

Developing A Simple Teaching Aid on The Human Circulatory System: Validity Evidence From Expert Judgement

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Abstract: Education is a comprehensive process that encompasses guidance, development, regulation, supervision, and the transmission of values from educators to learners. Learning media refer to any tools or resources employed to convey instructional messages in ways that stimulate students' thinking, emotions, attention, and motivation, thereby facilitating a structured, goal-directed, and well-managed learning experience. This study aims to develop a simple teaching aid on the human circulatory system for eleventh-grade students using readily available materials, while ensuring its validity as an instructional medium. The research adopted three of the five stages of the ADDIE development model—Analysis, Design, and Development. The study did not proceed to the implementation phase; instead, it focused on the development stage, particularly validity testing. Data were collected through interviews, classroom observations, and questionnaire distribution. The analysis combined quantitative methods, involving percentage score calculations, with qualitative evaluation derived from validators' feedback and recommendations. The findings indicate that students require visually engaging instructional media that are practical to use and aligned with the expectations of the Merdeka Curriculum. In conclusion, the design phase produced a prototype teaching aid that is considered appropriate for use in biology instruction, demonstrating a very high level of validity and strong potential to enhance the learning process.

Keywords: Biology; Development; Human Circulatory System; Simple Teaching Aid

INTRODUCTION

Quality education encompasses both process quality and product quality. Education is considered to be of high quality in terms of process when learning activities are implemented optimally, students are actively engaged in meaningful learning experiences, and the process is supported by the availability of adequate resources, including human resources, funding, facilities, and infrastructure (Siahaan et al., 2023). From an outcomes-oriented perspective, educational quality is demonstrated by its capacity to foster strong character and to develop individuals' potential (Armini, 2024)

Improving educational quality requires the use of learning media that stimulate students' motivation and effectively engage their attention and interest. Rizal et al. (2016) define learning media as all forms of tools used to deliver instructional messages that are capable of stimulating students' thoughts, feelings,

attention, and learning motivation, thereby encouraging a planned, goal-oriented, and controlled learning process. Learning facilities include instructional tools and learning media (Habsyi, 2020). Learning media can also be defined as means that contain instructional information or messages and are utilized in the implementation of the learning process (Rachmawati et al., 2025). Furthermore, learning media function as channels for conveying messages or information that embody specific instructional purposes (Hasan et al., 2021). As a key element of instruction, learning media mediate the transfer of content and contribute to improving students' comprehension of learning materials (Wulandari et al., 2023).

Learning media are defined as instructional resources, encompassing hardware and software, employed by teachers to convey learning materials during the teaching process. The application of learning media is expected to enhance instructional effectiveness and

efficiency while remaining aligned with predetermined learning objectives (Magdalena et al., 2021).

Learning media are employed by educators as a means of supporting the delivery of instructional materials in school-based learning. The use of such media contributes to the creation of a conducive learning environment, enabling students to maintain optimal focus during learning activities (Tafonao, 2018). Rasagama (2020) emphasizes that the application of learning media in teaching yields significant benefits by promoting an engaging learning environment. Learning media also play an important role in improving students' comprehension of instructional materials, thereby supporting the realization of learning objectives and enabling teachers to optimize classroom instruction.

Science teaching aids play a crucial role in the learning process, including: (1) helping to explain concepts so that students can more easily understand the material presented by the teacher; (2) strengthening students' mastery of learning materials; and (3) developing students' skills (Mujtahid et al., 2020). Alat peraga perlu dirancang selaras dengan Teaching aids should be designed in alignment with learning objectives, be capable of visualizing concepts concretely through real objects, images, or diagrams, possess adequate durability, use sturdy materials, and present attractive forms and colors without neglecting safety aspects in their use (Syukriani et al., 2022).

Students' lack of understanding of the human circulatory system material often results in their inability to explain the concepts when asked. The absence of appropriate learning media that could facilitate understanding further contributes to these difficulties. Evidence from Melati et al. (2023) indicates that visual learning media play a significant role in improving students' understanding of abstract concepts, including content related to the human circulatory system. More broadly, Awang (2015) stated that difficulties commonly experienced by students in learning biology are caused by the large number of unfamiliar scientific terms. Aswadin et al. (2021) further demonstrated that students' learning difficulties contribute to lower biology achievement, particularly in learning about the human circulatory system.

Based on the issues identified above, this study focused on developing a simple teaching

aid using easily accessible materials to support learning on the human circulatory system.

METHODS

This study was conducted from June to December 2025. The preliminary needs analysis took place at SMA Negeri 1 Mantang; however, the research was limited to the development stage, focusing specifically on validity testing. Therefore, the research subjects were expert validators rather than students. The study followed a research and development approach using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Nevertheless, this research was carried out only up to the Development stage.

Data collection involved media validation sheets completed by expert validators in both content and media. Material validation covered aspects such as alignment with competency requirements, accuracy and correctness of the content, and the adequacy of supporting materials. Meanwhile, media validation assessed durability, visual appeal, and flexibility. The data analysis combined quantitative and qualitative approaches. Quantitative analysis was conducted by calculating percentage scores to determine the level of validity, while qualitative analysis incorporated suggestions and feedback provided by the validators to improve the developed teaching aid. The validity scores were calculated using the following formula.

$$K = \frac{F}{N.I.R} \times 100\%$$

Where:

K = feasibility percentage

F = total score obtained from respondents

N = highest possible score in the questionnaire

I = number of items in the questionnaire

R = number of respondents

Furthermore, the level of validity was determined based on the following criteria:

Table 1. Criteria for Determining Validity Levels

Qualitative Data	Percentage (%)
Very Valid (VV)	75 – 100
Valid (V)	50 – 74
Invalid (I)	25 – 49
Highly Invalid (HI)	0 – 24

Source: (Riduwan, 2022)

RESULT AND DISCUSSION

In this study, curriculum analysis, material analysis, student needs analysis, student characteristics analysis, media validation, and material validation were conducted.

1. Curriculum Analysis

Curriculum analysis was conducted to identify the curriculum implemented at the school, obtain information regarding the materials taught in Grade XI, learning outcomes, learning objectives, and to select appropriate media to be developed in accordance with the applicable curriculum. Based on interviews, it was found that two curricula were implemented at SMA Negeri 1 Mantang, namely the 2013 Curriculum applied in Grade XII and the Merdeka Curriculum applied in Grades X and XI. At the curriculum analysis stage, the development of the simple teaching aid was guided by the Merdeka Curriculum, as this curriculum emphasizes student-centered learning and is oriented toward 21st-century competencies. Creative teachers are able to transform simple materials from the surrounding environment into meaningful teaching aids that meet students' needs (Nazarina et al., 2024).

2. Material Analysis

This stage was carried out by reviewing learning materials that were poorly understood by students based on teachers' assessments during the learning process. Based on observations, the human circulatory system was identified as an abstract topic because the objects being studied cannot be directly observed. This condition causes students to experience difficulties in understanding the concepts. The material analysis revealed that 75% of students experienced difficulties in understanding the human circulatory system content. Therefore, this topic was selected because it is considered challenging, difficult to observe directly, and requires visual support. Fathoni et al. (2021) similarly highlighted that the complexity of scientific terminology contributes to students' difficulties in understanding the human circulatory system.

3. Student Needs Analysis

To complement the data, questionnaires were used to assess students' views on the use of learning media in the school context. A needs analysis was then conducted to identify learners' requirements related to instructional material development. This approach supports the argument of Malina et al. (2021), who highlighted that needs analysis plays an important role in learning by providing students with resources that enhance understanding.

4. Student Characteristics Analysis

An analysis was conducted to examine students' characteristics and abilities during biology learning to ensure that the developed media aligned with the characteristics of students at the target school. Students' characteristics and prior abilities influence the effectiveness of the learning process. Data on student characteristics were obtained through interviews with teachers and the distribution of student characteristic questionnaires to Grade XI students via Google Forms. At this stage, students with visual learning styles were found to require media that can present concepts concretely and in a visually appealing manner, enabling information to be more easily understood and retained (Hildayah, 2019).

5. Material Validation

Material validation was conducted by two expert validators. Validation data were obtained by administering material validation sheets covering three aspects: alignment with competency requirements, accuracy and correctness of the content, and supporting materials. The validation sheets were provided to subject-matter experts, who then reviewed the developed materials by examining the overall content and the completeness of the material presented in the teaching aid. The comments and suggestions provided by the experts were used as guidelines for revising the material. The results of the material validation for the human circulatory system are presented in Table 2.

Table 2. Results of Material Validation

No	Assessment Aspect	Validators' Assessment Results (%)		Average (%)	Category
		I	II		
1.	Alignment with Competency Requirements	90	100	95	VV
2.	Material Accuracy	75	91.7	83.4	VV
3.	Supporting Materials	75	100	87,5	VV
Average		80	97.2	88.6	VV

Based on the material validation process, the data showed an average percentage score of 88.6%, indicating that the material was categorized as very valid in terms of alignment with competency requirements, accuracy and correctness of the content, and supporting materials. The very high validity results indicate that the content of the teaching aid is aligned with the learning outcomes and learning objectives of the Merdeka Curriculum and is relevant to students' levels of understanding. These findings also strengthen the principle of content validity in the development of learning media, as explained by Kholikin et al. (2024), which states that content aspects should reflect the appropriateness of subject matter, language use, relevance to the curriculum, and alignment with students' characteristics.

Based on these results, it can be concluded that the simple teaching aid is able to facilitate

students' understanding of the human circulatory system more concretely. This finding is consistent with the study by Rahmayani (2022), which reported that teaching aids can enhance students' understanding of scientific concepts by visualizing processes that are difficult to observe directly. Therefore, the developed teaching aid meets the criteria of content feasibility, conceptual accuracy, and supports the achievement of biology learning objectives at the senior high school level.

6. Media Validation

The teaching aid was validated by two expert validators. Media validity data were obtained using media validation sheets consisting of three aspects: durability, content, and presentation, with a total of eight indicators. The assessment results from Validator I and Validator II are presented in Table 3.

Tabel 3. Hasil Validasi Media

No	Assessment Aspect	Validators' Assessment Results (%)		Average (%)	Category
		I	II		
1.	Durability	91.7	100	95.8	VV
2.	Content	100	100	100	VV
3.	Presentation	87.5	100	93.8	VV
Average		93.1	100	96.5	VV

The media evaluation conducted by the two validators covered three assessment aspects. The durability aspect obtained a percentage score of 95.8%, which was categorized as very valid. The content aspect achieved a percentage score of 100% and was also categorized as very valid. The presentation aspect obtained a percentage score of 93.8%, categorized as very valid. Overall, the average validity score across all

aspects reached 96.5%, indicating that the developed teaching aid was very valid.

Learning media should have an attractive appearance, convey clear messages, and align with students' needs (Prastowo, 2018). High media validity also strengthens the function of teaching aids as concrete visual media. As stated by Arsyad (2013), concrete media such as teaching aids can help students understand complex concepts more easily.

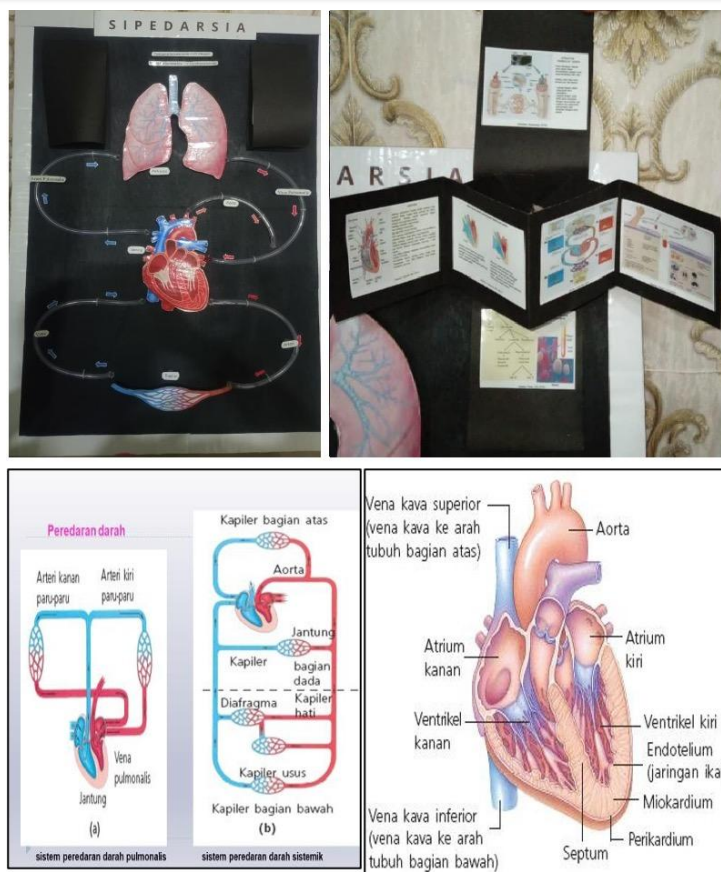


Figure 1. Simple Teaching Aid on the Human Circulatory System

CONCLUSION

Based on the results and discussion of this study, it can be concluded that the simple teaching aid developed for the human circulatory system for Grade XI students at SMA Negeri 1 Mantang is categorized as very valid in terms of both media and material aspects.

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