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Development and Validation of Lecture Maker-Based Biology Learning Media on Excretory System Material

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Abstract

Biology learning, particularly the abstract topic of the Excretory System, demands high visualization, which is often lacking in conventional media. This Research and Development (R&D) study, utilizing the ADDIE model and focusing on the validation stage, aimed to develop and assess the academic feasibility of a digital learning medium based on Lecture Maker software. Following a thorough analysis of curriculum objectives and student needs, the product was designed to integrate text, images, animations, and videos to present complex physiological concepts. Product validity was rigorously assessed by both subject matter and media experts, yielding an average total score of 4.15, which categorizes the medium as "Valid". Detailed results showed high scores for design/structure (4.19) and language (4.50), while the content/substance aspect received the lowest rating (*Sufficiently Valid*, 3.76), indicating specific areas for revision concerning the simplification of scientific language and enhanced visualization. In conclusion, the developed *Lecture Maker*-based medium is declared academically feasible and valid, fulfilling the criteria for quality educational media and is ready to be utilized in the subsequent implementation stage to assess its practical effectiveness on student learning outcomes

Keywords: *Lecture Maker, Learning Media, Excretory System, Validation, ADDIE Model*

A. Introduction

Biology learning is characterized by complex concepts, many of which require visualization of abstract structures and processes that are difficult for students to understand through conventional text-based explanations. This challenge increasingly demands that teachers provide media capable of supporting conceptual clarity and student engagement. In line with this need, digital transformation in education has driven significant changes in how teachers design and deliver learning, including in biology classrooms. Advances in information and communication technology have opened opportunities for the development of digital learning media that not only convey information but also facilitate deeper conceptual understanding through visualization, interactivity, and structured presentation. A number of international studies confirm that the integration of digital technology in learning improves learning quality and student engagement (Bond et al., 2020), while digital media is considered relevant in 21st-century learning as it supports higher-order thinking skills, creativity, and digital literacy (Chafshah et al., 2024).

Biology learning has complex and abstract characteristics, especially in topics involving physiological structures and processes that cannot be observed directly. The excretory system, for example, requires high visualization and concept integration skills because it covers the relationship between organ structures, working mechanisms, and physiological functions in the body. Previous research shows that students often have difficulty understanding the material on the excretory system because learning tends to be textual and lacks adequate visual representation (Anggriani et al., 2022). This condition is in line with the findings Dewi et al. (2023) which confirms that the limitations of learning media capable of visualizing biological processes are one of the factors hindering the formation of students' comprehensive conceptual understanding.

In line with these challenges, research on the development of biology learning media in recent years has shown a trend toward the use of interactive multimedia as a means of supporting conceptual learning. Various studies have reported the development of animation-based media, e-learning, and mobile learning designed to help students understand abstract biological concepts (Nurlaela et al., 2024). However, as shown by Yonanda et al. (2024) most of these studies focus more on the results of media implementation in learning, while studies on the quality of development products in the early stages, particularly media validity testing, have not received adequate attention.

Lecture Maker is a learning media development software that allows the integration of text, images, animations, and videos into a single structured interactive media. Several national studies report that Lecture Maker-based learning media has the potential to support learning because it is easy for teachers to develop and offers flexibility in presenting material (Y. S. Dewi et al., 2021). However, studies that specifically address the development of biology learning media based on Lecture Maker are still relatively limited, especially those that focus primarily on the product development process and validity testing. (Salam & Agustina, 2022).

Based on a review of the state of the art in biology learning media development research, a research gap is identified in the limited studies that develop Lecture Maker-based biology learning media using a systematic R&D approach with a clear focus on product validity testing. In R&D, expert validation is a crucial step to ensure feasibility in terms of content, learning design, and language before media implementation (Putri et al., 2021), and early-stage validity assurance is essential to build a strong development foundation (Sugiyono, 2020). This research is therefore urgent as unvalidated media may contain conceptual and design weaknesses that reduce instructional suitability (Armanda et al., 2025). Thus, development must be accompanied by structured expert validation procedures, as emphasized by Marisa et al. (2023) who noted that validation by media and material experts is key to ensuring that technology-based media is academically feasible before being used in learning.

Based on the above description, this study aims to develop Lecture Maker-based biology learning media on the topic of the excretory system and to analyze its validity based on assessments from subject matter and media experts. In addition to producing a valid digital learning product, this research is expected to contribute scientifically by enriching development studies on biology learning media, particularly those that emphasize early-stage expert validation as an essential component in R&D procedures. The findings are also intended to strengthen the practical implementation of multimedia-based learning in biology classrooms, providing a validated model that can be used as a reference for future media development and learning practice.

B. Literature Review

This study uses the Cognitive Theory of Multimedia Learning (CTML) as its main theoretical basis, because CTML explains the process of meaningful learning from a combination of words and images, which is the core of the Lecture Maker media developed. This theory is based on the assumptions of Dual Channel, Limited Working Memory Capacity, and Active Processing (Selecting, Organizing, and Integrating/SOI). Compliance with CTML principles is an absolute requirement, especially for complex Excretory System material, to ensure that the media successfully minimizes extraneous cognitive load and facilitates generative processing. Therefore, the expert validity test conducted is a crucial step to ensure that the media meets effective multimedia design standards (Mayer, 2024).

The subject of the Excretory System in Biology is characterized by a high level of abstraction, which requires the development of interactive media as a solution. This study uses a Research and Development (R&D) model with a focus on product validity testing as a key prerequisite. This approach is reinforced by research on the development of interactive media based on video tutorials in vocational schools, which also involves media experts and subject matter experts as validators. The results of the study show that the developed media are declared valid based on expert assessment and are in line with user needs. The similarity of procedures and findings directly confirms that the expert validation procedure is a crucial stage and an academic prerequisite to ensure that the developed Lecture Maker media are suitable for use before being implemented widely (Bustanil et al., 2019).

The relevance of Lecture Maker software as an interactive media development platform is reinforced by studies in other subjects, especially those that use similar development models. Research on the development of learning media using Lecture Maker software in Basic Programming subjects at vocational schools has produced very supportive findings. Expert validation results show that the media is considered highly valid (with a score of 3.59) and suitable for use as a learning aid (Fitriati & Ghazali, 2018).

C. Methodology

1. Research Design

This study is a research and development study that aims to produce biology learning media based on Lecture Maker that is valid in terms of content and design. The development model used is the ADDIE model, which in this study is limited to the development stage, particularly in the product validation process. This limitation of the development stage was done because the focus of the study was directed at testing the feasibility of learning media before it was implemented in classroom learning activities.

2. Research Stage

a. Analysis Stage

The analysis stage aims to identify the needs for developing learning media. The analysis is conducted through a review of the curriculum, the characteristics of biology material, and learning needs related to the use of digital media. At this stage, the suitability of Lecture Maker as a means of presenting biology material that allows for the integration of text, images, animations, and structured learning evaluation is also analyzed.

b. Design Stage

The design stage aims to develop a preliminary design for the learning media. Activities at this stage include developing the material structure, designing the media presentation flow, selecting visual displays, and designing validation instruments. The media design is tailored to the learning competencies and characteristics of the students so that the media developed has a systematic and easy-to-understand presentation flow.

c. Development Stage

The development stage is the stage of realizing the design into a Lecture Maker-based learning media product. The developed media is then validated by expert validators to assess the feasibility of the product. Validation is carried out by subject matter experts and media experts using a validation sheet that was prepared during the design stage. The aspects assessed include the suitability of the material, clarity of concepts, quality of media display, integration of media components, and the suitability of the media for use in biology learning. The results of the validation are used as a basis for revising the media until a valid product is obtained.

3. Subject Validation

The subjects in this study were expert validators consisting of biology experts and learning media experts. Validators were selected based on their scientific background and experience relevant to the field of learning media development and biology.

4. Instruments

The instrument used in this study was a learning media validation sheet. The validation sheet was designed in the form of a rating scale covering aspects of content suitability, presentation suitability, language suitability, and media display suitability. This instrument was used to obtain quantitative and qualitative data related to the validity level of the learning media developed.

5. Technique of Data Analysis

The validation data was analyzed using quantitative descriptive methods. The scores obtained from each validator were calculated to determine the validity level of the learning media. The analysis results were used to categorize the media into highly valid, valid, moderately valid, or less valid criteria. In addition, suggestions and input from validators were used as a basis for product revision so that the resulting learning media met the eligibility criteria.

D. Findings and Discussion

1. Findings

The Research Results section presents the main empirical findings obtained from the development stage, specifically the results of the needs analysis (Analysis) and the validity test results(Develop).

a. Results of the Analysis and Design Stage

1) Needs Analysis: One of the proposed solutions is to develop Lecture Maker-based learning media to maximize the teaching and learning process outside of class hours and face-to-face meetings, so that students can learn without being limited by space and time.
2) Student Analysis: Students in Grade XI IPA 1 are aged 16-17 years old, which according to Piaget's Theory is in the formal operational stage, where they are capable of abstract thinking. This condition is very suitable for teaching them with computer-assisted learning media.
3) Content analysis: a step taken to gain a deeper understanding of the learning material to be presented in the learning process, namely the concepts that students will learn in Biology learning media, which will later be developed using a hierarchical approach.
4) Objective analysis: the final step of analysis conducted to determine the learning objectives to be achieved in the learning material. The details of the learning objectives are as follows.

Table 1. Analysis of learning indicators and objectives

Indicator	Learning Objectives
1. Distinguishing between excretion, secretion, and defecation	Students are able to distinguish between the meanings of excretion, secretion, and defecation.
2. Identify the structure, function, and processes of the human excretory system.	1. List the organs and their excretory products in the human excretory system. 2. Describe the structure and function of the kidneys as excretory organs. 3. Describe the structure and function of the liver as an excretory organ. 4. Describe the structure and function of the lungs as excretory organs. 5. Describe the structure and function of the skin as an excretory organ.
3. Relating the structure, function, and processes of the human excretory system	1. Explain the process of urine formation. 2. Explain the process of CO2 excretion. 3. Explain the process of sweat formation. 4. Explain the process of bile fluid formation.

4.	Identifying abnormalities that occur in the excretory system	1. Identifying diseases/disorders of the kidneys. 2. Identifying diseases/disorders of the liver. 3. Identifying diseases/disorders of the lungs. 4. Identifying diseases/disorders of the skin.
5.	Providing examples of technologies to address abnormalities that occur in the excretory system	Explaining examples of the use of technology that can overcome the effects of abnormalities that occur in the excretory system
6.	Comparing the structure, function, and processes of the excretory system in animals	1. Identify the structure and function of earthworm excretory organs. 2. Identify the structure and function of grasshopper excretory organs. 3. Identify the structure and function of fish excretory organs. 4. Identify the structure and function of the excretory system of frogs. 5. Identify the structure and function of the excretory system of lizards. 6. Identify the structure and function of the excretory system of birds.

5) Product Design: The media was developed by presenting text, images, videos, and animations. Explanations of the structure of the sensory organs used text and images, while videos were used to explain the sensory process. The types of questions used were multiple choice and short answer questions.

b. Results of the Analysis and Design Stage

Product validity testing was conducted during the Development Stage by expert validators (biologists and media experts). The average validation results for Lecture Maker-based learning media are presented in Table 2:

Table 2. Average validation results of lecture makers based on assessment indicators

No.	Criteria	Validator		Total score	Description
		1	2		
1	Content/substance	4,13	3,38	3,76	Sufficiently Valid
2	Design/structure	4,63	3,75	4,19	Valid
3	Language	5,00	4,00	4,50	Valid
Average		4,59	3,71	**4,15**	**Valid**

Overall, the Lecture Maker-based learning media developed received an average total score of 4.15, which is categorized as "Valid." These results confirm that the media produced has met the validity criteria and is suitable for use in biology learning activities.

2. Discussion

The discussion focuses on the interpretation of the validation results (Table 2) and relates them to supporting literature to explain the feasibility of the developed product.

a. Interpretation of Validity Based on Aspects

1) Validity of Content/Substance Aspects

The content/substance aspect obtained the lowest score among the three assessed components, indicating that material quality still requires refinement at the conceptual level. In R&D classification, the category "Sufficiently Valid" implies that the media can be used with revisions, particularly in ensuring conceptual depth, clarity of explanation, and alignment with biological principles. This finding suggests that although the material is generally accurate, the presentation of excretory system concepts may not yet optimally support students' cognitive processing. The excretory system involves abstract physiological mechanisms that demand high-quality

visualization and precise terminology, and insufficient clarity can increase cognitive load and hinder meaningful understanding. Therefore, this result emphasizes the importance of content enrichment and simplification of scientific language during the revision stage to strengthen conceptual coherence before classroom implementation.

The excretory system material requires a high level of visualization because it covers abstract physiological mechanisms. Other studies show that the lack of adequate visual representation is the main cause of learning difficulties in this material (Anggriani et al., 2022). Subject matter experts focus on material suitability, conceptual clarity, and depth of coverage. Although categorized as Sufficiently Valid, these findings prompted improvements focused on simplifying scientific language and adding visualizations. The media revision process after validation is very important, where revisions are made to refine the product according to the validators' suggestions so that the media is ready for implementation. (Montela et al., 2024).

2) Design/Structure Aspects

The design and structure of the media received an average score of 4.19 in the "Valid" category. This score indicates that the media has met the standards of suitability in terms of appearance and presentation flow.

The high score in this aspect is supported by the use of Lecture Maker software, which allows the integration of text, images, animations, and videos into a single structured interactive media. In the context of visual design, the validator provided specific feedback regarding the consistency of font usage. This feedback is very important because visual design principles, including typography or font types, play a vital role in creating visual hierarchy and ensuring effective readability (Hakim & Hidayani, 2021). An optimal design, including appropriate contrast and good layout, will reduce the cognitive load on users and facilitate efficient information absorption. Therefore, minor improvements to design consistency identified by the validator are an important step toward achieving optimal product quality.

3) Language Aspects

The language aspect received the highest score, namely 4.50, with a rating of "Valid." Language validity ensures that information is presented clearly, effectively, and in a way that is easy for students to understand. Despite receiving the highest score, feedback from validators emphasized that some non-standard language was still found. This highlights the importance of careful editing. In interactive media development research, validation by language experts is a mandatory step to ensure that there is no ambiguity or inappropriate use of terms that could interfere with students' understanding of the material concepts. (Dahliaa et al., 2022). In the context of biology learning especially topics such as the excretory system that contain specific anatomical and physiological terminology minor linguistic inaccuracies can trigger misconceptions or hinder conceptual integration, since students' unfamiliarity with scientific terms and weak language literacy may impede comprehension of material content. Research in Indonesian education contexts shows that students' understanding of scientific language and literacy directly affects their ability to communicate and internalize scientific concepts (Aniyah et al., 2024), and that students' familiarity with science and biology terms varies and can affect their conceptual grasp (Aprilia et al., 2023). Therefore, even though the media has been categorized as valid, refinement of language use remains necessary to prevent conceptual misunderstanding and to strengthen the communicative clarity of the presented material.

b. Overall Validity and Implications for Media Development

This study successfully produced a Lecture Maker-based learning medium that was declared valid after undergoing validation by subject matter experts and media experts. These results reinforce the urgency of this study, which is to respond to the need for biology learning media that has been tested for feasibility.

These findings are in line with the results of other technology-based media development studies that also met the feasibility criteria (valid or highly feasible) after undergoing a validation procedure by experts (Dahliaa et al., 2022 ; Setiawan et al., 2025). This reinforces the conclusion that the R&D development procedure, including the ADDIE model used, is effective in producing quality media. Thus, the Lecture Maker-based learning media on the excretory system developed is declared academically feasible and ready to be followed up at the field trial stage (Implementation).

E. Conclusion

This study aimed to develop Lecture Maker-based biology learning media on the excretory system and examine its validity through expert judgment. The results show that the product meets the validity criteria overall, with content rated sufficiently valid and both design and language rated valid, indicating that the media is feasible for use with minor revisions. These findings demonstrate that structured validation in early R&D stages plays an essential role in ensuring conceptual clarity, visual presentation quality, and linguistic accuracy in biology learning media. This research contributes to the literature by providing a validated early-stage prototype that may serve as a reference model for future development of interactive biology media. While the product has been declared valid, further research is required to evaluate its practicality and effectiveness in real classroom implementation.

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F. References

Anggriani, S. P., Jufri, A. W., Syukur, A., & Setiadi, D. (2022). Pengembangan Materi Ajar Berbasis Video Kreatif Biologi pada Materi Sistem Ekskresi untuk Siswa Kelas XI SMA. *Jurnal Ilmiah Profesi Pendidikan*, *7*(1), 123–129. https://doi.org/https://doi.org/10.29303/jipp.v7i1.430

Aniyah, A. A. N., Siahaan, F. I., Nurkhofifah, I., & Febriana, I. (2024). Analisis Keanekaragaman Biologi dalam Konteks Penggunaan Bahasa Indonesia : Upaya Peningkatan Literasi Sains di Kalangan Pelajar. *Jurnal Biologi*, *1*(4), 1–7. https://doi.org/https://journal.pubmedia.id/index.php/biology/article/view/2591

Aprilia, S. L., Pranata, O. D., & Haryanto, T. (2023). ANALISIS TINGKAT FAMILIARITAS SISWA TERHADAP. *BIOEDUSAINS:Jurnal Pendidikan Biologi Dan Sains*, *6*(2), 580–591. https://doi.org/10.31539/bioedusains.v6i2.8216

Armanda, N., Permatasari, S., & Zuhafizh. (2025). VALIDITAS PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS DIGITAL POWIC PADA MATERI TEKS DESKRIPSI SEKOLAH MENENGAH PERTAMA. *Jurnal Basataka(JBT)*, *8*(1). https://doi.org/https://doi.org/10.36277/basataka.v8i1.590

Bond, M., Buntins, K., Bedenlier, S., Zawacki-richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education : a systematic evidence map. *International Jurnal of Educational Technology in Higher Education*, *17*(2). https://doi.org/https://doi.org/10.1186/s41239-019-0176-8

Bustanil, M. S., Asrowi, & Ardianto, D. T. (2019). Jurnal Teknologi Pendidikan Pengembangan Media Pembelajaran Interaktif Berbasis Video Tutorial Di Sekolah Menengah Kejuruan. *Jurnal Teknologi Pendidikan*, *21*(2), 119–134.

Chafshah, N. A., Pahrudin, A., Jatmiko, A., & Koderi. (2024). INTEGRASI TEKNOLOGI DAN MEDIA DALAM PEMBELAJARAN ABAD 21 DI PENDIDIKAN DASAR. *Jurnal Ilmiah Pendidikan Dasar*, *9*(4). https://doi.org/https://doi.org/10.23969/jp.v9i04.19887

Dahliaa, Riantob, S., & Yuhermanc. (2022). *PENGEMBANGAN MEDIA PEMBELAJARAN INTERAKTIF BERBASIS LECTORA INSPIRE DALAM MENINGKATKAN HASIL BELAJAR SISWA KELAS X LINTAS MINAT PADA MATA PELAJARAN GEOGRAFI DI SMAN 1 PADANG SAGO*. *3*(2), 106–113. https://doi.org/10.34312/jgej.v3i2.16098

Dewi, S. P., Anggraini, L., & Tibrani, M. M. (2023). The use of instructional media in the excretory system: a study on the perspectives of teachers and eleventh grade students of senior high school. *Biosfer: Jurnal Pendidikan Biologi*, *16*(2), 286–295. https://doi.org/10.21009/biosferjpb.27901

Dewi, Y. S., Amrina, A., Mudinillah, A., Rezi, M., & Gazali, G. (2021). Development of Arabic Learning Media with Lecture Maker Application. *Proceedings of the 6th Batusangkar International Conference*. https://doi.org/http://dx.doi.org/10.4108/eai.11-10-2021.2319505

Fitriati, I., & Ghazali, M. (2018). Pengembangan Media Pembelajaran Menggunakan Software Lecture Maker pada Mata Pelajaran Pemrograman Dasar di SMK Negeri 9 Bima. *Jurnal Pendidikan MIPA, 8*(1), 77–86.

Hakim, A. R., & Hidayani, R. (2021). PENGEMBANGAN MEDIA PEMBELAJARAN INTERAKTIF

BERBASIS LECTORA INSPIRE DALAM MENINGKATKAN HASIL BELAJAR SISWA KELAS X LINTAS MINAT PADA MATA PELAJARAN GEOGRAFI DI SMAN 1 PADANG SAGO. *WaPFi (Wahana Pendidikan Fisika)*, *6*(1).

Marisa, A., Putri, A. D., Agustiani, R., & Zahra, A. (2023). Proses Validasi Pengembangan Media Pembelajaran dengan iSpring 11. *Wahana Matematika Dan Sains: Jurnal Matematika, Sains, Dan Pembelajarannya, 17*(2), 45–55. https://doi.org/https://doi.org/10.23887/wms.v17i2.75130

Mayer, R. E. (2024). The Past , Present , and Future of the Cognitive Theory of Multimedia Learning. *Educational Psychology Review*, *36*(1). https://doi.org/10.1007/s10648-023-09842-1

Montela, W., Neltje, T. M., & Decky, W. K. (2024). Pengembangan Media Pembelajaran Berbasis Video Pembelajaran. *J-CEKI : Jurnal CendekiaIlmiah*, *3*(4).

Nurlaela, D., Santhi, D. D. Y., & Ardiasih, L. S. (2024). THE EFFECTIVENESS OF ANDROID-BASED INTERACTIVE MULTIMEDIA IN IMPROVING JUNIOR HIGH SCHOOL STUDENTS ENGLISH LEARNING OUTCOMES AND LEARNING MOTIVATION. *Journal of English Education and Applied Linguistics*, *13*(1). https://doi.org/10.24127/pj.v13i1.8925

Putri, D. A. H., Ardi, Alberida, H., & Yogica, R. (2021). Validitas Media Pembelajaran E-LearningBerbasis Edmodo pada Materi Sel untuk Peserta Didik Kelas XI SMA/MA. *Journal for Lesson and Learning Studies*, *4*(2), 230–237. https://doi.org/https://doi.org/10.23887/jlls.v4i2.34443

Salam, M. Y., & Agustina, A. (2022). DEVELOPMENT OF ARABIC VOCABULARY LEARNING USING LECTURE MAKER AT SDIT MASJID RAYA FLOOR BATU. *Jurnal Teknologi Pendidikan*, *11*(1). https://doi.org/https://doi.org/10.32832/tek.pend.v11i1.6080

Setiawan, gde I., Ambaradewi, N. L. G., & Dharmadewi, A. A. I. M. (2025). PENGEMBANGAN MEDIA PEMBELAJARAN DENGAN APLIKASI POWTOON PADA MATA KULIAH BIOTEKNOLOGI. *Jurnal Edukasi Matematika Dan Sains*, *14*(1). https://doi.org/https://doi.org/10.59672/emasains.v14i1.4563

Sugiyono. (2020). *Metode penelitian kuantitatif, kualitatif dan R&D*. Alfabeta.

Yonanda, D. A., Islahudin, I., Ramadhani, F. A., Febriyanto, B., Saputra, D., Yulianti, Y., & Nurhidayat, E. (2024). Improving Motivation and Learning Outcomes of Elementary School Students with Multimedia-Based Interactive Media. *Profesi Pendidikan Dasar*, *11*(3), 197–210. https://doi.org/10.23917/ppd.11i3.5761