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Analysis of integrated science and social studies (IPAS) learning activity problems at the elementary school level: a Design Thinking classroom observation study

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ABSTRACT

Integrated Science and Social Studies (IPAS) learning in primary schools requires active student engagement, critical thinking, collaboration, and contextual problem-solving. However, classroom implementation continues to face challenges, including limited identification of students' learning needs, insufficient collaborative and problem-solving activities, and inadequate feedback and reflection. This study aimed to analyze problems in IPAS learning activities based on classroom observations of teacher activities, student activities, classroom interactions, and the learning environment. The analysis was informed by Design Thinking, active learning, student-centered learning, formative assessment, and collaborative learning perspectives. A non-participant observation method was employed using a structured binary-scale ("Yes"/"No") instrument comprising 38 indicators across the three observation domains. The findings revealed relatively limited implementation in teacher and student activities, while classroom interaction and the learning environment demonstrated comparatively stronger performance. Positive practices included clearly communicated learning objectives and teachers' openness to students' opinions. However, weaknesses remained in collaborative learning, the use of instructional media, problem-solving activities, feedback, and end-of-lesson reflection. From a Design Thinking perspective, the learning process partially reflected the Empathize and Define stages, whereas the Ideate, Prototype, and Test stages were not yet systematically implemented. These findings highlight the need to strengthen the identification of students' learning needs, redesign collaborative and problem-solving activities, optimize instructional media, and ensure continuous feedback and reflection. Such improvements may support more student-centered, interactive, and meaningful IPAS learning in primary schools.

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Introduction

Natural and Social Sciences (*Ilmu Pengetahuan Alam dan Sosial*/IPAS) learning in elementary schools requires students not only to understand concepts but also to relate these concepts to the social and natural phenomena in their surroundings. This characteristic makes IPAS learning ideally contextual, collaborative, and student-centered, enabling students to develop critical thinking, problem-solving skills, and understanding through authentic experiences.

The urgency of active IPAS learning is closely related to the nature of scientific and social concepts, which are often abstract for elementary school students. When concepts are delivered primarily through verbal explanations and one-way learning activities, students may experience difficulties in connecting learning materials with their concrete experiences. A literature review of 25 studies on elementary science learning indicates that interactive media, such as animated videos, e-modules, educational games, learning applications, and augmented reality, can help visualize concepts, increase engagement, and support students' understanding. Nevertheless, media selection should consider its alignment with learning objectives, student characteristics, teacher readiness, and the availability of facilities so that media are not merely attractive but genuinely function as scaffolds for students' thinking processes (Prayoga et al., 2025; Saprudin et al., 2021).

In this context, IPAS learning activities need to provide students with opportunities to observe phenomena, formulate questions, discuss assumptions, explore alternative solutions, and reflect on their learning outcomes (Rizkiyana, 2026). Student engagement should therefore not be understood merely as attention or willingness to answer questions, but as cognitive, emotional, and behavioral involvement throughout the learning process. Actively engaged students need opportunities to express ideas, test their understanding, collaborate with others, and explain the reasoning behind their answers. Learning that remains predominantly verbal and teacher-centered may consequently produce only superficial participation and make it difficult for teachers to obtain an accurate understanding of students' prior knowledge, learning difficulties, and individual learning needs.

Exploring students' prior experiences and learning needs is an important step before teachers determine appropriate learning strategies. Such information can be obtained through guiding questions, simple concept maps, brief discussions, observation of student responses, or light diagnostic assessments (Aufat et al., 2026). These initial data can help teachers select relevant problem contexts and provide appropriate learning support. Thus, lesson planning should not be based solely on the sequence of subject matter but also on the actual conditions of the students who participate in the learning process.

In addition to identifying learning needs, contextual problems can help students recognize the relationship between IPAS concepts and the realities around them. Issues such as waste management, weather changes, water availability, environmental health, or local economic activities can serve as starting points for investigation. A study by Surya (2025) involving elementary school students demonstrated that problem-based learning was effective in improving reflective and critical thinking skills. Similarly, a meta-analysis of 42 articles published between 2020 and 2024 reported that Problem-Based Learning had a strong positive effect on both critical thinking and problem-solving abilities (Aripin et al., 2025). However, the problems presented in learning need to be accompanied by clear work instructions, guiding questions, and opportunities for students to discuss evidence before reaching conclusions.

The use of learning media is also important for bridging abstract IPAS concepts with more concrete learning experiences. Media may include pictures, real objects, information cards, short videos, e-modules, educational games, or simple applications selected according to learning objectives. A literature review of elementary science learning during the 2020–2025 period indicates that interactive media can support conceptual understanding, motivation, interest, and student engagement because they provide visual and dynamic learning experiences (Prayoga et al., 2025). Nevertheless, media should be integrated with activities involving observation, questioning, discussion, and problem-solving so that their use does not merely serve an entertainment function.

Learning quality is further determined by the availability of feedback and reflection. Formative feedback helps students identify what they have understood, recognize errors or shortcomings that need to be addressed, and determine the next learning steps they can take. A systematic review by Brandmo and Gamlem (2022) emphasizes that clear, timely, student-responsive, and action-oriented feedback is associated with improved learning outcomes and engagement. Therefore, feedback needs to be provided throughout the learning process, for example through guiding questions or comments on students' strategies, followed by meaningful reflection at the end of the lesson.

Collaboration also needs to be designed as an integral part of the learning structure rather than simply asking students to sit or work together. Teachers can organize small groups, assign roles, provide tasks that require the exchange of ideas, and establish success criteria that students understand. Classroom arrangement, access to learning resources, and a psychologically safe classroom atmosphere also influence the quality of these interactions. When collaborative activities are supported by meaningful problems, appropriate media, clear instructions, and feedback, students have greater opportunities to construct knowledge socially and develop self-confidence.

Despite the theoretical importance of active, contextual, collaborative, and student-centered learning, various problems are still encountered in classroom implementation, including in learning activities involving IPAS content. These problems may include limited exploration of students' needs and prior experiences, insufficient facilitation of discussion and group work, limited use of learning media, weak encouragement of problem-solving activities, and inconsistent feedback and reflection at the end of lessons. Such conditions may hinder the achievement of active, meaningful, and student-centered learning. To understand these problems more systematically, factual data obtained directly from classroom learning situations are needed rather than relying solely on planning documents. Classroom observation is particularly important because it can capture how teachers actually manage learning, how students respond, and how classroom interactions and environmental conditions support or hinder the learning process (Saprudin et al., 2022).

A framework is therefore needed to analyze classroom learning problems not merely as isolated weaknesses but as interconnected elements of instructional improvement. Design Thinking is relevant to this purpose because, in science and STEM/STEAM education, this approach can integrate inquiry, empathy toward users or students, idea development, prototyping, and iterative testing. A systematic review by Saseendran and Thomas (2025) indicates that its implementation requires teacher readiness, instructional flexibility, and adequate assessment mechanisms. Thus, the Design Thinking perspective provides a useful analytical lens for examining the relationships among teacher activities, student activities, classroom interactions, and environmental conditions.

In this study, Design Thinking is understood as a human-centered problem-solving approach that emphasizes empathy for users' needs, clear problem definition, idea development, prototyping, and iterative testing of solutions (Madi et al., 2026; Southern et al., 2026). In educational contexts, this approach is considered capable of strengthening student engagement, creativity, collaboration, empathy, and problem-solving abilities through contextual learning experiences oriented toward authentic needs (Saro et al., 2025). Its relevance to IPAS learning lies in its potential to connect the identification of students' learning needs, the formulation of learning problems, the development of ideas and solutions, and the evaluation of learning processes and outcomes. Previous evidence also shows that the implementation of Design Thinking in science education commonly involves inquiry-based tasks, empathy-oriented tools, and repeated prototyping activities, although its implementation may be constrained by teacher readiness, curricular rigidity, and inadequate assessment mechanisms (Saseendran and Thomas, 2025).

Accordingly, the use of the Design Thinking framework in the present study is intended not only to map observable stages of learning but also to analyze how students' needs, collaborative activities, learning media, problem-solving opportunities, feedback, and reflection operate as interconnected components of instructional practice. By examining actual classroom conditions, this study seeks to provide an evidence-based understanding of the gaps between the expected characteristics of active and student-centered IPAS learning and their implementation in primary school classrooms.

Therefore, this study aims to analyze problems in IPAS learning activities at the elementary school level based on classroom observation data covering teacher activities, student activities, classroom interactions, and the learning environment. Specifically, the study seeks to: (1) identify problems emerging in teacher activities, student activities, and classroom interactions and environmental conditions; (2) analyze these problems through the Design Thinking framework and relevant learning perspectives; and (3) formulate applicable recommendations for instructional improvement. The findings are expected to contribute to the improvement of IPAS learning by strengthening the identification of students' needs, collaborative and problem-solving activities, the use of appropriate learning media, and the provision of continuous feedback and reflection, thereby supporting more active, contextual, student-centered, and meaningful learning experiences.

Method

Research Approach and Type

This study employed a qualitative descriptive approach supported by simple quantitative data. The study was conducted at SD Negeri 2 Ternate City and involved a total of 33 students. Data were collected through direct observation of the classroom learning process using a structured observation sheet. The observation was non-participant in nature, meaning that the observer did not intervene in or participate in the teaching and learning activities but focused on systematically recording observable events and learning conditions.

Although the study primarily adopted a qualitative descriptive orientation, simple quantitative data were used to support the interpretation of the observation results. Each observation indicator was assessed using a binary response of "Yes" or "No," representing the presence or absence of observable evidence during the learning process. The fulfilled indicators were subsequently accumulated to obtain a descriptive score for each observation aspect. These scores were not intended for statistical inference but were used to provide an overview of the extent to which the expected learning practices were observed in the classroom.

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Instrument and Observed Aspects

The observation instrument consisted of three main domains: (1) teacher activities, comprising 15 indicators; (2) student activities, comprising 15 indicators; and (3) classroom interactions and learning environment, comprising 8 indicators. Thus, the instrument contained a total of 38 observation indicators.

The instrument was designed to examine classroom learning comprehensively by focusing not only on teacher performance but also on students' learning experiences, patterns of interaction, and classroom conditions as components of the instructional ecosystem. The observed indicators included several elements of contemporary learning, such as the use of real-world contexts, exploration of students' learning needs, guiding questions, collaboration, problem-solving activities, the use of learning media, feedback, reflection, and opportunities for active student participation. These components were considered relevant to IPAS learning, which requires students to connect scientific and social concepts with experiences and phenomena encountered in everyday life.

Data Collection Procedure

The data collection process was conducted through six main steps. First, a structured observation sheet was prepared based on the indicators of teacher activities, student activities, and classroom interactions and learning environment. Second, the researcher attended the classroom learning process directly as a non-participant observer. Third, observations were conducted throughout the learning process, covering the opening, core, and closing activities. Fourth, each indicator was marked based on observable evidence during the implementation of learning. Fifth, the number of fulfilled indicators was calculated for each observation domain. Finally, the observation results were interpreted descriptively to identify existing strengths, instructional challenges, and opportunities for improvement.

To maintain observational consistency, the observer used the same structured instrument and operational indicators throughout the observation process. Field notes were also used to record contextual evidence supporting each observation result. The consistency between the binary scores and the corresponding field notes was subsequently reviewed to ensure that the assigned scores reflected observable classroom conditions rather than general impressions. This procedure was intended to strengthen the consistency and transparency of the observation process.

Data Analysis Technique

The observation data were analyzed using descriptive analysis supported by simple quantitative calculations. For each domain, the number of indicators marked "Yes" was calculated and compared with the total number of indicators in that domain. The resulting scores were interpreted as descriptive representations of the extent to which the expected learning practices were evident during classroom observation. A higher proportion of fulfilled indicators indicated that more expected learning practices were observed, whereas a lower proportion indicated areas requiring greater attention and improvement. The binary scores were therefore used as supporting evidence for qualitative interpretation rather than as a basis for statistical generalization.

Subsequently, the findings were analyzed through the Design Thinking perspective, comprising the stages of *Empathize, Define, Ideate, Prototype,* and *Test*. The observation results were also interpreted in relation to active learning, student-centered learning, formative assessment, and collaborative learning. This analytical process enabled the study to identify not only which instructional components were insufficiently implemented but also how these limitations could be understood as interconnected problems within the learning process.

Through this analytical framework, weaknesses related to the identification of students' learning needs, problem formulation, idea development, collaborative activities, the use of learning media, feedback, reflection, and opportunities for testing or evaluating learning outcomes could be examined systematically. The results were ultimately used to formulate directions for instructional improvement aimed at strengthening more active, collaborative, student-centered, and meaningful IPAS learning in elementary schools.

Results and Discussions

The results of observations of the learning process are presented in Table 1.

Table 1. Summary of Observation Scores for Learning Activities

Observation Aspect	Score Obtained	Number of Indicators
Teacher activities	7	15
Student activities	6	15
Classroom interactions and environment	6	8

Source: Researcher observation results (2026)

Overall, the data indicate that the learning conditions are at a transitional stage. Several good instructional practices have already been observed; however, key elements of innovative learning have not yet been implemented comprehensively. This condition represents a fundamental issue that needs to be addressed so that learning, including IPAS instruction, can be implemented in a more active and meaningful manner.

Problems in Teacher Activity

The observation results showed that teacher activities fulfilled 7 out of 15 indicators. Several positive practices were evident during the learning process. The teacher opened the lesson by communicating clear learning objectives, related the material to students' real-life contexts, posed stimulating questions, provided opportunities for students to express their opinions, responded to students' questions or difficulties, allowed students to explore ideas, and demonstrated openness to students' feedback. These practices indicate that some elements of student-centered learning had been implemented. They also reflect the initial orientation of the Design Thinking process, particularly in the *Define* stage and, to a limited extent, the *Empathize* stage (Southern et al., 2026).

However, eight indicators were not fulfilled. The teacher had not systematically explored students' prior experiences or learning needs, facilitated discussion or group work, employed learning methods that broadly engaged students, provided sufficiently clear instructions, used appropriate instructional media, encouraged problem-solving activities, delivered formative feedback during the learning process, or concluded the lesson with reflection or a summary. These findings suggest that the strengths of the observed instruction remained concentrated on verbal interaction, whereas weaknesses were more apparent in the design and organization of learning activities. The learning process had not yet formed a complete sequence connecting needs identification, exploration, collaboration, problem solving, feedback, and reflection (Rahmawati et al., 2025).

This pattern is consistent with Saseendran and Thomas (2025), who found that the implementation of Design Thinking in science and STEM/STEAM education requires more than the introduction of creative activities. Effective implementation depends on the integration of inquiry, empathy-oriented exploration, idea development, prototyping, and iterative evaluation. Similarly, Southern et al. (2026) emphasize the importance of understanding learners' needs as a starting point for developing meaningful learning experiences. In the present study, although learning objectives and contextual questions were present, these initial elements were not followed by systematic activities that enabled students to collaboratively develop and test ideas.

The findings also support the argument of Johler (2022) that student-centered learning requires clear instructional structures and meaningful opportunities for participation. Clear objectives alone are insufficient when students do not fully understand the procedures, expected outcomes, or criteria for successful task completion. Therefore, the teacher's role needs to shift from primarily presenting information toward designing structured learning experiences in which students can identify problems, exchange ideas, test possible solutions, and evaluate their understanding.

Problems in Student Activity

Student activities received a score of 6 out of 15 indicators. Positive participation was observed in several aspects, including students' attention during learning, their willingness to answer or ask questions, their courage to express opinions, their attempts to complete assigned tasks, and their ability to connect learning materials with real-life experiences. The observer was also able to identify specific learning needs and difficulties experienced by some students. These findings demonstrate that the students possessed a foundation for active participation that could be developed further through more structured learning opportunities (Nuss & Smucker, 2022).

Nevertheless, the majority of the student activity indicators were not fulfilled. Students did not consistently understand the teacher's instructions, participate actively in group discussions, collaborate with peers, demonstrate strong curiosity, use available learning media effectively, display prominent creativity, engage in reflection, or demonstrate strong self-confidence. Moreover, the majority of students did not appear to be actively engaged throughout the learning process.

This finding should not be interpreted simply as evidence of low student motivation. Rather, it indicates that participation opportunities and instructional support may not have been sufficiently distributed across all students. Nuss and Smucker (2022) argue that active learning requires structures that encourage students to participate cognitively and behaviorally rather than merely attend to the teacher's explanations. Likewise, Suh (2011) highlights the importance of learning environments that are sufficiently safe, structured, and supportive to encourage students to communicate and participate.

The findings are also consistent with Karimah et al. (2024), who emphasize that student engagement is influenced by opportunities to make meaningful contributions, receive appropriate support, and participate in psychologically supportive learning environments. Thus, the limited engagement observed in this study may

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reflect a mismatch between students' potential for participation and the learning structures available to support that participation. Organizing students into small groups with clearly defined roles, such as observer, recorder, presenter, and questioner, could provide more equitable opportunities for each student to contribute and demonstrate understanding.

Problems in Classroom Interaction and Learning Environment

The observation results for classroom interaction and the learning environment showed a relatively higher score of 6 out of 8 indicators. Teacher-student interaction occurred in two directions, the classroom atmosphere was generally supportive of participation, and learning resources were relatively accessible. However, the observation also identified moments when students appeared confused, bored, or disengaged, as well as opportunities for instructional innovation based on problems emerging during the learning process.

Two major weaknesses were identified: the classroom arrangement did not sufficiently support discussion and collaboration, and learning barriers were not yet systematically identified. These findings reinforce the view of Nuss and Smucker (2022) that active participation is influenced not only by instructional tasks but also by the conditions under which interaction occurs. Classroom organization can either facilitate or restrict communication, peer support, and teachers' ability to monitor students' learning processes.

The limited use of instructional media also requires attention. As noted by Prayoga et al. (2025), interactive media can support conceptual understanding, motivation, interest, and student engagement, particularly when abstract concepts need to be visualized and connected to students' experiences. However, the present findings suggest that media should not be treated as an isolated technological addition. Instead, media need to be integrated into questioning, observation, discussion, and problem-solving activities. This interpretation is consistent with the observation-based findings of the present study, where the absence of meaningful media use was associated with limited opportunities for students to explore concepts and develop ideas collaboratively.

Analysis of Problems Based on the Design Thinking Perspective

The findings indicate that the observed IPAS learning process was still in a transitional stage toward a more complete Design Thinking cycle. The *Empathize* stage was not optimally implemented because students' prior experiences, learning needs, interests, and conceptual difficulties were not systematically explored. Although the teacher demonstrated openness to students' opinions, empathy in Design Thinking requires a more systematic effort to understand learners before determining instructional responses (Southern et al., 2026).

The *Define* stage was partially evident through the communication of learning objectives and the connection between learning materials and real-life contexts. However, unclear instructions and students' difficulties in understanding task procedures suggest that learning problems had not yet been translated into sufficiently accessible and meaningful tasks. This finding is consistent with Johler (2022), who emphasizes that meaningful student participation requires clarity regarding learning goals, task procedures, and expected contributions.

The *Ideate* stage was also limited. The absence of systematic group discussion, collaboration, and creative exploration reduced students' opportunities to exchange perspectives and develop alternative explanations or solutions. This finding corresponds with Saro et al. (2025), who highlight the importance of interaction and collaborative idea development within Design Thinking -oriented learning. Yu et al. (2024) similarly reported that Design Thinking can positively influence engagement, motivation, problem-solving skills, and academic achievement, particularly when its stages are implemented as an interconnected process rather than as isolated activities.

The *Prototype* and *Test* stages represented the most substantial gaps. Limited instructional media, minimal problem-solving activities, and the absence of systematic opportunities to create, present, evaluate, and revise ideas meant that students had limited opportunities to transform abstract understanding into concrete learning products or solutions. Saseendran and Thomas (2025) similarly found that Design Thinking in science and STEM/STEAM education commonly involves inquiry, the development of solutions, and iterative refinement. In the observed classroom, this transition from idea generation to experimentation and refinement had not yet been systematically established.

Furthermore, the absence of formative feedback and end-of-lesson reflection weakened the *Test* stage. Ismail et al. (2025) emphasize that testing within a Design Thinking process involves evaluating ideas and using the results to refine subsequent actions. In educational settings, this process can be realized through presentations, peer questions, teacher feedback, evidence comparison, and reflection. The absence of these activities in the observed learning process meant that neither students nor teachers obtained sufficient information about the effectiveness of the learning strategies or the development of students' understanding.

This interpretation is reinforced by Brandmo and Gamlem (2022), whose systematic review showed that clear, timely, student-responsive, and action-oriented feedback is associated with improved learning outcomes and engagement. Similarly, Nhlumayo et al. (2024) position formative assessment as a continuous process for identifying students' current understanding and determining appropriate follow-up actions. Therefore, the lack of feedback and reflection in the present study should not be viewed as a minor procedural weakness but as a structural gap that interrupted the transition from learning activities to evaluation and instructional improvement.

Analysis Based on Active and Student-Centered Learning

The findings also demonstrate a gap between the principles of active learning and their implementation in the observed classroom. Active learning was visible through stimulating questions, opportunities to express opinions, and students' attempts to complete tasks. However, these activities did not develop into deeper forms of participation because collaboration, systematic problem solving, experimentation, and reflection were limited. As argued by Nuss and Smucker (2022), active learning requires students to engage in processes of exploration, interaction, and meaning construction rather than merely respond to teacher questions.

From a student-centered learning perspective, the observed instruction demonstrated several positive foundations, particularly through two-way communication and teachers' openness to students' opinions. Nevertheless, the learning process had not yet fully positioned students' needs, prior experiences, and difficulties as the basis for instructional decision-making. Johler (2022) and Karimah et al. (2024) similarly emphasize that student-centered learning depends on meaningful participation, appropriate support, psychological safety, and opportunities for students to contribute to the learning process.

The present findings therefore suggest that the observed classroom was not entirely teacher-centered, but rather occupied an intermediate position between conventional teacher-directed instruction and fully student-centered learning. This constitutes an important theoretical contribution of the study: the transition toward student-centered and Design Thinking -oriented learning may occur gradually rather than through a simple dichotomy between "teacher-centered" and "student-centered" practices. Positive practices, such as contextual questioning and openness to student opinions, can serve as initial foundations. However, without systematic needs assessment, collaboration, ideation, prototyping, feedback, and reflection, the transformation remains incomplete.

Problems in Formative Assessment, Feedback, and Collaborative Learning

One of the most significant findings was the absence of consistent formative feedback during the learning process and the lack of reflection or summary at the end of the lesson. From the perspective of formative assessment, this represents a substantial instructional limitation because students may participate in learning activities without receiving sufficient information about what they have understood, what requires improvement, and what actions should be taken next (Nhlumayo et al., 2024; Sibela et al., 2024).

This finding is supported by Brandmo and Gamlem (2022), who found that effective feedback should be clear, timely, responsive to students' needs, and oriented toward subsequent action. Rahman et al. (2017) similarly reported that feedback is more effective when it provides meaningful guidance rather than merely indicating whether an answer is correct or incorrect. Therefore, the absence of feedback observed in this study may have limited teachers' ability to identify misconceptions and students' ability to regulate and improve their own learning.

Collaboration was also insufficiently developed. The absence of facilitated group work, limited student discussion, and classroom arrangements that did not support interaction indicate that collaborative learning had not yet been systematically designed. This finding corresponds with Johler (2022), who emphasizes that collaboration requires instructional structures that promote communication, shared responsibility, and the exchange of ideas rather than simply placing students in groups.

In the context of IPAS learning, formative assessment, feedback, and collaboration can be integrated within a single learning sequence. Teachers may begin by presenting a contextual problem, organize students into groups with specific roles, monitor students' reasoning through guiding questions, provide feedback while students develop solutions, and conclude the activity with reflection or an exit ticket. This approach is consistent with the studies of Putra et al. (2024), Rafiki et al. (2022), and Rezeki et al. (2026), which emphasize the importance of using learning evidence and student responses as a basis for subsequent instructional actions.

Practical Implications for IPAS Instruction and Teacher Professional Development

The identified gaps have direct implications for improving IPAS instruction and teacher professional development. Professional development programs should not focus exclusively on the transmission of new teaching models or the introduction of digital media. Instead, they need to strengthen teachers' capacity to diagnose students' learning needs, design contextual problems, facilitate collaborative learning, use instructional media purposefully, provide formative feedback, and guide student reflection.

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Based on the observation findings, teacher professional development can be organized around the Design Thinking cycle. Teachers can first learn to identify students' prior experiences and learning difficulties through brief diagnostic activities (*Empathize*). These findings can then be used to formulate contextual learning problems and communicate clear learning objectives (*Define*). Teachers can subsequently design discussion and idea-generation activities (*Ideate*), facilitate experiments, investigations, or the creation of simple learning products (*Prototype*), and use feedback and reflection to evaluate and improve students' understanding (*Test*).

This sequence is consistent with Jasmaniah (2025), who emphasizes the importance of implementing instructional improvement as an integrated cycle rather than as separate actions. It is also aligned with Saseendran and Thomas (2025), who highlight the iterative nature of Design Thinking implementation in science and STEM/STEAM education.

Practically, IPAS teachers may begin with relatively simple changes, such as using diagnostic questions to identify students' prior knowledge, incorporating images or concrete objects to visualize abstract concepts, assigning structured roles during group work, asking students to develop alternative solutions to contextual problems, and ending lessons with brief reflection questions or exit tickets. These practices can gradually strengthen the movement from information-oriented instruction toward learning experiences characterized by exploration, collaboration, experimentation, feedback, and continuous improvement.

Overall, the observation results demonstrate that the learning process had established several positive foundations, particularly through clear learning objectives, contextual connections, stimulating questions, and opportunities for students to express opinions. However, the low scores for teacher and student activities indicate that these positive practices had not yet developed into a comprehensive student-centered learning process.

From the Design Thinking perspective, the observed classroom can be characterized as being in a transitional stage. Elements of *Empathize* and *Define* had partially emerged, whereas *Ideate, Prototype,* and *Test* remained insufficiently developed. The findings therefore extend the understanding of instructional transformation by showing that the implementation of innovative learning frameworks is often gradual and uneven across different stages.

The main implication is that improving IPAS learning should involve an integrated redesign of learning activities rather than isolated interventions. Teachers need to begin with students' actual needs, organize contextual and collaborative problem-solving activities, use media as tools for exploration, and consistently provide feedback and reflection. Through this integrated sequence, IPAS learning can more effectively support students in connecting concepts with real-life phenomena, developing solutions collaboratively, and continuously improving their understanding.

Conclusions

This study aimed to identify problems in teacher activities, student activities, and classroom interactions and learning environment; analyze these problems through the Design Thinking framework and relevant learning perspectives; and formulate recommendations for improving IPAS learning at the elementary school level. The findings indicate that the observed learning process had established several positive foundations, particularly in the clarity of learning objectives, the connection between learning materials and real-life contexts, the use of stimulating questions, teachers' openness to students' opinions, and two-way teacher–student interaction. However, substantial problems remained in the exploration of students' learning needs, facilitation of collaboration, clarity of instructions, use of instructional media, problem-solving activities, formative feedback, closing reflection, student creativity, and the active engagement of the majority of students. The analysis using the Design Thinking framework further shows that the observed learning process had not yet developed into a complete and integrated cycle. Elements related to understanding the learning context and defining instructional goals were partially evident, whereas the systematic identification of students' needs (*Empathize*), collaborative generation of ideas (*Ideate*), development and experimentation of solutions (*Prototype*), and evaluation through feedback and reflection (*Test*) were not yet optimally implemented. These findings also indicate that the observed instruction occupied a transitional position between conventional teacher-directed learning and more fully student-centered learning. From the perspectives of student-centered learning, formative assessment, and collaborative learning, the primary areas requiring improvement include the systematic diagnosis of students' needs, the design of structured collaborative activities, the purposeful integration of instructional media, clearer task instructions, and continuous feedback and reflection. The findings suggest that the identified problems are amenable to targeted pedagogical intervention through a more systematic implementation of the Design Thinking cycle. For example, the limited exploration of students' needs can be addressed through the *Empathize* stage by using diagnostic questions, observation of prior experiences, and identification of learning difficulties. Weak collaboration can be strengthened through the *Ideate* stage by organizing structured group discussions and encouraging students to generate alternative solutions to contextual IPAS problems. Similarly, the limited use of media and problem-solving activities can be addressed through the *Prototype* stage by engaging students in experiments, investigations, models, or other simple representations of proposed solutions. Finally, the absence of consistent feedback and reflection can be addressed through the *Test* stage, in which students evaluate their ideas, receive formative feedback, and revise their understanding or solutions.

Therefore, improving IPAS learning should not rely on isolated instructional changes but on an integrated process that connects students' needs, problem formulation, collaborative exploration, solution development, and continuous evaluation. Such an approach has the potential to transform the currently partial learning process into a more empathetic, collaborative, creative, reflective, and student-centered learning environment aligned with the demands of twenty-first-century education. This study is limited by its focus on classroom observation in one elementary school involving 33 students. Therefore, the findings should be interpreted within the specific instructional context observed and are not intended for broad statistical generalization. Future studies may involve multiple schools, repeated classroom observations, and additional data sources, such as teacher and student interviews, to provide a more comprehensive understanding of IPAS learning problems and the effectiveness of interventions based on the Design Thinking framework.

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