

Development of Interactive Media on the Human Digestive System (Si CerMa) Based on PBL to Improve Learning Outcomes in Science for Grade 5 Primary School Students

Ria Juhariyani, Sarwanto, Roemintoyo

Universitas Sebelas Maret
riajuhariyani@student.uns.ac.id

Article History

accepted 1/8/2025

approved 1/9/2025

published 1/10/2025

Abstract

The digitisation of education, such as the Chromebook procurement programme by the Ministry of Education, Culture, Research and Technology, is an important indicator of the readiness of educational units to face the challenges of the 21st century. However, the lack of innovation among teachers in utilising this technology has resulted in low student learning outcomes. Therefore, this study aims to review the literature on the development of interactive media on the human digestive system (Si CerMa) to improve the learning outcomes of fifth-grade elementary school students in science. The research method used in this study is the Systematic Literature Review (SLR) method. Data collection was carried out by documenting articles published in the last five years. A total of 20 accredited national and international journal articles obtained from Google Scholar, SINTA, and DOAJ were used in this study. The results showed that Si CerMa media, which contains learning outcomes and objectives, materials and videos, student worksheets based on Problem-Based Learning (PBL), evaluations, and educational games, can significantly improve student learning outcomes. The conclusion of this study is that the interactive Si CerMa media is effective and suitable for use in primary school learning to improve learning outcomes, with the main features being developer profiles, learning outcomes and objectives, material on the human digestive system and its functions, evaluation, and edugames.

Keywords: Interactive Media, Human Digestive System, Learning Achievement, IPAS

Abstrak

Digitalisasi pendidikan, seperti program pengadaan *chromebook* oleh Kemdikbudristek, menjadi indikator penting kesiapan satuan pendidikan menghadapi tantangan abad ke-21, namun kurangnya inovasi guru dalam pemanfaatan teknologi ini menyebabkan rendahnya hasil belajar siswa. Untuk itu, penelitian ini bertujuan untuk mengkaji literatur pengembangan media interaktif materi sistem pencernaan manusia (Si CerMa) untuk meningkatkan hasil belajar IPAS siswa kelas V SD. Metode penelitian yang digunakan dalam penelitian ini adalah metode SLR (*Systematic Literature Review*). Pengumpulan data dilakukan dengan mendokumentasikan artikel dalam kurun waktu 5 tahun terakhir. Artikel yang digunakan dalam penelitian ini sebanyak 20 artikel jurnal nasional dan internasional yang terakreditasi yang diperoleh dari *Google Scholar*, *SINTA* dan *DOAJ*. Hasil penelitian menunjukkan bahwa Media Si CerMa yang berisi capaian dan tujuan pembelajaran, materi serta video, lembar kerja peserta didik berbasis *Problem Based Learning* (PBL), evaluasi, dan game edukasi secara signifikan dapat meningkatkan hasil belajar siswa. Simpulan dari penelitian ini adalah media interaktif Si CerMa efektif dan layak digunakan dalam pembelajaran sekolah dasar untuk meningkatkan hasil belajar, dengan fitur utama berupa profil pengembang, capaian dan tujuan pembelajaran, materi organ pencernaan manusia dan fungsinya, evaluasi, dan edugame.

Kata kunci: Media Interaktif, Sistem Pencernaan Manusia, Prestasi Belajar, IPAS



INTRODUCTION

The development of information and communication technology (ICT) in the era of the Industrial Revolution 4.0 has brought major changes to various sectors, including education. In Indonesia, the acceleration of education digitalization has become a strategic agenda for the government to respond to global challenges while improving the quality of learning. This situation presents an opportunity for the education sector to optimally integrate technology into the teaching and learning process. However, the implementation of these technologies in the field still faces various challenges, ranging from low digital literacy among teachers, limited technical training, to the scarcity of contextual and interactive learning materials. One subject matter that faces significant challenges is Natural and Social Sciences (IPAS). Natural and Social Sciences (IPAS) contains a lot of content, including material on the human organ system. Mentions the reasons for the importance of students learning IPAS, its usefulness for life and work in the future, as part of the nation's culture, can train children's critical thinking skills, and has educational values that have the potential to shape students' personalities as a whole. IPAS material is abstract, complex, and requires strong visualization, often making it difficult for students to understand if presented only through conventional methods such as lectures or Student Worksheets (LKS). This situation results in low learning outcomes and minimal student involvement in learning. The success of IPAS learning can be measured by the achievement of all the goals that have been set, which is reflected in the IPAS learning outcomes.

The hope from this research is to provide a positive impact, namely aimed at improving student learning outcomes, especially in learning IPAS material on the human digestive system, not only that, the researcher hopes that teachers will always develop themselves to create interactive and fun learning media.

However, in reality, the problem is that there are still schools where the level of achievement of IPAS learning outcomes is low because they have not met the established completion standards. Based on findings during observations, the causes of low cognitive domain learning outcomes include a) in teaching, teachers only use student textbooks even though each school has received Chromebook and LCD assistance, b) teachers prefer to explain material using the lecture method only because it is considered not to require time to prepare it, c) teachers have not facilitated direct interaction with students, d) learning is monotonous so student involvement becomes passive, students appear bored and less focused in class, students have difficulty understanding the material.

Then from the average data of the summative assessment for the even semester of the 2024/2025 academic year where some students have not reached the KKTP. Based on these problems, teachers must use learning media to motivate students to participate in learning. Learning media is an intermediary for everything that can be used to convey messages and stimulate student learning processes (Aqib, 2019). Learning media influences the effectiveness of learning (Rajagukguk et al., 2021). The learning media in question is in the form of interactive multimedia. Interactive multimedia is a combination of various media elements such as text, graphics, photography, animation, video, and audio presented as a unified whole in educational media (Samodra et al., 2019). Interactive multimedia has several unique features that

are not found in other media, including: (a) interactivity that facilitates feedback, (b) freedom to determine learning topics, and (c) systematic control over the learning process. This is further supported by research conducted by Topano et al. (2021), which states that interactive multimedia is very effective as a learning tool for improving students' cognitive learning outcomes. In addition, this media can be categorized as valid by validators and has received very positive responses from students. Various national studies have demonstrated the effectiveness of interactive media in improving learning outcomes. Astuti et al. (2020) developed Android-based interactive multimedia that was proven to improve students' science learning outcomes. On the other hand, research by Ozmen (2021) shows that AR-based interactive media and digital games can significantly improve students' understanding of digestive system material.

From the explanation above, it can be concluded that there are still research gaps in the form of the need for interactive media that can bridge the gap between the availability of technology and its utilization in the learning process, which specifically integrates PBL in the human digestive system material in grade V elementary school. Therefore, the development of PBL-based Si CerMa interactive media is very urgent and relevant. This media is designed independently without dependence on a specific platform, enriched with visual animations, audio, and text, and equipped with problem-based LKPD that is contextual to students' daily lives. The presence of Si CerMa is expected to answer three needs at once: (1) helping students understand the abstract concepts of the digestive system in a more concrete and interesting way, and (2) encouraging critical thinking and problem-solving skills through the application of PBL, 3) and optimizing the use of facilities and infrastructure at school.

Based on the problems above and this research aims to develop interactive media for the human digestive system which will later be tested for feasibility and effectiveness whether it can improve the IPAS learning outcomes of grade V elementary school students, the researcher will conduct development research entitled "Development of Problem Based Learning-Based Interactive Media for the Human Digestive System to Improve IPAS Learning Outcomes of Grade V Elementary School Students."

METHOD

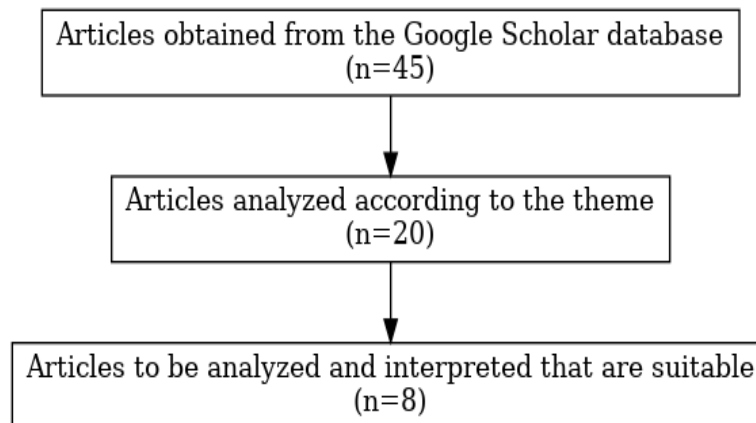
This study employs the Systematic Literature Review (SLR) approach, a method that systematically reviews and synthesizes scientific articles, guided by the guidelines of Kitchenham and Charters (2007) and the PRISMA framework (Moher et al., 2009). The research procedure consists of three main stages: planning, implementation, and reporting, depicted through the PRISMA flow chart. This approach was chosen because it provides a structured process for identifying, evaluating, and synthesizing relevant research evidence.

The object of this research is scientific articles discussing the development of interactive learning media on the human digestive system for fifth-grade elementary school students. Inclusion criteria include articles published between 2020–2025, having undergone a peer-reviewed process, and directly addressing interactive learning media in the context of elementary schools. Meanwhile, exclusion criteria include research not published in reputable journals, articles outside that year range, and research not relevant to the learning context of elementary school students.

Articles were collected between March–July 2025 through several databases, including Google Scholar, SINTA, DOAJ, and indexed national and international journals. The selection of this period aims to ensure the timeliness and relevance of the data analyzed.

The data collection technique used is document analysis, with stages of identification, screening, eligibility checking, and determining the articles to be included for further analysis. This selection process follows the four-step PRISMA flow, so only articles that meet the criteria are analyzed in this study.

Figure 1. Flowchart at the Systematic Literature Review stage



For the data analysis technique, thematic analysis based on the Braun and Clarke framework (2006) is used. This analysis includes the stages of understanding the data, coding, developing themes, reviewing, and refining themes to find patterns and trends in the development of interactive media. Thematic analysis was chosen because it is flexible and widely used in educational research to interpret qualitative data systematically.

RESULTS AND DISCUSSION

In the initial stage of this study, the researchers selected research articles to find literature published in several scientific journals. This study involved analysing and summarising the findings from articles found in the Google Scholar, Sinta, Scopus, and DOAJ databases related to learning about the human digestive system. To begin the data search process, the researcher read the abstracts of each literature to evaluate their relevance to the research topic. Based on this search, twenty (20) related articles were identified, as listed in Table 1, which contains a list of studies on the learning of the human digestive system in primary schools from 2020 to 2025.

Table 1. Results of the analyzed article

Researchers and Year	Journal Title	Conclusion
Ashhabi, A. (2025)	Development of GENSI CERIA Interactive Learning Media (Genially Human Digestive System) for Grade V Students of SDN 02 Kedungjati, Grobogan Regency. https://jppipa.unram.ac.id/index.php/jcar/article/view/11189	This study developed GENSI CERIA interactive media based on Genially and Wordwall using the ADDIE model. Expert validation showed a very valid category (94.1% and

		93.3%). Trials improved student scores (59.75 to 90) with an N-Gain of 0.72 (high), so the media was declared feasible and effective.
Adhana, H. M., & Andriani, A. E. (2024)	Development of Interactive Multimedia based on Problem-Based Learning to Improve IPAS Learning Outcomes. Jurnal Penelitian Pendidikan IPA, 10(9), 6737-6745. https://doi.org/10.29303/jppipa.v10i9.7588	This development research with the Borg & Gall model aims to develop, test the feasibility, and effectiveness of PBL-based interactive multimedia in Grade V elementary school. The results of expert, teacher, and student validation showed a very feasible category (92.5%–98.75%) and effectively improved IPAS learning outcomes.
Fitria, Y., Iswari, L., Amini, R., Kristiawan, M., & Kiswanto, A. (2022)	Interactive Multimedia on Learning Achievement of the Digestive System in Elementary School. International Journal of Elementary Education, 6(4), 542-550. https://doi.org/10.23887/ijee.v6i4.53357	The aim of this research is to create a valid interactive multimedia (MI) product for 5th-grade science classes in elementary schools using the ADDIE development model. The research results show positive results: (1) valid with an average score of 4.7 with very valid qualifications (2) practical with an average score of 89.03 with very practical qualifications and (3) effective in increasing student learning success at an average class of 94.8 (95% successful). The conclusion of this research is that the Digestive System MI is effective in improving student learning achievement.
Abdul Ghani, A. S., Abdul Rahim, A. F., Yusoff, M. S. B., & Hadie, S. N. H. (2022)	Developing an interactive PBL environment via persuasive gamify elements: A scoping review. Research and Practice in Technology Enhanced Learning, 17(1),	Research shows that gamification (points, badges, leaderboards, challenges) in PBL increases student

21. <https://link.springer.com/article/10.1186/s41039-022-00193-z> motivation, engagement, and persistence. The aim of this interactive media research is to strengthen activeness, aiming to improve learning outcomes and 21st-century skills such as critical thinking, problem-solving, and collaboration.
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|--|---|--|
| Nurhidayati, N., Widiarti, N., & Purwati, P. D. (2024) | Development of Interactive Dispensia Media Based on Problem-Based Learning to Increase Motivation and Learning Outcomes of Human Digestive System in Grade V Students. <i>International Journal of Research and Review</i> , 11(12), 573–582. https://doi.org/10.52403/ijrr.20241262 | Development of Problem-Based Learning-based Interactive Dispensia media on the human digestive system material for Grade V elementary school. The research results show that the media is valid, practical, and effective in increasing student motivation and learning outcomes through an interactive approach. |
| Cong, W., & Ironsi, C. I. (2025) | Integrating mobile learning and problem-based learning in improving students action competence in problem-solving and critical thinking skills. https://www.nature.com/articles/s41599-025-05397-4#citeas | Research shows that PBL-based mobile learning improves problem-solving skills, critical thinking, and cognitive learning outcomes. Students are more flexible in accessing material, actively ask questions, discuss, and independently seek solutions, thus supporting the development of higher-order thinking competencies. |
| Budakoglu, I. İ., Coşkun, O., & Ozeke, V. (2023). | e-PBL with multimedia animations: a design-based research. <i>BMC Medical Education</i> , 23(1), 338. https://link.springer.com/article/10.1186/s12909-023-04298-x | Penelitian e-PBL with multimedia animations: a design-based research mengembangkan model Problem-Based Learning berbasis elektronik yang dipadukan dengan animasi multimedia. Hasilnya menunjukkan desain e-PBL ini meningkatkan motivasi, |

pemahaman konsep, kolaborasi, serta keterampilan berpikir kritis siswa secara signifikan dalam pembelajaran.

Sahronih, S.,
Purwanto, A., &
Sumantri, M. S. (2020)

The effect of use interactive learning media environment-based and learning motivation on science learning outcomes. *International Journal for Educational and Vocational Studies*, 2(3), 1-5. <https://doi.org/10.29103/ijevs.v2i3.2429>

This research shows that the use of environment-based interactive learning media has a positive effect on motivation and science learning outcomes. Students are more motivated, active, and obtain significant improvements in learning achievements compared to conventional learning, so the media is declared effective.

Various previous studies have shown consistent findings that interactive media based on specific learning models are effective in increasing both student motivation and learning outcomes. Ashhabi (2025), for example, developed GENSI CERIA based on Genially and Wordwall with the ADDIE model, which proved to be valid and significantly increased student scores. This finding is in line with Mayer's multimedia learning theory, which explains that the integration of text, images, and interactivity strengthens information processing. Similar results were shown by Adhana and Andriani (2024), who developed multimedia based on Problem-Based Learning (PBL) with the Borg & Gall model. The high validity of the product and the increase in learning outcomes are consistent with the constructivism principle that students learn more effectively when actively solving problems.

In line with this, Fitria et al. (2022) developed Android-based interactive multimedia through ADDIE. The product was rated valid, practical, and effective in improving learning outcomes. This reinforces instructional design theory, which emphasizes the importance of systematic development and usability principles to ensure learning effectiveness. Meanwhile, Abdul Ghani et al. (2022), through a literature review, confirmed the role of gamification elements such as points, badges, and leaderboards in increasing student motivation and persistence. This finding supports Self-Determination Theory (SDT) that fulfilling the needs of autonomy, competence, and relatedness encourages intrinsic motivation.

Other research conducted by Nurhidayati, Widiarti, and Purwati (2024) also showed that PBL-based Dispensia interactive media was able to increase student motivation and learning outcomes. This reinforces the theory of learning motivation, which explains that there is a positive relationship between intrinsic motivation and the achievement of learning outcomes. This finding is reinforced by research by Cong and Ironsi (2025), which shows that the integration of mobile learning with PBL can improve critical thinking and problem-solving skills. The accessibility of mobile technology

expands learning space and time, in line with social cognitive theory which emphasizes the importance of social interaction in learning.

In addition, Budakoglu, Coşkun, and Ozeke (2023) developed an e-PBL model enriched with multimedia animation through design-based research. The research results showed an increase in motivation, conceptual understanding, and collaboration, in accordance with multimedia learning theory and social constructivism. This research confirms that animation visualization in PBL can strengthen the understanding of abstract concepts. Furthermore, Sahronih, Purwanto, and Sumantri (2020) found that environment-based interactive media increased student motivation and science learning outcomes. This is consistent with Contextual Learning Theory, which emphasizes the importance of linking material with students' real experiences to make learning more meaningful.

Overall, these eight studies provide strong evidence that the development of interactive media based on PBL, gamification, mobile learning, and environmental context can increase student motivation, engagement, and learning outcomes. These findings not only support multimedia learning, PBL, SDT, and contextual learning theories, but also demonstrate the relevance of technology integration in supporting 21st-century skills. Thus, the existing empirical evidence strengthens the argument that the development of interactive media such as Si CerMa has great potential to improve the quality of IPAS learning on human digestive system material in elementary schools.

CONCLUSION

A systematic review of 8 scientific articles shows that interactive media plays a crucial role in improving the quality of integrated IPAS (Natural and Social Sciences) learning, particularly on the topic of the human digestive system for fifth-grade elementary school students. Interactive media formats—such as multimedia, AR/VR, and educational games—have been proven to enhance students' conceptual understanding, motivation, and learning outcomes. Most media development processes employ systematic models such as ADDIE and Research and Development (R&D), emphasizing learner-centered and needs-based approaches.

Based on these findings, the "Si CerMa" interactive media is recommended as an adaptive and contextual learning solution aligned with the digital transformation agenda in education. Designed with technological integration and grounded in constructivist principles, this media holds great potential to increase student engagement and support the achievement of 21st-century competencies, including critical thinking, collaboration, and digital literacy. Therefore, it is recommended that teachers and media developers continue to innovate in integrating relevant technologies and learning approaches to create more meaningful learning experiences. Furthermore, further research is needed to test the effectiveness of Si CerMa media on a larger scale and in diverse contexts.

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