Design and Development of a Biology Learning Website to Improve Biological Literacy on Human Reproductive System Topics

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Abstract

The use of appropriate media is an important factor in improving student understanding in biology learning. One of the essential skills that need to be developed through biology learning is biological literacy, which includes nominal, functional, structural, and multidimensional aspects as a basis for understanding concepts in depth. Therefore, learning media designed based on biological literacy principles has the potential to effectively improve students' biological literacy skills. The purpose of this study was to develop and produce effective website-based learning media that aligns with the principles of the Merdeka Curriculum to improve students' biological understanding and literacy in the topic of the human reproductive system. This study used a modified ADDIE model, with emphasis on the Analysis, Design, and Development phases. Data collection instruments consisted of needs analysis, expert validation of language, content, and media by two experts, and readability testing conducted by two biology teachers and participating students. Descriptive analysis was used to interpret the data. The validation results showed that the media obtained high scores in all evaluated aspects (language, content, and media) which were included in the very valid category. Readability tests by teachers and students also showed very valid results. It can be concluded that this web-based learning media meets the quality and effectiveness standards that have been set in the learning design so that it is considered suitable for use in the learning process.

INTRODUCTION

Media is a means of communication used to convey messages from a sender to a receiver (Anggraini *et al.*, 2024; Astuti *et al.*, 2024). In educational settings, teachers can incorporate media as a tool to help present learning materials to students more effectively. It plays a vital role in the teaching and learning process by supporting instructional delivery, enhancing motivation for both educators and learners, shaping the learning atmosphere, and contributing to a more engaging and productive educational environment (Hardiyantari, 2017; Nur *et al.*, 2017; Sapriyah, 2019). In biology education, which focuses on the study of life and living systems, the complexity of topics especially those involving internal human biological processes can pose challenges for comprehension. Without the aid of appropriate media, conveying such abstract and intricate content can be difficult. One particular topic that significantly benefits from the integration of visual and interactive media is the human reproductive system. The topic of the human reproductive system encompasses a wide range of complex issues, extending beyond biological content to include personal and social dimensions (Šorgo & Šiling, 2017; Zahrawani & Suharti, 2018; Mulyaningsih *et al.*, 2024). Students' misconceptions regarding this topic are often influenced by various factors such as peer discussions, environmental and familial beliefs, insufficient explanations from educators, the use of unfamiliar scientific terminology, and information

obtained from unreliable sources (Oztas & Oztas, 2016; Maigoro *et al.*, 2017). Based on needs analysis conducted among a group of twelfth-grade students, 68.8% perceived the human reproductive system as moderately difficult to learn, while 15.6% found it to be difficult. The use of effective instructional media can help learners form clearer and more accurate visualizations of the concepts involved (Zahrawani & Suharti, 2018; Mulyaningsih *et al.*, 2024).

Websites can be utilized as effective instructional media. They are capable of delivering learning materials efficiently and interactively (Tambunan *et al.*, 2016; Utami *et al.*, 2020; Suripah & Susanti, 2022; Safi & Singh, 2023). One of the advantages of website-based learning is the ability to provide access to the latest information by referencing up-to-date sources available on the internet (Utami *et al.*, 2020; Aslett et al., 2024). Websites can integrate various multimedia elements such as text, images, animations, videos, and quizzes into a unified learning platform, which helps enhance students' comprehension and improve learning outcomes (Pramana *et al.*, 2020; Kuncoro & Hidayati, 2021; Jannah & Atmojo, 2022; Nurlatifah *et al.*, 2022). Another key benefit of web-based media is its accessibility students can access materials easily, quickly, and flexibly, at any time and from any location, without diminishing the educational value of the content (Astuti *et al.*, 2020; Suripah & Susanti, 2022). Therefore, integrating websites into the learning process aligns well with the needs of digital native learners in today's technology driven educational environment.

Comprehension of biological concepts can be achieved through biological literacy skills (Andini *et al.*, 2023; Fauziah *et al.*, 2025; Salema *et al.*, 2024). Biological literacy can be defined as the ability to locate, select, interpret, integrate, and evaluate information from various sources that can help students grasp biological concepts. This understanding is not aimed merely at achievement, but requires students' ability to apply it in comprehending biological phenomena and issues (Oktriani & Ekadiansyah, 2020; Anakara, 2021; Sabaruddin, 2022). Based on these skills, biological literacy can support students in understanding the concept of the human reproductive system. The use of learning media that does not encourage active student engagement, such as PowerPoint, may reduce students' literacy levels (Andini *et al.*, 2023; Salema *et al.*, 2024). Therefore, selecting appropriate and engaging media is essential to foster deeper understanding and promote students' active involvement in learning.

The Merdeka Curriculum emphasizes student freedom in terms of learning style, pace, and sources of information used. The teacher's role in implementing the Merdeka Curriculum is to act as a facilitator who creates an active, creative, and innovative classroom environment. Students are encouraged not only to listen to the teacher's explanation but also to independently explore learning materials using devices connected to the internet, relevant images, and educational videos. The Merdeka Curriculum is designed to prevent students from being overwhelmed by the material delivered by the teacher (Erihadiana *et al.*, 2022; Zakso, 2022). Utilization of website-based instruction is sparsely researched in human reproductive system learning (Djamahar *et al.*, 2020; Anik, 2022; Salema *et al.*, 2024). The product is developed in Indonesian with relevant up-to-date diagrams of human reproductive system. The product satisfy Merdeka Curriculum criteria of learning differentiation, which students can learn at their own pace. With this website-based media, it is hoped that human reproductive system learning process will be more effective and be able to improve students' biological literacy skill.

The Merdeka Curriculum emphasizes student autonomy in terms of learning style, pace, and sources of information used. In implementing the Merdeka Curriculum, the teacher's role is to act as a facilitator who fosters an active, creative, and innovative classroom environment. Students are encouraged not only to listen to the teacher's explanations but also to independently explore learning materials using internet-connected devices, relevant images, and educational videos. This curriculum is designed to prevent students from feeling overwhelmed by the material presented by the teacher (Zakso, 2022; Ramadhani & Rosy, 2023). The use of website based instructional media in the learning of the human reproductive system has been scarcely studied (Zahrawani & Suharti, 2018; Astuti *et al.*, 2020; Djamahar *et al.*, 2020). The product developed is in Indonesian and includes relevant, up-to-date diagrams of the human reproductive system. It meets the Merdeka Curriculum's criteria for differentiated learning, allowing students to learn at their own pace. Through this website-based media, it is hoped that the learning process of the human reproductive system will become more effective and that students'

biological literacy skills will improve. The purpose of this study was to develop and produce effective website-based learning media that aligns with the principles of the Merdeka Curriculum to improve students' biological understanding and literacy in the topic of the human reproductive system.

METHOD

The method used in this research is a development research approach, which follows a modified version of the ADDIE model (Mellisa & Saputri, 2023; Puspitasari *et al*., 2023; Siregar *et al.*, 2022). The ADDIE model was chosen because of its systematic, logical, and flexible structure, making it suitable for developing web-based learning products. Furthermore, this model allows for gradual evaluation and revision at each stage, ensuring product quality can be properly controlled before implementation. This modified ADDIE model consists of three main stages: Analysis, Design, and Development. The model was adapted to better align with the specific objectives of this study as well as the characteristics of the product being developed (Szabo, 2022). During the analysis stage, needs assessment and problem identification were conducted to determine the requirements for the instructional media. In the design stage, the product's framework, content, and user interface were planned based on the analysis results. The development stage involved the actual creation and refinement of the website-based instructional media. Each stage included iterative reviews and revisions to ensure that the product met quality standards and educational goals. Figure 1 illustrates the overall development process used in this study. This systematic approach aims to produce an effective and user-friendly learning tool tailored to the target students.
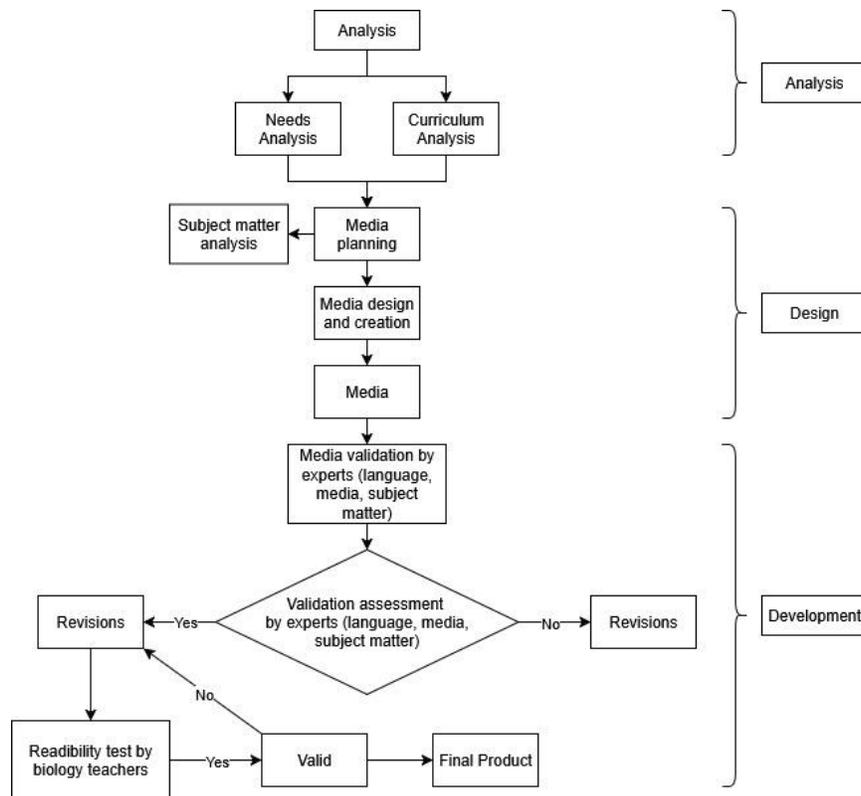

Figure 1. Modified ADDIE Development Stages
Source: Adapted from (Mellisa & Yanda, 2019)

The initial phase of this study was planning, which involved gathering information about the needs of both students and teachers in learning the human reproductive system, particularly regarding the use of

instructional media. At this stage, interviews were conducted with two biology teachers and questionnaires were distributed to students to identify these needs. Additionally, a literature review was carried out to obtain relevant supporting data. Next, the product was developed into a prototype, which was then validated by two experts in terms of language, content, and instructional media. Validation was conducted using separate questionnaires for each aspect. The content expert validation indicators used to assess the accuracy, relevance, and alignment of the material with learning objectives are presented in Table 1.

Table 1. Content expert validation indicators

Criteria	Number	Assessment item
Content	4	Completeness of website content development
	6	The up-to-date of the material by using examples and cases found in everyday life
	8	Relevance of the material taught to students' real-life situations
	12	Suitability of the material with students' development
Content Presentation	5	Clarity in presenting information
	10	Appropriateness of the material presentation
	11	The up-to-date of the material by using examples and cases found in everyday life
	1	Completeness of supporting materials for presentation
	2	Alignment of material concepts with learning outcomes and the applicable curriculum
Contextual Assessment	3	Compatibility of biological literacy concepts with the human reproductive system material
	7	Accuracy of the human reproductive system material concepts in relation to biological literacy skills
	9	The ability to encourage students to connect their existing knowledge with its application in everyday life

The media expert validation indicators used to evaluate the graphical design, layout consistency, readability, and overall visual quality of the learning media are presented in Table 2.

Table 2. Media expert validation indicators

Criteria	Number	Assessment item
Content	5	The website is organized systematically
	6	Explanations are provided for unfamiliar terms
	12	Suitability with students' level of cognitive development
	16	The website encourages student engagement in learning
Content Presentation	1	Ease of access to the website
	2	Appropriateness of font size, color, and image clarity for easy understanding
	3	Good quality of images/photos
	4	Good quality of images/photos
	7	Proportional website layout
	8	Appropriateness of font size and type selection
	9	Use of images is accompanied by relevant sources/references
Contextual Assessment	10	The website is simple and easy to understand, making it suitable for learning the human reproductive system
	11	Alignment of statements and questions on the website with biological literacy concepts
	15	Effectiveness of images in visualizing concepts of the human reproductive system

The language expert validation indicators used to assess clarity, sentence structure, word choice, spelling accuracy, and the suitability of language for students' level are presented in Table 3.

Table 3. Language expert validation indicators

Criteria	Number	Assessment item
Language Presentation	2	Use of language that is easy to understand
	3	Use of language on the website follows proper Indonesian writing conventions
	4	Sentences do not create multiple interpretations
	7	Consistent use of terms and sentences
	9	Accuracy of grammar and spelling
Formatting	1	Clarity of sentence structure on the website
	5	Use of sentences appropriate to students' level of thinking
	6	Proper use of biological terminology
	8	Use of sentences that stimulate students' curiosity
	10	Language that motivates students to study the material further

The questionnaires given to both teachers and experts employed a Likert scale, with scores ranging from 1 to 4: 1 indicating strongly disagree, 2 disagree, 3 agree, and 4 strongly agree. Validation scores from both groups were calculated using the following formula:

$$\text{Score} = \frac{Obtained\ Score}{Sum\ of\ Indicators}.$$

The scoring criteria used to interpret these results are detailed in Table 4. After the validation process, the product was revised based on the feedback, suggestions, and corrections provided by the validators. These revisions aimed to improve the quality and effectiveness of the instructional media to better meet the needs and expectations of its users. Consequently, the final product is expected to be optimally utilized in the learning process of the human reproductive system.

Table 4. Validation scoring criteria

Score	Category
1.00 – 1.75	Invalid
1.76 – 2.50	Less Valid
2.51 – 3.25	Valid
3.26 – 4.00	Highly Valid

RESULT AND DISCUSSION

The development of the website-based learning media for the human reproductive system was conducted using the ADDIE model Analyze, Design, Develop, Implement, and Evaluate which is widely applied in the design of e-learning and web-based instructional systems (Taqwa, 2022; Rahmawati, 2024). In this study, a modified version of the ADDIE model was employed, focusing specifically on the stages of Analysis, Design, and Development to create an effective educational tool (Taqwa, 2022; Rahmawati, 2024). The primary goal of the media development was to enhance students' biological literacy by providing clear, accessible, and engaging learning content. The framework of biological literacy including cognitive, skill-based, and attitudinal, which identifies four major dimensions: nominal, functional, structural, and multidimensional literacy (Semilarski & Laius, 2021; Rahmawati, 2024). A description of each dimension of biological literacy is presented in detail in Table 5.

Table 5. Biological literacy dimensions

Dimension	Characteristics
Nominal	Can identify biological questions and terms. Understand biological learning misconceptions. Can offer explanations for biological concepts.
Functional	Use of biological vocabulary. Can define biological terms correctly. Can memorize biological concepts.
Structural	Understand conceptual diagrams of biology. Possesses knowledge and procedural skills. Interpret biological in their own way.
Multidimensional	Realizes the value of biology among other disciplines. Understand the inetractions between biology and society.

Based on Table 5, the biological literacy dimensions, each dimension has distinct but interrelated characteristics. Nominal literacy refers to the ability to recognize and identify biological terms. Functional literacy relates to the ability to explain biological concepts simply and use scientific information in everyday contexts. Structural literacy emphasizes understanding the relationships between concepts and the ability to explain biological mechanisms in greater depth. Meanwhile, multidimensional literacy reflects the ability to integrate biological knowledge with social, environmental, and ethical aspects in decision making. Integrating these dimensions into the website design promotes conceptual understanding, scientific reasoning, and problem solving skills essential to mastering biological concepts. This structured and theory informed approach ensured that the developed media not only conveyed factual knowledge but also supported higher-order thinking and application skills related to biology (Semilarski & Laius, 2021; Taqwa, 2022; Rahmawati, 2024).

The website was created using the Google Sites platform and features comprehensive content on the human reproductive system. The learning objectives cover a wide range of topics, including the anatomy and physiology of both the male and female reproductive systems, reproductive hormones, the menstrual cycle, fertilization, embryogenesis, pregnancy and childbirth, reproductive technologies, as well as common disorders affecting the reproductive system. The media incorporates images and diagrams that clearly illustrate the material, enhancing students' understanding of the subject. Videos were intentionally excluded from this media because most available videos on the human reproductive system are in english, which may not be suitable for the target audience. A snapshot of the final product can be seen in Figure 2.

2(a)

Cairan pada saluran reproduksi wanita akan membantu perjalanan sperma untuk fertilisasi dengan proses yang dinamakan **capacitation** atau **priming**. Cairan ini meningkatkan motilitas spermatozoa dan mengurangi molekul kolestrol yang berada pada membran kepala sperma, menipiskan membran ini membantu pelepasan enzil lisosomal yang dibutuhkan sperma untuk menembus dinding oosit.

2(b)

Kondom

Terbuat dari karet lateks, plastik poliuretan atau sekum hewan. Dapat berwarna, kering atau dilubrikasi, permukaan berbagai macam. Kondom dipakai di penis yang telah mengalami ereksi sebelum coitus dengan menyisakan sedikit bagian ujung untuk menampung sperma. Kondom dilepas setelah ejakulasi dan hanya sekali pakai.

2(c)

Evaluasi Bab Sistem Reproduksi Manusia

Setelah mempelajari bab ini mohon untuk mengisi evaluasi berikut

○ Susuk (KB Implan)

7. Siklus menstruasi dibagi menjadi tiga fase diantaranya... *

○ Ovulasi, proliferasi, luteal
○ Sekresi, ovulasi, menstruasi
○ Menstruasi, sekresi, ejakulasi
○ Menstruasi proliferasi, sekresi
○ Luteal, proliferasi, sekresi

8. Peleburan antara sel sperma dengan sel ovum dan menghasilkan zygot disebut... *

○ Fertilisasi
○ Ekskresi
○ Menstruasi
○ Oogenesis
○ Relaksin

2(d)

Figure 2. Screenshot of finished product

The final product aligns with the various dimensions of biological literacy. Figure 2(a) represents the nominal dimension, focusing on the identification of biological terms. Figure 2(b) illustrates the use

of biological terminology, with key terms highlighted in bold within the content. Figure 2(c) reflects the multidimensional aspect, emphasizing the understanding of biology's role and relevance within society. Figure 2(d) shows an evaluation form created in Google Forms, which corresponds to the structural dimension of biological literacy. The results of the experts' validation on the language aspect, including clarity, sentence structure, word choice, and suitability for students' level, are presented in Table 6.

Table 6. Results of experts' validation on language aspect

| Aspects | Number | Expert Validator | | Average |
		1	2	
	2	4.00	4.00	
	3	3.00	4.00	
Presentation	4	3.00	4.00	3.60
	7	3.00	4.00	
	9	3.00	4.00	
Total		16	20	
	1	3.00	4.00	
	5	4.00	4.00	
Format	6	4.00	4.00	3.50
	8	2.00	4.00	
	10	2.00	4.00	
Total		15	20	
Average		3.10	4.00	3.55
Category		Valid	Highly Valid	Highly Valid

The results of the experts' validation on the subject matter aspect, including content accuracy, depth of material, and alignment with learning objectives and curriculum standards, are presented in Table 7.

Table 7. Results of experts' validation on subject matter aspect

| Aspects | Number | Expert Validator | | Average |
		1	2	
	4	4.00	4.00	
Content	6	3.00	4.00	3.75
	8	3.00	4.00	
	12	4.00	4.00	
Total		14	20	
	5	4.00	4.00	
Presentation	10	4.00	4.00	3.80
	11	3.00	4.00	
Total		11	12	
	1	4.00	4.00	
	2	3.00	4.00	
Contextual score	3	3.00	4.00	3.50
	7	3.00	4.00	
	9	3.00	4.00	
Total		16	20	
Average		3.43	4.00	3.68
Category		Highly Valid	Highly Valid	Highly Valid

The results of the experts' validation on the media aspect, including graphical design, layout consistency, readability, and visual presentation quality, are presented in Table 8.

Table 8. Results of experts' validation on media aspect

| Aspects | Number | Validator Ahli | | Average |
		1	2	
Content	5	3.00	4.00	
	6	2.00	4.00	
	12	4.00	4.00	3.37
	16	2.00	4.00	
Total		11	16	
Presentation	1	4.00	4.00	
	2	3.00	4.00	
	3	3.00	4.00	
	4	4.00	4.00	3.66
	7	3.00	4.00	
	8	3.00	4.00	
Total		20	24	
Contextual score	9	2.00	4.00	
	10	3.00	4.00	
	11	3.00	4.00	3.37
	15	3.00	4.00	
Total		11	16	
Average		2.93	4.00	3.46
Category		Valid	Highly Valid	Highly Valid

Based on the validation results, the human reproductive system website-based learning media is considered valid, as it has successfully met the three main validation aspects: language, content, and instructional material. Each aspect was carefully evaluated by experts to ensure the product adheres to academic and pedagogical standards. The development process followed a rigorous framework to guarantee that the media is not only accurate but also user-friendly and engaging for students. The website incorporates clear explanations, relevant diagrams, and interactive elements designed to facilitate effective learning. Furthermore, it includes appropriate learning indicators and objectives aligned with curriculum requirements, which are expected to guide students toward achieving the intended learning outcomes in an optimal manner. Consequently, this website-based media is deemed highly suitable for integration into biology learning activities in schools. Its design supports diverse learning styles and allows students to study at their own pace, enhancing both motivation and understanding.

Although the media was categorized as feasible and suitable for use, several revisions were implemented following constructive feedback from the validators. These improvements aimed to address minor gaps and enhance the clarity and accessibility of the content. One important recommendation was to better integrate biological concepts with real-life contexts, which has been shown to significantly improve learning outcomes (Sugiharni, 2018; Appiah-Adjei et al., 2025). Research indicates that students who engage with life context based learning approaches demonstrate superior content comprehension, stronger problem solving skills, and more effective decision making compared to peers who learn through traditional, lecture-based methods (Prasetya et al., 2021; Agyei, 2022). By situating biological topics within familiar daily experiences, context-based teaching increases both the quantity and quality of students' knowledge acquisition. This method actively connects new information with prior knowledge and personal experiences, enabling students to form deeper and more cohesive understandings of complex biological processes. Therefore, adopting this approach in the website's content is expected to make the learning experience more meaningful and relevant, fostering better retention and application of biological concepts (Astuti *et al*., 2020; Utami *et al.*, 2020; Quimat & Picardal, 2024). The results of the validation conducted by biology teachers, which evaluate the practicality, relevance, and suitability of the learning media for classroom implementation, are presented in Table 9.

Table 9. Results of validation by biology teachers

Aspects	Biology Teacher		Average
	1	2	
Subject Matter	4.00	4.00	4.00
Language	4.00	3.60	3.80
Format	4.00	4.00	4.00
Benefit	4.00	3.50	3.75
Average	4.00	3.77	3.88
Category	Highly Valid	Highly Valid	Highly Valid

based on the readability test results conducted by biology teachers, the website-based learning media oriented toward enhancing biological literacy is classified as highly valid, with an average score of 3.88. The learning media was considered effective and engaging, as it is presented in a website format that is easily accessible for students, aligning with the objectives of the differentiated learning approach in the Merdeka Curriculum. The website also includes illustrative images that accurately represent the reproductive system material. Biological terms are highlighted in bold, making them easier for students to study and understand. The development of the human reproductive system website-based learning media oriented toward enhancing biological literacy was conducted using a modified version of the ADDIE development model. The modification was applied by limiting the ADDIE stages to the development phase, in line with the research objective to produce a website-based learning media product that focuses on improving biological literacy (Rahmawati, 2024; Taqwa, 2022).

In the analysis phase, needs analysis was conducted involving students and biology teachers to identify the urgency of this research. The student needs analysis revealed that many students found it difficult to understand the human reproductive system material due to the lack of effective instructional media capable of clearly explaining the concepts. This information served as a reference for the subsequent development stages. Science learning cannot be carried out effectively without instructional aids, as these play an essential role in helping students visualize abstract biological processes and construct meaningful understanding (Semilarski & Laius, 2021; Rahmawati, 2024). Instructional aids, particularly instructional materials, help students develop problem solving skills and scientific attitudes necessary for inquiry-based learning (Sundayana, 2018; Taqwa, 2022). Instructional materials are defined as resources that teachers can use to facilitate and support the teaching and learning process, enabling active participation and conceptual engagement (Adeoye et al., 2023; Rahmawati, 2024). Bukoye (2019) emphasized that when instructional materials meet the needs of the teaching process, students gain better access to learning content and can learn at their own pace, which positively impacts their academic achievement.

The second stage, design, is based on the urgency identified in the analysis phase and focuses on developing a website-based learning medium for the human reproductive system. The design stage began with the creation of a storyboard, which served as the conceptual blueprint for the website developed using the Google Sites platform. This initial model was later refined into a complete prototype referred to as draft product 1. Google Sites was chosen as the platform due to its user friendly interface, easy integration with other Google tools such as Google Forms, and responsiveness across multiple devices (Haryani et al., 2021; Rahmawati, 2024). These features make Google Sites an accessible medium for both teachers and students to engage in interactive and multimedia based learning. The website-based learning media was developed with a focus on improving biological literacy, as this competency enables students to apply biological knowledge in daily life and make informed decisions (Semilarski & Laius, 2021; Coppi et al., 2023). The content on the website supports literacy development by training students' digital literacy skills including searching for, evaluating, and utilizing online information effectively (Mutohhari et al., 2022; Rahmawati, 2024). Furthermore, students are expected to understand, analyze, and synthesize the information they encounter through guided exploration and reflection activities integrated into the website. Biological literacy, comprising the dimensions of nominal, functional,

structural, and multidimensional literacy was assessed using a summative test administered after the core learning activities (Semilarski & Laius, 2021; Coppi *et al*., 2023).

The development phase was implemented after the completion of the design process. During this stage, the website-based instructional media on the human reproductive system designed to strengthen students' biological literacy was produced and subjected to expert validation. The validation process involved assessments by specialists in language, content, and media design, each reviewed by two expert validators chosen for their qualifications and consent to participate in the evaluation (Susanti et al., 2024; Meisuri *et al.*, 2025). The evaluation focused on determining the validity of the developed product across these three domains. Based on the analysis results, the content validation achieved the highest score, indicating that the material was categorized as highly valid. This strong result was largely attributed to the clarity and relevance of the material presentation. The learning content provided through the website aligns closely with the learning objectives of the human reproductive system topic in the Merdeka Curriculum and integrates both knowledge and skill competencies expected in science learning. Furthermore, the developed website material was confirmed to be relevant to the curriculum standards applied in schools and effectively supports the achievement of learning outcomes (Rahmawati, 2024; Taqwa, 2022).

The overall average score for content validation fell within the highly valid category. Layout and font choices contributed to the highest average score in the presentation aspect, demonstrating that the website was designed to enhance readability. Systematic organization of the content ensures smooth transitions between subtopics. A navigation menu provides students with the ability to directly access specific sections, allowing for self-paced learning. Such flexibility accommodates differences in individual learning speeds, which website-based learning media can effectively support (Sugiharni, 2018; Haka *et al.,* 2024; Haleem *et al*., 2022). In the language validation, the results also fell into the highly valid category. The highest score was again in the presentation aspect, showing that the content was written in proper standard Indonesian, following the rules of general guidelines for Indonesian spelling. The language used on the website was clear and matched the students' cognitive abilities.

Revisions to the website were made based on the results of the validation test, incorporating suggestions and comments from expert validators. Improvements included the addition of references to support the content on the human reproductive system, proper source citations for the images, and a glossary for all content to ensure consistent use of biological terminology rather than everyday language. Certain aspects of the product can be further developed, such as the inclusion of videos, more representative images, and the revision of overly rigid language to better suit high school students. A summative test instrument was also integrated into the media to assess students' biological literacy skills (Anakara, 2021; Coppi *et al.*, 2023). The integration of the human reproductive system material with students' everyday knowledge enhanced their understanding by placing abstract concepts into meaningful, real-world contexts. This approach enabled students to appreciate the relevance of the material, connect theoretical concepts to practical applications, and improve their overall comprehension of biological principles (Taqwa, 2022; Appiah-Adjei et al., 2025). However, further research is recommended to evaluate the impact of this website-based learning tool on students' biological literacy and academic performance in real classroom environments.

CONCLUSION

The human reproductive system website-based learning media, designed to enhance biological literacy, was successfully developed and is considered suitable for use in educational settings. This conclusion is supported by validation results from expert reviewers and biology teachers, who rated the media highly across language, content, and media aspects, respectively each falling into the very valid category. These results indicate that the media meets established standards for quality and effectiveness in instructional design. In a broader context, this media offers potential benefits for global education by providing accessible, technology-based learning resources that can be adapted to diverse cultural and linguistic settings. Specifically, it supports educators and students by facilitating self-paced, interactive

learning that can accommodate various learning styles and improve engagement with complex biological topics. Ultimately, this development contributes to advancing science education, promoting digital literacy, and fostering critical thinking skills among students, particularly in regions where traditional resources are limited. Nationally, this media can enhance the quality and accessibility of biology education, supporting teachers and students throughout the country.

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