



Needs Analysis for a Deep Learning-Based Problem-Based Learning (PBL) Model in Primary School IPAS Subjects

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Abstract: The modern curriculum necessitates a fundamental shift in IPAS instruction from rote memorization to deep learning of concepts; however, field implementation often remains superficial. Furthermore, while the Problem-Based Learning (PBL) model is effective, teachers frequently encounter constraints in designing contextual scenarios that ensure that deep learning occurs. Consequently, this research aims to analyze the specific necessities for developing a PBL model based on deep learning for primary school IPAS subjects. This qualitative descriptive study involved 32 teachers and 171 Grade 4 students at primary schools, utilizing comprehensive questionnaires to assess needs across cognitive, pedagogical, technical, socio-cultural, and evaluative dimensions. The analysis reveals that all surveyed aspects fall into the “High Need” category. Specifically, teachers prioritized evaluation (97.75%) and pedagogical (93.35%) aspects, highlighting a critical demand for increased competence in authentic assessment and innovative strategies. Similarly, students indicated urgent needs in evaluative (97.07%) and technical (94.38%) domains. These findings confirm a significant gap in current instructional practices. It is concluded that developing a PBL-Deep Learning model that integrates local socio-cultural contexts with authentic, supportive evaluation instruments is essential to enhance students' conceptual mastery and facilitate effective teaching.

Keywords: Deep learning; IPAS; Learning models; Needs analysis; Problem based learning

Introduction

The current primary school curriculum, particularly through Natural and Social Sciences (IPAS) subjects, can build the foundation of students' science and social literacy (Ardianti et al., 2022). The science of science is no longer just a matter of fact learning, rather, it should lead to a deep understanding of concepts, critical thinking, creative thinking, and collaboration (deep learning) (Syawaluddin et al., 2024). Recent studies emphasize that science learning must facilitate students to deepen their understanding of the natural world, yet significant obstacles such as a lack of facilities and teacher skills persist (Agus et al., 2025). This gap contradicts the 21st-century skill requirements and the spirit of Indonesia's curriculum renewal, which

necessitates learning media based on scientific literacy to be fully effective (Fadlah et al., 2024). However, various studies show that IPAS learning in Indonesia still tends to be rote-oriented and has not stimulated high-level thinking skills (Fahruddin et al., 2023). This demand is in line with the necessary skills in the 21st century as well as the spirit of educational curriculum renewal in Indonesia that emphasizes meaningful and contextual learning (Ifdaniyah et al., 2024; Indarta et al., 2022). The problem-based learning (PBL) model is recognized to be very effective in achieving these goals.

PBL is an approach that puts students in real-world problem situations as the starting point of learning, which encourages them to investigate, analyze, and find solutions independently and collaboratively (Imroatus et al., 2025; Sagita et al., 2023). Meta-analysis research

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confirms that PBL significantly improves students' critical thinking skills in elementary science, especially when compared to conventional methods (Yani, 2025). By engaging students in authentic investigations, PBL integrates knowledge, skills, and values, thereby fostering active participation and autonomy (Ariyani et al., 2025). The essence of the PBL model lies in the involvement of students in authentic investigations to find real solutions to contextual problems (Chotimah et al., 2020). PBL directs students to learn through authentic contextual problem solving, so as to integrate knowledge, skills, and values meaningfully (Endaryati et al., 2023; Fuad et al., 2019). PBL in primary school creates students who are more active, critical thinkers, and self-sufficient in IPAS learning (Syaifi et al., 2022).

PBL is an effective strategy for improving higher-order thinking skills (Raharjo et al., 2023). However, its application is often constrained by the limitations of teachers in designing problem scenarios that are contextual and adaptive to student characteristics (Chotimah et al., 2023; T. T. D. Susanto et al., 2022). Furthermore, research emphasizes that the success of the model learning is highly dependent on the availability of valid and well-developed learning media to support the investigation process and enhance critical thinking skills (Lestari et al., 2024). Without such support, the implementation tends to remain superficial. Although PBL has proven effective, the challenge in IPAS learning is how to ensure the problem-solving process that students undertake actually achieve a level of deep understanding (deep learning) (Husnayadi, 2024).

However, the application of PBL often faces constraints, particularly regarding the depth of learning and teacher readiness. While PBL promotes activity, ensuring that the problem-solving process leads to genuine Deep Learning often requires supportive media. Azizah et al. (2025) emphasize that integrating PBL with interactive worksheets (E-LKPD) is essential to visualize abstract IPAS concepts and sustain student motivation. Similarly, for PBL to be truly effective in elementary settings, it must be supported by valid and practical learning tools that guide students through structured inquiry (Putri et al., 2024; Saralee et al., 2024). Additionally, researchers note that PBL implementations must be carefully designed to accommodate diverse student needs to prevent cognitive overload and ensure meaningful learning occurs (Darmawati et al., 2025; S. Susanto et al., 2025).

The concept of deep learning in education refers to an approach that focuses on three main aspects: meaningful learning (learning that relevant to student lives) (Pes et al., 2023), mindful learning (conscious and active learning), and joyful learning (pleasant learning experiences) (Montanaro et al., 2022). While PBL promotes activity, "doing" a problem does not guarantee

"understanding" it; ensuring that the problem-solving process leads to genuine deep learning remains a significant challenge that requires innovative media interventions (Ayuningsih et al., 2025). By integrating the principles deep learning, The PBL model can be improved so that students not only solve problems, but are also able to associate new knowledge with wider contexts, reflect deeply, and use their knowledge in new situations (González-Marcos et al., 2021; McPhail, 2021).

The conventional PBL model may not yet be fully structured to explicitly lead teachers and students to the principles of deep learning systematically in IPAS learning at elementary schools (Ediyanto et al., 2023). Therefore, there is a need for an innovative learning model that combines PBL excellence with the philosophy of deep learning (Yang et al., 2022).

The novelty of this research lies in the specific synthesis of "Deep Learning" principles (meaningful, mindful, and joyful) into the PBL framework specifically for primary school IPAS subjects. While PBL is widely studied and deep learning is a known theoretical concept, there is a scarcity of research that operationalizes the convergence of these two approaches into a unified instructional model for Indonesian primary education. Conventional PBL models are not typically structured to explicitly guide teachers in ensuring the "Mindful" and "Joyful" aspects of learning are present during the problem-solving process (Ediyanto et al., 2023; Yang & Rao, 2022). This study fills that gap by moving beyond general PBL implementation to design a specialized, depth-oriented framework.

This research is logically necessary for two main reasons. First, implementation readiness: A theoretical model cannot be successfully implemented without a clear understanding of the current "gap" in the field. A preliminary needs analysis is the crucial first step to identify specific teacher difficulties in facilitating deep reflection and student readiness for autonomous inquiry (Fadlah et al., 2024). Second, quality assurance in curriculum transition: As schools transition to new curricula, there is a risk that "active learning" becomes superficial "busy work." This research provides the empirical basis to formulate a model that ensures student activity actually translates into cognitive depth.

A preliminary study or needs analysis is a crucial step to identify teacher readiness, suitability of IPAS materials, implementation challenges, and the specific characteristics required of deep learning-based PBL models to be relevant and optimally applied in the primary school environment. Based on this urgency, this research aims to conduct a deep learning-based Problem-Based Learning (PBL) model that needs analysis on IPAS elementary school subjects to formulate an innovative model framework that can

improve the quality of IPAS learning processes and outcomes in depth. The research question in this study is: How do teachers and students perceive the need for a deep learning-based PBL model in elementary school IPAS learning?

Method

The research method used is an inquiry approach, which aims to examine the needs and opinions of 32 elementary school teachers and 171 fourth-grade elementary school students as an early stage in designing innovative learning models. The questionnaire was completed online on Google Forms voluntarily. The type of research used is qualitative descriptive research reinforced with simple quantitative data (Mihias, 2019).

This research was conducted using a procedural framework divided into three primary phases: preliminary study, planning, and model implementation. The initial phase focused on analyzing the needs for developing a Deep Learning based Problem-Based Learning (PBL) model for the Natural and Social Sciences (IPAS) subject. To acquire comprehensive data, the primary instruments utilized were in-depth interview guides and structured survey questionnaires. Data collection employed source and technique triangulation methods, combining interviews and surveys to clarify and validate field data in depth (Sugiyono, 2017). The collected data were analyzed by exploring findings or phenomena from various informants (teachers and students) and other sources; these data were subsequently reduced and described to derive meanings relevant to the deep learning context. Visually, the detailed strategic steps of this research are presented in Figure 1.

Place and Subject of Study

The research place was chosen from two primary schools, namely SD Negeri 150 Palembang and SD Az-Zahrah Palembang, which are familiar with the Merdeka curriculum (IPAS) or have tried the PBL model. The subject of this study was 32 IPAS subject teachers and 171 related fourth-grade students as a source of data on interests, difficulties, and learning styles.

Data Collection and Analysis

The techniques used include data triangulation (a combination of several techniques) to improve validity. The instrument used was a questionnaire form. The instrument consisted of 11 statements for teachers and 13 statements for students. Respondents assessed each item on a scale of 1 to 5, with 1 meaning total disapproval and 5 meaning full approval. Responses were processed

by summing the percentages of 1 and 2, and 4 and 5, respectively, which are interpreted as disapproval and approval. The average response for each item is calculated and used to interpret the result. To facilitate the interpretation and presentation of respondent proportions, the 5-point Likert scale score is recoded into two categories: Agree (score 3–5) and Disagree (score 1–2). The merging of categories is done for descriptive purposes; for inferential analysis, additional analysis is performed using the original 1–5 scores to keep ordinal information (sensitivity analysis reported). Content validity is reviewed by educational experts and learning technology specialists.

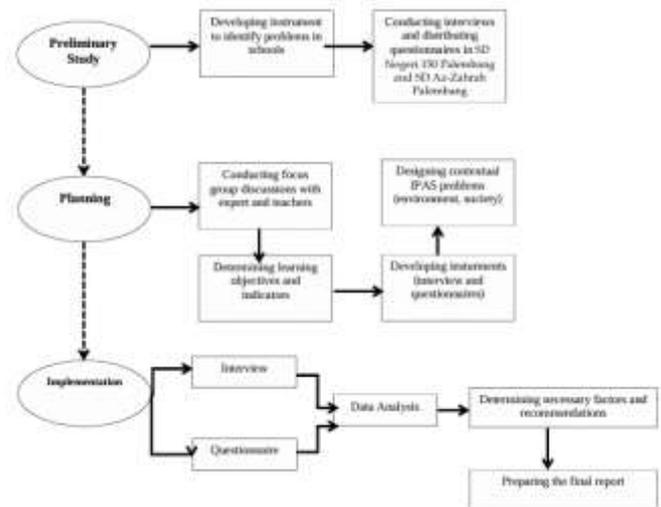


Figure 1. Research stage

The results of the analysis are used as a conceptual basis for the development of digital learning media that are contextual and aligned with the characteristics of elementary school learners.

Table 1. Grid of Needs Analysis Grid (Raharjo, 2004)

Aspect	Number Statement	
	Students	Teacher
Cognitive	1-3	1- 3
Pedagogical	4-7	4 - 6
Technique	8-9	7 - 8
Social culture	10	9 - 11
Evaluation	11	12-13

Based on the results of a preliminary needs analysis, the six main aspects—pedagogical, technical, cognitive, aesthetic, socio-cultural, and evaluative—became a reference in the development of research instruments. In addition, the researchers added 13 additional statements to describe learners’ learning activities at home that still relate to these six aspects. Detailed aspect mapping and compact indicators are presented in Table 2.

Table 2. Aspects of Deep Learning PBL Model Learning

Aspect	Indicator	Number Statement
Cognitive	Understanding and conceptual reasoning	1-3
Pedagogical	Strategy and independence learn	4-6
Technique	Acces and use of the device	7-8
Social culture	Engagement and cooperation	9-11
Evaluation	Reflection and feedback	12-13

Table 3. Categories of Needs Analysis Scale

Score	Category of Assessment
5	Strongly agree
4	Agree
3	Enough
2	Disagree
1	Strongly disagree

The data is analyzed using the percentage technique using the formula:

$$P = \frac{f}{N} \times 100\% \tag{1}$$

With:

- P = percentage
- f = number of scores earned N
- N = maximum number of scores.

The percentage results are then categorized according to the level of need (low, medium, high, very high).

Table 4. Category Level of Need

Percentage (%)	Category of need
0 - 25	Very low
26 - 50	Low
51 - 75	Medium
76 - 100	High

Results and Discussion

This discussion outlines the findings of the needs analysis and provides a theoretical justification for the design of problem based learning (PBL) based models Deep learning proposed. The survey results are described as follows.

Analysis of Student Needs

The results of the analysis show that the socio-cultural aspect has the highest average value (13.98) with a standard deviation of 1.564. This indicates that teachers assess the importance of integrating social and cultural values in IPAS learning through deep learning-based PBL models, particularly to foster cooperation,

empathy, and the relevance of local contexts in the learning process. A relatively low standard deviation value indicates that teachers’ responses to this aspect tend to be uniform and consistent. The pedagogical aspect ranked second, with an average value of 13.19 and a standard deviation of 1.974. These findings suggest that teachers have a high need for the application of innovative pedagogical approaches that can help them improve learning effectiveness and student involvement. A slightly greater variation in responses than in the socio-cultural aspect suggests differences in teachers’ levels of understanding and experience in applying PBL-based learning models and deep learning technologies.

Table 5. Analysis of student needs

Aspect	N	Min	Max	Mean	Std. Deviation
Cognitive	171	8	15	12.15	1.755
Pedagogical	171	8	15	13.19	1.974
Technique	171	6	10	9.44	.983
Social culture	171	8	15	13.98	1.564
Evaluation	171	6	10	9.71	.772
Valid N (listwise)	171				

Next, the cognitive aspect obtain an average value 12.15 with standard deviation 1.755. These results illustrate that teachers have a fairly good awareness of the importance of developing high-level thinking skills of learners. However, compared to the socio-cultural and pedagogical aspects, the cognitive aspects still show room for improvement especially in designing learning activities that encourage analysis, synthesis, and evaluation of knowledge. The evaluative aspect obtained an average value of 9.71 with a standard deviation of 0.772, while the technical aspect had an average value of 9.44 with a standard deviation of 0.983. Both aspects indicate a relatively moderate level of need. The near-upper-level averages suggest that teachers require further support in the use of learning technologies, as well as in the development of evaluation instruments capable of assessing deep learning-based processes and learning outcomes more authentically.



Figure 2. Diagram of the results of data analysis on student’s needs for each aspect

Based on the results of the students' needs analysis graph on the learning aspects of the Deep Learning-based Problem-Based Learning (PBL) model, it appears that all aspects are in the high category according to the criteria in Table 5 (range 76–100%). The evaluative aspect obtained the highest percentage (97.07%), demonstrating that students have a very high need for a learning model that helps them in the process of self-evaluation and understanding learning outcomes. The technical and socio-cultural aspects each obtained percentages of 94.38% and 93.17%, signifying that students need technical support in the use of media or learning tools as well as learning that is relevant to their socio-cultural context. Meanwhile, the pedagogical aspect obtained a value of 87.95%, demonstrating that students still need an engaging, interactive, and learner-centered learning approach. As for the cognitive aspect, it showed the lowest value (80.97%); however, it remains relatively high, which means that students need improvement in terms of understanding concepts and applying knowledge. Overall, these results indicate that students have a high level of need across all learning aspects, with a primary focus on evaluative and technical aspects to support the effectiveness of Deep Learning-based PBL models.

Analysis of Teacher Needs

Based on the results of the analysis of teachers' needs for the Deep Learning-based Problem-Based Learning (PBL) model, an average value (mean) and standard deviation (std. deviation) were obtained, which reflect the level of teacher needs in each learning aspect. The pedagogical aspect showed the highest average score (23.34) with a standard deviation of 1.331, which indicates that teachers have a very high need for the implementation of interesting, interactive, and student-centered learning strategies to make the teaching and learning process more effective. Furthermore, the evaluative aspect obtained an average score of 4.89 with a standard deviation of 0.318, indicating that teachers consider it important to have an objective and transparent assessment system that can measure students' higher-order thinking skills comprehensively.

Table 6. Analysis of Teacher Needs

Aspect	N	Min	Max	Mean	Std. Deviation
Cognitive	80	7	10	9.20	.683
Pedagogical	80	19	25	23.34	1.331
Technique	80	8	10	9.28	.729
Social culture	80	2	5	4.00	.941
Evaluation	80	4	5	4.89	.318
Valid N (listwise)	80				

The technical and cognitive aspects had relatively balanced average scores (9.28 and 9.20, respectively), with low standard deviations, indicating a stable need for technical support in the use of Deep Learning-based PBL models. Meanwhile, the socio-cultural aspect obtained an average score of 4.00 with a standard deviation of 0.941, showing that teachers still perceive difficulties or obstacles when teaching social studies. Overall, these results illustrate that teachers have a high level of need across all learning aspects.

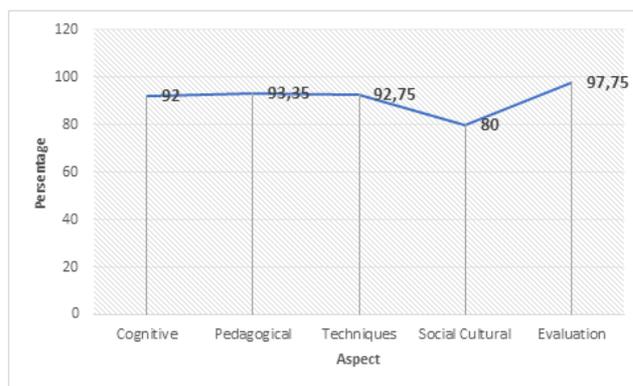


Figure 3. Diagram of the results of data analysis on teacher needs for each aspect

The results of the analysis of teacher competency development needs showed that all learning aspects measured – Cognitive (92%), Pedagogical (93.35%), Technical (92.75%), Socio-Cultural (80%), and Evaluation (97.75%) – were in the High Needs category (76%–100%). These findings indicate a strong and equitable need for improving teachers' professional competence. Specifically, the Evaluation aspect showed the highest percentage of need (97.75%), confirming that improving teachers' ability to design and implement learning assessments is the most urgent priority. The learning process in social studies subjects has been running well so far. Meanwhile, although the socio-cultural aspect occupies a lower percentage (80%), this confirms that classroom learning, especially in social studies, still encounters obstacles. Overall, all teaching dimensions require substantial developmental interventions. In aggregate, these data provide a strong basis for the need to develop a Deep Learning-Based Problem-Based Learning (PBL) Model in elementary school science subjects.

Teacher Interview Results

Based on interviews with 78 teachers, most teachers stated that IPAS lesson planning in grade IV was carried out with reference to ATP, teaching modules, and the learning objectives of the Merdeka Curriculum. In terms of evaluation, teachers used various assessments such as worksheets, observations, project assessments, and short

quizzes. The main learning resources used most frequently were the Ministry of Education and Culture's IPAS books, teaching modules, and student worksheets. In terms of learning models, teachers most often used Discovery Learning, PBL, and Project-Based Learning because they were considered to be in line with the active and curious characteristics of fourth-grade students. However, teachers still faced obstacles such as time constraints, a lack of practical facilities, and differences in students' abilities to work in groups. In understanding IPAS, teachers assess that the uniqueness of IPAS lies in the integration of science and social concepts so that learning is more contextual and closer to everyday life. The integration of science and social studies is carried out through thematic projects, case studies, and environmental observations. Most teachers stated that IPAS learning is able to encourage the development of critical thinking skills, problem solving, and the ability to conclude information through investigation and group discussion activities.

Discussion

The results of the needs analysis show that the pedagogical aspect occupies the highest priority among teachers, followed by the socio-cultural and cognitive aspects, while the technical and evaluative aspects also require strengthening. These findings indicate that teachers demand the development of learning models that facilitate more interactive and student-centered teaching strategies and support the active involvement characteristic of Problem-Based Learning, as an effort to improve the quality of IPAS learning. This finding aligns with empirical evidence that PBL is effective in improving students' critical thinking skills and engagement, thereby reinforcing teachers' need for stronger pedagogical capacity in its implementation (Su et al., 2025).

The high need for socio-cultural aspects reflects teachers' desire for science learning to be contextualized with local realities and cultural values of students. Contextual and constructivist approaches in learning have been proven to increase the relevance of the material and learning motivation, therefore the integration of socio-cultural contexts in the design of Deep Learning-based PBL needs to be prioritized so that students' real problems become the starting point for learning (Gannar et al., 2025).

The evaluative aspect needs to be strengthened through the application of authentic assessments that assess PBL learning processes and products (e.g. rubrics, portfolios, collaborative observations) and utilize learning analytics capabilities to provide formative feedback. Recent literature highlights the importance of authentic assessments in assessing the high-level thinking competencies and collaborative skills

developed through PBL (Siregar et al., 2025), therefore the design of evaluation instruments should be an integral part of model development (Shroff et al., 2023; Widyatama et al., 2025).

Based on findings and literature review, it is suggested that the development of a Deep Learning-based PBL model should (1) prioritize strengthening teachers' pedagogical capabilities through PD (Professional Development) programs that focus on PBL design and the use of AI for learning; (2) integrate the local socio-cultural context in PBL problem scenarios; (3) provide adequate technical training and infrastructure; and (4) design authentic evaluation instruments that utilize learning data for continuous feedback. These steps are expected to close the gap between teachers' needs and readiness to implement such innovative models (Riani et al., 2025).

The limitations of this study include the localized scope of respondents (primary schools in a specific area), which requires caution in generalizing the findings. Therefore, further research is recommended to test the Deep Learning-based PBL prototype model in various school contexts and to measure its impact on students' learning outcomes and critical thinking skills.

Conclusion

Based on the results of the analysis of teachers' needs for developing a Deep Learning-based Problem-Based Learning (PBL) model in science subjects, it was found that teachers have high needs in the Cognitive (92%), Pedagogical (93.35%), Technical (92.75%), Socio-Cultural (80%), and Evaluation (97.75%) aspects, all of which fall into the High Needs category. This indicates that teachers urgently require a learning model that strengthens their pedagogical capacity to manage innovative, contextual, and student-centered learning. Similarly, the analysis of students' needs shows that all learning aspects of the Deep Learning-based PBL model fall into the high category. The evaluative aspect obtained the highest percentage (97.07%), while the technical and socio-cultural aspects reached 94.38% and 93.17%, respectively, indicating that students require technical support and learning tools aligned with their socio-cultural context. The pedagogical aspect obtained a score of 87.95%, showing that students still need engaging, interactive, and student-centered learning approaches. The cognitive aspect recorded the lowest score (80.97%), yet it remains within the high category. Based on these findings, several recommendations are proposed: (1) immediately design and develop a Deep Learning-Based PBL prototype model, including teacher guidelines (updated syntax with deep learning emphasis) and supporting teaching materials such as authentic IPAS problem-based student worksheets; (2)

integrate social values and local cultural contexts into the learning model to enhance relevance and engagement; (3) place strong emphasis on the Reflection stage of PBL to promote deep conceptual understanding and knowledge transfer; and (4) conduct advanced research to evaluate the effectiveness of the developed model across diverse school contexts in improving students' critical thinking, collaboration, and technological literacy skills.

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All authors contributed to the writing and revision of this article. For example, B.Y. contributed to data collection by conducting research; U.C. and M.R. contributed to the supervision of article preparation.

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Conflicts of Interest

The authors declare no conflict of interest in the publication of this scientific article.

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