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Trends and Characteristics of Problem Based Learning Media Development at Junior High School Level: A Literature Review

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ABSTRACT

The rapid development of information technology has encouraged the birth of various innovations in education, including innovations in learning media used to support the learning process. The application of the Problem Based Learning (PBL) learning model in learning media is one innovation that seeks to improve the quality of learning that facilitates the improvement of 21st century skills. This study adopts a descriptive literature study approach with the main objective of mapping and analyzing the development trends of PBL-based learning media at the junior high school level published during the 2022-2026 period. The data collection procedure involved a systematic search on Google Scholar and Mendeley Web using various relevant keywords followed by selection of articles that met the previously established inclusion criteria, resulting in the selection of 15 articles. The results of the study show: (1) The most widely developed media are modules, LKPD, and interactive multimedia; (2) The majority use ADDIE and 4D as development models; (3) The focus of most development is learning outcomes and critical thinking; and (4) Biology subjects are the areas most developed in PBL-based media. These findings indicate that the development of PBL-based learning media at the junior high school level continues to evolve and has the potential to become an innovation that can improve the quality of the learning process.

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INTRODUCTION

The development of information technology has had a far-reaching impact and influence that cannot be ignored in various sectors of life. Technology in education offers ease of access, and knowledge is no longer limited by space, time, or specific groups. This has the potential to expand learning opportunities for all levels of society. This situation has driven a transformation in the education system, impacting the curriculum, learning methods, and the roles of educators and students in the learning process (Simanjutak et al., 2026). A shift in the role of teachers has occurred, with teachers now acting as facilitators in the learning process, creating a learning environment that supports independent learning (Azzahra et al., 2025). This shift in role is crucial because learning in the digital era no longer focuses solely on mastering material. This condition is related to the industrial revolution, which encourages schools to prepare students not only with memorization skills but also with the 4C skills (critical thinking, communication, collaboration, and creativity), which are core competencies of 21st-century education to foster academic, professional, and social success (Stanikzai, 2023).

This transformation demonstrates the need for education to introduce innovations that adapt to changes brought about by developments in information technology, ensuring their relevance and ability to meet students' competency needs. To support this, the learning process must not rely solely on technology as a means of obtaining information, but must also be innovative in delivering information that encourages active student engagement. (Krismitha Saroro & Setyo Wardhani, 2024) stated that the use of innovative learning media can increase motivation, understanding, and collaboration, creating a more interactive and relevant experience. Therefore, innovative learning media integrated with student-centered learning models is needed, allowing technology to act as a facilitator in the development of 21st-century competencies.

Learning media is a tool for conveying information from teachers to students, thus creating an effective learning process to increase student motivation and engagement to achieve optimal learning outcomes and skill (Krismitha Saroro & Setyo Wardhani, 2024). One relevant learning model to be integrated into learning media is Problem-Based Learning (PBL), where this model considers students as active subjects who learn through solving contextual problems. Problem Based Learning (PBL) is a learning approach that places students in complex problem-solving situations so that they are encouraged to store knowledge in real contexts, identify what needs to be learned, and develop reflective and flexible thinking skills in making decisions and solving problems (Hmelo-Silver, 2004). PBL is based on constructivism theory where students do not only receive information, but also actively participate in creating their own knowledge and understanding (Salsabila & Muqowim, 2024). Constructivism views that knowledge is actively constructed through experience and direct student involvement, thereby encouraging higher-order thinking skills through contextual problem solving (Koçoğlu & Kanadlı, 2025). There are four main principles of Problem-Based Learning (PBL): constructive, collaborative, contextual, and independent,

enabling students to actively build and reconstruct prior knowledge with new information, collaborate, and evaluate their own learning as an effort to develop responsibility for learning and foster the character of lifelong learners (Jaganathan et al., 2024). Therefore, the integration of learning media and PBL can be a potential strategy to support meaningful learning oriented toward the development of 21st-century skills.

In line with the increasing understanding of problem-based learning innovations, research on the development of PBL-based learning media has also shown progress. Various PBL-based media innovations have been developed, such as interactive multimedia, modules, worksheets (LKPD), learning applications, and web-based digital media. These media developments aim to increase the effectiveness of PBL implementation while addressing the evolving needs of digital learning. Numerous studies also demonstrate that PBL-based media can improve learning outcomes (Waruwu et al., 2022), critical thinking skills (Yulanda et al., 2023), and students' science process skills (Safitri et al., 2022).

Although the number of studies on the development of PBL-based learning media continues to increase, most research still focuses on developing specific products and testing their effectiveness. Studies that comprehensively map research trends, particularly at the junior high school level, are still relatively limited. Therefore, this study offers a mapping of the trends and characteristics of PBL-based learning media development at the junior high school level for the period 2022-2026. This study not only describes the number of studies but also analyzes their characteristics based on the type of media developed, development orientation, development model, subjects, and learning materials implemented in PBL-based learning media. This information can provide an overview of the direction of research development and identify potential future research opportunities.

METHOD

This research uses a literature review approach focusing on scientific articles as the primary source. This method was chosen to provide an overview and qualitative synthesis of trends and characteristics in the development of PBL-based science learning media at the junior high school level. The literature search was conducted through academic databases such as Google Scholar and Mendeley Web. The search strategy used a combination of keywords, including: "PBL-based learning media," "science media development for junior high school," "problem-based learning media development," and "PBL media for science," using both Indonesian and English. The publications used as sources were scientific articles published between 2022 and 2026 to identify developments and changes in trends occurring in the current period.

Following the keyword search, a selection process was conducted by identifying the title, abstract, and content of the articles. The inclusion criteria applied included: (1) articles discussing the development of learning media integrated with the PBL model; (2) research subjects were junior high school students or equivalent; (3) articles were available in full text and written in Indonesian or English; and (4) articles containing information on media types, development models, and trial results. Articles

that only discussed PBL without media development, or those conducted at other educational levels, were excluded from the study. Based on these stages, 15 articles were selected to then identify patterns, trends, and characteristics of media development. The results of the synthesis are presented in the form of a narrative description that outlines the tendencies of media types, dominant development models, and characteristics of PBL-based learning media developed at the junior high school level.

FINDINGS AND DISCUSSION

Developing learning media by integrating learning models is an innovation in education. Integrating learning media with specific learning models is a form of educational innovation that can improve the effectiveness and quality of the learning process by providing a more meaningful learning experience tailored to the characteristics and needs of students (Syafi'i & Rapi, 2022). One learning model widely integrated in learning media development is Problem-Based Learning (PBL). PBL is widely chosen in learning media development because it is oriented towards solving real-world problems, allowing learning media to be designed in a more contextual and interactive manner. Media integration with PBL provides opportunities for students to investigate, analyze information, and develop solutions to given problems, thereby enhancing problem-solving skills (Yasin & Novaliyosi, 2023). Furthermore, the learning syntax in PBL can be integrated with various digital media features, such as problem presentation, provision of learning resources, discussions, and learning evaluations, enabling learning media to function not only as a means of conveying information but also as a facilitator of the systematic problem-solving process. Learning media integrated with PBL syntax can function as a guide (scaffolding) that helps students follow each stage of problem solving systematically, both independently and collaboratively (Septia & Jasiah, 2025).

The article identification and selection process was conducted using predetermined inclusion and exclusion criteria, resulting in 15 articles eligible for analysis. These articles were published between 2022 and 2026 and focused on the development of Problem-Based Learning (PBL)-based learning media at the junior high school level. This number demonstrates the increasing attention of researchers to the integration of the PBL model with various learning media to support student-centered learning. This aligns with the needs of 21st-century learning, which demands critical thinking, problem-solving, collaboration, and technological literacy. Furthermore, the development of digital technology has encouraged the emergence of various learning media innovations that can accommodate the syntax of Problem-Based Learning. The analysis was conducted based on the year of publication, the type of media developed, the development model used, the subjects, and the development orientation targeted by the research.

Types of Media Developed

The analysis of 15 selected articles revealed that modules and worksheets (LKPD) were the most dominant media category, with five studies developing modules (Marinda et al., 2023; Ningrum et al., 2024; Turahmah et al., 2022; Waruwu et al., 2022; Yanti, 2023) and four studies developing LKPD (Khovivah et al., 2022; Safitri et al., 2022; Sari et al., 2022; Yulanda et al., 2023). Furthermore, two studies developed interactive multimedia (Hakim et al., 2023; Kindangen et al., 2023) and the other media types included virtual labs (Noris et al., 2022), Android-based media (Elci et al., 2021), Google sites (Damayanti et al., 2024), and comics (Jatiningsih & Dewi, N, 2022). Details of the types of media developed based on PBL are presented in Figure 1.

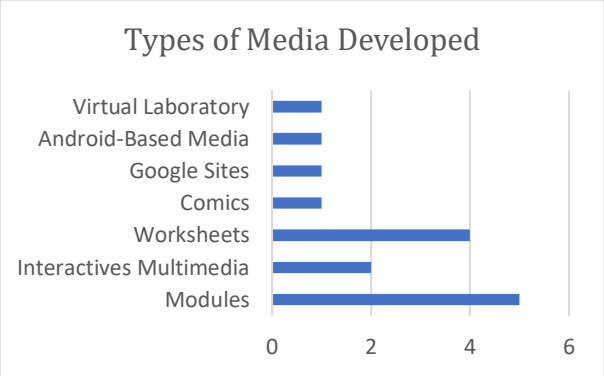

Figure 1. Types of Media Developed

The media developed tends to integrate text, images, audio, animation, and evaluation within a single learning platform, thereby supporting problem-solving activities, a key characteristic of PBL. This phenomenon demonstrates a shift from conventional media to digital media, which seeks to utilize technology to create a more engaging, flexible, interactive, and contextual learning environment for students. The dominance of modules as the most widely developed media indicates that researchers view them as effective in supporting the implementation of Problem-Based Learning (PBL). This is because modules are considered capable of presenting material systematically, coherently, and structured, making it easier for students to remember and understand the concepts learned, including complex material (Turahmah et al., 2022; Yanti, 2023). In addition to functioning as a learning resource, modules are also designed to facilitate independent learning so that students can learn according to their own abilities and pace (Ningrum et al., 2024; Turahmah et al., 2022). These characteristics align with the principles of PBL, which place students at the center of learning and encourage them to actively construct knowledge through inquiry and problem-solving. Along with the development of educational technology, modules have developed into electronic modules (e-modules) that combine various multimedia elements, such as images, videos, animations, simulations, and interactive quizzes, so that they are able to present material in a more varied, interactive, easily accessible, and effective way to support the implementation of PBL and improve the quality of learning (Marinda et al., 2023).

Type of Development Model Used

The results show that the ADDIE model is the most widely used development model in research on Problem Based Learning (PBL)-based learning media development at the junior high school level, amounting to 40%. Furthermore, the 4D model is used in 27% of studies, followed by the Borg & Gall model at 20%, while 13% of studies use other development models. Details of the development models used in PBL-based media development are presented in Figure 2.

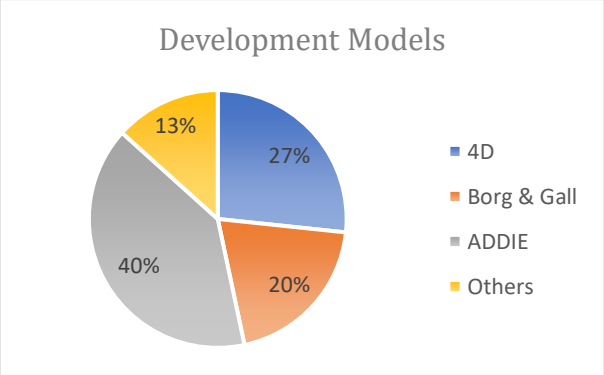

Figure 2. Type of Development Model Used

The dominance of the ADDIE model in research on the development of learning media based on Problem Based Learning indicates that this model is considered capable of producing systematic and quality learning products. The ADDIE model is designed as a development model that is oriented towards solving problems through the creation of products that suit user needs (Ningrum et al., 2024). This model consists of five stages, namely analysis, design, development, implementation, and evaluation, which are carried out sequentially and interrelated (Branch, 2009). This logical sequence of stages makes it easier for researchers to design, develop, implement, and evaluate learning media systematically. Each product is developed based on a needs analysis so that the resulting media is relevant to the characteristics of students and learning objectives. In addition, the evaluation and review process at each stage allows developers to continuously revise and refine products before being implemented widely (Sari et al., 2022). These characteristics make the ADDIE model flexible to be applied to various types of learning media, including modules, LKPD, and interactive multimedia, so it is not surprising that this model is the main choice in research on the development of PBL-based learning media.

Development Orientation

Based on development orientation, most research focuses on improving students' learning outcomes and critical thinking. In addition to learning outcomes and critical thinking, several studies have also developed PBL-based media oriented towards improving learning independence, scientific literacy, Higher Order Thinking Skills (HOTS), learning motivation, and science process skills. Details of the PBL-based media development orientation are presented in Figure 3.

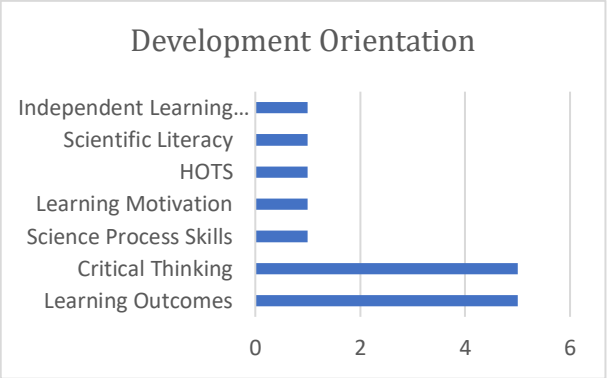

Figure 3. Development Orientation

These findings indicate that the development of PBL-based media is not only directed at improving cognitive aspects, but also at developing higher-order thinking skills, which are the main objectives of 21st-century learning. Learning outcomes are the most widely used indicator because they can describe the effectiveness of the media developed in helping students achieve learning objectives. Meanwhile, critical thinking skills are a dominant focus because they are one of the main competencies of the 21st century (Trilling & Fadel, 2009). This competency can be developed through the application of PBL, which requires them to identify problems, analyze information, evaluate various alternative solutions, and make decisions based on evidence, thus training critical thinking skills (Hmelo-Silver, 2004; Savery, 2006). The emergence of these various orientations indicates that the development of PBL-based media is starting to be directed to support the development of 21st-century competencies more comprehensively.

Subjects and Materials

The study results show that the development of PBL-based learning media is most often applied to biology subjects at 67%, while science materials are 20%, and physics 13%. Details of the subjects developed using PBL-based media are presented in Figure 4.

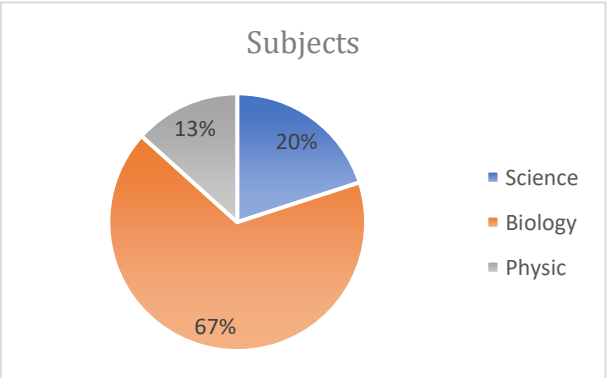

Figure 3. Development Orientation

The characteristics of biology subjects that require problem-solving skills, conceptual understanding, and relationships between concepts make PBL an appropriate approach to be implemented. These characteristics are in line with the principles of PBL which use authentic problems as a starting point for learning to encourage students to develop critical thinking, problem-solving, and decision-making skills (Hmelo-Silver, 2004; Savery, 2006). Many concepts in biology are abstract and involve processes that cannot be observed directly, so they require the help of learning media for visual representation to be more concrete by displaying processes and relationships between concepts that are difficult to understand if only explained through text (Ferdig et al., 2015). This makes the development of PBL-based media in biology subjects more common than other subjects. Based on the results of the study, the materials that are often found to be developed in PBL-based media are the excretory system, respiratory system, digestive system, and circulatory system where these materials include complex materials involving organ structures, physiological mechanisms, and their relationship to health disorders that are often encountered in everyday life. These findings indicate that the selection of subjects and materials in the development of PBL-based media is influenced by the suitability of the characteristics of the material with the PBL syntax.

CONCLUSION

This study provides an overview of the trends and characteristics of Problem-Based Learning (PBL)-based learning media development at the junior high school level, based on a literature review of articles published between 2020 and 2026. The study results indicate that PBL-based media development is dominated by modules, student worksheets (LKPD), and interactive multimedia. In terms of development models, the ADDIE and 4D models are the most widely used because they have systematic, logical, and flexible stages in producing learning media tailored to students' needs. Based on development orientation, most research focuses on improving learning outcomes and critical thinking skills, although some studies also develop media oriented toward independent learning, scientific literacy, Higher Order Thinking Skills (HOTS), learning motivation, and science process skills. Furthermore, Biology is the subject with the most PBL-based media development, particularly in topics such as the excretory system, respiratory system, digestive system, and circulatory system, which have contextual characteristics and are suitable for implementation through problem-based learning.

These findings indicate that the development of PBL-based learning media at the junior high school level continues to evolve as an effort to support student-centered learning and the development of 21st-century skills. However, this study also identifies remaining research opportunities, namely the development of more innovative technology-based media, expanding the application of PBL to other subjects, and developing media oriented towards other competencies, such as creativity, collaboration, communication, digital literacy, and self-regulated learning. Therefore, the results of this study are expected to serve as a reference for researchers and

education practitioners in determining the direction of PBL-based learning media development in the future.

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