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Flipped Problem-Based Learning on Basic Literacy and Self-Regulated Learning: A Systematic Literature Review

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ABSTRACT

Educational transformation in the digital age requires adaptive learning approaches to develop students' basic literacy. This study aims to analyze the effect of Flipped Problem-Based Learning (FPBL) on basic literacy, explore the role of Self-Regulated Learning (SRL), and examine the interaction between the two in 21st-century learning. A Systematic Literature Review (SLR) based on PRISMA guidelines was conducted using Harzing's Publish or Perish application, searching the Google Scholar and Scopus databases. Initially, 607 articles were identified. After screening for relevance and applying inclusion and exclusion criteria, 10 international articles were selected. These articles, published between 2020 and 2025 and indexed in Scopus, DOAJ, and SINTA, focused on FPBL, SRL, and basic literacy. The analysis reveals that FPBL positively impacts literacy, particularly in reading, numeracy, problem-solving, critical thinking, and digital literacy. SRL plays a central role in technology-based self-directed learning, where students with high self-regulation exhibit better literacy outcomes. The interaction between FPBL and SRL demonstrates a synergistic effect, further strengthening the development of basic literacy. In conclusion, this review emphasizes the significant contribution of FPBL to improving students' basic literacy skills. It also highlights the vital role of SRL in optimizing self-directed learning and literacy outcomes. Combining FPBL with SRL strategies creates an adaptive, effective learning environment, essential for enhancing literacy in the digital age.

Keywords: Flipped Problem-Based Learning; Basic Literacy; Self-Regulated Learning.

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1. INTRODUCTION

The development of information-based media technology in the era of globalization and digitalization has driven major transformations in various aspects of life, including in the field of education. This transformation not only presents opportunities but also significant challenges for the education system, particularly in equipping students with foundational literacy skills, including reading literacy, numeracy, science, and digital literacy (Maritsa et al., 2021; Setyawan & Citrawati, 2023). International data such as the Programme for International Student Assessment (PISA) consistently show that Indonesian students still face significant challenges in these areas, with performance lagging far behind the average of countries in the Southeast Asian region (OECD, 2023). Low critical thinking skills and weak self-regulation in learning exacerbate this situation, highlighting the urgent need for more contextual and adaptive learning innovations (Nasrullah & Asmarini, 2024).

In response to these challenges, various innovative learning approaches have been introduced. One approach that has received considerable attention is Flipped Problem-Based Learning (FPBL), which integrates the flipped classroom with problem-based learning. FPBL enables students to access learning materials independently through digital media first, then utilize face-to-face time for problem-solving and active, contextual discussions. Arnata et al. (2020) highlight that this approach fosters self-regulated learning and critical thinking. Additionally, Ni et al. (2024) show that combining flipped classrooms with problem-based learning enhances students' problem-solving skills and overall academic performance, while also contributing to improved collaboration and engagement during in-class activities. These findings align well with the principles of FPBL, reinforcing its effectiveness in modern educational contexts. FPBL creates opportunities for students to actively build knowledge through exploration and discussions based on real-world problems. Various studies indicate that this approach can enhance digital literacy, critical thinking skills, and communication abilities (Bahri et al., 2024; Saragih & Purwati, 2025).

Research by Saragih & Purwati (2025) shows that the use of PBL-based flipbook media is effective in improving writing skills and cooperative attitudes among elementary school students. This supports the assumption that interactive and collaborative learning can foster motivation and deeper understanding of the material, including basic literacy aspects. In addition, an experimental study by Bahri et al. (2024) also proves that the combination of positive perceptions of learning media, digital literacy skills, and SRL abilities contributes simultaneously by 86.41% to the improvement of cognitive learning outcomes of students in rural areas, with SRL being the highest contributor at 71.42%. Furthermore, Rahayu & Wulandari (2023) found that the PBL model significantly improved students' reasoning abilities, with moderate enhancements in their ability to analyze and evaluate problems. Similarly, Rokhman et al. (2025) emphasized the positive impact of PBL on critical thinking and digital literacy in geography education, demonstrating how it helps students engage with content while developing essential digital skills for real-world applications.

However, the success of flipped problem-based learning (FPBL) cannot be separated from the self-regulated learning (SLR) abilities of students. SRL is key to managing independent and flexible learning processes, as required by the FPBL model. Research indicates that students with high levels of SRL are able to set learning goals, choose appropriate learning strategies, and continuously evaluate their progress (Harahap, 2023). In the context of technology- and digital-based learning, self-regulated learning is the key to academic success. Recent studies indicate that students with high levels of SLR perform better in online and hybrid learning environments (Jin et al., 2023; Luo & Zhou, 2024). Specifically, studies have shown that SRL strategies significantly improve learning outcomes in blended learning contexts, with SRL being strongly linked to better academic performance, particularly in self-directed e-learning settings (Luo & Zhou, 2024; Men et al., 2023).

Interestingly, the integration of the PBL approach and SRL abilities is not only complementary but also creates a synergistic effect that can strengthen overall basic literacy achievement. A study by Farnsworth & Ge (2025) in The Interdisciplinary Journal of Problem-Based Learning and a bibliometric analysis by Xue et al. (2025) indicate that problem-based learning becomes more effective when supported by strong student self-regulation and a responsive digital environment. This aligns with research by Bahri et al. (2024), which emphasizes the importance of SRL skills as a foundation for optimizing students' digital literacy and learning outcomes in disadvantaged areas.

The findings of Gao & Liu (2025) in their article Towards Tailored Online Learning emphasize the importance of understanding students' profiles and individual needs in designing meaningful learning experiences. An approach that considers aspects of motivation, learning styles, and self-regulation abilities has been shown to significantly improve student engagement and academic achievement. In the context of education from elementary to higher education levels, understanding the connection between innovative learning approaches and students' internal capabilities is the foundation for building an adaptive education system focused on strengthening literacy. This is further supported by recent research showing the positive impact of self-regulated learning (SRL) on students' academic success. Xu et al. (2023) confirm that SRL interventions lead to moderate improvements in academic outcomes in blended and online environments across different educational levels. Similarly, Men et al. (2023) highlight how SRL strategies, especially those related to goal-setting and time management, enhance learning performance in online professional training, underscoring the importance of self-regulation in e-learning settings. Furthermore, studies by Li & Huang (2024) emphasize that SRL strategies, particularly those related to planning and monitoring, play a critical role in enhancing students' academic outcomes in both blended and online learning environments. Therefore, this study aims to: (1) understand the impact of FPBL implementation on improving students' basic literacy, (2) explore the role of SRL in supporting the process and outcomes of basic literacy learning, and (3) examine in depth the interaction between FPBL implementation and SRL levels in students' basic literacy achievement.

This study is built on three main theoretical frameworks. First, Constructivism Theory, which emphasizes that knowledge is formed by students through experience and direct involvement in learning (Suryana et al., 2022). Second, the theory of self-regulated learning, based on Zimmerman's three-phase framework encompassing planning, execution, and reflection, as outlined in recent studies (Efklides & Schwartz, 2024; Ge et al., 2025). Third, the Modern Literacy Theory, which expands the concept of literacy from understanding reading and writing alone to having the ability to think critically about many things, solve problems, and utilize digital technology (Kamariah et al., 2023).

In addressing these objectives and research questions, this study uses a qualitative approach with the Systematic Literature Review (SLR) method, which refers to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol. This method was chosen because it provides a systematic and transparent framework for the process of identifying, selecting, and reporting relevant literature (Page et al., 2021). SLR enables researchers to review, screen, and synthesize scientific findings from various national and international journals relevant to the topics of FPBL, SRL, and basic literacy of students (Diningrat et al., 2024). The literature review was conducted through systematic stages: starting from searching reputable academic databases such as Scopus and Google Scholar, selecting articles based on specific inclusion and exclusion criteria, thematic analysis, to the development of an integrative conceptual model.

By integrating these findings, this study aims to develop an adaptive, contextual, and relevant FPBL and SRL-based literacy learning model tailored to the needs of students in the digital age. The results of this study are expected not only to contribute to the development of 21st-century learning theory but also to provide practical policy directions for teachers, education policymakers, and literacy program implementers at both the local and national levels in creating a more responsive, inclusive, and transformative learning system.

2. METHOD

This study uses a qualitative approach with the Systematic Literature Review (SLR) method based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. This method was chosen with the aim of systematically collecting, evaluating, and synthesizing various relevant research findings on Flipped Problem-Based Learning (FPBL), Self-Regulated Learning (SRL), and the development of basic literacy among students. Through this approach, the study seeks to build a deep understanding of the relationship between FPBL and SRL on basic literacy skills based on existing empirical evidence, without conducting direct experiments (Indah Sari et al., 2023).

The research process began with the formulation of the research focus and questions, which encompassed three main aspects: how the FPBL model influences basic literacy skills, the role of SRL in supporting the development of such literacy, and how the interaction between the two forms an adaptive and self-directed learning environment. The literature search process used Harzing's Publish or Perish application from the Google Scholar and Scopus databases. In this stage, the researchers used a combination of keywords such as “flipped classroom,” “problem-based learning,” “digital literacy,” “critical thinking,” “reading literacy,” “numeracy,” and “self-regulated learning” to find relevant articles.

Next, the screening process is carried out in layers. Initial selection is based on the title and abstract, followed by a full review of articles that meet the criteria. The articles included in the final analysis are publications from 2020 to 2025, written in Indonesian or English, based on empirical research (quantitative, qualitative, or mixed), and directly related to FPBL, SRL, or basic literacy (Ardianti et al., 2022; Sutarni et al., 2021). Articles that were not available in full text, irrelevant to the research focus, or solely conceptual reviews without data-based foundations were excluded from the synthesis process.

Data extracted from each article included publication details (author, year, country), the learning approach used (such as flipped classroom, problem-based learning, or a combination of both), the basic literacy indicators examined (e.g., numeracy, reading, critical thinking), the aspects of SLR studied (such as motivation, self-assessment, and learning strategies), and the main findings. The EndNote application was used for organizing and managing the selected articles, while Microsoft Excel was employed to sort and code the data for further analysis. This process ensured systematic data handling and avoided inconsistencies.

This information was then categorized into major themes according to the focus of the study, such as the effectiveness of FPBL on the development of critical thinking and numeracy literacy, the contribution of SRL to motivation and learning independence, and integrative strategies between the two in digital and hybrid learning (Bahri et al., 2024; Diningrat et al., 2024; Jin et al., 2023). Data synthesis was conducted using a narrative approach that emphasized thematic grouping, identification of relationship patterns, inconsistencies, and distinctive findings across studies. The conceptual model developed based on these data aims to illustrate how the combination of FPBL and SRL can form a learning ecosystem that supports the strengthening of students' basic literacy. The entire process of document selection and analysis is visualized in a PRISMA flowchart in accordance with the latest guidelines (Page et al., 2021), as shown in Figure 1.

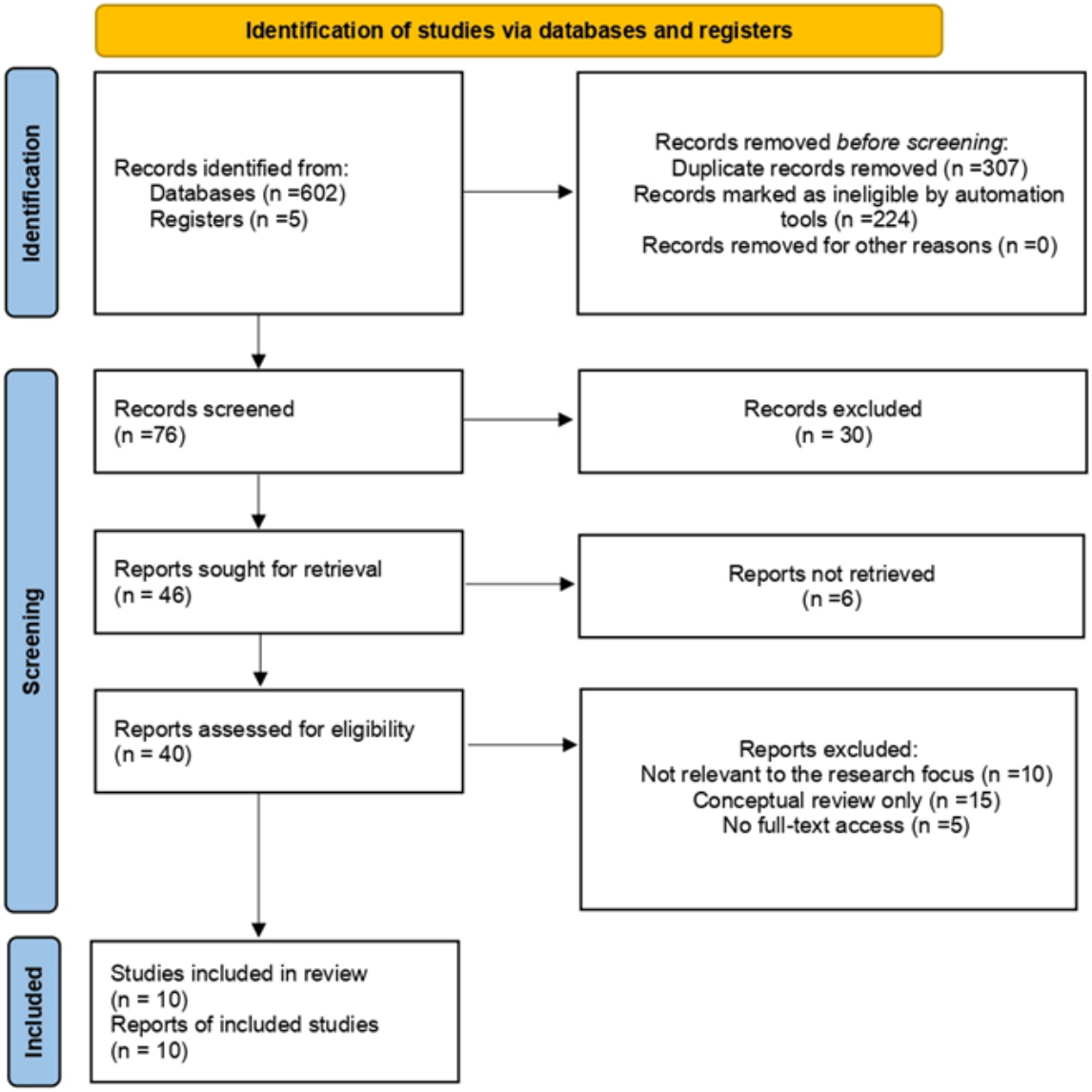

Figure 1. Prisma Flow Chart

Based on the PRISMA flowchart in Figure 1, researchers identified 607 articles from Google Scholar and Scopus (2020–2025). After initial screening, 531 articles were eliminated due to duplication and irrelevance by an automated system. Of the 76 articles screened, 30 were irrelevant based on their titles and abstracts. A total of 46 articles were tracked, but 6 were not available in full. Of the 40 articles assessed for eligibility, 30 were eliminated because they were irrelevant, only conceptual reviews, or inaccessible. Finally, 10 articles met the criteria and were further analyzed in this study.

3. RESULT AND DISCUSSION

This study is based on a tabulation of literature reviews from articles related to the influence of the flipped problem-based learning model on students' basic literacy in the context of self-regulated learning, as shown in Table 1.

Table 1. Literature Review Results

Author/Year	Journal	Research Results
(Farnsworth & Ge, 2025)	The Interdisciplinary Journal of Problem Based learning	FPBL significantly improves critical and collaborative literacy. There was an increase in student participation scores from 3.1 to 4.5 (Likert scale), and an increase in conceptual understanding and critical thinking skills of more than 20%.
(Adah Miller et al., 2025)	Disciplinary and Interdisciplinary Science Education Research	This study shows that the implementation of Problem-Based Learning (PBL) at the elementary school level can improve students' cognitive flexibility. PBL creates a learning environment that encourages exploration, critical thinking, and problem-solving. This approach also strengthens students' scientific literacy, as they are actively involved in formulating questions, seeking information, and building understanding.
Domu et al., (2023)	Journal of Education and E-Learning Research	The flipped problem-based learning (FPBL) model significantly improves students' statistical literacy. Empirical data shows that the post-test scores of the experimental group increased from 58.96 to 86.02.
Dan & Mohamed, (2024)	Contemporary Educational Technology	The flipped classroom approach, including problem-based learning, consistently improves students' language literacy. Empirically, more than 70% of the studies reviewed reported significant improvements in student performance, motivation, and participation in language learning.
(Diningrat et al., 2024)	Journal of Educators Online	The relationship between the flipped classroom strategy and SRL on satisfaction and learning outcomes. The results showed an increase in self-regulation scores from 3.1 to 4.3 on a 5-point scale and a positive correlation between SRL and digital literacy.
Bahri et al., (2024)	Journal of Technology and Science Education	The significant contribution of self-regulated learning (SRL) to learning outcomes and digital literacy. The results show that SRL contributes 71.42% to learning outcomes.
Xue et al., (2025)	Journal of Educational Technology and Online Learning	The results show that since 2020, there has been a sharp increase in publications linking SRL to digital literacy, personalized learning, and technology-based learning.
Anthonysamy et al., (2020)	Education and Information Technologies	Self-regulated learning (SRL) strategies significantly enhance students' digital literacy. Based on a survey of 563 respondents and PLS-SEM analysis, the three domains of SRL (metacognitive, resource management, and motivation) positively influence digital literacy, with an R^2 value of 0.612 and significance $p < 0.001$.
Gao & Liu, (2025)	Educational Technology and Society	The integration of FPBL and SRL in adaptive online learning significantly improves digital literacy.

Author/Year	Journal	Research Results
Utomo et al., (2024)	International Journal of Pedagogy and Teacher Education	The combined impact of FPBL and SRL on improving critical reading literacy among 102 students. The results showed an increase in post-test scores from 63.1 to 84.5, with an N-Gain of 0.71 (high category).

3.1 The Effect of Flipped Problem Based Learning on Basic Literacy

The Flipped Problem-Based Learning (FPBL) model is increasingly relevant in the context of digital and pandemic learning, as demonstrated in a study by Chi et al. (2022) titled "Implementation of the Flipped Classroom Combined with Problem-Based Learning in a Medical Nursing Course." This study demonstrates that the integration of the flipped classroom and PBL significantly enhances mastery of subject matter and higher-order thinking skills, including critical thinking and collaboration abilities, which are at the core of foundational literacy. Farnsworth & Ge (2025) further support these findings through an editorial in The Interdisciplinary Journal of Problem-Based Learning, emphasizing the effectiveness of the FPBL approach in developing critical thinking literacy and collaborative reflection. The quasi-experimental results they highlight show an increase in student engagement from a score of 3.1 to 4.5 on the Likert scale, as well as an increase in argumentative literacy of over 20%.

Community literacy is not only the responsibility of formal education but is closely linked to government interventions, as demonstrated in the study by Suhadhan et al. (2023), which highlights "The Role of Local Governments in Enhancing Community Literacy in Banten Province." If FPBL is adopted in community-based literacy programs facilitated by local governments, this approach can empower communities through active and contextual learning. Additionally, Ariyani et al. (2025), through their study on the effectiveness of the School Literacy Movement, demonstrated an increase in elementary students' reading interest through guided and independent literacy activities, aligning with the spirit of active and reflective learning in the FPBL approach. Nsyengula et al. (2024) in their study Enhancing Competency-Based Learning Through Flipped Classroom Approach demonstrated that the implementation of FPBL in competency-based English language learning in secondary schools promotes students' contextual literacy. These findings are in line with Miller et al. (2025), who also showed that the flipped and problem-based approaches improve contextual communication skills, discussion engagement, and reading comprehension in an active learning environment.

Digital literacy, as part of basic literacy, is also strengthened through the FPBL approach. Research by Domu et al. (2023) in the Journal of Education and E-Learning Research confirms that the FPBL model can improve students' statistical literacy. The post-test scores of the experimental group increased significantly from 58.96 to 86.02, compared to the control group, which only rose to 74.27 ($p < 0.001$). A bibliometric study by Dan & Mohamed (2024) also identified over 309 articles supporting the effectiveness of the flipped classroom approach, including those based on problem-based learning, in improving students' language literacy and critical thinking skills. Over 70% of the studies they reviewed reported significant improvements in participation, motivation, and academic literacy outcomes.

3.2 The Role of Self-Regulated Learning in Basic Literacy Learning

Research related to SRL by Sutarni et al. (2021) as found in the journal "Self-Regulated Learning and Digital Learning Environment: Its Effect on Academic Achievement During the Pandemic" shows that SRL is the key to successful online learning. SRL enables students to set goals, monitor the learning process, and evaluate outcomes, which supports the development of basic literacy skills independently, especially in the era of online and digital learning. In line with this, Khoiriah (2022) demonstrates that an Assessment for Learning approach based on high-order thinking skills (HOTS) can enhance numeracy literacy skills while fostering independent and reflective learning behaviors key components of SRL. Furthermore, in a study conducted by Rahmawati et al. (2022), it was found that students with high levels of SRL were able to adapt well to changes in the learning system, including managing access to digital resources, determining learning strategies, and maintaining motivation.

Diningrat et al. (2024) emphasize that integrating SRL into digital learning can promote improvements in student literacy through independent and collaborative learning. Meanwhile, Bahri et al. (2024) highlight that SRL in science education contributes to strengthening students' scientific literacy by training them to set learning goals and reflect on their conceptual understanding. Xue et al. (2025), through a bibliometric study, show that SRL is a major trend in technology-based learning designs such as MOOCs and AI, which aim to create personalized learning that is adaptive and relevant to digital literacy needs. Furthermore, Anthonysamy et al. (2020) assert that SRL plays a major role in shaping digital literacy competencies, particularly through metacognitive skills, time management, and strong learning motivation in a digital environment.

3.3 Interaction between Flipped Problem Based Learning and Self Regulated Learning

The interaction between Flipped Problem-Based Learning (FPBL) and Self-Regulated Learning (SRL) demonstrates a synergy that enhances the effectiveness of both approaches in literacy-based learning. FPBL provides an active learning environment, while SRL optimizes student participation within that environment. This aligns with the findings of Gao & Liu (2025) in the article "Towards Tailored Online Learning: Predicting Learner Profiles in an Online Learning Environment with Perceived Needs Satisfaction," which states that the effectiveness of an online learning environment heavily depends on students' profiles, self-regulation, and personal needs that must be met by a flexible digital learning system. Additionally, research by Izadpanah (2022) shows that the flipped teaching approach can enhance academic resilience, self-directed learning, and student autonomy in EFL, reinforcing the argument that SRL plays a crucial role in optimizing the implementation of flipped and problem-based learning.

In the context of higher education, Utomo et al. (2024) in the journal "Student Literacy and Literacy Skills in Higher Education: A Bibliometric Review" note that interdisciplinary and multimodal approaches are crucial in the development of student literacy. FPBL and SRL, when combined, form a multimodal learning model that addresses cognitive (concept understanding), affective (motivation), and metacognitive (learning reflection) aspects. Meanwhile, Halimatussakdiah et al. (2023) reveal that audiovisual-based literacy workshops in disaster-affected areas encourage students to be active, independent, and reflective in the learning process, demonstrating the practical application of FPBL and SRL principles in a contextual and inclusive setting. The theoretical implication of this integration is the importance of modifying active learning theory by explicitly incorporating SRL elements, as guided by The Interdisciplinary Journal of Problem-Based Learning. This creates opportunities to develop a learning theory that

is not only problem-centered but also personalized through adaptive self-regulation strategies in a digital environment. Based on findings reinforced by global and national literature:

PBL: not only an effective method for improving basic literacy in the classroom context, but also has the potential to be implemented at the community level by local governments.

SRL: supports the critical ability of self-directed learning in the digital age, strengthening aspects of digital literacy and critical thinking.

FPBL–SRL integration: forms an interactive and adaptive learning model, relevant in online and blended learning environments.

The combination of FPBL and SRL also implies the need to redefine basic literacy in the 21st-century context, which now includes digital literacy, information management, critical inquiry, and lifelong learning skills.

4. CONCLUSION

Based on a systematic review of relevant literature using the Systematic Literature Review (SLR) method and the PRISMA guidelines, this study concludes that the consistent application of the Flipped Problem-Based Learning (FPBL) model contributes positively to improving students' basic literacy skills. FPBL has proven effective in creating an active and student-centered learning environment, strengthening critical thinking skills, deep reading skills, and fostering student independence and responsibility in the learning process. This approach fundamentally reconstructs the roles of teachers and students in the context of 21st-century learning, which is adaptive to technology and global challenges. Furthermore, findings from the analyzed literature indicate that Self-Regulated Learning (SRL) plays a crucial role as an internal factor that strengthens the literacy learning process. Students with high levels of SRL demonstrate better capacity in planning, monitoring, evaluating, and reflecting on their learning process. They also have a stronger tendency to set learning goals, manage time effectively, and overcome learning obstacles independently all of which significantly contribute to strengthening basic literacy.

One of the strategic findings of this study is the synergistic interaction between FPBL and SRL. The implementation of FPBL yields more optimal results in improving basic literacy when supported by high levels of SRL in students. This means that the success of innovative learning strategies like FPBL is highly dependent on students' internal readiness to manage and regulate their own learning processes. The collaboration between problem-based instructional design and technology (as in FPBL) with the enhancement of self-regulation skills forms a comprehensive and adaptive learning ecosystem tailored to the dynamics of modern education. Thus, this study recommends the need to integrate the FPBL approach and SRL development into school curricula and learning practices as a strategic effort to continuously improve students' basic literacy. This is increasingly relevant in the context of the digital disruption era, where demands for information literacy, technology, and critical thinking are an integral part of students' readiness for the future.

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