



Needs analysis for animated video development in biology learning among grade X and XII high school students

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Article	Abstract
<p>Keywords: Animated video; Biology learning; Mendel's laws; Needs analysis; Student preferences</p> <p>Article History Received: July 21, 2026 Accepted: October 24, 2026 Published: October 28, 2026</p>	<p>Some biology material is difficult to understand because it contains many terms, interrelated concepts, and processes that cannot be observed directly. These conditions highlight the need for instructional media that can help students understand the material through clearer and more engaging presentations. This study aims to analyze the need for developing animated video media for biology instruction at SMAN 2 Kota Bangun by identifying student characteristics, material considered difficult, and preferred learning media. This study employed a descriptive cross-sectional survey as part of the needs analysis phase within the ADDIE development framework. Data were collected in July–August 2025 via an online questionnaire administered to 58 Grade X and XII students selected through purposive sampling. The data were analyzed using frequencies, percentages, and thematic grouping of open-ended responses. The results showed that most respondents were Grade XII students (82.8%), female (75.9%), and aged 17 years (50.0%). Mendel's Laws were the most frequently reported difficult topic (39.7%), followed by genetics (24.1%). Learning difficulties were primarily related to dense content, abstract concepts, and scientific terminology. Animated videos were the most preferred learning medium (63.8%), mainly because students perceived them as helpful for understanding and visualizing the material. These findings provide an initial basis for designing animated videos on Mendel's Laws with a systematic presentation of concepts and stages of genetic crosses. However, the findings reflect students' perceived needs and preferences, while the feasibility and effectiveness of the proposed media require further evaluation.</p>

INTRODUCTION

Biology instruction involves various concepts, structures, and biological processes that are often difficult to observe directly. Some topics contain numerous scientific terms, abstract concepts, and complex relationships that require students to understand and connect different types of information. These characteristics can make biology learning challenging, particularly when instructional materials are not supported by adequate visual representations. Nisak [1] identified that students' difficulties in learning biology are associated with the large amount of material, complex concepts, and scientific terminology that is difficult to understand. Similar findings were reported by Çimer [2], who surveyed eleventh-grade students and found that topics such as cell division, genes and chromosomes, and the endocrine system were perceived as difficult, mainly because of the nature of the topics, teaching approaches, students' study habits, and limited learning resources; notably, the students recommended greater use of visual materials to make biology learning more effective. In the Indonesian context, Mardin et al. [3] reported that senior high school students perceived heredity as the most difficult biology topic, followed by the coordination system, the circulatory system, genetic material, and cell division, with the abstract and complicated nature of these topics being the most frequently reported reason. Therefore, selecting appropriate instructional media is important to support students' understanding of biological concepts. However, before selecting or developing instructional media, it is necessary to identify the specific learning difficulties experienced by students and the types of media they prefer.

Among the challenging topics in biology are genetics and inheritance, which require students to understand the relationships between genes, alleles, genotypes, phenotypes, and patterns of trait inheritance. Difficulties with these topics have proven persistent: a follow-up survey of Scottish students showed that, while difficulties with some other topics had largely disappeared after curriculum revisions, genetics remained perceived as difficult [4]. Learning these topics also involves interpreting genetic symbols, applying crossing procedures, and determining possible inheritance outcomes. Lee and Byun [5] found that high school students experienced difficulties in interpreting information, selecting problem-solving strategies, and using genetic representations when solving genetics problems. Tsui and Treagust [6] further showed that secondary students could reason from genotype to phenotype but struggled to reason from phenotype to genotype and across generations. Similarly, Ojo [7] identified misconceptions and limitations in students' conceptual understanding of genetics, while Machová and Ehler [8] attributed students' misconceptions in genetics to a disconnection between the rules of inheritance and the functions of DNA across levels of biological organization in curricula and textbooks. Comparable difficulties have been reported in Indonesia, where most twelfth-grade students at one senior high school did not reach learning mastery on the topic of inheritance of traits [9]. These findings indicate that learning difficulties in biology may involve not only the amount of information presented but also the complexity of concepts and the processes students need to understand [5–9].

Digital transformation has expanded opportunities for integrating technology into educational practices. The use of digital technology in learning can provide access to various educational resources and support more engaging learning experiences [10]. When aligned with learning objectives, technology-based instructional media can support the presentation of information through different visual and interactive formats [11]. These opportunities are particularly relevant to biology instruction because some biological structures, mechanisms, and processes cannot be observed directly. A meta-analysis of science curriculum materials found that dynamic visualizations supported students' conceptual understanding of scientific phenomena more effectively than static visuals, particularly when combined with instructional scaffolds such as reflection prompts and visual cues [12]. Consequently, instructional media capable of presenting biological concepts through clearer visual representations may help address some of the difficulties students encounter during learning.

One type of instructional media with potential for use in biology education is animated video. Animated videos are audiovisual media that combine moving images, narration, and other visual elements to present instructional content. The cognitive theory of multimedia learning explains that well-designed combinations of words and pictures can promote deeper learning than words alone, because learners process verbal and visual information through complementary channels [13]. This combination allows biological concepts and processes to be represented dynamically rather than solely through static images or verbal explanations. Meta-analyses have reported a small-to-medium overall advantage of instructional animations over static pictures, with larger effects when animations are representational rather than decorative [14] and when they are accompanied by narration [15]. Kotimah [16] reviewed the use of Powtoon-based animated videos in science education and highlighted their potential as engaging audiovisual learning media. Research by El Hammoumi et al. [17] on cell biology instruction also showed that three-dimensional interactive animations can support the presentation of complex biological concepts, with students reporting positive experiences in understanding the material. Similarly, O'Connor et al. [18] examined the use of animations to support learning about gastrulation and neurulation, demonstrating their potential to visualize complex developmental processes. Although these studies were conducted in different educational contexts, their findings suggest that animation can serve as a useful medium for representing abstract and dynamic biological processes.

However, the development of animated instructional media should not rely solely on technological features or visual attractiveness. Brame [19] emphasized that effective educational videos must manage learners' cognitive load, sustain engagement, and promote active learning. The suitability of a medium depends on the characteristics of the subject matter, learning objectives, and the needs of

its intended users [20]. Fitriani et al. [21] conducted a needs analysis as part of the development of animated videos for adolescent health promotion. Their study showed that prospective users were interested in animated videos because the combination of moving images and sound made information delivery more engaging. The developed media also received positive evaluations regarding visualization, duration, and audio, with a reported suitability score of 89.33%. These findings demonstrate the importance of considering user needs during media development. In the context of biology instruction, needs analysis can help identify which topics students perceive as difficult, the reasons for these difficulties, and the types of instructional media they prefer. Such information can provide an initial basis for determining the content priorities and general format of the media before the design and development stages begin.

Previous studies have explored animated videos from different perspectives. Kotimah [16] discussed their application in science education, while El Hammoumi et al. [17] and O'Connor et al. [18] investigated the use of animations to support the understanding of complex biological concepts. Fitriani et al. [21] incorporated needs analysis into the development and evaluation of animated health promotion media. These studies provide important evidence regarding the potential and development of animated instructional media. However, findings from previous studies cannot directly establish which biology topics are perceived as difficult by students at SMAN 2 Kota Bangun, why students experience these difficulties, or which instructional media they prefer. Without this contextual information, decisions about the content and format of animated videos may not adequately reflect the needs of the intended users. Therefore, a school-specific needs analysis is necessary to provide an empirical basis for planning instructional media development. Rather than introducing a new instructional technology, this study contributes contextual evidence about students' perceived learning difficulties and media preferences during the initial needs analysis phase.

Based on these considerations, this study addresses two research questions: (1) Which biology topics do students perceive as difficult to understand, and what reasons do they report for these difficulties? and (2) Which types of instructional media do students prefer, and what reasons underlie their preferences? Accordingly, this study aims to analyze students' learning needs as an initial basis for developing animated video media for biology instruction at SMAN 2 Kota Bangun by identifying biology topics perceived as difficult, the reasons for these difficulties, and students' instructional media preferences. The findings are expected to provide preliminary considerations for developing animated videos primarily intended for students, while also offering teachers information to support the selection and planning of instructional media that respond to students' learning needs. This study is limited to the Analysis phase of the ADDIE development framework, which focuses on identifying learning needs, learner characteristics, and instructional goals before design decisions are made [20], and does not include media development, product validation, or effectiveness testing.

RESEARCH METHOD

This study employed a descriptive cross-sectional survey design during the Analysis phase of the ADDIE development framework. The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation [22]. However, the present study was limited to the Analysis phase, which aimed to identify biology topics perceived as difficult and students' instructional media preferences as an initial basis for developing animated video media. The subsequent stages of the ADDIE model were not conducted in this study. Data were collected from July 16 to August 5, 2025, at SMAN 2 Kota Bangun, Kutai Kartanegara Regency, East Kalimantan, Indonesia. The study involved 58 students, consisting of 10 Grade X students and 48 Grade XII students, selected through purposive sampling. These grade levels were selected to provide an overview of students' learning needs at the beginning and final stages of senior high school education. Respondent characteristics, including age, gender, and grade level, are presented in Table 1.

Table 1. Respondent Characteristics

Characteristics	Category	Frequency (n)	Percentage (%)
Age	14 years	1	1.7
	15 years	8	13.8
	16 years	8	13.8
	17 years	29	50.0
	18 years	10	17.2
	19 years	2	3.4
Gender	Female	44	75.9
	Male	14	24.1
Grade level	Grade X	10	17.2
	Grade XII	48	82.8

Data were collected using a researcher-developed needs assessment questionnaire distributed online through Google Forms. The questionnaire consisted of four main questions covering two aspects of needs analysis: learning difficulties and instructional media preferences. The first aspect focused on identifying biology topics perceived as difficult and the reasons for these difficulties, while the second aspect examined students' preferred instructional media and the reasons underlying their preferences. These aspects are consistent with previous studies examining students' needs for instructional media in biology education [23,24]. The questionnaire items and response types are presented in Table 2.

Table 2. Questionnaire Items Used in the Needs Analysis

Aspect	Questionnaire item	Response type
Learning difficulties	Which biology topic do you find most difficult to understand?	Multiple-choice
Learning difficulties	What are the reasons or difficulties you experience in understanding the topic?	Open-ended
Media preferences	Which type of instructional media do you prefer?	Multiple-choice
Media preferences	Why do you prefer the selected instructional media?	Open-ended

The questionnaire combined closed-ended and open-ended questions to obtain descriptive information about students' perceived learning difficulties and media preferences. The closed-ended questions were used to identify the distribution of difficult biology topics and preferred instructional media, while the open-ended questions allowed respondents to explain the reasons underlying their answers. The questionnaire was not designed as a psychometric scale, and internal consistency testing was therefore not applied. The instrument was developed by the researchers without formal expert validation or pilot testing before data collection. This limitation was considered when interpreting the findings.

Data from the closed-ended questions were analyzed using descriptive statistics, specifically frequencies and percentages. Open-ended responses were analyzed through thematic grouping based on similarities in their main meanings. This approach is consistent with the use of thematic analysis to organize qualitative responses into meaningful categories [25]. Responses with similar meanings were grouped into categories representing students' learning difficulties and instructional media preferences. For example, responses such as "Isi materi terlalu banyak" (too much learning material) were grouped under content density, while "banyak istilah yang sulit" (many difficult terms) was categorized under conceptual and terminological difficulties. Similarly, responses such as "lebih mudah di pahami" (easier to understand) were grouped under comprehension support, while "Seru" (enjoyable) was categorized under media attractiveness. Responses that did not identify a specific reason were distinguished from those providing explicit explanations, while responses lacking substantive information were classified separately. The categories and illustrative responses were then interpreted descriptively alongside the

closed-ended findings to identify preliminary considerations for subsequent animated video development.

RESULT AND DISCUSSION

Biology Topics Perceived as Difficult to Understand

The needs analysis focused on identifying biology topics that students perceived as difficult to understand and the reasons underlying these difficulties. Identifying students' learning difficulties is an important consideration in planning instructional media because the content and presentation should respond to the needs of the intended users. Biology involves abstract concepts, complex structures, scientific terminology, and processes that cannot always be observed directly. These characteristics may create challenges when the material is not supported by adequate explanations and visual representations. Magfiroh and Murtini [24] emphasized the importance of identifying students' needs when planning digital instructional media for biology learning. The distribution of biology topics perceived as difficult is presented in Figure 1.

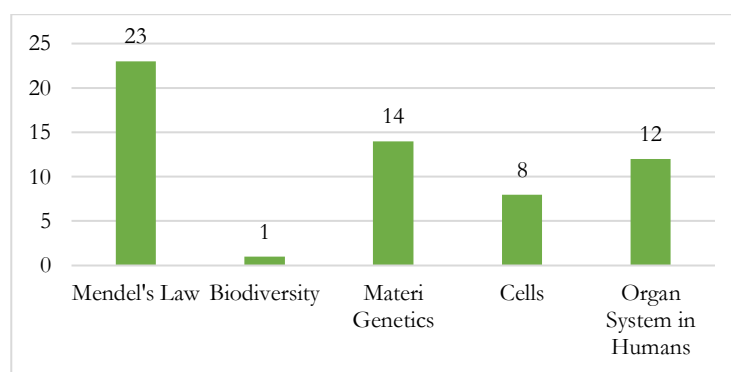


Figure 1. Frequency Distribution of Biology Topics Perceived as Difficult to Understand

As shown in Figure 1, Mendel's Laws were the most frequently reported difficult topic, selected by 23 respondents (39.7%). Genetics was selected by 14 respondents (24.1%), followed by human organ systems with 12 respondents (20.7%), cells with 8 respondents (13.8%), and biodiversity with 1 respondent (1.7%). When Mendel's Laws and genetics were considered together as inheritance-related topics, they accounted for 37 respondents (63.8%). This finding indicates that inheritance-related materials were frequently perceived as difficult among the participating students. Nevertheless, the results represent students' perceptions of learning difficulty rather than an objective measurement of their conceptual understanding.

To obtain a more detailed understanding of these difficulties, students' open-ended responses were examined based on their main meanings. The responses revealed several recurring reasons, including extensive or dense learning materials, difficulties understanding scientific terminology and conceptual relationships, problems involving genetic-cross procedures, and instructional conditions that students considered less supportive. Some respondents also expressed general difficulties without providing a specific explanation. These responses were considered separately to avoid attributing difficulties to causes that the students had not explicitly identified.

One recurring reason involved the amount and density of learning material. For example, the response "Isi materi terlalu banyak" (too much learning material) indicated that some students considered the volume of information to be a challenge. Other responses similarly described biology material as extensive, lengthy, or requiring considerable time to understand. This finding is consistent with Nisak [1], who identified the amount of learning material and difficulties understanding biological concepts and terminology as factors associated with students' learning difficulties. In the present study, these responses suggest that the organization of instructional content deserves attention, particularly when students must understand several related concepts within the same topic.

Another group of responses identified difficulties involving scientific terminology, abstract concepts, and relationships between biological processes. For example, the response "banyak istilah yang sulit" (many difficult terms) explicitly referred to the challenge of understanding scientific language. Other students described difficulties distinguishing genetic concepts or understanding biological processes that could not be observed directly. These findings suggest that some students may require clearer explanations of terminology and representations that illustrate relationships among concepts. However, responses that merely stated that the material was difficult to understand were not treated as evidence of a specific terminological or conceptual problem.

Mendel's Laws are particularly relevant in this context because the topic involves interconnected concepts, including genes, alleles, genotypes, phenotypes, dominant and recessive traits, gamete formation, and patterns of inheritance. Students are also required to interpret genetic symbols, construct genetic-cross diagrams, and determine possible genotype and phenotype ratios. Some respondents who selected Mendel's Laws described confusion involving inheritance problems and calculations. One student, for example, stated that the material required strong understanding and involved confusing calculations. This response illustrates that difficulties may arise not only from the terminology used in genetics but also from the reasoning and procedures required to solve inheritance problems.

These findings are consistent with Lee and Byun [5], who identified errors among high school students when interpreting genetics problems, selecting problem-solving strategies, and using genetic representations. Similarly, Ojo [7] reported misconceptions and limitations in secondary school students' conceptual understanding of genetics. These studies suggest that difficulties in genetics learning may involve the interpretation and application of concepts rather than memorization alone. Therefore, explanations of Mendel's Laws should consider how students connect information from a problem, apply genetic-cross procedures, and interpret the resulting inheritance ratios.

Difficulties involving genetics and inheritance were also discussed by Muliana and Irfan [26] in their analysis of instructional material needs in Basic Biology. Their findings highlighted the complexity and scope of genetics-related material as considerations in preparing instructional resources. Although their study involved university students, it provides a relevant comparison concerning the conceptual demands of inheritance topics. In the present study, the frequent selection of Mendel's Laws suggests that it may be considered a priority when determining the content of subsequent instructional media development.

Students also reported difficulties related to instructional approaches and learning conditions. These included concerns about less effective explanations, uninteresting instructional media, and classroom environments that made concentration difficult. For example, the response "penjelasan guru kurang efektif" (the teacher's explanation is less effective) identified instructional explanation as a perceived difficulty. Such responses indicate that some students considered the presentation of learning material, rather than its content alone, to be an important part of their learning experience. Nevertheless, the survey did not include classroom observations or teacher interviews; therefore, these statements should be interpreted as students' perceptions rather than independent evaluations of teaching practices.

Other difficult topics included human organ systems and cells, selected by 12 respondents (20.7%) and 8 respondents (13.8%), respectively. Responses concerning these topics referred to extensive material, difficulties remembering biological structures and functions, and problems visualizing processes or relationships among components. These findings indicate that the demand for clearer explanations and representations was not confined to Mendel's Laws. However, Mendel's Laws remained the single most frequently selected difficult topic, providing a reasonable basis for prioritizing this material during the initial planning of instructional media.

Overall, the findings concerning difficult biology topics indicate that students' reported difficulties involved both content-related and instructional considerations. Extensive material, scientific terminology, conceptual relationships, and genetic-cross procedures emerged as relevant issues for subsequent instructional planning. In particular, the development of learning materials on Mendel's Laws

may consider concise explanations, clear definitions, appropriate illustrations, and the systematic presentation of genetic-cross procedures. These considerations are preliminary interpretations of students' perceived needs and do not establish that a particular instructional medium will be effective in resolving the reported difficulties.

Students' Preferences for Biology Instructional Media

In addition to identifying difficult biology topics, the needs analysis examined students' preferences for instructional media and the reasons underlying their choices. Understanding these preferences provides initial information about the media formats students consider suitable for their learning. Wulandari et al. [23] highlighted the relevance of engaging digital multimedia in meeting students' needs in biology education. Nevertheless, instructional media selection should consider not only students' preferences but also the characteristics of the learning material and the intended learning objectives. The distribution of preferred instructional media is presented in Figure 2.

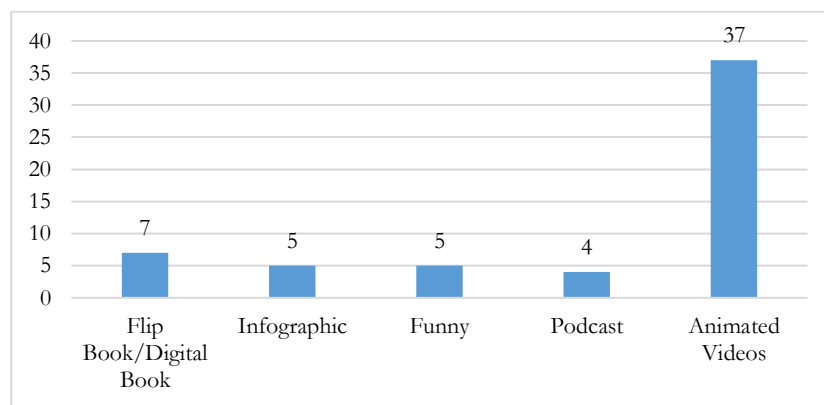


Figure 2. Frequency Distribution of Students' Preferred Biology Instructional Media

As shown in Figure 2, animated videos were the most frequently preferred instructional medium, selected by 37 respondents (63.8%). Flipbooks or digital books were selected by 7 respondents (12.1%), while infographics and comics were each selected by 5 respondents (8.6%). Podcasts were selected by 4 respondents (6.9%). These results indicate that animated videos were more frequently preferred than the other media formats presented in the questionnaire. However, the selection of alternative formats also shows that students did not have uniform instructional media preferences. Further examination of the open-ended responses revealed several reasons underlying students' media preferences. The recurring reasons included perceived support for understanding and visualization, attractiveness and enjoyment, accessibility and flexibility, personal preference, and the organization of learning information. These explanations provide additional insight into the considerations students reported when selecting instructional media.

One frequently expressed reason was the perception that a particular medium could make learning material easier to understand. For example, responses such as "lebih mudah di pahami" (easier to understand) indicated that students valued media they believed could support comprehension. Some students who preferred animated videos specifically referred to the use of images, movement, and explanations as features that could help them visualize the material. These responses suggest that students' interest in animated videos was associated with their expectations of clearer explanations and representations of biological concepts. However, these expectations should not be interpreted as evidence that animated videos had already improved their learning outcomes.

Another recurring consideration was the attractiveness of instructional media. Responses such as "Seru" (enjoyable) and statements describing animated videos as interesting or less monotonous indicated that some students valued the learning experience associated with the selected medium. The combination of illustrations, movement, and narration may help explain why animated videos appealed to these respondents. At the same time, media attractiveness should be distinguished from instructional

effectiveness because an enjoyable presentation does not necessarily ensure accurate conceptual understanding.

Other respondents emphasized accessibility, convenience, and the organization of information. Some students preferred digital books because they could read or revisit the material, while others selected podcasts because they could listen to explanations in different situations. The response "Lebih sistematis dan tertata" (more systematic and organized), given in support of infographics, illustrates the importance that some students placed on structured information. These responses indicate that media preferences were influenced by different considerations and that no single format necessarily addresses every student's learning needs.

Previous studies provide a relevant basis for interpreting the potential use of animated media in biology learning. Delgado et al. [27] investigated comprehension outcomes using text- and video-based learning resources among secondary school students, showing that videos can serve as an alternative format for presenting instructional content. Orraryd and Tibell [28] also examined the use of animations in representing students' biological conceptions, highlighting their relevance to the communication and representation of biological ideas. These studies suggest that the instructional value of audiovisual representations depends on how they are used to communicate learning content.

Mnguni and Moyo [29] examined the use of animations to support students' visualization of basic mitosis concepts. Their findings indicated that animations could assist students in representing biological processes that involve changes and relationships among components. Similarly, El Hammoumi et al. [17] investigated interactive three-dimensional animations in cell biology instruction and reported positive findings regarding students' experiences of learning with animated representations. Although these studies involved different participants and learning contexts, they provide relevant considerations for using animations to explain biological structures and processes. At the high school level, Harefa et al. [30] developed animated video media as a supplement to food-content testing laboratory activities and reported a validity score of 90.50%. Their study illustrates how animated videos may be developed and evaluated for particular biology learning activities. Nevertheless, findings concerning the validity or instructional benefits of media developed in previous studies cannot be directly transferred to the present study, which has not yet produced or evaluated an animated video.

In the context of Mendel's Laws, animated videos may provide a format for presenting relationships among genes, alleles, genotypes, and phenotypes, as well as the stages involved in genetic crosses. Moving illustrations and sequential explanations could be considered for demonstrating gamete formation, the use of genetic symbols, the construction of genetic-cross diagrams, and the interpretation of genotype and phenotype ratios. These proposed features respond to the conceptual and procedural issues identified in the needs analysis. However, the questionnaire did not specifically ask students which media they preferred for Mendel's Laws, so the combination of this topic and animated video format represents a preliminary development consideration rather than a directly established topic-specific preference.

Furthermore, animations are not necessarily more effective than static representations in every learning situation. Zhuang and Liu [31] emphasized that the instructional value of animation depends on factors such as learning content, learner characteristics, visual design, and the management of information. Excessive movement or irrelevant visual elements may increase cognitive load and interfere with comprehension. Therefore, the development of animated instructional media should emphasize relevant visual representations, organized explanations, and appropriate pacing rather than prioritizing visual attractiveness alone.

Taken together, the findings from the two aspects of the needs analysis provide preliminary considerations for selecting the content and format of instructional media. Mendel's Laws were the most frequently reported difficult biology topic, while animated videos were the most frequently preferred instructional medium. The students' explanations further identified challenges involving extensive material, scientific terminology, and the interpretation of biological concepts, as well as preferences for

media that could support understanding and visualization. Table 3 summarizes how these findings may inform the subsequent planning of animated instructional media.

Table 3. Implications of Needs Analysis Findings for Animated Video Development

Needs analysis findings	Preliminary implications for media development
Mendel's Laws were the most frequently reported difficult topic.	Prioritize basic inheritance concepts and genetic-cross procedures.
Students reported difficulties related to extensive or dense learning material.	Organize explanations into concise and logically sequenced sections.
Some students reported difficulties involving terminology and conceptual relationships.	Provide clear definitions, labeled illustrations, and representations of related concepts.
Some students reported confusion involving genetic-cross procedures.	Consider step-by-step demonstrations of genetic crosses and inheritance ratios.
Animated videos were the most frequently preferred instructional medium.	Consider audiovisual animation as the format for subsequent media development.
Students valued media that they perceived as understandable and visually engaging.	Emphasize conceptual clarity, relevant illustrations, and organized explanations.

The implications presented in Table 3 are intended to provide preliminary guidance for subsequent media design and development. They should not be interpreted as validated product specifications because the questionnaire did not directly assess detailed design requirements, such as video duration, narration style, animation speed, or visual complexity. These features require further consideration and evaluation during the next stages of the ADDIE model. Accordingly, the present study provides an initial basis for considering the development of animated videos on Mendel's Laws rather than evidence of their feasibility or effectiveness.

Several limitations should be considered when interpreting the findings. First, the study involved 58 students selected through purposive sampling, with Grade XII students representing the majority of respondents. Consequently, the findings may not represent the needs of all students at the school or in other educational contexts. Second, the researcher-developed questionnaire was not subjected to formal expert validation or pilot testing before data collection. The question concerning learning difficulties also included illustrative examples that may have influenced students' responses. Third, some open-ended responses were brief or did not provide specific explanations, limiting the depth of interpretation. Finally, follow-up interviews and direct assessments of conceptual understanding were not conducted. Future research could incorporate interviews and additional needs assessments to clarify students' learning difficulties and refine the proposed media design. Overall, the findings indicate that Mendel's Laws may be considered a priority for subsequent instructional media development, while animated videos represent a format preferred by many of the participating students. The analysis of students' reported reasons provides additional information concerning the organization, explanation, and visualization of the proposed learning material. Nevertheless, further design, validation, implementation, and evaluation are required before conclusions can be drawn regarding the suitability and effectiveness of animated videos in supporting biology learning at SMAN 2 Kota Bangun.

CONCLUSION

The needs analysis conducted at SMAN 2 Kota Bangun identified Mendel's Laws as the most frequently reported difficult biology topic, selected by 23 respondents (39.7%), followed by genetics with 14 respondents (24.1%). Students' learning difficulties were associated with extensive learning materials, scientific terminology, complex concepts, and difficulties understanding genetic-cross procedures. In terms of instructional media preferences, animated videos were the most frequently selected medium, preferred by 37 respondents (63.8%). Students generally perceived instructional media

as helpful when they provided clearer explanations, supported visualization, and made learning more engaging. These findings provide preliminary considerations for developing animated video media on Mendel's Laws, particularly through the systematic presentation of basic inheritance concepts, relevant visual representations, and step-by-step explanations of genetic crosses. However, the findings reflect students' perceived learning difficulties and media preferences rather than evidence of the effectiveness of animated videos. Therefore, further research involving media design, expert validation, implementation, and evaluation is necessary to determine the suitability and effectiveness of the proposed instructional media.

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AUTHOR CONTRIBUTIONS

The first author contributed to identifying the research location, collecting data, interpreting the findings, and drafting the manuscript. The second author provided supervision, played a major role in data analysis and interpretation, and contributed substantially to the development and revision of the manuscript. Both authors contributed to the preparation of the questionnaire and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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