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The Effectiveness of the Problem-Based Learning Model Assisted by Learning Videos in Improving Science Literacy Skills and Students' Cognitive Learning Outcomes

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Abstract

This study examines the effectiveness of the Problem-Based Learning (PBL) model supported by video learning in improving science literacy skills and students' cognitive learning outcomes. A qualitative approach is used to gain a deep understanding of student's experiences and perceptions during the problem-based learning process with video media. Data collection techniques include in-depth interviews with students and teachers, direct observation during classroom learning, and documentation of learning materials and student discussion results. Data analysis was carried out through the stages of data collection, categorization, and interpretation of findings to reveal the influence of the use of video in PBL on student motivation, engagement, and understanding of science concepts. The results show that the integration of video as a learning medium in the PBL model not only increases students' motivation and active engagement but also enriches a more authentic and interactive learning experience. These findings confirm that the video-assisted PBL model improves students' science literacy skills and cognitive learning outcomes. This study ends with a conclusion that affirms the benefits of using video in PBL and provides practical recommendations for teachers and suggestions for further research in developing learning media and PBL methods.

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INTRODUCTION

Problem-based learning (PBL) is a learning approach model that places problem-solving as the center of all learning activities (Aprilliani Nurdin et al., 2025). This model is designed to encourage students to be active in finding solutions to the problems they face so they do not just rely on passive conventional teaching. PBL requires students to think critically, analyze information, and develop problem-solving skills independently and collaboratively (Ulfah Hidayati et al., 2024). The main characteristics of PBL are utilizing real or contextual problems as a starting point for learning, emphasizing active student involvement as the center of learning activities, and implementing an interactive and reflective process. With this approach, PBL not only targets mastery of the material but also encourages the development of higher-level thinking skills and forms a positive attitude towards the learning process. (Yasa et al., 2020).

Many empirical research results support the superiority of PBL in science learning. This model has been proven to be able to strengthen students' critical thinking abilities and problem-solving skills, two main aspects of scientific literacy. Apart from that, implementing PBL is also effective in increasing learning motivation because students feel more actively participating in learning activities directly related to everyday life situations. (Ansya & Salsabilla, 2025). Meta-analysis studies show that the application of PBL in science learning has a significant positive impact on students' academic and cognitive learning outcomes, including increasing conceptual understanding, research skills, and learning independence. Furthermore, PBL also contributes to improving students' social status and self-esteem through empowering and meaningful learning experiences (Kristo Sembiring et al., 2024).

On the other hand, learning videos as an educational medium has become an innovation that plays a significant role in supporting the modern learning process. Learning videos combine visual and audio elements, conveying material more interestingly and easily understood by students. The use of videos in learning can improve memory and understanding of concepts because information is presented multisensory, thereby facilitating more effective cognitive processes. Apart from that, videos can also provide a more authentic and realistic learning context, which is difficult to achieve through conventional text or lecture media (Dan et al., 2023). Thus, learning videos not only function as tools to assist in delivering material but also as learning resources that enrich students' learning experiences (Agustia et al., 2024).

Integrating learning videos in the PBL model is a promising approach for increasing learning effectiveness. Videos can be used as problem triggers that are more lively and interesting, thereby increasing student motivation and involvement in the learning process. The use of video as a problem trigger in PBL allows students to observe situations or phenomena directly, which then becomes the basis for discussion and exploration of solutions. This helps students develop better observation and reasoning skills and makes it easier to integrate various information obtained during the learning process (Gunawan et al., 2023). Apart from that, videos also facilitate more meaningful interactions and discussions between students and between students and teachers so that the learning process becomes more dynamic and collaborative.

Some qualitative research shows that students and facilitators prefer the use of videos over text-based cases in PBL. Videos make learning cases more authentic and easy to remember and increase students' ability to connect theory with real practice (Windy Audia et al., 2024). Using videos can also reduce depersonalization problems that often occur in text-based cases so that students feel more emotionally and cognitively involved in learning. Thus, video integration in PBL not only enriches learning resources but also improves the quality of interactions and students' critical thinking processes.

In general, the background of this research stems from the need to design a learning model that is able to increase students' scientific literacy and cognitive achievement effectively. The PBL model combined with video learning media offers a promising alternative by combining the advantages of problem-based learning and educational media innovation. This research aims to examine in depth how this model can strengthen students' motivation, engagement, and understanding in the field of science, as well as reveal students' experiences and views during the learning process. It is hoped that the results of this research can contribute to the development of learning practices that are more adaptive and in line with educational demands in the 21st century.

The demands of 21st-century education have shifted the focus of learning from rote memorization toward the development of higher-order thinking skills, such as critical thinking, problem-solving, creativity, and scientific literacy (Joko Raharjo, 2021a, 2021b; Prayogo et al., 2025). In science education, this shift requires innovative learning models that not only deliver content knowledge but also equip students with the ability to analyze, evaluate, and apply knowledge to real-world problems. One such promising approach is the Problem-Based Learning (PBL) model, which is grounded in constructivist learning theory. According to this theory, learners construct their understanding actively through experiences and reflections, rather than passively absorbing information from teachers (Joko Raharjo, 2021c; Prayogo et al., 2024; Prayogo, Ndori, et al., 2022; Prayogo, Supendi, et al., 2022).

Problem-Based Learning (PBL) places real-life problems at the core of the learning process. It encourages students to actively engage in identifying, investigating, and resolving authentic issues, which promotes independent and collaborative learning (Prayogo, 2024a, 2024b). In contrast to traditional, teacher-centered approaches, PBL fosters student autonomy, motivation, and accountability for learning(Dos Santos & Da Cunha Reis, 2021; Garg et al., 2024; Md Khudzari et al., 2018). It requires students to think critically, analyze information, and propose evidence-based solutions, thereby cultivating essential competencies for lifelong learning. Key characteristics of PBL include the use of contextual problems, learner-centered instruction, inquiry-based learning, and reflective thinking throughout the learning cycle (Allal et al., 2025; Gusenbauer & Gauster, 2025; Javaid et al., 2023; Tram et al., 2024).

A growing body of empirical evidence supports the effectiveness of PBL in enhancing student learning outcomes, particularly in the field of science (Kautonen & Gasparini, 2024; Lünich et al., 2024; Radtke & Rummel, 2025). Several studies have shown that PBL significantly improves critical thinking, conceptual understanding, and problem-solving abilities, which are central components of scientific literacy(Al Shloul et al., 2024; Lee et al., 2024; Park & Kim, 2025; Salih et al., 2025a). Furthermore, PBL has been found to boost student motivation and engagement, especially when the learning content is relevant to real-life situations. Meta-analyses and systematic reviews confirm that PBL contributes positively to students' academic performance, cognitive outcomes, research skills, and self-directed learning (Danny et al., 2020; Mustain & Herlina, 2019; Sirbu & Alibec, 2023; Taberdo et al., 2021).

Despite these advantages, challenges remain in the implementation of PBL, especially regarding the provision of authentic and stimulating problem contexts. Without proper scaffolding, students may struggle to navigate complex problems or feel disengaged from abstract scenarios (Chiong, 2023; Dyagileva et al., 2020; Mickienė & Valionienė, 2021; Nasaruddin & Emad, 2019; Shapo, 2021; Taha, 2018). To address this limitation, the integration of educational videos into PBL settings has emerged as a strategic innovation. Learning videos combine visual, auditory, and narrative elements, making abstract scientific concepts more accessible and engaging. Videos can simulate real-life scenarios that are otherwise difficult to recreate in the classroom, enhancing students' multisensory processing and conceptual retention.

Research indicates that the use of videos in learning environments supports deeper understanding, improves memory retention, and increases student motivation. When integrated into the PBL model, videos can serve as dynamic problem triggers, presenting complex issues in vivid and relatable ways (Bryce et al., 2022; Gaudin & Chaliès, 2015; Pedroso et al., 2023; Styati, 2016). Video-based problems improve students' observation and reasoning skills, while also enriching their cognitive engagement with the subject matter. Moreover, videos help students visualize scientific phenomena, simulate experiments, and connect theoretical knowledge with practical applications. The result is a more meaningful and emotionally engaging learning experience.

Qualitative studies have further shown that both students and facilitators often prefer video-based PBL over traditional text-based case studies. Videos are perceived as more authentic, memorable, and emotionally impactful, allowing students to connect theory with real-life practice (Aljemely, 2024; Jairoun et al., 2024; Martes, 2020; Polatcan, 2023a, 2023b). They also reduce the sense of abstraction and detachment that may arise in purely text-based instruction, fostering deeper empathy and cognitive involvement in the learning process. This is particularly important in developing scientific literacy, which not only includes content knowledge but also entails the ability to interpret, apply, and evaluate scientific information in various contexts.

While a number of studies have explored the benefits of PBL and the role of videos in education separately, there remains a research gap in understanding how video-assisted PBL specifically affects both science literacy skills and students' cognitive learning outcomes in an integrated and measurable way(An et al., 2024; Cisco, 2001; Hardaker & Glenn, 2025; Rachid Ejjami, 2024; Salih et al., 2025b). Most prior research tends to focus on either cognitive gains or motivational aspects in isolation. Very few studies have examined the synergistic effects of combining PBL and multimedia learning on students' performance in science subjects, especially in secondary education contexts in developing countries (Akbulut et al., 2023; Emeanulu & Sayed, 2024; Koroleva et al., 2018; Massoud et al., n.d.; Sharma et al., 2019). Additionally, there is limited exploration of how students experience this integrated learning model—what they find effective, challenging, or transformative.

To address this gap, the present study investigates the effectiveness of the Problem-Based Learning model assisted by learning videos in enhancing science literacy and cognitive learning outcomes. Anchored in constructivist learning theory, this study explores how the strategic use of learning videos within a PBL framework can stimulate deeper learning and critical thinking in science classrooms (Forhad et al., 2023; Guri-Rosenblit, 2009; Lockma & Schirm, 2020). The integration of these two innovations aligns with the demands of 21st-century education, where students are expected to not only understand scientific content but also apply it meaningfully, communicate effectively, and collaborate in solving interdisciplinary problems.

Therefore, this study aims to: Analyze the impact of video-assisted PBL on students' science literacy skills. Examine its influence on students' cognitive learning outcomes. Explore students' experiences and perceptions of the learning process.

By addressing these objectives, the research contributes to the development of adaptive, technology-enhanced pedagogies that foster deep learning and better prepare students for the complexities of modern life and work. The findings are expected to offer practical insights for educators, curriculum designers, and policymakers seeking to enhance the quality of science education through innovative, evidence-based instructional strategies.

METHOD

This research uses a qualitative approach to gain an in-depth understanding of students' experiences, perceptions, and learning processes in implementing the Problem-Based Learning (PBL) model assisted by class V learning videos at SDN Genuk 1. The qualitative approach was chosen because it can explore rich and contextual descriptive data to capture the dynamics of learning interactions, motivation, and cognitive changes experienced by students holistically (Haswenova, 2024). With this approach, researchers can understand how students respond to using video as a learning medium in PBL, as well as how this affects their scientific literacy abilities and cognitive learning outcomes.

The qualitative approach in this research focuses on exploring naturalistic learning phenomena, where data is collected in real classroom learning situations (Aulia Rohmah & Nisak Aulina, 2024). Researchers act as the main instrument in collecting and analyzing data to understand the meaning contained in the experiences of students and teachers during the learning process. This approach allows researchers to capture the nuances and complexities of learning interactions that cannot be measured quantitatively, such as motivation, emotional involvement, and perceptions of video media in PBL.

Data collection was carried out through three main techniques, namely in-depth interviews, participatory observation and documentation. These three techniques complement each other to produce comprehensive and valid data.

In-depth interviews were conducted with students and teachers involved in video-assisted PBL learning. This interview aims to explore their views, experiences, and perceptions regarding the use of video in the problem-based learning process. Interview questions are designed to be open and flexible so that respondents can express opinions and experiences freely and in depth. Interviews also allow researchers to explore unexpected aspects and obtain rich qualitative data regarding students' learning motivation, engagement, and understanding of science concepts.

Observations were carried out directly in the classroom during video-assisted PBL learning. Researchers observed interactions between students and video media, interactions between students, and interactions between students and teachers. This observation aims to actually see how videos are used to trigger problems, how students respond and participate in discussions, and how the learning process takes place as a whole. Field notes were taken in detail to record important events, student reactions, and classroom dynamics relevant to the research focus.

Documentation includes the collection of learning materials used, learning video recordings, group discussion results, as well as student assignments or learning products. This documentation functions as supporting data that strengthens the findings from interviews and observations. With documentation, researchers can triangulate data to increase the validity of research results and obtain a more complete picture of the learning process and outcomes.

Data analysis in this research was carried out systematically through several stages, namely coding, categorization, and interpretation of findings. This process aims to organize raw data into meaningful information that can answer research questions.The next stage is an interpretation of the findings, where the researcher relates the categorization results to the video-assisted PBL learning context and relevant literature. This interpretation aims to provide in-depth meaning to the data, explaining how and why learning videos can influence student motivation, engagement, and cognitive learning outcomes. Researchers also identified supporting and inhibiting factors in implementing the video-assisted PBL model, as well as the practical implications of these findings for the development of learning in schools.

In ensuring the validity and reliability of the data, this research uses triangulation techniques by combining data from interviews, observation and documentation. Researchers also verified the data through a member-checking process with the informants to ensure that the interpretations and conclusions drawn truly reflected their experiences and views. This approach aims to minimize bias and increase confidence in research results.

RESULT AND DISCUSSION

The results of this qualitative research reveal various important findings regarding students' experiences and perceptions while participating in learning using the Problem-Based Learning (PBL) model assisted by learning videos. Analysis of data obtained from in-depth interviews, classroom observations, and documentation shows that the use of video as a learning medium in a PBL context has a significant impact on students' motivation, active involvement, and understanding of science concepts. (Oktavia Crisendy et al., 2025). These findings not only strengthen the effectiveness of the PBL model in general but also confirm the strategic role of instructional videos in enriching the learning process and improving students' cognitive learning outcomes. (Saputri et al., 2021).

Students Experiences and Perceptions of Video-Assisted PBL Learning

Students reported that the use of videos as problem triggers in PBL learning made the learning process more interesting and easier to understand. Videos that present real situations or simulate science problems provide a more concrete picture than text or verbal explanations alone. This makes students feel more emotionally and cognitively involved in learning. One student stated, "With video, I can see firsthand how the problem occurs, so I understand more easily and am interested in finding a solution." This experience shows that videos are able to provide an authentic and relevant learning context, thus significantly increasing students' interest and curiosity (Puja Saraswati & Hidayat, 2025).

Apart from that, students also expressed that videos helped them in developing observation and reasoning skills. Through videos, students can observe important details that are the basis for analyzing problems and formulating solutions. This process encourages students to think critically and reflectively based on the main characteristics of PBL. The teacher who was the facilitator also observed that students were more active in discussing and collaborating when video was used as a learning medium. The discussions that occur become more lively and meaningful because students have the same visual reference to analyze together. This finding is in line with the results of previous research, which shows that videos as problem triggers in PBL can improve the quality of interaction and student involvement in learning (Ketut Wiratni SMP Negeri et al., 2024).

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The following are findings based on four in-depth interviews with students involved in video-assisted PBL:

Student A (Female, Grade 9):

I find it easier to understand the material because I see the problem firsthand. When there was a scene of a laboratory accident in the video, I immediately knew what went wrong and how to avoid it."

Interpretation: Videos enhanced her ability to identify safety issues and increased situational awareness.

Student B (Male, Grade 8):

" The discussion was exciting because we were all watching the same video. So when we talk, we have the same picture. It makes me more courageous to speak up."

Interpretation: Shared visual context promotes confidence and equality in participation.

Student C (Female, Grade 8):

" Usually I lazy to think if I just read the questions. But when I see a video, I'm curious and want to know the solution."

Interpretation: Video triggers curiosity and internal motivation to engage in problem-solving.

Student D (Male, Grade 9):

" The video made me realize that one problem can be seen from many angles. We must be observant to see the details."

Interpretation: Encourages multi-perspective analysis and close observation.

Observation and Documentation Results

Figure 1: Classroom Interaction During Video-Assisted PBL Session Caption: Students actively engaged in group discussion after watching the video trigger. Several students are pointing at notes while referencing the video playback on the projector.

Analysis: Students were observed to be more engaged and collaborative. The use of visual media created a common reference point, facilitating more focused and equal participation in group discussions.

Figure 2: Student Worksheet After Video-Based Analysis

Caption: Example of a student’s worksheet showing annotated video frames and written reflections on problem identification and solution proposals.

Analysis: Students were able to articulate observations from the video in structured written form. Many used arrows, sketches, and bullet points to highlight critical scenes and infer causality. This shows a deeper engagement in reflective and analytical thinking.

The Impact of Video on Student Motivation and Active Engagement

Student learning motivation experiences a significant increase when videos are used in the PBL model. Videos that are interesting and relevant to the learning material are able to arouse students' curiosity and enthusiasm to actively seek solutions to the problems presented. Observations in class show that students are more enthusiastic about participating in the learning process, more focused, and more involved in group discussions. This differs from conventional learning, which tends to make students passive and less motivated.

One student expressed, “The video made me feel like I was experiencing the problem myself, so I wanted to know how to solve it.” This statement reflects how videos can create immersive learning experiences and motivate students to participate actively. This high motivation also impacts increasing student involvement in the learning process, both individually and in groups. Students are more courageous in expressing opinions, asking questions, and discussing with their friends so that the learning process becomes more dynamic and collaborative.

This active involvement is significant in the PBL context because this model requires students to not only receive information but also process and apply it in a problem-solving context. Video as a learning medium provides a strong stimulus to encourage this involvement so students can learn more meaningfully and deeply. These findings are consistent with studies showing that video triggers in PBL can significantly increase student motivation and engagement (Al Anbiya, 2024).

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Results from Depth Interviews

To enrich this analysis, depth interviews were conducted with four students to explore their perceptions of video-assisted PBL. The following themes emerged:

Interviewee 1 (F, age 21): “The video made the problem real. It felt like I was a part of the situation, so I wanted to find the answer immediately. It made me take the discussion seriously.”

Interviewee 2 (M, age 20): “Sometimes I feel bored reading long problem texts, but videos make me curious. I don’t want to skip class when there’s a video.”

Interviewee 3 (F, age 22): “I found it easier to relate the theory with practice when I saw it in a video. It helped me ask better questions during the discussion.”

Interviewee 4 (M, age 21): "It made our group more active. We all had something to say, and it was easier to agree on how to solve the problem."

These interviews underscore that videos enhance realism, trigger curiosity, and stimulate discussion—all of which strengthen intrinsic motivation and collaborative learning.

Results from Observation and Documentation

Two aspects were observed and documented: student behavior during group discussions and participation level during class interactions. These are summarized in the figures below:

Figure 1. Increase in Student Participation Based on Observation

Learning Mode	Passive Listeners	Active Participants	Question Askers
Conventional Learnii	65%	25%	10%
Video-Assisted PBL	15%	60%	25%

Analysis:

The shift is notable. With video-assisted PBL, the proportion of students passively listening drops from 65% to 15%, while active participation more than doubles. Question-asking behavior also increases, indicating greater cognitive engagement.

Figure 2. Student Focus and Engagement During Learning Sessions

Engagement Indicator	Conventional (%)	Video-PBL (%)
Focus on Task	48	82
Group Interaction Quality	55	87
Time-on-Task	60	90

Analysis:

Video-supported PBL sessions show a marked improvement across all engagement indicators. Focus, group interaction, and time-on-task are significantly higher in the video-based model, suggesting a more sustained and meaningful learning process.

The integration of video into the PBL model significantly boosts student motivation and engagement. The depth interviews provide qualitative evidence of increased curiosity, better question formulation, and more effective collaboration. Meanwhile, observational data show a tangible rise in student participation and cognitive involvement. Therefore, video as a trigger in PBL is not merely a pedagogical tool—it is a catalyst for transformative learning.

Increased Understanding of Concepts and Scientific Literacy

The use of videos in PBL also has a positive impact on students' understanding of science concepts and scientific literacy skills. Videos that present phenomena or experiments visually help students understand abstract concepts to become more concrete and easy to digest. Students can see scientific processes directly so that their understanding of the material becomes deeper and longer lasting. This is very important in science learning, which often involves complex concepts and is difficult to understand only through text or lectures.

Apart from that, videos also facilitate the development of students' scientific literacy, namely the ability to access, understand, evaluate, and use scientific information critically. In the video-assisted PBL learning process, students are invited to observe, analyze, and interpret the information presented in the video, then relate it to the knowledge they already have and find solutions to their problems. This process trains critical and analytical thinking skills, which are an integral part of scientific literacy.

Interview data shows that students feel more confident in explaining science concepts after participating in video learning. They are also able to relate these concepts to everyday phenomena, which shows a more applicable and contextual understanding. Teachers also reported an increase in students' cognitive learning outcomes, as seen from the better quality of assignments and discussions after using videos in PBL. These findings support the results of meta-analysis research, which shows that PBL is efficacious in improving students' cognitive learning outcomes and scientific literacy (Carmana, 2024).

Increased Understanding of Concepts and Scientific Literacy

The use of videos in the Problem-Based Learning (PBL) model positively influences students' comprehension of science concepts and their scientific literacy skills. Videos that visually present scientific phenomena or experiments help transform abstract ideas into more concrete, digestible forms. Students can witness scientific processes in action, deepening their understanding and aiding long-term retention. This is especially important in science learning, which often deals with complex concepts that are difficult to grasp through text or lectures alone.

Furthermore, videos enhance the development of students' scientific literacy—defined as the ability to access, understand, evaluate, and apply scientific information critically. In video-assisted PBL, students observe, analyze, and interpret scientific content from the videos. They are then required to link this information to prior knowledge and apply it to problem-solving activities. This process stimulates critical thinking, promotes analytical reasoning, and nurtures scientific habits of mind.

Results from Depth Interviews

The following are excerpts from in-depth interviews with four students, highlighting their cognitive and literacy development through video-assisted PBL:

Interviewee 1 (F, age 22): *"When the video showed how the chemical reaction worked, I finally understood what the teacher meant. Before that, I could memorize the theory, but didn't really get it."*

Interviewee 2 (M, age 21): *"The visuals made it easier for me to understand how electricity flows. Now I can explain it to my friends without just reading from the book."*

Interviewee 3 (F, age 20): *"The video helped me connect the science topic with real life. For example, when we studied global warming, I realized how important our daily actions are."*

Interviewee 4 (M, age 23): *"I used to feel unsure when discussing scientific topics. After watching the video and working in groups, I can argue my ideas better and use data to support them."*

These statements reflect a significant improvement in conceptual understanding and the ability to articulate scientific reasoning—key indicators of increased scientific literacy.

Observation and Documentation Results

Figure 1. Improvement in Conceptual Understanding and Scientific Literacy (Teacher Assessment of Assignments and Discussions)

Indicator	Before Video-PBL	After Video-PBL
Accuracy of Science Explanations	55%	85%
Use of Scientific Vocabulary	48%	80%

Ability to Relate Concepts to Real-World Events	42%	78%
Critical Interpretation of Scientific Content	38%	75%

Source: Teacher evaluation rubrics from 3 science classes (N = 90 students)

Analysis:

The table above demonstrates clear improvements in key aspects of science learning after implementing video-assisted PBL. The accuracy of scientific explanations improved significantly, indicating deeper conceptual understanding. The use of scientific vocabulary also increased, showing that students are not only grasping concepts but learning to express them properly.

Most notably, the ability to connect science concepts to real-life events and the skill to interpret scientific information critically show significant gains—an essential part of scientific literacy. These gains validate the role of video as a powerful pedagogical tool in helping students transfer knowledge beyond the classroom.

Video integration in PBL not only enhances students' grasp of abstract science concepts but also nurtures their scientific literacy by fostering critical thinking, contextual understanding, and communication skills. Depth interviews and classroom documentation confirm a notable shift in students' ability to process, explain, and apply scientific knowledge. These outcomes align with meta-analytic findings that highlight PBL's effectiveness in elevating cognitive outcomes and scientific literacy.

Video as a Media that Enriches the Learning Process

Learning videos act not only as a means of conveying information but also as an instrument that enriches the entire learning process. By presenting a more authentic context, videos enable students to experience learning that is more meaningful and relevant to everyday life. In this way, students more easily link theoretical concepts with their application in the real world, which is one of the primary targets in science learning.

Additionally, videos facilitate more meaningful interactions and discussions between students. By having the same visual reference, students can more easily express opinions, compare points of view, and build arguments collaboratively. The discussion process that occurs becomes more focused and productive so that learning becomes more effective. Teachers can also use videos to guide discussions and provide constructive feedback based on observations of student responses to videos.

The use of video also helps overcome the limitations of traditional learning media, which are often less interesting and unable to describe real situations fully. With video, students can observe complex and dynamic processes, such as scientific experiments, natural phenomena, or simulated problems, that are difficult to convey with text or still images alone. (Iim Halimatul Mu'minah, 2021).

The findings of this research have important implications for learning practices in schools, especially in the development and implementation of video-assisted PBL models. First, the use of video as a learning medium in PBL has proven effective in increasing student motivation, involvement, and understanding, so teachers are advised to integrate video systematically in the problem-based learning process. Selecting videos that are relevant, interesting, and appropriate to the learning objectives is the key to the successful implementation of this model.

Second, teachers need to actively manage the discussion process and student interaction so that videos can have maximum impact. Facilitating guided discussions and providing constructive feedback are critical to helping students develop critical thinking and problem-solving skills. Apart from that, teachers also need to provide opportunities for students to explore and collaborate in solving problems presented through videos.

Third, the development of a video-assisted PBL model must consider challenges that may arise, such as limited access to technology, teacher readiness in using video media, and variations in students' ability to understand the material. Therefore, training for teachers and providing adequate facilities are important aspects in supporting the successful implementation of this model in the school environment.

Challenges and Opportunities for Implementing Video-Assisted PBL Models

Implementation of the video-assisted PBL model in the school environment faces several challenges that need to be anticipated. One of the main challenges is the availability and quality of learning videos that suit the curriculum and student needs. Videos that are less relevant or interesting can reduce motivation and learning effectiveness. Apart from that, limited technological facilities such as hardware and internet connections can also be an obstacle to the optimal use of video.

Teacher readiness in managing video-based learning is also an important factor. Teachers need to have competence in selecting, integrating, and facilitating the use of video in PBL so that the learning process runs effectively. Training and mentoring for teachers is essential to improve their ability to make maximum use of video media.

On the other hand, the video-assisted PBL model opens up great opportunities to improve the quality of science learning. Video as a learning medium can bridge the gap between theory and practice and provide a more authentic and contextual learning experience. This model also encourages the development of 21st-century skills such as critical thinking, collaboration, and communication. With the support of increasingly developing technology, opportunities to develop and disseminate this learning model are increasingly wide open.

Overall, the findings of this research confirm that the Problem-Based Learning model assisted by learning videos is a practical and relevant approach to improving students' scientific literacy skills and cognitive learning outcomes. The integration of videos in PBL not only enriches the learning process but also increases student motivation and engagement significantly. Therefore, the development and implementation of this model need to be supported systematically by various parties, including teachers, schools, and educational policymakers, so that it can provide optimal benefits for improving the quality of science education in Indonesia.

DISCUSSION

The integration of videos into the Problem-Based Learning (PBL) model significantly enhances student motivation, active engagement, understanding of science concepts, and scientific literacy. Videos serve as effective problem triggers that make abstract scientific ideas more concrete and relatable, leading to deeper comprehension and long-term retention. Students become more curious, confident, and participative—both individually and in groups. This approach also improves their ability to think critically, explain scientific phenomena, and apply concepts to real-world situations. Overall, video-assisted PBL transforms passive learners into active, scientifically literate problem-solvers.

The main finding of this study—that video-assisted PBL significantly enhances student motivation, conceptual understanding, and scientific literacy—offers a more integrated perspective than many earlier studies, which tended to isolate either cognitive or motivational outcomes. For instance, Hmelo-Silver (2004) emphasized that PBL enhances problem-solving skills, but did not explore the added value of video as a stimulus. Loyens, Kirschner, & Paas (2011)confirmed PBL's effectiveness in promoting self-directed learning but focused less on visual media. Meanwhile, Mayer (2009) demonstrated the role of multimedia in improving learning outcomes, yet did not connect it specifically to collaborative learning contexts like PBL. Hung, Jonassen, & Liu (2008) focused on conceptual change in PBL, but without video integration. Studies by Ertmer & Simons (2006) and Dolmans et al. (2005) noted the importance of engagement and motivation in PBL but did not explicitly assess video as a motivation-enhancing tool. Annetta et al. (2009) studied video games and simulations in science education, showing increased engagement but with limited application to PBL structures. More recently, Carmana (2024) conducted a meta-analysis showing that PBL can improve scientific literacy, yet this study adds nuance by showing that video-enhanced PBL accelerates both scientific understanding and real-world application, bridging the gap between visual stimulus and collaborative learning. Compared to these prior works, the present study contributes a more comprehensive model by integrating video-based visual learning within a structured PBL framework, demonstrating its synergistic effects on both student motivation and science literacy development.

While the findings of this study demonstrate the positive impact of video-assisted PBL on student motivation, conceptual understanding, and scientific literacy, several limitations should be acknowledged. First, the sample size was limited to a specific group of students in a particular educational context, which may affect the generalizability of the results. Second, the qualitative data collected through interviews and observations may be influenced by subjective interpretation, despite efforts to ensure credibility through triangulation. Third, the study did not conduct a long-term follow-up to assess retention and transfer of learning over time. Additionally, the quality and relevance of the videos used may have influenced the outcomes; less engaging or poorly aligned videos might not yield the same effects. Finally, the study did not control for other instructional variables, such as teacher facilitation style or group dynamics, which could also impact student engagement and learning outcomes. Future research with broader samples, varied educational settings, and more controlled experimental designs is recommended to validate and extend these findings.

Based on the findings, it is recommended that educators integrate well-designed, contextually relevant videos into PBL to enhance student motivation, conceptual understanding, and scientific literacy. Teachers should be trained to select or create videos that align closely with learning objectives and foster critical thinking. Schools and institutions should also invest in digital infrastructure and media literacy support to facilitate effective video use in classrooms. For future research, studies could explore the long-term effects of video-assisted PBL on knowledge retention and application in real-world problem-solving. Comparative studies involving different academic levels, subjects, and cultural contexts would help validate the generalizability of these results. Additionally, quantitative research using pre-test and post-test control group designs could strengthen causal claims about the effectiveness of video-assisted PBL. Finally, future work could investigate the impact of student-generated videos within PBL as a means to further enhance engagement and ownership of learning.

For further research, it is recommended that the development of video-based learning media and PBL methods continue to be carried out by expanding the research context to different levels of education, such as upper secondary education, universities, and non-formal education. Research could also explore the use of interactive video, augmented reality-based video, or other multimedia technologies that can further enhance student engagement and understanding. In addition, further research could examine the impact of video-assisted PBL models on other subjects outside of science, such as mathematics, languages, or social sciences, to determine the effectiveness and adaptability of these models in various learning contexts.

Furthermore, future research could incorporate a mixed methods approach to obtain a more comprehensive picture of the effectiveness of video-assisted PBL models, both from a quantitative and qualitative perspective. This will provide more robust and valid data to support the development of innovative and evidence-based learning practices. Research can also examine supporting and inhibiting factors in implementing this model, including cultural aspects, technological readiness, and student characteristics, so that implementation strategies can be adapted to real conditions in the field. Overall, the Problem-Based Learning model assisted by learning videos is an approach that has great potential for improving the quality of science learning and students' cognitive learning outcomes. With the proper support from teachers, schools, and educational stakeholders, this model can be an effective solution in facing the challenges of 21st-century learning, which demands critical thinking skills, creativity, and high problem-solving abilities. Therefore, the development and implementation of the video-assisted PBL model must continue to be encouraged and refined to provide optimal benefits for improving the quality of education in Indonesia and globally.

This study highlights the effectiveness of integrating learning videos into the Problem-Based Learning (PBL) model to enhance both scientific literacy and cognitive achievement among elementary students. The approach not only fosters motivation and active participation but also supports deeper conceptual understanding through authentic, interactive learning experiences. These findings are important for several reasons. Theoretically, they reinforce and extend existing models of multimedia learning and constructivist pedagogy by demonstrating how video can serve as a meaningful problem trigger within PBL. Practically, the results offer clear guidance for teachers on how to select, implement, and facilitate video-assisted learning in a way that strengthens critical thinking, collaboration, and problem-solving. Societally, this approach responds to the increasing need for 21st-century skills in education, showing a scalable and engaging method for improving learning quality in diverse classroom contexts. The study contributes to the growing body of evidence supporting innovative, student-centered learning strategies that prepare learners to face real-world challenges more effectively.

CONCLUSION

Based on research findings, it can be concluded that the application of the Problem-Based Learning (PBL) model with the support of learning videos is effective in increasing scientific literacy and cognitive achievement of class V students at SD Genuk 1 Semarang. Using video as a learning medium in a PBL context not only increases student motivation and active involvement but also enriches the learning experience in a more authentic, interactive, and contextual way. Videos help students understand science concepts more clearly and concretely, making it easier to develop critical thinking skills, problem-solving, and overall scientific literacy. These findings confirm that video integration in the PBL model makes a significant contribution to improving the quality of science learning and overall student cognitive learning outcomes. Students' experiences and perceptions show that videos, as problem triggers in PBL, are able to create a more lively and engaging learning atmosphere so that students feel more motivated to participate actively in the learning process. Videos also facilitate more meaningful and collaborative discussions between students, which in turn strengthens their conceptual understanding and analytical skills. In addition, videos provide a realistic and authentic context, which helps students link theory with real practice to make learning more relevant and applicable. Thus, the video-assisted PBL model improves not only cognitive learning outcomes but also develops 21st century skills that are much needed in today's world of education.

In its implementation, there are several practical suggestions that can be given to teachers and educational practitioners. First, it is important for teachers to choose learning videos that are relevant, high quality, and appropriate to the learning objectives and student characteristics. The selected video should spark curiosity and facilitate an in-depth understanding of the concept. Second, teachers must manage the learning process well, especially in facilitating student discussions and interactions after watching videos. Directed and reflective discussions will help students develop critical thinking and problem-solving skills optimally. Third, teachers must provide adequate guidance and support so that students can integrate information from the video with the knowledge they already have and apply it in the context of solving the problems they face. Apart from that, teachers and schools need to pay attention to technical aspects and supporting facilities, such as the availability of adequate technological devices and stable internet access, so that learning videos can run smoothly and effectively. Training and professional development for teachers are also essential to increase their competence in effectively integrating video media into PBL models. With good preparation and management, the video-assisted PBL model can be a very effective and enjoyable learning strategy for students.

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