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Research Paper

A Descriptive Study of the Need for Biology Learning Media to Enhance Student Learning Effectiveness in the Human Locomotor System Topic at SMA Negeri 10 Jambi

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ABSTRACT

This study aims to describe the needs for biology learning media, particularly instructional models, to improve student learning effectiveness in the human locomotor system topic at SMA Negeri 10 Jambi. The research employed a descriptive survey method using questionnaires and interviews with 31 eleventh-grade students. The results show that the most frequently used learning media are videos or animations (76%), followed by images or diagrams (71%), and digital presentations such as PowerPoint (61%). However, the use of concrete instructional models such as 3D models remains low (26%), as does the frequency of practical activities, with only a minority of students participating (35% reported never having done a practicum). Most students consider visual and interactive media, particularly videos and 3D models, to be the most helpful in understanding abstract concepts related to the human locomotor system. These findings suggest the need for the development of innovative, contextually relevant, and student-appropriate biology instructional models to enhance learning effectiveness, engagement, and meaning.

Keywords: learning media; instructional models; need analysis; human locomotor system.

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INTRODUCTION

To achieve active, innovative, creative, effective, and enjoyable learning (PAIKEM), teachers must develop their potential and professionalism. This is expected to foster students' cognitive, affective, and psychomotor domains. To support such learning, teachers require facilities and infrastructure that enhance the quality of the classroom. One essential element is the use of instructional models that help students understand the subject matter.

Instructional models are concrete objects or sets of tools intentionally designed to help instill or develop concepts, facts, and principles in learning. Their purpose is to assist teachers in making the teaching and learning process more effective and efficient. Russefendi (1994:132), in Lestari (2006), defines instructional models as tools to explain or realize concepts. Nasution (1985:95), in Herlina (2006), describes them as aids for more effective teaching. Their function is to visualize what cannot be seen or is challenging to observe, making it more transparent and enhancing understanding or perception. Criteria for selecting instructional models include alignment with learning objectives, student characteristics, cost, user safety, and ease of use.

Biology lessons, especially those related to internal structures and mechanisms of the human body, often face challenges due to their abstract and theoretical nature (Luthifah & Zulyusri, 2024). Concepts such as bone structure, joints, and muscle function in the human locomotor system cannot be directly observed in class, which can lead to difficulties in comprehending the material and ultimately lower learning outcomes.

According to Miranda et al. (2022), the use of concrete learning media, such as instructional models, is highly effective in clarifying material, deepening understanding, and training students' skills. Instructional models serve to concretize learning experiences, transforming abstract concepts into tangible forms. Facilities and infrastructure play a crucial role in supporting the teaching and learning process. The success of educational programs in schools depends heavily on the quality of these resources. Such activities provide students with opportunities to learn actively, acquire knowledge, and develop psychomotor skills. Additionally, learning encourages student creativity in problem-solving, such as asking questions about unclear topics (Budiyanto, 2015).

Instructional models in science, particularly biology, have several important roles: (a) clarifying concepts to facilitate student understanding; (b) reinforcing mastery of material related to the subject; and (c) developing skills. Besides their critical role in learning, instructional models also function as learning resources, educational methods, and educational facilities. According to the National Education Standards

Agency (BSNP, 2006), high schools must have furniture, educational equipment, media, consumables, and laboratory facilities.

LITERATURE REVIEW

Learning Media

Learning media are an integral part of the overall learning system and process, determining learning activities and serving as a crucial element in education. Teachers should be able to use affordable and efficient tools, even if simple, to achieve learning objectives. Thus, teachers must have sufficient knowledge of learning media. The term "media" comes from the Latin "medius," meaning middle, intermediary, or deliverer. Media can be interpreted as a channel for conveying messages from sender to receiver (Sadiman, 1993). In summary, media serve as containers for messages that the source intends to transmit to the target or recipient, with the instructional message aimed at facilitating the learning process (Daniyati Ani et al., 2023).

The Association of Education Communication Technology (AECT) defines media as all forms and channels used for message delivery (Januszewski & Molenda, 2008). The National Education Association (NEA) describes media as devices that can be manipulated, heard, seen, or read, along with instruments used effectively in teaching and learning activities, influencing instructional program effectiveness. Gagne and Briggs (1974) stated that learning media are tools used to deliver learning content that can stimulate students to participate in the learning process. Daryanto (2010) adds that learning media include anything—people, objects, or the environment—that can be used to convey or channel messages in learning, stimulating students' attention, interest, thoughts, and feelings. Hamka (2018) defines learning media as physical or non-physical aids intentionally used as intermediaries between educators and students to facilitate more effective and efficient understanding of learning material, thereby attracting students' interest in further study.

The Human Locomotor System

The human locomotor system is a core biology topic taught in high school and is considered difficult due to its abstract nature. It is essential for understanding the interconnectedness of human body systems, and failure to master this concept can hinder comprehension of subsequent topics, thus impeding achievement of curriculum goals (Mea Firmina, 2024). The locomotor system regulates all body movements through the interaction of bones, muscles, and joints. Rifqiawati and Hisani (2010) stated that the skeletal system stores minerals, forms blood cells, provides muscle attachment, protects soft organs, and supports the body. The high school curriculum for this topic includes explaining skeletal structure and function, describing bone structure, and identifying diseases or disorders of the locomotor system. The human skeleton consists of about 206 bones, including the skull, trunk, and limbs (Tanjung, 2021; Syaifuddin, 2006; Irianto, 2010).

METHOD

This research employed a descriptive method. Descriptive research examines the current status of a group, object, set of conditions, system of thought, or class of events, aiming to provide a systematic, factual, and accurate description of the facts, characteristics, and relationships among the phenomena studied. Data were collected through interviews and questionnaires distributed to students at SMA Negeri 10 Jambi to ensure validity.

Participants

The participants in this study were grade 11 students of SMA Negeri 10 Jambi.

Instruments

A questionnaire was used in this study to collect data for the analysis of learning media use.

RESULT

A total of 31 eleventh-grade students participated in this study, focusing on the human locomotor system. The analysis of learning media usage revealed a strong preference for dynamic and visual content. As shown in Table 1, videos and animations were the most frequently utilized media, cited by 25 out of 31 students (76%), followed by images or diagrams (71%) and digital presentations (61%). In contrast, physical and interactive instructional models, such as 3D models, were used by only 8 students (26%), suggesting that access to hands-on resources remains limited. Other media, including digital worksheets, practice applications, simulations (AR/VR/PhET), and microscopes, were reported by fewer than 20% of respondents.

Table 1. Frequency of Learning Media/Instructional Model Use

Media/Instructional Model	Frequency (out of 31)
Video/animation	25
Images/diagrams	22
Digital presentations	19
3D models/instructional models	8
Digital worksheets/flipbooks	5
Practice apps/platforms	4
Simulations/AR/VR/PhET	2
Microscopes & slides	2

The frequency of media use, as detailed in Table 2, further highlights this disparity. While nearly half of the students (48%) reported using learning media quite often (2-3 times), a significant proportion (45%) indicated that they rarely or never engaged with such resources. This inconsistency suggests that the

integration of learning media in classroom practice is not yet systematic or equitable across the student cohort.

Table 2. Frequency of Media/Instructional Model Use

Frequency Category	Number of Students
Quite often (2-3x)	15
Rarely (≤1x)	9
Rarely	5
Often (≥4x)	2

Practical activities and demonstrations were also found to be infrequent. As shown in Table 3, only 6 students experienced three or more practicum sessions, while 14 reported 1-2 sessions, and 11 students (35%) stated they had not participated in any practicum at all. The limited exposure to hands-on activities may contribute to students' perceptions of insufficient exploration and engagement with the subject matter.

Table 3. Frequency of Practicum/Demonstration

Frequency Category	Number of Students
1-2 times	14
None	11
3-4 times	6

When asked to identify the most helpful learning activities or media (Table 4), the vast majority of students (87%) selected video or animation simulations, underscoring the importance of dynamic visualizations in supporting conceptual understanding. Three-dimensional models and practicum kits were also highly valued, chosen by 68% of students, indicating a strong interest in hands-on, experiential learning despite their limited availability. Other activities, such as educational games, interactive quizzes, and the use of microscopes, were also noted as beneficial, though to a lesser extent.

Table 4. Most Helpful Activities/Media (Multiple Choice, Max 3)

Activity/Media	Frequency (out of 31)
Video/animation simulation	27
3D model/practicum kit	21
Educational games/interactive quizzes	14
Microscopes & slides	11
Case studies/simple experiments	9
AR/VR/interactive simulation	5
Stepwise digital worksheet/flipbook	5

Overall, these findings demonstrate a clear preference among students for visual and interactive learning media, particularly those that offer dynamic or hands-on experiences. However, the relatively low frequency of use for physical models and practical activities points to ongoing challenges in resource provision and instructional practice. Addressing these gaps by increasing access to diverse and interactive learning media may enhance student engagement and improve learning outcomes in complex biology topics such as the human locomotor system.

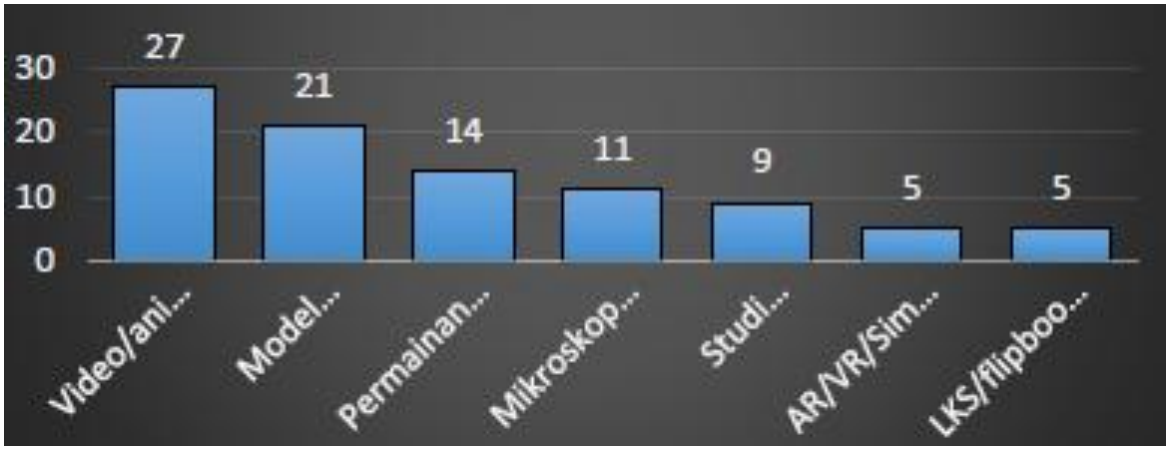

Figure 1. Learning media distribution frequency.

Figure 1 above illustrates the frequency with which students identified various types of learning media and activities as most helpful in understanding the human locomotor system. The data reveal that video or animation simulations were the most frequently selected option, with 27 students indicating that these were the most beneficial. This is followed by three-dimensional models or practicum kits, chosen by 21 students, highlighting a strong preference for both dynamic visualizations and hands-on learning experiences.

Educational games and interactive quizzes were also popular, with 14 students citing them as helpful, suggesting that interactive and engaging activities play a significant role in supporting student learning. 11 students mentioned the use of microscopes and slides. In comparison, case studies or simple experiments were selected by 9 students, indicating some interest in practical and inquiry-based approaches.

More advanced or less commonly available media, such as AR/VR simulations and stepwise digital worksheets or flipbooks, were each chosen by 5 students. This lower frequency may reflect limited access to such resources or less familiarity among students. Overall, the chart underscores a clear student preference for visual, interactive, and hands-on learning media, with dynamic content and physical models being particularly valued in the study of complex biological systems.

DISCUSSION

The results of this study provide important insights into the current landscape of biology learning media utilization among eleventh-grade students, particularly in the context of the human locomotor system. The data reveal a pronounced preference for dynamic, visual, and interactive media, with videos and animations being the most frequently used and most highly valued by students. This finding is consistent with Akmal and Yefterson (2023), who reported that monotonous and conventional teaching methods often lead to low student enthusiasm, and that the introduction of animation videos can significantly enhance student engagement and learning effectiveness. The high selection rate for video/animation in this study (87%) underscores the critical role of dynamic visual content in supporting students' conceptual understanding of complex biological systems.

The preference for visual and interactive media is further supported by Firdaus et al. (2023), who found that students require learning media that not only present content in a detailed and engaging manner but also facilitate a deeper understanding of abstract concepts. In the present study, images, diagrams, and digital presentations were also frequently used, indicating that students benefit from a variety of visual aids. However, the relatively low use of physical and interactive instructional models, such as 3D models and practicum kits (only 26% of students reported frequent use), points to a significant gap between student needs and available resources. This gap is echoed in the findings of Norra (2020), who observed that while schools may possess a range of media types—including visual, audio-visual, and technology-based media—access to interactive and hands-on resources remains limited, often due to constraints in funding, infrastructure, or teacher expertise.

The limited frequency of practicum and demonstration activities, with 35% of students reporting no practicum experience, further highlights the challenges faced in providing experiential learning opportunities. Oktavia (2022) found that both teachers and students in Aceh Barat had minimal exposure to augmented reality (AR) media, despite recognizing its potential to make abstract biological structures more accessible and engaging. The lack of hands-on and digital interactive media in the current study suggests that similar barriers—such as limited facilities, insufficient teacher training, and lack of institutional support—persist in many educational settings. This is particularly concerning given the well-established benefits of experiential learning, which allows students to construct knowledge through direct interaction with learning materials (Miranda et al., 2022).

The literature also emphasizes the importance of supplementary and innovative learning resources to address the challenges of abstract and memorization-heavy biology content. Suryanda et al. (2020) demonstrated that students often struggle with biology due to the volume of material that requires memorization and the abstract nature of the subject matter. Their research on the development of

pocketbooks based on mind maps (BIOMAP) showed that such resources can help students organize and retain information more effectively, making learning more systematic and less overwhelming. Similarly, Yudistira et al. (2021) found that students benefit from concise, image-rich booklets that serve as supplementary learning materials, particularly for complex topics like the human immune system. These findings suggest that the development and integration of diverse, student-centered learning materials can play a crucial role in enhancing learning outcomes.

The need for electronic and contextual learning media is also well-documented. Luthifah and Zulyusri (2024) reported that students overwhelmingly support the use of e-booklets that are concise, systematic, and contextualized to their everyday experiences. Such resources not only make learning more relevant but also help bridge the gap between theoretical knowledge and practical application. In the present study, the relatively low use of digital worksheets, practice apps, and AR/VR simulations may reflect both a lack of access and a lack of familiarity among students and teachers. This highlights the importance of ongoing professional development and institutional investment in digital literacy and infrastructure.

Teacher perspectives are equally important in shaping the effective use of learning media. Zulyetty (2018) found that biology teachers overwhelmingly require multimedia, PowerPoint, and video-based media to support instruction, but often face challenges in accessing or developing these resources. The present study's findings, which reveal inconsistencies in the frequency of media use (with 45% of students rarely or never using learning media), suggest that teacher readiness, resource availability, and institutional support are crucial factors influencing the integration of learning media in the classroom.

The broader educational context also supports the integration of varied and technology-based learning media. Chusniah and Rayungsari (2024) found that students often perceive mathematics as difficult and unengaging, and that the use of technology-based and game-based learning media can significantly improve motivation and learning outcomes. However, they also noted that inadequate facilities and a lack of readiness among teachers and students can hinder the effective use of such media. These findings are directly relevant to the present study, where students expressed a clear preference for interactive and engaging media but reported limited access to such resources. In addition, the shift in curriculum requirements, such as those outlined in the 2013 Curriculum, emphasizes science-based learning and the use of media that support inquiry, experimentation, and critical thinking (Norra, 2020). The present study's results, which highlight the value of video, animation, and hands-on models, align with these curricular goals and underscore the need for schools to invest in a broader range of learning media.

Ultimately, the development of innovative learning media should be complemented by ongoing teacher training and institutional support. As noted by Miranda et al. (2022) and Mea Firmina (2024), teacher creativity and innovation are central to creating dynamic and effective learning environments. Professional

development programs that focus on the use of digital, interactive, and hands-on media can empower teachers to meet the diverse needs of their students better and implement more engaging and effective instructional strategies.

In summary, the findings of this study, supported by a broad body of literature, highlight the critical importance of providing students with access to a diverse array of learning media—particularly those that are dynamic, visual, and interactive. Addressing the current gaps in resource availability, teacher training, and institutional support is essential for creating more engaging, effective, and meaningful biology learning experiences. By investing in innovative, student-centered learning materials and supporting teachers in their professional development, schools can better equip students to master complex and abstract topics such as the human locomotor system, ultimately improving learning outcomes and fostering a lifelong interest in science.

CONCLUSION

This research demonstrates that eleventh-grade students strongly prefer dynamic, visual, and interactive learning media—particularly videos, animations, and 3D models—when studying the human locomotor system. While digital and visual media are widely used and highly valued for their ability to clarify abstract concepts and increase student engagement, the actual use of hands-on and interactive resources such as physical models and practicum kits remains limited, primarily due to resource constraints and inconsistent implementation. The findings also reveal that a significant proportion of students have limited opportunities for practical activities, which may hinder their ability to explore and internalize complex biological concepts. To address these challenges, it is recommended that schools and educators invest in a broader range of learning media, enhance teacher training for the integration of innovative resources, improve access to educational infrastructure, encourage more experiential learning, and develop concise, visually rich supplementary materials to support independent study.

The implications of these findings are significant for educational practice and policy. By recognizing and responding to students' preferences for dynamic and interactive learning media, educators can create more engaging and effective learning environments that promote conceptual understanding and motivation. Investment in diverse and innovative learning resources, coupled with targeted teacher training, can help bridge the gap between traditional and modern instructional approaches, ultimately improving student outcomes in biology and other science subjects. Furthermore, these results highlight the importance of ongoing needs analysis and resource development to ensure that educational practices remain responsive to the evolving challenges and opportunities in science education.

DATA AVAILABILITY STATEMENT

Data is available upon request to the authors.

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GENERATIVE AI STATEMENT

Portions of the literature review, data analysis, and manuscript preparation in this research were supported by the use of artificial intelligence (AI) tools, including language generation and translation assistance. The authors have critically reviewed and edited all AI-generated content to ensure accuracy, originality, and alignment with the research objectives and academic standards.

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