



## **Enhancing Elementary Education through Technology-Based Learning Media: A Constructivist Problem-Based Learning Approach**

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### **Abstract**

**Background:** The integration of digital technology in elementary education has become increasingly important in fostering active, student-centered learning aligned with constructivist and Problem-Based Learning principles. However, empirical evidence regarding the holistic integration of multiple digital platforms within elementary classrooms remains limited.

**Aims:** This study aimed to explore how an elementary school teacher integrates Quizizz, YouTube, and Canva to support constructivist Problem-Based Learning and to examine the pedagogical impacts and challenges arising from such implementation.

**Methods:** A qualitative design was employed through an in-depth semi-structured interview with one purposively selected elementary school teacher experienced in technology-enhanced instruction. Data were analyzed thematically to identify patterns related to digital integration, student engagement, inquiry processes, creativity, and implementation challenges. Trustworthiness was ensured through member checking and literature triangulation.

**Result:** The findings revealed that Quizizz facilitated interactive formative assessment and reflective problem-solving; YouTube supported inquiry through authentic, real-world visual contexts; and Canva fostered creativity, critical thinking, and collaborative knowledge construction. The integration of these platforms enhanced student motivation, participation, and higher-order thinking. Although challenges such as unequal device access and varying digital literacy emerged, strategic scaffolding, group collaboration, and blended learning approaches effectively mitigated these barriers.

**Conclusion:** The study demonstrates that purposeful integration of technology within a constructivist Problem-Based Learning framework can transform elementary classrooms into inquiry-driven, collaborative learning environments that promote creativity, digital competence, and meaningful knowledge construction.

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## **INTRODUCTION**

The integration of technology in elementary education has become increasingly essential in the 21st century, as digital tools offer opportunities to enhance student engagement, creativity, and critical thinking. Traditional teaching methods often focus on rote memorization, which limits students' ability to solve real-world problems. By incorporating technology-based learning media, such as Quizizz (Benyamin et al., 2021; Dewi et al., 2022; Dhamayanti, 2021; Indrayana, 2022), YouTube (Ambarwati & Kurniasih, 2021; Jamil et al., 2022; Rahmatika et al., 2021; Wahyuningsih et al., 2022), and Canva (Elsa & Anwar, 2021; Mulyati et al., 2022; A. R. A. Putri & Marhamah, 2022),

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teachers can foster more active, student-centered learning, allowing learners to construct knowledge, collaborate, and develop higher-order thinking skills.

Previous studies have demonstrated the benefits of technology in enhancing student learning. Research indicates that Quizizz promotes interactive learning and immediate feedback, improving knowledge retention and engagement (A. N. Putri et al., 2024). YouTube has been shown to facilitate conceptual understanding through multimedia visualizations and real-life examples, supporting inquiry-based learning (Kristiani & Pradnyadewi, 2021). Additionally, Canva and other digital design tools encourage students to present information creatively, strengthening problem-solving and critical thinking skills (K.N. Widyatnyana, 2021). Studies also highlight the synergy between technology and constructivist, problem-based learning (PBL) approaches, where students actively construct knowledge by engaging with authentic problems (Sajidan et al., 2022).

Despite the growing body of research, most studies have focused on secondary or higher education, with limited exploration in elementary classrooms. Furthermore, few studies investigate how teachers integrate multiple digital tools, Quizizz, YouTube, and Canva, simultaneously within a constructivist, problem-based learning framework. There is also limited qualitative evidence capturing teachers' firsthand experiences, challenges, and strategies in fostering active, student-centered learning with technology in elementary education.

This study addresses these gaps by providing an in-depth exploration of a teacher's practical implementation of technology-based learning media in an elementary classroom. By combining three distinct digital tools and examining their application within a PBL constructivist approach, the study offers novel insights into holistic technology integration. Additionally, the study highlights practical strategies for overcoming challenges such as digital literacy disparities and device access, contributing to the growing knowledge of equitable and effective technology use in early education.

The purpose of this study is to explore how an elementary school teacher integrates Quizizz, YouTube, and Canva to facilitate constructivist, problem-based learning. Specifically, it aims to identify the teacher's strategies, observations of student engagement, and approaches to addressing challenges in technology-based learning. The findings are expected to inform educators and researchers about effective methods for implementing technology to support active, student-centered learning and the development of critical thinking and creativity in elementary education.

## METHOD

This study employed a qualitative research design using a deep, semi-structured interview to explore how an elementary school teacher integrates technology-based learning media within a constructivist, problem-based learning (PBL) framework. Qualitative methods were chosen to gain in-depth insights into the teacher's experiences, perceptions, and strategies, allowing a rich understanding of the practical implementation of Quizizz, YouTube, and Canva in student-centered learning.

The participant was one elementary school teacher with experience in integrating technology in classroom instruction. Selection was based on purposive sampling, targeting teachers who actively use digital tools in constructivist and PBL approaches. The interview focused on three main topics: (1) the purpose and use of technology-based media, (2) observations of student engagement and learning outcomes, and (3) challenges and strategies for effective implementation. Open-ended questions enabled the participant to provide detailed narratives and real-life examples from classroom practice.

Data analysis followed a thematic approach. The interview transcript was carefully reviewed, coded, and categorized based on emerging themes related to technology use, constructivist learning principles, PBL application, and observed outcomes. Representative excerpts were selected to illustrate key findings. To ensure trustworthiness, member checking was conducted, allowing the teacher to verify the accuracy of the interpreted responses. Triangulation with relevant literature supported the credibility of the findings and the connection to established theories on constructivist learning, PBL, and technology integration in education.

## RESULTS AND DISCUSSION

### Results

This study explored how an elementary school teacher integrated technology-based learning media Quizizz, YouTube, and Canva within a Problem-Based Learning (PBL) framework guided by constructivist principles. Through in-depth interviews, four major themes emerged: (1) purposeful use of digital media to support problem-solving, (2) enhancement of creativity and inquiry, (3) challenges in digital implementation, and (4) observed impact on student learning. The following table summarizes each theme, its description, and representative statements from the teacher.

**Table 1.** Themes of Teacher's Experience Using Technology-Based Learning Media

No	Theme	Description	Teacher's Statement
1	Purposeful Use of Digital Media for Problem-Solving	The teacher strategically employed Quizizz to promote active learning through formative assessments and problem-solving quizzes.	"I use Quizizz not just for quizzes, but to challenge students with problems related to the lesson... It makes learning more active and reflective."
2	Enhancement of Inquiry and Real-World Connection	YouTube was utilized to present real-life contexts and stimulate student inquiry and collaboration through visual problem identification.	"I show short videos... Afterward, I ask them to identify problems and solutions based on the video."
3	Fostering Creativity and Critical Thinking	Canva served as a creative platform where students analyzed problems and presented visual solutions through posters and infographics.	"I ask students to create posters or infographics... They must analyze the problem, gather information, and present their findings visually."
4	Challenges and Mitigation Strategies	The teacher encountered barriers such as unequal access, differing digital literacy, and technical issues, which were addressed through group work and guidance.	"Some students had no devices or didn't know how to use the apps, so I divided them into groups and guided them step by step."
5	Positive Impact on Student Learning	Overall, the integration of technology within PBL increased student motivation, engagement, and higher-order thinking.	"Students are more active in class. They don't just memorize; they explore, ask questions, and find solutions themselves."

The teacher's integration of Quizizz demonstrated intentional alignment with PBL goals. Rather than using it solely for quizzes, it functioned as an interactive medium for students to tackle contextualized problems. This strategy encouraged immediate reflection, feedback, and deeper understanding—hallmarks of constructivist learning. Additionally, the teacher emphasized that the gamified format of Quizizz increased student enthusiasm and reduced anxiety during assessments. Students were able to review misconceptions instantly, fostering a self-regulated learning environment. As a result, the use of Quizizz not only assessed learning outcomes but also became a dynamic tool for formative learning within PBL.

Using YouTube, the teacher provided authentic, real-world scenarios that grounded abstract lessons in concrete experiences. Students engaged in observation and inquiry-based discussions, identifying and proposing solutions collaboratively. This aligns with PBL's emphasis on connecting

learning to life beyond the classroom. The videos selected were age-appropriate and culturally relevant, allowing students to relate the content to their daily lives. Moreover, the visual and auditory elements of YouTube supported diverse learning styles, especially for students who struggled with text-based materials. Through guided questioning after video sessions, the teacher helped students develop analytical and reflective thinking skills.

Through Canva, students were encouraged to express their problem-solving processes creatively. Designing posters or infographics required analysis, synthesis, and evaluation—skills essential for critical and creative thinking. The teacher highlighted that these visual tasks enhanced engagement and comprehension through hands-on creation. Canva also fostered teamwork as students collaborated to design visual products that represented their shared understanding. The process of selecting colors, images, and layouts promoted digital literacy and aesthetic awareness. Furthermore, students took pride in sharing their Canva creations with peers, building confidence and a sense of ownership in their learning outcomes.

Despite the benefits, challenges emerged, such as unequal device access and varied digital proficiency. The teacher mitigated these by organizing group-based tasks, providing step-by-step support, and blending online and offline learning activities. These approaches promoted inclusivity and ensured that technological barriers did not hinder participation. The teacher also noted that initial training sessions were essential to familiarize students with each digital tool. Collaboration among students with different levels of digital skills became a valuable peer-learning experience. By maintaining flexibility in task design, the teacher ensured that learning objectives were achieved regardless of students' access to technology.

Overall, integrating Quizizz, YouTube, and Canva within the PBL model led to observable improvements in student motivation and participation. Students became active constructors of knowledge, demonstrating curiosity, independence, and collaboration. The teacher's reflections affirm that technology, when used thoughtfully, can transform traditional instruction into an engaging, problem-centered experience. The combination of these platforms created a multi-modal learning environment that supported both cognitive and emotional engagement. Students were not merely recipients of information but co-creators of learning artifacts. Consequently, this integration illustrates how digital tools can enhance both the process and product of learning in the context of elementary education.

## Discussions

This study aimed to explore how elementary school teachers use technology-based learning media, Quizizz, YouTube, and Canva in implementing Problem-Based Learning (PBL), and what pedagogical impacts and challenges arise from such integration. The findings reveal that the teacher's technological choices align strongly with constructivist learning theories and effectively enhance engagement, collaboration, and creativity among students. Additionally, the integration of these digital tools transformed traditional classroom dynamics into more interactive and student-centered environments. Teachers were able to facilitate inquiry, discussion, and reflection, which promoted deeper understanding of the learning material. Furthermore, the study highlights that while technology enhanced motivation and participation, it also required teachers to continuously adapt their instructional strategies and digital competencies.

### 1. How does the teacher use technology-based learning media to support PBL?

The findings show that the teacher's use of Quizizz, YouTube, and Canva plays a significant role in facilitating PBL stages, from problem introduction to reflection. Quizizz is used to present problem-solving questions interactively, helping students test hypotheses and receive immediate feedback. This resonates with Piaget's constructivist theory, which posits that learners build knowledge through active engagement and reflection (Marinda, 2020). The interactive and gamified nature of Quizizz encourages cognitive conflict and resolution, key mechanisms for conceptual growth in constructivist learning.

The teacher's implementation of technology in PBL is grounded in intentional pedagogical design (Isnani, 2023). Each platform Quizizz, YouTube, and Canva, is strategically positioned within specific phases of the learning cycle to maximize engagement and reflection. Quizizz, for example, is not only used for assessment but also as a formative tool to diagnose misconceptions early in the learning process. The teacher uses its immediate feedback feature to facilitate real-time reflection

and peer discussion. This encourages students to reconstruct their understanding based on evidence and reasoning rather than rote memorization. As a result, the technology effectively becomes an extension of constructivist pedagogy, reinforcing the principle that learners actively build meaning through experience and interaction.

## 2. How do these media promote collaboration and inquiry in learning?

The use of YouTube videos in class stimulates students' curiosity and supports group discussions, encouraging them to analyze, question, and connect ideas collaboratively. This practice reflects Vygotsky's social constructivism, particularly the Zone of Proximal Development (ZPD), where students progress through guided interaction and peer collaboration (Erbil, 2020). Technology thus acts as a mediating tool, allowing learners to co-construct knowledge through observation, communication, and shared exploration central processes in effective PBL environments.

YouTube serves as a dynamic medium for initiating inquiry and fostering collaboration among students. The teacher curates videos that present authentic, real-world problems aligned with the PBL theme, prompting students to observe, question, and hypothesize. These visual stimuli encourage active dialogue as learners work together to interpret information and propose solutions. The discussions that follow often lead to co-construction of knowledge, where ideas are negotiated and refined through social interaction. By providing a shared reference point, YouTube acts as a common ground for collaborative meaning-making. Consequently, the integration of multimedia resources transforms the classroom into a participatory community of learners engaged in joint inquiry and discovery.

## 3. How does technology use foster creativity and higher-order thinking?

The integration of Canva allows students to visualize solutions and present their ideas creatively, promoting higher-order thinking and problem analysis. This reflects (Ban, 2023) view of PBL as a process of tackling authentic, complex problems that require critical thinking and self-directed learning. Through Canva, students transform abstract ideas into visual representations, thereby deepening comprehension and fostering creative expression, skills essential in 21st-century education.

The use of Canva in the final stages of PBL enables students to synthesize their findings and express them through creative digital outputs. Students design infographics, posters, and presentations that illustrate their solutions to the given problems, integrating text, visuals, and data. This multimodal process cultivates critical thinking as learners evaluate which information best represents their ideas and how to communicate it effectively. Furthermore, the open-ended design environment of Canva allows students to experiment with colors, layouts, and symbols, enhancing their aesthetic and conceptual creativity. The teacher guides this process by emphasizing that creativity is not only about design but also about clarity, logic, and innovation in problem-solving. Through this activity, students demonstrate autonomy and confidence as knowledge creators, not merely consumers.

## 4. What challenges arise in using technology for PBL, and how are they addressed?

Despite the pedagogical benefits, challenges such as unequal access to digital devices and differences in students' digital literacy were observed. The teacher mitigated these by implementing collaborative group work, guided instruction, and a blended learning model that balances online and offline activities. These approaches are consistent with prior studies (Hew & Brush, 2007), emphasizing that scaffolding and collaboration can reduce digital inequality while maintaining engagement in technology-enhanced learning environments.

The teacher acknowledges that technology integration in PBL presents both technical and pedagogical challenges. Unequal device ownership and inconsistent internet access occasionally disrupt participation, particularly in collaborative activities. To address this, the teacher organizes mixed-ability groups so that students with stronger digital skills can assist peers who face difficulties. Offline alternatives, such as printed worksheets and shared devices, ensure inclusivity and continuity of learning. Moreover, the teacher invests time in building digital literacy through short tutorials and modeling sessions before major projects begin. This proactive approach helps bridge digital gaps while maintaining a supportive, student-centered learning atmosphere that upholds the integrity of PBL principles.

### 5. What are the implications for technology integration in elementary education?

Overall, the study confirms that when technology-based media are aligned with constructivist and PBL principles, they can transform the classroom into a student-centered, inquiry-driven environment. Technology not only supports knowledge construction and critical thinking but also enhances motivation and creativity. This finding aligns with (Ertmer & Ottenbreit-leftwich, 2010), who argue that meaningful technology integration depends on pedagogical alignment and teachers' ability to design learner-centered experiences.

The findings suggest that technology, when thoughtfully integrated into PBL, can redefine the elementary classroom as a space of active exploration and creativity. Teachers play a crucial role as facilitators who curate resources, scaffold inquiry, and nurture digital competence. This study underscores that effective technology integration goes beyond tool usage, it requires alignment with pedagogical intentions and student learning goals. Moreover, technology-infused PBL fosters essential 21st-century competencies such as critical thinking, collaboration, and digital literacy, preparing learners for future challenges. Schools and policymakers should therefore provide continuous professional development to empower teachers in designing meaningful, technology-enhanced learning experiences. Ultimately, technology integration should be viewed as a pedagogical transformation, not merely a technical adoption.

In other words, the result underscores that effective technology use in PBL is not about the tools themselves, but about how teachers design, guide, and scaffold learning experiences to promote reflection, collaboration, and problem-solving. These insights contribute to the ongoing discourse on technology-enhanced constructivist learning and provide practical implications for teacher training and classroom innovation in the AI-driven education era.

#### *Implications*

The findings of this study provide important pedagogical implications for elementary education in the digital era. First, the structured integration of Quizizz, YouTube, and Canva within a constructivist Problem-Based Learning framework demonstrates that technology can meaningfully enhance inquiry, collaboration, and higher-order thinking when aligned with clear instructional goals. Rather than functioning as isolated digital add-ons, these platforms operated as pedagogical mediators that scaffolded problem identification, exploration, and creative solution development. Second, the results highlight the central role of teacher intentionality in technology integration. Effective digital learning is not determined by tool sophistication, but by how educators design reflective questioning, collaborative tasks, and authentic problem scenarios. Third, the study reinforces the importance of fostering digital literacy alongside cognitive development. Elementary classrooms must cultivate not only conceptual understanding but also students' confidence in navigating digital environments responsibly and creatively. Consequently, technology-enhanced PBL should be viewed as a holistic approach that simultaneously nurtures inquiry, collaboration, creativity, and digital competence.

#### *Contribution of Community Service*

This community service initiative contributes to the growing discourse on technology-supported constructivist learning in elementary education by offering a practical, experience-based model of integration. Unlike studies that examine a single digital platform, this initiative demonstrates the complementary use of three distinct tools within one coherent PBL cycle. The collaborative partnership between higher education researchers and elementary practitioners also strengthens the translational value of the findings, bridging theoretical perspectives with classroom realities. Furthermore, the qualitative insights from the teacher's reflections provide contextualized evidence of how digital tools can transform classroom dynamics from teacher-centered delivery to student-centered inquiry. By documenting strategies for overcoming digital inequality and literacy gaps, the initiative offers a replicable framework for schools seeking inclusive and sustainable technology adoption. Thus, the study extends beyond theoretical exploration and contributes actionable strategies for professional development and instructional innovation.

### *Limitations*

Despite its meaningful insights, this study presents several limitations that warrant consideration. The research was conducted with a single elementary school teacher, limiting the breadth of perspectives and contextual variability. The reliance on qualitative interview data, although rich and detailed, does not allow for statistical generalization or measurement of long-term learning impact. Additionally, the implementation context reflects specific institutional and cultural characteristics that may differ across schools or regions. Technological constraints, including device availability and internet stability, may also influence replicability in less-resourced environments. Therefore, while the findings illuminate promising pedagogical practices, they should be interpreted as context-specific evidence rather than universally applicable conclusions.

### *Suggestions*

Future initiatives should consider expanding participant diversity by involving multiple teachers across different grade levels and school contexts to enhance transferability. Longitudinal investigations examining sustained effects on critical thinking, creativity, and digital literacy would provide deeper understanding of long-term impact. Incorporating mixed-method approaches, including classroom observations and student performance data, may further triangulate findings and strengthen evidentiary depth. Schools are encouraged to provide structured professional development that equips teachers with pedagogical design skills rather than focusing solely on technical tool usage. Moreover, policymakers should prioritize equitable infrastructure development to ensure that digital integration does not exacerbate educational disparities. By embedding reflective evaluation, teacher capacity building, and inclusive access strategies, technology-based PBL can evolve into a sustainable model for transformative elementary education.

## **CONCLUSION**

The deep interview with an elementary school teacher demonstrated that integrating Quizizz, YouTube, and Canva within a constructivist, problem-based learning (PBL) framework enhances student engagement, creativity, and critical thinking. Quizizz facilitates interactive problem-solving and immediate feedback, YouTube stimulates inquiry and real-world connections, and Canva encourages creative knowledge representation. Despite challenges such as unequal access to devices and varying digital literacy, the teacher effectively mitigated these barriers through group work, guided instructions, and blended online-offline activities. These findings suggest that technology-based learning media, when purposefully integrated with PBL principles, can support active, student-centered learning and foster higher-order thinking skills in elementary education. This study contributes to the understanding of practical strategies for implementing technology in constructivist learning environments, highlighting the potential of digital tools to bridge theory and real-world problem solving.

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Their institutional guidance and scholarly environment significantly contributed to the conceptual refinement and methodological rigor of this study. Finally, we acknowledge the elementary students whose enthusiasm, creativity, and active participation enriched the implementation process and strengthened the authenticity of the findings. Their engagement demonstrates the transformative potential of thoughtfully integrated technology in fostering inquiry, collaboration, and meaningful learning experiences in elementary education.

### AUTHOR CONTRIBUTION STATEMENT

MB conceptualized the study, developed the theoretical framework, and supervised the overall research design. AL contributed to classroom implementation, data collection, and contextual interpretation of pedagogical practices. MW supported methodological refinement and critically reviewed the manuscript for academic rigor and coherence. IL conducted the interviews, performed thematic analysis, drafted the initial manuscript, and coordinated revisions. All authors contributed to data interpretation, reviewed the final manuscript, and approved the submitted version. All authors agree to be accountable for all aspects of the work.

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