**Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi dan Biologi**
**Vol. 8, Issue 2, December 2025**
**Pages : 184 – 191**

**p-ISSN: 2621-3702**
**e-ISSN: 2621-7538**

# The effectiveness of IMLO Biology media in enhancing students' learning motivation under the Merdeka Curriculum

**Risma Delima Harahap[1]*, Budianto Bangun[2], Sakinah Ubudiyah Siregar[3], Tegar[1]**
[1]Department of Biology Education, Faculty of Teacher Training and Education, Universitas Labuhanbatu
[2]Department of Information Technology, Faculty of Sains and Technology, Universitas Labuhanbatu
[3]Department of Mathematics Education, Faculty of Teacher Training and Education, Universitas Labuhanbatu
Jl. Sisingamangaraja No. 126-A Km. 3.5 Aek Tapa, Rantauprapat, Labuhanbatu Regency,
North Sumatra, 21415, Indonesia
*corresponding author: rismadelimaharahap@ulb.ac.id

## ABSTRACT

The Merdeka Curriculum emphasizes student-centered learning and the integration of digital media. However, empirical investigations focusing specifically on IMLO Biology media and its impact on students' learning motivation are still scarce. This lack of evidence creates a research gap regarding the effectiveness of interactive, curriculum-aligned digital tools in motivating students to learn biology. Addressing this gap is important because learning motivation plays a crucial role in achieving the competency goals outlined in the Merdeka Curriculum. This study aims to analyze the effectiveness of IMLO Biology media in enhancing students' learning motivation. A quantitative survey design was employed with a purposive sample of 60 eleventh-grade science students from two public upper secondary schools in South Rantau, North Sumatra, during the 2024-2025 academic year. Data were collected through questionnaires, observations, and interviews, then analyzed using frequency distribution. The results indicate that IMLO Biology media is effective in increasing students' learning motivation, with an average score of 85.72%, categorized as very good. Students showed higher interest, stronger engagement, and improved comprehension of abstract biological concepts. IMLO Biology media supports the principles of the Merdeka Curriculum by offering interactive and motivating learning experiences. This study provides empirical evidence to fill the identified research gap and highlights the educational importance of integrating well-designed digital media to foster student motivation in science learning.

**Keywords:** Biology, IMLO, media, Merdeka Curriculum, motivation

## INTRODUCTION

The Merdeka Curriculum promotes the development of 21st-century competencies, such as critical thinking, creativity, collaboration, and digital literacy, through student-centered and technology-integrated learning approaches (Lince, 2022; Rahmadayanti, 2022). However, field observations in several upper secondary schools in South Rantau District indicate that 70–85% of teachers still rely on conventional learning tools, while only a small proportion make use of digital media. Limited digital literacy and insufficient school facilities further contribute to this issue (Afrilia et al., 2022; Habibah et al., 2020; Nauraida & Triwiyanto, 2024; Nurharirah & Effane, 2022).

Consequently, the teaching of abstract biological concepts remains less effective, even though such concepts require visualization and interactive features to support comprehension (Gümüş & Okur, 2010; Haryana et al., 2022; Li et al., 2025). IMLO (Increase Motivation Learning Outcome) Biology media was developed as a potential solution to address these challenges, offering macromedia-based interactive animations, clear visuals, and curriculum-

aligned content designed to enhance student motivation and understanding. Previous studies have shown that interactive multimedia can improve students' motivation, interest, and engagement (Arisanti & Adnan, 2021; Hasnawiyah & Maslena, 2024; Husna & Supriyadi, 2023; Julianti et al., 2022; Kamilah et al., 2023; Tulyakul et al., 2022).

However, existing studies mostly examine general multimedia rather than IMLO Biology specifically, and few are conducted within the Merdeka Curriculum framework, which requires learning media to support digital-based, innovative, and student-centered instruction (Ambe et al., 2024; Martoredjo, 2023; Setiyawan, 2021). Thus, there is a mismatch between curricular expectations and the limited availability of empirically tested interactive biology media.

Based on previous literature, no study has specifically evaluated IMLO Biology media for improving upper secondary school students' motivation in South Rantau District, and research on IMLO within the Merdeka Curriculum remains scarce (Hutabarat et al., 2022; Nissa et al., 2021). Therefore, the novelty of this study lies in its empirical examination of IMLO Biology media as an interactive, curriculum-aligned digital tool designed to enhance students' learning motivation.

Accordingly, this study aims to determine the effectiveness of IMLO Biology media in increasing students' learning motivation, providing both theoretical contributions to address the research gap and practical guidance for optimizing digital-based biology learning.

## METHOD

This study employed a survey method with a quantitative approach, which is widely used in educational research to examine the effectiveness of instructional media on student outcomes (Grace, 2014). This method was chosen because it allows for systematic data collection and statistical analysis to describe the impact of using IMLO Biology media on students' learning motivation. Data were collected through questionnaires, observations, and interviews, providing both numerical and descriptive evidence of students' responses to the media.

### Population and sample

The population of this study comprised all upper secondary school students in South Rantau District, Labuhanbatu Regency, North Sumatra. The research sample was determined using purposive sampling, based on the consideration that the selected schools represented typical characteristics of biology learning in the district. The criteria for school selection included the implementation of the Merdeka Curriculum, teacher qualifications in biology, and the availability of learning facilities and media. The sample consisted of 60 students, with 30 students from class XI MIPA 1 of SMA Negeri 1 South Rantau and 30 students from class XI MIPA 1 of SMA Negeri 2 South Rantau. Both schools were considered to have equivalent characteristics in terms of curriculum implementation, teacher expertise, and learning resources, ensuring that the sample accurately represented the student population in the district.

### Research instruments

The instruments used in this study consisted of a learning motivation questionnaire, observation sheets, and interview guidelines. The questionnaire contained 12 dichotomous ("Yes/No") items based on the ARCS motivation model developed by Keller and Suzuki (1987). The instrument was validated by three experts, consisting of one media expert, one content expert, and one educational evaluation expert. Validation focused on content relevance,

clarity of items, and alignment with motivation indicators.

The reliability of the questionnaire was tested using Cronbach's Alpha, resulting in a coefficient of 0.87, indicating that the instrument has high reliability and is suitable for measuring students' learning motivation. Observation sheets and interview guidelines were also reviewed by the same experts to ensure content validity.

### Data analysis

Quantitative data from the questionnaire were analyzed using frequency distribution formulas to calculate the percentage of student responses.

$$P = \frac{F}{N} \times 100\%$$

Note:
P = Percentage
F = Frequency
N = Number of respondents

The average questionnaire scores were calculated based on a standard score of 100, referring to Table 1.

Table 1. Average values of frequency distribution

| No | Learning Motivation Questionnaire Score (%) | Assessment Category |
|---|---|---|
| 1 | 81 – 100 | Very Good |
| 2 | 61 – 80 | Good |
| 3 | 41 – 60 | Fair |
| 4 | 21 – 40 | Poor |
| 5 | 0 – 20 | Very Poor |

(Source: Arikunto et al., 2023)

Qualitative data from observations and interviews were analyzed descriptively to strengthen the findings from the questionnaire data.

## RESULTS AND DISCUSSION

To examine the effectiveness of IMLO Biology interactive learning media in enhancing students' learning motivation, the researcher conducted an effectiveness test by distributing a learning motivation questionnaire to students after using the IMLO Biology media. Additionally, observations and interviews were conducted. The level of students' learning motivation using IMLO Biology interactive learning media, as obtained from the questionnaire, is presented in Table 2. The student motivation questionnaire was administered as a separate instrument from the observations, immediately after the IMLO Biology media was implemented. It consisted of 12 clearly written statements measuring aspects of learning motivation based on the ARCS model, including Attention, Relevance, Confidence, and Satisfaction. The questionnaire used a dichotomous "Yes/No" scale, and the responses were converted into numerical scores to categorize students' motivation levels as Poor, Fair, Good, or Very Good. Each "Yes" response was scored as 1 and "No" as 0, with the total score indicating the overall motivation level for each student. The questionnaire was designed to provide quantitative data reflecting students' motivation during the learning process. The summary of students' learning motivation questionnaire results is shown in Table 2.

Table 2. Summary of students' learning motivation questionnaire results

| No | Statement | Yes | No | Percentage Yes | Percentage No | Category |
|---|---|---|---|---|---|---|
| 1 | I enjoy studying biology | 45 | 15 | 75 | 25 | Good |
| 2 | Biology contains abstract material but is interesting to learn | 35 | 25 | 58.33 | 4.67 | Fair |
| 3 | I find biology material difficult to understand if I only read the book | 58 | 2 | 96.66 | 3.34 | Very Good |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | I am more interested in learning biology through IMLO Biology video slides than reading a book | 58 | 2 | 96.66 | 3.34 | Very Good |
| 5 | The IMLO Biology video slides help me understand the biology material | 59 | 1 | 98.33 | 1.67 | Very Good |
| 6 | The lighting quality in the IMLO Biology video slides is adequate | 50 | 10 | 83.33 | 16.67 | Very Good |
| 7 | The language used in the IMLO Biology video slides is clear and easy to understand | 58 | 2 | 96.66 | 3.34 | Very Good |
| 8 | The images in the IMLO Biology video slides are clearly visible | 58 | 2 | 96.66 | 3.34 | Very Good |
| 9 | The audio volume in the IMLO Biology video slides is clear | 50 | 10 | 83.33 | 16.67 | Very Good |
| 10 | The information in the IMLO Biology video slides helps me realize that biology material is closely related to daily life | 50 | 10 | 83.33 | 16.67 | Very Good |
| 11 | The IMLO Biology video slides facilitate my independent problem-solving | 58 | 2 | 96.66 | 3.34 | Very Good |
| 12 | I am more motivated to study independently at home with the IMLO Biology video slides | 59 | 1 | 99.33 | 1.67 | Very Good |
| | **Average** | | | **88.69** | **11.31** | **Very Good** |

Based on Table 2, overall students' learning motivation toward the use of IMLO Biology media falls into the "Very Good" category, with an average percentage of 88.69%. This indicates that IMLO Biology media has a strong positive effect on enhancing students' learning motivation in biology, which aligns with the findings of Jainiyah et al., (2023) and Hasnawiyah and Maslena (2024), who reported that interactive learning media significantly increase students' affective and behavioral engagement. It is also consistent with Kamilah et al., (2023), and Julianti et al., (2022) which showed that multimedia instructional designs enhance both interest and persistence in science topics. In contrast, some studies indicate that multimedia alone is not always sufficient (Arisanti & Adnan, 2021) and related work found only modest gains in motivation when interactive media were implemented without aligned pedagogical strategies or sufficient teacher facilitation.

These differences suggest that the effectiveness of IMLO Biology media depends not only on its intrinsic design quality, but also on how it is integrated into instruction (teacher guidance, activity structure, and assessment). Therefore, while our results show a strong direct effect of IMLO Biology on student motivation, future implementations should emphasize teacher training and instructional alignment to maximize and sustain those motivational benefits, who reported that the presence of interactive learning media positively influences students' motivation. These results suggest that well-designed media can play an important role in engaging students and supporting the learning process.

For item number 1, 75% of students indicated that they enjoy studying biology, which falls into the "Good" category. This result suggests that most students have an initial interest in biology, although 25% of students are less inclined toward the subject. This finding aligns with the opinion of Noviatami et al., (2024), who stated that interest is one of the main factors in fostering learning motivation.

Furthermore, for items 3 to 12, the majority of students responded "Yes," with percentages exceeding 80% and even approaching 100%. For instance, for item number 5, 98.33% of students stated that IMLO Biology media made it easier for them to understand biology material. Similarly, for item number 12, nearly all students (99.33%) reported being more enthusiastic about learning independently at home with the use

of this media. These results indicate that IMLO Biology media is effective in supporting student-centered learning, as emphasized in the Merdeka Curriculum (Lince, 2022).

In addition, the quality aspects of the media also received a "Very Good" rating. A total of 83.33% of students evaluated that the lighting and audio in the media were adequate, while 96.66% stated that the language and visuals in the video slides were clear and easy to understand. This reinforces the view of Setiyawan, (2021), who emphasized that the clarity of visual and audio displays is an important factor in the successful use of learning media.

Thus, it can be concluded that the use of IMLO Biology media not only enhances students' understanding of the material but also fosters higher learning motivation. This finding aligns with Kocasaraç and Mlotshwa (2024) learning motivation theory, which emphasizes that engaging, clear, and student-appropriate media can increase interest and enthusiasm for learning. In this study, the interactive features of IMLO Biology, such as visual simulations, quizzes, and immediate feedback, directly supported students' attention, relevance, confidence, and satisfaction, consistent with Keller's ARCS model of motivation. For example, students reported higher engagement and willingness to complete biology tasks, demonstrating that the media's design effectively stimulated intrinsic motivation, as proposed by Deci and Ryan's Self-Determination Theory. These results suggest that integrating well-designed interactive media can concretely enhance both cognitive understanding and motivational aspects of learning.

These results are further supported by interviews conducted purposively with selected students and teachers, providing additional qualitative evidence of the positive influence of IMLO Biology media on student motivation. The interviews revealed that teachers in upper secondary schools across South Rantau District considered IMLO Biology media to be relevant to the learning needs within the Merdeka Curriculum. One teacher stated, "This media helps me present abstract concepts in a way that is easier for students to understand". This statement illustrates that IMLO Biology is capable of supporting project- and exploration-based learning in accordance with the principles of the Merdeka Curriculum. These findings are consistent with the study by Hutabarat et al., (2022), which emphasizes that project-based learning is one of the key approaches in the Merdeka Curriculum, promoting student-centered activities that increase engagement and motivation.

Most teachers reported that the use of IMLO Biology media led to an increase in students' learning motivation**.** They observed that students were more enthusiastic, engaged actively in the classroom, and asked more questions during the learning process. Students also expressed positive perceptions of the media. They stated that IMLO Biology made learning more interesting, helped them understand complex biological concepts, and motivated them to study independently at home.

This was reflected in a teacher's comment: "Students are usually passive, but when using IMLO media, they appear more enthusiastic and confident in expressing their opinions". These findings are in line with learning motivation theory, which emphasizes the importance of using innovative media. The presence of interactive media can enhance students' learning motivation (Husna & Supriyadi, 2023).

Although effective, some teachers still faced technical challenges, such as limited laboratory facilities and available time. For instance, one teacher remarked, "Sometimes students have to take turns using the media because the number of units is limited". These challenges indicate the need for adequate facilities and infrastructure to optimize the

implementation of IMLO. This is consistent with the findings of previous research (Nurharirah & Effane, 2022), which states that schools lacking adequate facilities and infrastructure can hinder the teaching and learning process, and similarly, the findings of previous research (Nauraida & Triwiyanto, 2024), which states that a lack of facilities and infrastructure in schools can reduce students' learning motivation.

Teachers hope for further training to maximize the use of this media. Some also suggested that schools increase the number of devices so that all students can access them simultaneously.

## CONCLUSION

The findings of this study indicate that the IMLO Biology media is highly effective in enhancing students' learning motivation, as reflected in the overall score of 88.69% categorized as Very Good. The positive responses obtained from observations and interviews demonstrate that students became more active, engaged, and confident when interacting with the media, particularly in comprehending abstract biological concepts. Theoretically, these results reinforce the view that interactive multimedia grounded in the ARCS motivation model can significantly strengthen students' intrinsic motivation and learning engagement. Practically, the study provides evidence-based support for teachers and curriculum developers to integrate IMLO Biology media as a digital learning resource aligned with the principles of the Merdeka Curriculum. Future research is recommended to examine the long-term impact of IMLO media on various learning outcomes, such as critical thinking skills and conceptual mastery, as well as to test its applicability in broader educational settings and with larger sample sizes to enhance the generalizability of the findings.

## REFERENCES

Afrilia, L., Neviyarni, Arief, D., & Amini, R. (2022). Efektivitas media pembelajaran berbasis video animasi untuk meningkatkan motivasi belajar peserta didik kelas IV sekolah dasar. *Jurnal Cakrawala Pendas, 8*(3), 710–721. https://doi.org/10.31949/jcp.v8i3.2559

Ambe, B. A., Agbor, C. E., Amalu, M. N., Ngban, A. N., Bekomson, A. N., Etan, M. O., Ephraim, I. E., Asuquo, E. E., Eyo, O. E., & Ogunjimi, J. O. (2024). Electronic media learning technologies and environmental education pedagogy in tertiary institutions in Nigeria. *Social Sciences & Humanities Open, 9*, 100760. https://doi.org/10.1016/j.ssaho.2023.100760

Arikunto, S., Saputra, W. N. E., Khoirunnisa, D. A., & Sawai, R. P. (2023). Development and validation of teacher competency perception scale in Indonesia: The Rasch analysis. *Journal of Professional Teacher Education, 1*(1), 11–21. https://doi.org/10.12928/jprotect.v1i1.491

Arisanti, Y., & Adnan, M. F. (2021). Pengembangan multimedia interaktif berbasis software macromedia flash 8 untuk meningkatkan motivasi dan hasil belajar peserta didik sekolah dasar. *Jurnal Basicedu, 5*(4), 2122–2132. https://doi.org/10.31004/basicedu.v5i4.930

Grace, D. (2014). Intersectionality-informed mixed methods research: A primer. *Health Sociology Review, 23*(4), 478–490.

Gümüş, S., & Okur, M. R. (2010). Using multimedia objects in online learning environment. *Procedia - Social and Behavioral Sciences, 2*(2), 5157–5161. https://doi.org/10.1016/j.sbspro.2010.03.838

Habibah, R., Salsabila, U. H., Lestari, W. M., Andaresta, O., & Yulianingsih, D. (2020). Pemanfaatan teknologi media pembelajaran di masa pandemi Covid-19. *Trapsila: Jurnal Pendidikan Dasar, 2*(2), 1-13. https://doi.org/10.30742/tpd.v2i2.1070

Haryana, M. R. A., Warsono, S., Achjari, D., & Nahartyo, E. (2022). Virtual reality learning media with innovative learning materials to enhance individual learning outcomes based on cognitive load theory. *The International Journal of Management Education, 20*(3), 100657. https://doi.org/10.1016/j.ijme.2022.100657

Hasnawiyah, H., & Maslena, M. (2024). Dampak penggunaan media pembelajaran interaktif terhadap prestasi belajar sains siswa. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian, 10*(2), 167–172. https://doi.org/10.26740/jrpd.v10n2.p167-172

Husna, K., & Supriyadi, S. (2023). Peranan manajemen media pembelajaran untuk meningkatkan motivasi belajar siswa. *AL-MIKRAJ Jurnal Studi Islam dan Humaniora, 4*(1), 981–990. https://doi.org/10.37680/almikraj.v4i1.4273

Hutabarat, H., Elindra, R., Harahap, M. S., & Pendidikan, F. (2022). Analisis penerapan kurikulum Merdeka Belajar di SMA Negeri Sekota Padangsidimpuan. *Jurnal MathEdu Mathematic Education Journal, 5*(3), 58–69. https://doi.org/10.37081/mathedu.v5i3.3962

Jainiyah, J., Fahrudin, F., Ismiasih, I., & Ulfah, M. (2023). Peranan guru dalam meningkatkan motivasi belajar siswa. *Jurnal Multidisiplin Indonesia, 2*(6), 1304–1309. https://doi.org/10.58344/jmi.v2i6.284

Julianti, C., Harahap, R. D., & Safitri, I. (2022). The use of multimedia in biology learning: MAS Subulussalam Sumberjo student responses. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan, 4*(3), 306. https://doi.org/10.20527/bino.v4i3.13812

Kamilah, S. F., Wahyuni, I., & Ratnasari, D. (2023). Pengembangan media pembelajaran interaktif berbasis website menggunakan Google Sites pada materi ekosistem kelas X SMA. *Biodik, 9*(3), 176–181. https://doi.org/10.22437/biodik.v9i3.25523

Keller, J. M., & Suzuki, K. (1987). Use of the ARCS motivation model in courseware design. In D. H. Jonassen (Ed.), *Instructional designs for microcomputer courseware* (pp. 401–434). Lawrence Erlbaum.

Kocasaraç, H., & Mlotshwa, H. F. (2024). Comparison of virtual reality perceptions of teachers working in Türkiye and South Africa. *South African Journal of Education, 44*(3), 1–10. https://doi.org/10.15700/saje.v44n3a2390

Li, Y.-K., Xiao, C.-L., Ren, H., Li, W.-R., Guo, Z., & Luo, J.-Q. (2025). Unraveling the effectiveness of new media teaching strategies in pharmacology education under different educational backgrounds: Insights from 6,447 students. *European Journal of Pharmacology, 989,* 177255. https://doi.org/10.1016/j.ejphar.2025.177255

Lince, L. (2022). Implementasi kurikulum Merdeka untuk meningkatkan motivasi belajar pada sekolah menengah kejuruan pusat keunggulan. *Prosiding Seminar Nasional Fakultas Tarbiyah dan Ilmu Keguruan IAIM Sinjai, 1*(1), 38–49. https://doi.org/10.47435/sentikjar.v1i0.829

Martoredjo, N. T. (2023). Social media as a learning tool in the digital age: A review. *Procedia Computer Science, 227*, 534–539. https://doi.org/10.1016/j.procs.2023.10.555

Nauraida, I. D., & Triwiyanto, T. (2024). Hambatan dalam implementasi manajemen sarana dan prasarana di sekolah: Sebuah meta-analisis. *BERSATU: Jurnal Pendidikan Bhinneka Tunggal Ika, 2*(4), 35–45. https://doi.org/10.51903/bersatu.v2i4.448

Nissa, A. D. A., Toyib, M., Sutarni, S., Akip, E., Kadir, S., Ahmad, & Solikin, A. (2021). Development of learning media using Android-based Articulate Storyline software for teaching algebra in junior high school. *J. Phys.: Conf. Ser.* 1720 012011. https://doi.org/10.1088/1742-6596/1720/1/012011

Noviatami, Putri., Lestari, H., Fitriani, Y & Lestari, R. F. (2024). Meningkatkan Minat Belajar Siswa Pada Mata Pelajaran Bahasa Indonesia Menggunakan Aplikasi Quizizz di kelas XI SMA IT Izzuddin Palembang. *Journal Sains Student Research, 2*, 55–62. https://doi.org/10.61722/jssr.v2i2.1169

Nurharirah, S., & Effane, A. (2022). Hambatan dan solusi dalam manajemen sarana dan prasarana pendidikan. *Karimah Tauhid, 1*(2), 220. https://doi.org/10.30997/karimahtauhid.v1i2.7709

Rahmadayanti, D. & Hartoyo, A. (2022). Potret kurikulum merdeka, wujud merdeka belajar di sekolah dasar. *Jurnal Basicedu, 6*(4), 5877–5889. https://doi.org/10.31004/basicedu.v6i4.3431

Setiyawan, H. (2021). Pemanfaatan media audio visual dan media gambar pada siswa kelas V. *Jurnal Prakarsa Paedagogia, 3*(2). https://doi.org/10.24176/jpp.v3i2.5874

Tulyakul, S., Werathummo, A., Khun-Inkeree, H., Rotsuwan, W., & Reudhabibadh, R. (2022). The motivation and teaching strategies in pre-service physical education teachers. *Journal of Education and Learning (EduLearn), 16*(2), 164–171. https://doi.org/10.11591/edulearn.v16i2.20396