar & Reflianto, 2019). Educators must be able to develop learning media that can be applied in offline and online learning or hybrid learning/blended learning (Ahmad, 2018). Learning media that must be developed by educators are learning media that do not hinder the usual learning process with information, education, and entertainment (Malik & Agarwal, 2012). Furthermore, the learning media must be accessible by students anywhere and anytime using digital devices and internet technology by paying attention to the validity of the material, the validity of the media, and the validity of the evaluation instrument so that students will learn through the right learning process (Prayitno & Hidayati, 2017; Prayitno & Hidayati, 2021a; Prayitno & Hidayati, 2020; Hidayati & Irmawati, 2019; Hidayati & Irmawati, 2020).

The problem found through previous research in Biology Education at three Private Universities in East Java is the high level of misconceptions of Biology Education students on general biology material with a value of 75% (Prayitno & Hidayati, 2022). The high complaints of students who have difficulty in obtaining valid and accountable general biology material with a value of 40.2%. The high desire of students to lecturers so that lecturers are able to make valid general biology material with a value of 94.1%. The high desire students to lecturers are able to develop general biology material in the form of a web app so that it is easily accessible for offline and online learning with a value of 70.6% (Prayitno & Hidayati, 2021a). This happens because there are many sources of subject matter on the internet whose authenticity and validity cannot be distinguished by students. Students' habits are also without thinking and immediately visiting the sources of subject matter on the internet even though the authenticity and validity cannot be done. Furthermore, it is recommended for lecturers teaching general biology anywhere to always provide correct information, valid reading sources, valid learning media, and appropriate learning models so that there are no misconceptions among students. In addition, the results of the analysis of the general biology learning resources used show that the existing general biology learning resources only contain material text, images, and evaluation questions as well as instructions for

practicum activities which are provided separately by the lecturer. Thus, here students are only seen to memorize material concepts and are not empowered to be able to solve problems found in society. The evaluation questions provided can only be done manually and the results of the evaluation questions still have to be checked by the lecturer sometime in the future and then the lecturer announces the value to students so that it is less practical and efficient.

One of the innovative solutions to solve the problems above is to develop general biology content based on a web app on the GEN-BIO platform. The general biological content to be developed contains ten biological materials, including basic concepts and methodology of biology, biosystematics, cell biology, plant anatomy and physiology, animal anatomy and physiology, growth and development, microbiology, genetics and evolution, ecology, and biotechnology. The general biological content must have valid criteria that are tested by material experts, media experts, and practitioners so that the content can be accounted for. This general biological content will be integrated with information and communication technology in the form of a web app and packaged in the form of the GEN-BIO platform so that it has easy access for users. Users can access this general biological content through a web browser and the android operating system on their mobile phone. The general biology content based on the web app on the GEN-BIO platform contains materials (text, images, videos), minilabs and video tutorials, student worksheets based on project-based learning (PjBL) and video tutorials on pjbl activities, and competency tests based on HOTs that the results can be seen directly by the user. Project-based learning (PjBL) activities on the GEN-BIO platform support all students to work on certain projects related to problems in the community that are relevant to the subject matter. They will learn to find problems that they will find solutions to through project activities. They will learn to design, schedule, implement projects, monitor projects, test project results in front of other friends, and evaluate and reflect on project products so that they can be implemented in the community. HOTs-based competency test is very suitable for intellectual development of students in higher education. Students will be directed to work on competency tests with higher-order thinking through analyzing, evaluating, and creating. Thus, general biology content based on the web app on the GEN-BIO platform is one of the learning media that can combine information content, internet technology, digital device, and edutainment that will make the learning process take place dynamically and be able to empower 21st-century skills such as thinking skills, critical and problem-solving, creative, collaborative, and communicative (Almarabeh et al., 2016; Hidayati & Irmawati, 2019).

The focus of this research is the development of general biology content based on a web app on the GEN-BIO platform with the Thiagarajan development model through three stages, namely define, design, and develop. While the disseminate will be carried out in the next research using a quasi-experimental method. The general biology content developed is ten biological materials as described above with text, images, videos, minilabs and video tutorials, student worksheets based on project-based learning (PjBL) and video tutorials on PjBL activities, and competency tests based on HOTs. The general biology content is integrated into the web app through a digitization process and packaged in the GEN-BIO platform. The general biology content based on the web app on the GEN-BIO platform already has a Copyright with a certificate number EC00202179704 and a trademark application process with a JID2021093794 number. Meanwhile, this research is clearly different from previous research, where previous research focused on the development of interactive multimedia that contains only a few biological materials such as cell biology, human anatomy, and physiology, and microbiology with student activity sheets based on STEM (Science, Technology, Engineering, and Mathematics) and interactive multimedia is not integrated in the web app (Hidayati & Irmawati, 2019; Prayitno & Hidayati, 2020). Furthermore, there

is research that develops interactive multimedia based on a website. Where the research only focuses on one biological material, namely the human respiratory system, and website-based interactive multimedia that only contains developer profiles, biological materials, evaluations, animations, games, and glossaries and does not contain minilabs, worksheets based on project-based learning, and HOTs-based competency test questions (Sudikin et al., 2020). In addition, the difference between this research and previous research is that the development model used in this study uses the Thiagarajan development model, while previous studies have used the Borg and Gall and ADDIE development models. Thus, the purpose of this research is to produce a web app-based general biology content form on the GEN-BIO platform that meets the valid criteria and is suitable for use in learning in Biology Education in Higher Education.

RESEARCH METHODS

The type of this research is research and development, with the Thiagarajan development model, namely the define, design, and develop stages. This study only uses three stages of the Thiagarajan development model because the focus of this research is only to determine the level of validity of the material elements, media, practitioners, and readability of the general biological content developed. The research subjects involved were two lecturers, one practitioner of the learning media industry, and 43 students of Biology Education in Higher Education.

The research instruments used in this study were a needs analysis sheet in the form of a G-form given to 100 respondents, a Semester Lecture Plan (SLP) analysis sheet, a material expert validation sheet given to one lecturer, a media expert validation sheet given to one expert from industrial partners, practitioner validation sheets given to one lecturer, and readability test sheets given to 43 Biology Education students. All of the above research instruments were declared valid by two expert lecturers who became evaluators. The research procedure for the development of general biology content for web apps on the GEN-BIO platform can be described in Figure 1.

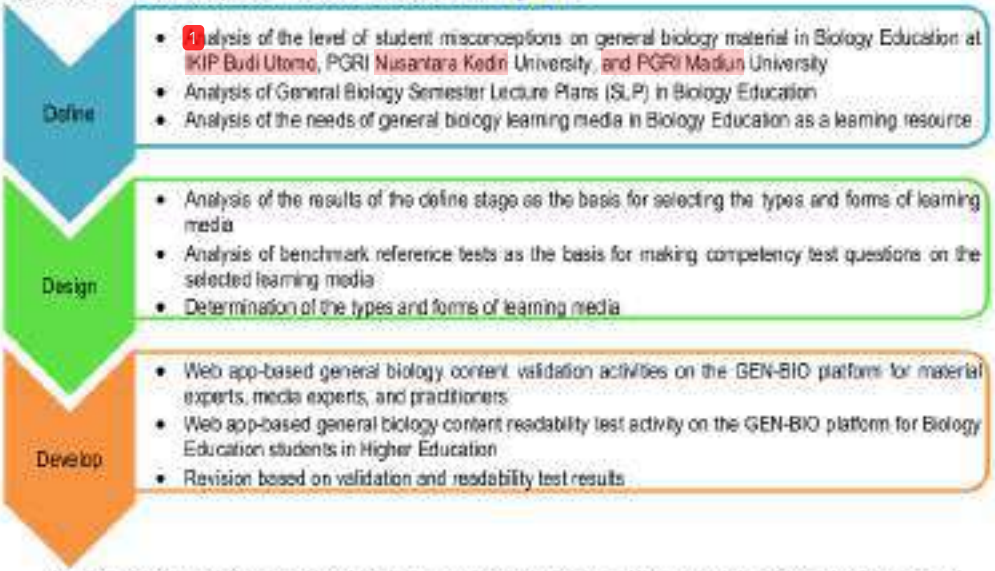

Figure 1. Research Procedure for General Biology Content Development Web App on the GEN-BIO Platform

Data collection techniques were carried out by distributing questionnaires in the form of G-forms, needs analysis sheets, material expert validation sheets, media expert validation sheets, practitioner validation sheets, and readability test sheets to Biology Education students, material expert lecturers, media expert lecturers, practitioner lecturers, and lecturers as evaluators of research instruments. Analysis of the research data was carried out with quantitative descriptive on expert validation scores, readability test scores, and additional information. Furthermore, the results of the data analysis will be matched with a table of criteria for the validity of the learning media adapted from Hidayati & Irmawati (2019). The table of criteria for the validity of learning media can be seen in Table 1.

Table 1. Criteria for Validity of Learning Media

Scale (%)	Criteria	Information
81-100	Very valid	No revision
61-80	Valid	No revision
41-60	Quite valid	Revision
21-40	Not valid	Revision
0-20	Very invalid	Revision

FINDING AND DISCUSSION

The findings from the define stage can be explained as follows. (1) the level of the misconception of Biology Education students on general biology material is 75%. This happens because of many factors such as past learning experiences, information from books, information from educators, information from peers, information from the internet, and information obtained from other sources so these factors can cause students to have misconceptions about general biology concepts. As an example of the results of previous research, students' highest misconceptions can be seen in the concept of the definition of biology. They tend to be passive and accept directly the meaning of the word biology which comes from the word bios and logos. The mindset of students is limited by two words that make up biology. Students should take a broader view when defining biology. Biology is the science that studies life. Students have to think more broadly about life. In studying life, our minds and eyes must focus on objects that exist in life on earth that are not abstract. Things that are biotic and abiotic. Biotics are living things, while abiotic are not living things, but their role is always to support living things in navigating life. So, the proper definition of biology is one of the sciences that study life with biotic, abiotic objects and the interactions between them. (2) Complaints of students who have difficulty getting general biology material that is valid and can be accounted for are 40.2%. Students feel that general biology material is very large and complex and it is difficult to find valid and reliable general biology material on the internet. This happens because there are many sources of subject matter on the internet whose authenticity and validity cannot be distinguished by students. Students' habits are also without thinking and go directly to sources of subject matter on the internet to be cited in the work of their assignments even though their authenticity and validity cannot be done. (3) The desire of students to lecturers to make valid general biology material is 94.1%. (4) The desire of students to lecturers for general biology material to be developed in the form of a web app so that it is easily accessible for offline and online learning (100%). Valid learning resources need to be developed by lecturers to meet student learning needs so that they can help students understand the subject matter well. Lecturers are always trusted to develop valid learning resources because they have competence there. While on the internet anyone can write course material and share it with everyone, even though the writing is not necessarily valid. This is what motivates students so that their lecturers develop valid learning resources so that they have no difficulty in getting learning resources.

Furthermore, the results of the analysis of the Semester Lecture Plan show that Biology Education students must understand and master ten general biology materials in detail; (1) basic concepts and methodology of biology, (2) cell and molecular biology, (3) biosystematics, (4) anatomy and physiology of plants, (5) anatomy and physiology of animals, (6) growth and development of plants and animals, (7) microbiology, (8) genetics and evolution, (9) ecology, and (10) biotechnology.

In addition, the results of the analysis of the general biology learning resources used show that the existing general biology learning resources only contain material text, images, and evaluation questions as well as instructions for practicum activities which are provided separately by the lecturer. So, here students are only seen to memorize material concepts and are not empowered to be able to solve problems found in society. The evaluation questions provided can only be done manually and the results of the evaluation questions still have to be checked by the lecturer sometime in the future and then the lecturer announces the value to the students. The competency test questions given are in the form of multiple choice in each chapter with HOTS-based questions. The types of multiple-choice questions were chosen to facilitate the assessment of answers using technology. Furthermore, this type of HOT-based multiple-choice questions will encourage students to work on competency tests with higher-order thinking through analyzing, evaluating, and creating. In general, it can be said that general biology learning resources that have been used are still limited for offline learning activities and have not been integrated with information technology. When developing learning media, need analysis, curriculum analysis, and analysis of student learning resources must first be carried out so that the learning media that will be developed are in accordance with the urgency of needs (Fitriani et al., 2018; Prayitno & Hidayati, 2020; Hidayati & Irmawati, 2020).

The results of the design stage can be explained as follows. Based on the findings from the previously defined stage, it can be concluded that (1) must develop ten valid general biological contents. (2) Must develop ten valid general biology content and be integrated with information technology such as a web app so that it is easily accessible by students anywhere and anytime without being hindered by space and time and is able to support offline and online learning. (3) The ten general biology content that is integrated with information technology such as the web app must contain complete information on the learning process so that it needs to contain material (text, images, and videos), minilabs, and video tutorials, student worksheets based on project-based learning (PjBL) and video tutorials on PjBL activities, and HOTs-based competency tests whose results can be seen directly by students. Thus, the forms and types of learning media that are set to be developed are general biology content based on a web app on the GEN-BIO platform. The GEN-BIO platform is a program that can be accessed with a web browser and an android operating system called GEN-BIO. GEN-BIO is a brand name in the form of a logo proposed by the Directorate General of Intellectual Property of the Republic of Indonesia. Furthermore, general biology content based on the web app on the GEN-BIO platform can be accessed via the link https://tapedubiologi.com/. The display of general biology content based on the web app on the GEN-BIO platform can be seen in Figure 2. The user account dashboard for general biology content based on the web app on the GEN-BIO platform can be seen in Figure 3. The display of one of the ten general biology content based on the web app on the GEN-BIO platform can be seen in Figure 4.

Figure 2. Display of Web App-Based General Biology Content on the GEN-BIO Platform

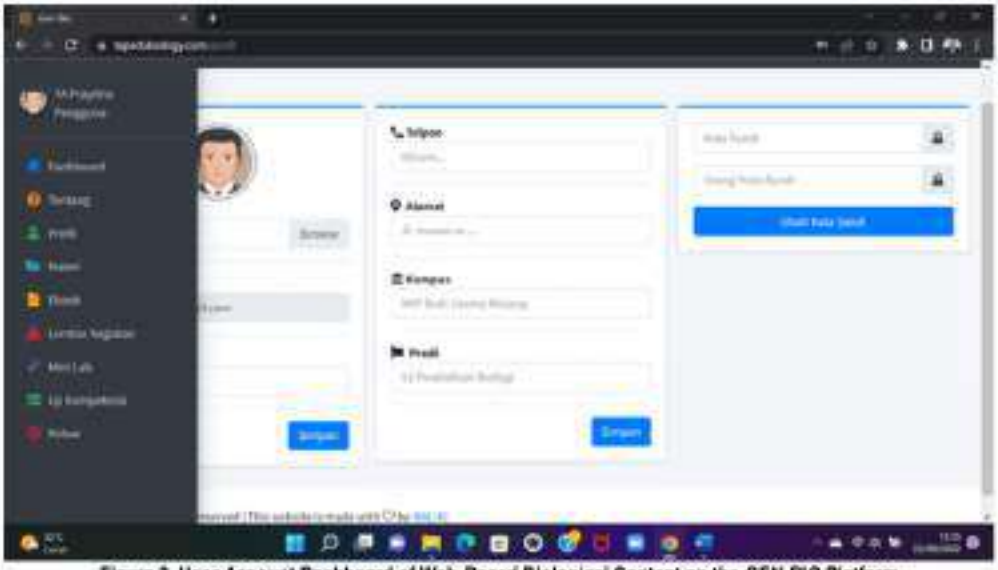

Figure 3. User Account Dashboard of Web-Based Biological Content on the GEN-BIO Platform

A web app is a learning media design that prioritizes the participation of students to communicate by utilizing materials, digital media, information technology, and the internet so that the presence of this learning media is suitable for offline and online learning and can predictably increase student interest and achievement (Istifarch, 2021); (Afrilia et al., 2021); (Januarisman & Ghufron, 2016); (Kaur et al., 2015). Website-based media will provide easy access for students through information technology independently so that it will be easier for them to develop knowledge (Ferdiansyah et al., 2020); (Figna et al., 2020). Furthermore, website-based media can be accessed online by students anytime and anywhere when they carry out the learning process (Astuti et al., 2020).

Figure 4. Display of One of the Ten Web-Based General Biology Content on the GEN-BIO Platform

The results of the develop stage of this research can be explained as follows. (1) The results of material expert validation on web app-based general biology content on the GEN-BIO application can be seen in Table 2. (2) The results of media expert validation on web app-based general biology content on the GEN-BIO application can be seen in Table 3. (3) The results of practitioner validation on general biology content based on the web app on the GEN-BIO application can be seen in Table 4. The results of the readability test by students on general biology content based on the web app on the GEN-BIO application can be seen in Table 5.

Table 2. Results of Material Expert Validation on Web App-Based General Biology Content on the GEN-BIO Application

No	Aspects	Score (%)	Criterias
1	Completeness of general biology content based on the web app on the GEN-BIO platform	97	Very valid
2	Web app-based general biology content accuracy on the GEN-BIO platform	95	Very valid
3	Web app-based general biology content presentation on the GEN-BIO platform	100	Very valid
4	The truth of the basic concepts and methodology of biology from general biology content web-based app on the GEN-BIO platform	100	Very valid
5	The correctness of cell and molecular biology concepts from web app-based general biology content on the GEN-BIO platform	100	Very valid
6	The truth of the biosystematics concept of web-based general biology content on the GEN-BIO platform	100	Very valid
7	The truth of the concepts of plant anatomy and physiology from general biology content based on a web app on the GEN-BIO platform	100	Very valid
8	The truth of the concept of animal anatomy and physiology from web-based general biology content on the GEN-BIO platform	100	Very valid
9	The truth of the concept of growth and development of plants and animals from web-based general biology content on the GEN-BIO platform	100	Very valid

No	Aspects	Score (%)	Criterias
10	The correctness of microbiological concepts from web-based general biology content on the GEN-BIO platform	100	Very valid
11	The truth of the concept of genetics and the evolution of the general biology content web-based app on the GEN-BIO platform	100	Very valid
12	The truth of the concept of biotechnology from general biology content web-based app on the GEN-BIO platform	100	Very valid
	Average	98,06	Very valid

Table 2 shows that ten general biology content based on web apps on the GEN-BIO platform are declared to be very valid from material elements with a value of 98.06%. This can be used as a recommendation that ten general biology content web-based apps on the GEN-BIO platform from material elements are suitable for general biology learning in Biology Education in Higher Education. In addition, the general biology content based on the web app on the GEN-BIO platform is declared complete with a score of 97%. The general biology content based on the web app on the GEN-BIO platform is declared complete and is declared accurate with a value of 96%. The general biology content based on the web app on the GEN-BIO platform is stated to be very well presented with a score of 100%. Input from material experts, namely research data from developers and research results from scientific journals can be added to general biology content based on the web app on the GEN-BIO platform so that students can be assigned to discuss existing research problems. The truth of the material concept is very important to be given to students so that they do not experience misconceptions and can achieve learning goals (Azizah et al., 2018; Hidayati & Irmawati, 2019). Errors in conveying material concepts made by lecturers to students will make students fail in learning and students will be unable to solve the problems they are facing through wrong concepts (Prayitno & Hidayati, 2020).

Table 3. Media Expert Validation Results on Web App-Based General Biology Content on the GEN-BIO Application

No	Aspects	Score (%)	Criterias
1	Web app-based general biology content component on the GEN-BIO platform	100	Very valid
2	Web app-based general biology content displayed on the GEN-BIO platform	93,75	Very valid
3	Technical quality of web-based general biology content on the GEN-BIO platform	95	Very valid
4	Web app-based general biology content visualization on the GEN-BIO platform	100	Very valid
5	Web app-based general biology content design on the GEN-BIO platform	93,75	Very valid
6	Typography of general biology content web-based app on the GEN-BIO platform	75	Valid
7	Illustration of general biology content based on the web app on the GEN-BIO platform	100	Very valid
8	Web app-based general biology content design on the GEN-BIO platform	92,86	Very valid
9	Web app-based general biology content typography on the GEN-BIO platform	100	Very valid
10	Illustration of web-based general biology content on the GEN-BIO platform	83,33	Very valid
11	Appropriateness of web-based general biology content language on the GEN-BIO platform	100	Very valid
12	Eligibility of presenting web-based general biology content on the GEN-BIO platform	100	Very valid
	Average	94,47	Very valid

Table 3 shows that the general biology content based on the web app on the GEN-BIO platform is stated to be very valid from the media elements with a value of 94.47%. This can be used as a recommendation that the general biology content based on the web app on the GEN-BIO platform from media elements can be declared suitable for use in learning in Biology Education in Higher Education. Media expert commentary is the media element of the general biology content based on the web app on the GEN-BIO platform is good. Good information technology-based learning media are media that provide easy access and contain complete information to help students understand concepts and develop knowledge (Hartoyo & Abdul Gafur, 2019). Website-based learning media that are interesting and generate student interest in learning are media that contain material in the form of text, images, videos, minilabs, student worksheets, and competency tests (Fauzi & Maksum, 2020; Sadikin et al., 2020). In addition, website-based learning media must have a design that is easily accessible, easy to read, and attracts users (Figna et al., 2020).

Table 4. Results of Practitioner Validation on Web App-Based General Biology Content on the GEN-BIO Application

No	Aspek	Nilai (%)	Kriteria
1	Web app-based general biology content design on the GEN-BIO platform	100	Very valid
2	Completeness of general biology content based on the web app on the GEN-BIO platform	91,67	Very valid
3	Concept description of web-based general biology content on the GEN-BIO platform	95	Very valid
4	Types of student activities on web-based general biology content on the GEN-BIO platform	90,63	Very valid
5	Web app-based general biology content competency test on the GEN-BIO platform	90	Very valid
6	Web-based general biology content minilab on the GEN-BIO platform	100	Very valid
7	Compatibility of web app-based general biology content on the GEN-BIO platform with the developmental level of students	100	Very valid
	Average	95,33	Very valid

Table 4 shows that the general biology content based on the web app on the GEN-BIO platform can be declared very valid from the practitioner's point of view with a value of 95.33%. This is very good to be recommended so that it can be used in learning in Biology Education in Higher Education.

Table 5. Student Readability Test Results on Web App-Based General Biology Content on the GEN-BIO Platform

No	Aspects	Response (%)			
		Strongly Agree	Agree	Don't Agree	Disagree
1	General biology content identity web-based app on the GEN-BIO platform	46,5	51,2	2,3	0
2	Easy access to web-based general biology content on the GEN-BIO platform	32,6	60,5	7	0
3	Easy access anytime and anywhere general biology content based on a web app on the GEN-BIO platform	39,5	46,5	7	7
4	Security of personal data of users of general biology content based on a web app on the GEN-BIO platform	53,5	41,9	4,6	0
5	Ease of operation and access menu of general biology content based on the web app on the GEN-BIO platform	30,2	62,8	2	5

No	Aspects	Response (%)			
		Strongly Agree	Agree	Don't Agree	Disagree
6	Completeness of general biology content based on the web app on the GEN-BIO platform	41,9	53,5	4,6	0
7	Systematics of general biology content web-based app on the GEN-BIO platform	27,9	65,1	7	0
8	Images available in the web-based general biology content app on the GEN-BIO platform help students understand the concept	39,5	51,2	9,3	0
9	Language Clarity of general biology content web-based app on the GEN-BIO platform	30,2	60,5	7	2,3
10	The general biology content menus based on the web app on the GEN-BIO platform are easy to operate and access for students	34,9	55,8	9,3	0
11	The web app-based general biology content student activity sheet on the GEN-BIO platform helps enable independent and classical learning	25,6	72,1	2,3	0
12	The general biology content student activity sheet based on the web app on the GEN-BIO platform contains issues of life and technology	34,9	60,5	4,6	0
13	The general biology content student activity sheet based on the web app on the GEN-BIO platform reflects the syntax of the project-based learning model	34,9	41,9	20,9	2,3
14	The web app-based general biology content mini quiz on the GEN-BIO platform can develop higher-order thinking skills	34,9	62,8	2,3	0
15	The web app-based general biology content competency test on the GEN-BIO platform reflects higher-order thinking skills	25,6	62,8	11,6	0
16	The web app-based general biology content minilab on the GEN-BIO platform helps students understand and prove concepts	32,6	53,5	11,6	2,3
17	Web app-based general biology content minilab on the GEN-BIO platform related to life and technology	18,6	69,8	7	4,6
18	Instructions for conducting the general biology content competency test based on the web app on the GEN-BIO platform are easy to understand	39,5	55,8	4,7	0
19	The web app-based general biology content competency test language on the GEN-BIO platform is easy to understand	23,3	69,8	7	0
20	The interactive form of general biology content based on the web app on the GEN-BIO platform helps measure the ability of each student	44,2	53,5	2,3	0
21	The value that immediately appears in the general biology content based on the web app on the GEN-BIO platform makes students feel challenged and more careful to prepare themselves before doing work	34,9	55,8	7	2,3

No	Aspects	Response (%)			
		Strongly Agree	Agree	Don't Agree	Disagree
22	The general biology content based on the web app on the GEN-BIO platform that students learn can generate interest in learning	23,3	65,1	11,6	0
23	General biology content based on a web app on the GEN-BIO platform that students learn can lead to independence in learning	32,6	55,8	7	4,6
24	The general biology content based on the web app on the GEN-BIO platform studied by students can improve high-level abilities	30,2	58,1	9,3	2,4
25	The general biology content based on the web app on the GEN-BIO platform is relevant in supporting general biology learning	39,5	55,8	4,7	0
26	Web app-based general biology content on the GEN-BIO platform is structured and easy to understand	34,9	62,8	2,3	0
27	General biology content based on the web app on the GEN-BIO platform can trigger student learning motivation	25,6	67,4	5	2
28	The general biology content based on the web app on the GEN-BIO platform can make it easier to learn general biology concepts	39,5	53,5	5	2
29	The types of questions on general biology content based on the web app on the GEN-BIO platform can foster students' higher-order thinking skills	32,6	58,1	4,5	4,8
30	Student activities on general biology content based on a web app on the GEN-BIO platform are in accordance with the flow of the project-based learning model	32,6	60,5	7	0
31	The competency test on general biology content based on the web app on the GEN-BIO platform can measure the level of student understanding	20,9	69,8	9,3	0
32	Text, images, and videos on general biology content based on the web app on the GEN-BIO platform help students master concepts	51,2	39,5	9,3	0
	Average	34,02	57,93	6,76	1,3

Table 5 shows that 43 students strongly agree (34.02%) and agree (57.93%) with using web-based general biology content on the GEN-BIO platform for general biology learning in Biology Education. They really hope that web app-based general biology content on the GEN-BIO platform can be used for offline and online learning so that it can be used anytime and anywhere. The general biology content based on the web app on the GEN-BIO platform is in line with the statement of the results of previous studies that one of the website-based learning media must make it easy for students to obtain valid subject matter, provide flexibility in communicating with educators, provide motivation to develop knowledge, makes it easy to master the concept of subject matter, and makes it easy to improve the 21st-century skills of students (Figna et al., 2020; Fauzi & Maksum, 2020; Astuti et al., 2020; Haryani & Saputra, 2021; Istifaroh, 2021; Afrilia et al., 2021; Hidayati & Irmawati, 2019).

Compared to the findings of previous studies, the findings of this study are unique, namely general biological content that is integrated into the web app and introduced to the GEN-BIO platform. The general biology content based on the web app is equipped with material delivery videos, equipped with minilabs and laboratory work tutorial videos, equipped with student worksheets based on project-based learning and video tutorials on project work stages, and competency tests based on HOTs. Project-based learning activities (PjBL) on the GEN-BIO platform support all students to work on certain projects related to problems in the community that are relevant to the subject matter and without restrictions by educators. They will learn to find problems that they will find solutions to through project activities independently. Through discussion and collaboration with educators, they will learn to design, schedule, implement projects, monitor projects, test project results in front of others, and evaluate and reflect on project products so that they can be implemented in the community. The HOTs-based competency test is very suitable for the intellectual development of students in higher education. Students will be directed to work on competency tests with higher-order thinking through analyzing, evaluating, and creating. Thus, after completing the competency test questions, students will gain higher-order thinking experience and are accustomed to doing higher-order thinking in learning.

CONCLUSION

Based on the research findings, the conclusion of this study is that general biology content based on the web app on the GEN-BIO platform is suitable for use in learning in Biology Education in Higher Education. This is reinforced by the validity of the material elements (98.06%), media elements (94.47%), practitioners (95.33%), and student readability (34.02% strongly agree, 57.93% agree). The ideal and intact learning media to meet the needs of offline and online learning that is independent or classical in today's Biology Education in Higher Education is general biology content based on a web app on the GEN-BIO platform because this media contains ten biological materials (text, images, etc.), and videos), minilabs and video tutorials, student worksheets based on project-based learning (PjBL) and video tutorials on PjBL activities, and competency tests based on HOTs. The recommendation of this research finding for lecturers and students of Biology Education at Indonesian Universities is that all of you can take advantage of web app-based general biology content on the GEN-BIO platform for learning because this media has been confirmed to be valid and accountable.

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