Teaching Strategies and the Quality of Science Education for Upper Grade Elementary School Students

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Abstract: This study aims to analyze teachers' teaching strategies in improving the quality of science learning for upper grade students (IV, V, and VI) at the SD Inpres Perumnas II Makassar. The results show that teachers implement various strategies including selecting approaches that suit students' needs, using a variety of learning methods, actively involving students in learning activities, utilizing media that support conceptual understanding, and implementing continuous evaluation to assess learning success. All of these strategies complement each other and help create more engaging, understandable, and relevant science learning for students. Research findings also revealed that the choice of teaching strategy is influenced by several important factors: student characteristics, the characteristics of the science material being taught, the availability of learning media and facilities, the learning environment, and the desired learning objectives. These five factors serve as the basis for teachers to determine the most appropriate strategy, ensuring a more effective, focused learning process that enhances students' understanding of the material. Furthermore, this study identified several challenges teachers face in implementing science teaching strategies, such as diverse student abilities, time constraints, a lack of supporting media and facilities, sub-conducive classroom conditions, and uneven student motivation. These challenges require teachers to be creative and adapt strategies to ensure learning objectives are achieved and the quality of science instruction continues to improve.

Keywords: Learning Media; Science Learning; Student Characteristics; Teacher Challenges; Teaching Strategies

1. Introduction

Science and Social Studies (IPAS) learning at the elementary school level plays a strategic role in fostering students' critical thinking, collaboration skills, and socio-environmental awareness from an early age. As an integrated subject, IPAS is designed to combine scientific and social concepts to equip learners with essential 21st-century life skills relevant to global challenges. Ideally, IPAS learning emphasizes active engagement through exploration, experimentation, and contextual understanding of natural and social phenomena. However, in many educational settings, classroom practices have not fully reflected this integrative and innovative spirit, particularly when teaching strategies remain teacher-centered and procedural rather than inquiry-driven and student-oriented [1].

This misalignment between curricular goals and instructional practice is evident in the local context of IPAS learning at UPT SPF SD Inpres Perumnas II Makassar. Preliminary observations conducted in June 2025 in collaboration with the school principal and upper-grade teachers revealed that IPAS instruction is still predominantly dominated by conventional, one-way teaching methods. Lecturing and individual assignments remain the primary instructional strategies, resulting in passive student participation, limited classroom interaction, and declining learning motivation. Classroom observations in Grades IV, V, and VI

further indicated minimal use of environment-based learning media and insufficient dialogic interaction between teachers and students, suggesting that IPAS learning has not yet provided meaningful and engaging learning experiences.

Teaching strategies adopted by teachers constitute a critical determinant of IPAS learning quality. Inappropriate or monotonous instructional strategies may lead to suboptimal achievement of Basic Competencies as mandated by the Merdeka Curriculum [2]. Effective teaching strategies are expected to accommodate students' diverse learning needs through varied, active, and collaborative approaches aligned with instructional objectives and learner characteristics [3]. Within the IPAS framework, learning should be implemented thematically and holistically by integrating science and social studies, positioning teachers as facilitators who encourage exploration, group discussion, experimentation, and presentation to foster meaningful understanding [4], [5]. Nevertheless, empirical realities indicate that many teachers still treat IPAS as two separate subjects, resulting in fragmented learning experiences and limited conceptual integration among students.

The challenges faced by teachers in implementing effective IPAS strategies are closely linked to their readiness to interpret and operationalize the Merdeka Curriculum. This curriculum emphasizes differentiated instruction, strengthening the Pancasila Student Profile, and creating a humanistic and context-responsive learning environment. The success of learning implementation largely depends on teachers' ability to translate learning outcomes into relevant and contextual classroom activities [6]. However, limited conceptual understanding of IPAS, insufficient pedagogical training, and low digital literacy hinder teachers from optimally utilizing available instructional resources, including the Merdeka Teaching Platform provided by the government. This condition reflects a persistent gap between policy-level support and classroom-level implementation, particularly in the development of adaptive and innovative teaching strategies.

Previous studies have shown that low-quality IPAS learning is often driven by limited teacher training in scientific approaches and underutilization of local-based learning resources [7]. In fact, leveraging the surrounding environment as a living laboratory aligns strongly with the principles of Project-Based Learning and Problem-Based Learning promoted within the Merdeka Curriculum. Furthermore, cooperative learning models such as jigsaw, round robin, and inside-outside circle have been empirically proven to enhance active participation, social interaction, and students' communication skills [8]. Teacher creativity in selecting challenging, relevant, and context-based instructional strategies is therefore pivotal in achieving learning objectives in IPAS [9], [10]. Despite these findings, existing studies tend to focus on general instructional models and have not sufficiently examined variations in teachers' teaching strategies within specific school contexts, particularly in upper-grade elementary classrooms implementing the Merdeka Curriculum.

At a broader level, the quality of IPAS learning in elementary education has direct implications for the achievement of national education goals. High-quality IPAS instruction is essential in developing future generations with systematic and analytical thinking skills as well as strong awareness of social and environmental issues, which are crucial in responding to global challenges such as technological advancement, climate change, and social dynamics [11], [12], [13]. Therefore, a comprehensive and context-sensitive analysis of teachers' instructional strategies is urgently needed to identify patterns, strengths, and limitations in IPAS learning implementation. This study aims to analyze the teaching strategies employed by teachers to improve the quality of IPAS learning among upper-grade students (Grades IV, V, and VI) at UPT SPF SD Inpres Perumnas II Makassar, examine factors influencing teachers' strategy selection, and identify challenges encountered in implementing effective instructional strategies. The findings are expected to contribute empirically to the enhancement of IPAS learning practices and to strengthen teachers' capacities as key agents of change in elementary education.

2. Literature Review

Teaching Strategies

Teaching strategies are widely recognized as a fundamental pedagogical framework that shapes instructional direction, learning quality, and classroom effectiveness. Rather than functioning merely as teaching techniques, strategies are understood as integrated systems encompassing planning, implementation, and evaluation of learning processes that guide teacher–

student interactions toward instructional goals [14], [15]. This perspective positions teaching strategies as flexible and context-responsive constructs that must align with student characteristics and classroom dynamics. Further conceptual developments emphasize that teaching strategies operate as adaptive pedagogical patterns that allow teachers to reflect on learning processes and adjust instructional decisions to improve learning outcomes [16].

Recent studies indicate that effective teaching strategies reflect teachers' pedagogical competence and capacity for innovation. Teaching strategies are increasingly associated with teachers' ability to organize learning experiences that are responsive to students' needs while integrating instructional resources and educational technology to enhance learning relevance and engagement [17], [18]. From this perspective, teaching strategies are no longer static choices but dynamic pedagogical instruments that evolve in response to curricular demands and classroom realities.

The literature also suggests that instructional strategies should be viewed as complementary rather than isolated categories. Common instructional orientations—such as expository, inquiry-based, cooperative, and contextual strategies—serve different pedagogical purposes and may be combined adaptively depending on learning objectives and subject characteristics. Inquiry-based and cooperative strategies are particularly relevant for exploratory learning contexts, while contextual strategies strengthen the connection between academic content and students' lived experiences. However, empirical findings reveal a persistent tendency toward teacher-centered expository strategies, which may constrain student participation and limit opportunities for deep learning.

Teaching Strategies and Student Developmental Characteristics

The effectiveness of teaching strategies at the elementary level is closely linked to students' developmental characteristics, particularly in upper-grade classrooms. Students in Grades IV–VI are situated within the concrete operational stage, where logical reasoning begins to develop but remains grounded in concrete experiences [19]. At this stage, learning strategies that emphasize hands-on activities, visual representations, and experiential learning are more likely to support conceptual understanding than abstract or purely verbal instruction.

In addition to cognitive development, social-emotional and moral development shape students' learning needs. Upper-grade elementary students demonstrate increasing social awareness, sensitivity to peer interaction, and a growing preference for collaborative learning experiences. Instructional strategies that incorporate group work, discussion, and cooperative learning are therefore considered developmentally appropriate and pedagogically effective [20]. Despite this understanding, existing studies often treat developmental factors and teaching strategies as separate constructs, leaving limited insight into how developmental considerations are systematically integrated into instructional strategy selection, particularly in IPAS learning contexts.

Merdeka Curriculum and Learning Quality

The Merdeka Curriculum represents a shift toward flexible, competency-based, and student-centered education. This curriculum grants teachers autonomy to design learning experiences that align with students' contexts and learning needs while emphasizing character development and 21st-century competencies [2], [21]. A central feature of the Merdeka Curriculum is differentiated instruction, which requires teachers to adapt learning strategies according to students' interests, abilities, and learning profiles. The curriculum further promotes contextual, project-based, and problem-based learning approaches to support the development of the Pancasila Student Profile, including critical thinking, collaboration, creativity, and social responsibility. The successful implementation of these principles depends largely on teachers' ability to translate curricular flexibility into coherent teaching strategies. Pedagogical freedom within the Merdeka Curriculum therefore entails professional accountability, requiring teachers to integrate instructional strategies that remain aligned with curricular goals and students' real-life experiences [14], [22]. Despite its conceptual strengths, empirical studies indicate a persistent gap between curriculum design and classroom practice. Teachers frequently encounter challenges in implementing adaptive and innovative strategies consistently, resulting in uneven learning experiences across classrooms. This discrepancy highlights the need for empirical investigation into how teaching strategies are enacted within the Merdeka Curriculum, particularly in integrative subjects such as IPAS.

Learning Quality as an Educational Outcome

Learning quality is commonly conceptualized as a multidimensional outcome reflecting student engagement, instructional relevance, pedagogical effectiveness, and assessment practices. Learning quality is evident when students actively participate in learning activities, experience meaningful instruction, and demonstrate holistic development across cognitive, affective, and skill domains [23], [24]. This perspective emphasizes that learning quality emerges from sustained interaction among teachers, students, instructional strategies, and learning environments [25]. Key indicators of learning quality include student engagement, clarity of learning objectives, appropriateness of instructional strategies, authentic assessment, and constructive feedback. Reflective teaching practices and continuous instructional adjustment are also considered essential characteristics of high-quality learning environments [26]. Importantly, teaching strategies function not only as instructional tools but also as formative assessment mechanisms that enable teachers to monitor learning progress and refine instructional decisions.

IPAS Learning in Elementary Schools

IPAS is an integrative subject that combines natural and social sciences to promote contextual and transdisciplinary learning. IPAS instruction is designed to help students understand causal relationships between natural phenomena and social life, fostering holistic reasoning and critical inquiry [27]. Through experiential and inquiry-based learning activities, IPAS encourages students to actively observe, investigate, and reflect on real-world phenomena [28]. Beyond conceptual understanding, IPAS contributes to character development and the cultivation of life skills aligned with the goals of the Merdeka Curriculum. Collaborative projects and contextual discussions embedded in IPAS learning support the development of scientific literacy, social awareness, communication skills, and ecological responsibility [29]. These characteristics position IPAS as a subject that demands adaptive and innovative teaching strategies capable of supporting student-centered and process-oriented learning.

The reviewed literature highlights the interdependence of teaching strategies, student developmental characteristics, curriculum implementation, learning quality, and the integrative nature of IPAS instruction. Teaching strategies emerge as a central mediating variable that connects curricular intentions with learning outcomes. However, existing studies largely remain conceptual or normative and provide limited empirical evidence on how teachers design and implement IPAS teaching strategies in upper-grade elementary classrooms within the Merdeka Curriculum framework. Furthermore, prior research rarely integrates developmental considerations, instructional challenges, and classroom-level variations into a single analytical perspective. This study addresses these gaps by providing a contextual and empirical analysis of teaching strategies in IPAS learning and their implications for learning quality in upper-grade elementary education.

3. Proposed Method

Research Design and Approach

This study employed a qualitative descriptive research design to explore teachers' instructional strategies in improving the quality of IPAS learning in upper-grade elementary classrooms. A qualitative approach was selected to capture the complexity and contextual nature of instructional practices as they naturally occur in school settings without manipulation or intervention. This approach allowed for in-depth understanding of participants' perspectives, classroom dynamics, and instructional decision-making processes through inductive analysis and meaning-oriented interpretation. The researcher functioned as the primary research instrument, enabling flexible engagement with the field and responsiveness to emerging data throughout the research process. The study was conducted at UPT SPF SD Inpres Perumnas II Makassar during the first semester of the 2025/2026 academic year, specifically from July to December 2025. This site was selected due to its implementation of diverse instructional strategies in upper-grade classrooms, providing a relevant context for examining IPAS teaching practices under authentic conditions.

Participants

The participants consisted of six informants selected purposively based on their direct involvement in IPAS learning. These included three classroom teachers representing Grades IV, V, and VI, as well as three student representatives from upper-grade classes. This

composition enabled the study to capture multiple perspectives on instructional strategies, encompassing both teacher practices and student learning experiences.

Data Collection Procedures

Data were collected through non-participant classroom observations, semi-structured in-depth interviews, and document analysis to ensure comprehensive and triangulated data sources. Non-participant observations were conducted to systematically record instructional strategies employed by teachers during IPAS lessons without researcher intervention. Observation protocols were prepared in advance to maintain focus on instructional interactions, strategy implementation, and classroom engagement. Semi-structured interviews were conducted with the school principal and upper-grade teachers to explore their instructional planning, strategy selection, and perceived challenges in implementing IPAS learning. Interview guides were developed prior to data collection to ensure alignment with research objectives while allowing flexibility for probing and clarification. Follow-up interviews were conducted when necessary to deepen understanding and verify emerging interpretations. Document analysis complemented observational and interview data by examining institutional and instructional records, including lesson documentation, attendance records, teacher notes, instructional assessment instruments, photographs, and video recordings of classroom activities. Additional documents related to school history, teacher profiles, and available learning facilities were also reviewed to contextualize instructional practices within the broader school environment.

Instruments and Measures

In line with qualitative research conventions, the primary research instrument was the researcher, supported by structured observation guidelines, semi-structured interview protocols, and documentation checklists. These instruments were designed to capture consistent and relevant data related to teaching strategies, classroom interactions, and learning quality indicators in IPAS instruction.

Data Analysis Techniques

Data analysis followed an interactive and inductive qualitative analysis process conducted concurrently with data collection. The analysis involved systematic data reduction through selection, summarization, and coding of relevant information obtained from observations, interviews, and documents. Reduced data were then organized and displayed thematically to facilitate pattern recognition and cross-source comparison. The final stage involved drawing and verifying conclusions through continuous interpretation of emerging themes, relationships, and instructional patterns. Verification was conducted throughout the analysis process by revisiting data sources and conducting additional field checks when incomplete or ambiguous findings were identified.

4. Results and Discussion

Results

Instructional Strategies Applied by Teachers in Improving the Quality of IPAS Learning

The results indicate that upper-grade teachers (Grades IV–VI) applied instructional strategies through a reflective and contextual decision-making process. Strategy selection was not fixed but dynamically adjusted based on students' initial abilities, class characteristics, learning objectives, and classroom conditions. Teachers consistently combined exploratory activities, discussion, project-based tasks, and the use of concrete examples to support students' understanding of IPAS concepts.

Grade VI instruction emphasized guided discussions, simple experiments, and structured worksheets to support analytical thinking, while Grade V teachers frequently implemented small-scale projects and demonstrations to bridge concrete and abstract concepts. In contrast, Grade IV instruction relied heavily on contextual storytelling, manipulatives, and concrete learning media to accommodate students' developmental stages. Across all grades, teachers acknowledged that no single strategy was universally effective, necessitating continuous adjustment and reflection.

Variation of Teaching Methods

Teachers demonstrated consistent variation in instructional methods, including group discussions, demonstrations, experiments, contextual storytelling, and project-based learning. These methods were perceived as effective in increasing students' engagement and conceptual understanding. However, challenges emerged in managing group dynamics, time allocation for projects, and transitions between activities, particularly when students displayed differing levels of readiness. Students reported that learning became more meaningful when instructional methods involved hands-on activities, visual representations, and collaborative tasks. Conversely, reliance on textbook-centered explanations was perceived as less effective, particularly for abstract IPAS concepts.

Student Engagement in IPAS Learning

Active student engagement emerged as a central indicator of instructional quality. Teachers employed questioning techniques, structured group roles, paired projects, and hands-on activities to promote participation. Engagement levels varied by grade level, with older students demonstrating greater verbal participation during discussions and younger students showing higher engagement during concrete and kinesthetic activities. Despite generally positive engagement, teachers noted that some students remained passive, requiring closer supervision and clearer task instructions. Students confirmed that participation increased when learning activities were experiential and directly connected to everyday life.

Use of Instructional Media

Instructional media played a crucial role in supporting IPAS learning. Teachers utilized videos, diagrams, self-made teaching aids, and concrete materials sourced from the surrounding environment. Media selection was closely aligned with students' cognitive development and learning styles. While media use enhanced motivation and comprehension, limitations in media availability, maintenance issues, and unequal distribution among student groups were identified as constraints.

Evaluation of Instructional Strategies

Evaluation practices were primarily formative and reflective in nature. Teachers assessed strategy effectiveness through observation of student participation, analysis of student work, group presentations, and informal feedback sessions. Although evaluation was routinely conducted, teachers acknowledged limitations in documenting feedback systematically and in conducting individual-level assessments, particularly during group-based activities.

Factors Influencing Strategy Selection

Several factors influenced teachers' instructional decisions, including student characteristics, material complexity, availability of media and facilities, classroom conditions, learning objectives, and student motivation. Teachers consistently adjusted strategies based on these interrelated factors to ensure learning objectives were achieved.

Challenges in Implementing Effective Instructional Strategies

Teachers faced persistent challenges related to heterogeneous student abilities, limited instructional time, insufficient learning media, classroom management constraints, and fluctuating student motivation. These challenges required teachers to continuously balance instructional depth, classroom control, and learning engagement within restricted conditions.

Discussion

Adaptive Instructional Strategies and Learning Quality

The findings demonstrate that effective IPAS instruction in upper elementary grades depends on teachers' ability to implement adaptive and flexible instructional strategies. Teachers' emphasis on experiential learning, contextualization, and student-centered approaches aligns with the principle of learning by doing, which is essential for developing scientific understanding at the elementary level [30] . The integration of discussion, experimentation, and concrete examples supports students' cognitive transitions from concrete to more abstract reasoning [5].

Method Variation and Differentiated Instruction

The use of varied instructional methods reflects teachers' awareness of diverse learning styles and abilities within a single classroom. Differentiated instruction emerged as an implicit strategy, particularly in Grades V and VI, where students' cognitive readiness varied significantly. This finding supports Hidayat's assertion that instructional variation is critical for maintaining engagement and facilitating deeper conceptual understanding in science-based subjects [31].

Student Engagement as a Core Indicator of Instructional Quality

Active student engagement was found to be both an outcome and a prerequisite of effective instructional strategies. Consistent with Suryani (2021), engagement increased when students were given opportunities to interact, experiment, and collaborate. However, passive participation among some students highlights the need for clearer scaffolding and structured accountability within group activities.

Instructional Media and Contextual Learning

The findings confirm that instructional media function as a cognitive bridge between abstract concepts and real-world phenomena. The strategic use of visual and concrete media enhanced comprehension and motivation, particularly for younger students. This supports Hidayat's argument that media integration is not merely supplementary but central to effective IPAS instruction [25]. Nevertheless, limited facilities constrained the full implementation of experiential learning, reinforcing Hasanah's observation regarding infrastructure disparities in elementary education [32], [33]

Evaluation Practices and Reflective Teaching

Teachers' reliance on formative evaluation underscores the role of reflection in improving instructional quality. While evaluation was conducted regularly, its informal nature limited systematic documentation and individual feedback. This finding suggests a gap between reflective practice and structured assessment, indicating the need for more robust evaluation frameworks within IPAS instruction.

Determinants of Strategy Selection

Student characteristics, material complexity, and instructional goals were the most influential determinants of strategy selection, consistent with Najib's assertion that instructional alignment must consider both content demands and learner readiness. Classroom conditions and resource availability further shaped teachers' pedagogical decisions, highlighting the contextual nature of instructional effectiveness [34].

Challenges and Professional Implications

The interconnected challenges of heterogeneous abilities, time constraints, limited media, classroom dynamics, and student motivation confirm that instructional strategy implementation is a complex professional task. As noted by Hasanah and Wardani teachers' capacity to adapt, improvise, and reflect becomes a defining factor in sustaining instructional quality [35]. These findings emphasize the need for institutional support, professional development, and resource enhancement to enable teachers to implement effective IPAS instruction consistently.

6. Conclusions

This study concludes that the improvement of IPAS learning quality in upper-grade elementary classrooms is largely determined by teachers' ability to design and implement adaptive and context-sensitive teaching strategies. These strategies are reflected in the selection of approaches aligned with students' needs and characteristics, the application of varied instructional methods, the promotion of active student engagement, the use of instructional media that support conceptual understanding, and the implementation of continuous evaluation to assess instructional effectiveness. The findings indicate that high-quality IPAS instruction does not rely on a single strategy, but rather emerges from the integration of multiple pedagogical components that are applied reflectively and responsively within classroom practice.

From a theoretical perspective, this study reinforces the view that teaching strategies function as a key mediating variable between curriculum objectives and the quality of the learning process, particularly within the integrative nature of IPAS instruction. The findings underscore the importance of student-centered learning, instructional differentiation, and contextualized teaching approaches as foundational elements for enhancing learning quality at the elementary level. From a practical and managerial perspective, the results suggest that teachers and schools should continuously develop diverse instructional strategies, strengthen institutional support for learning facilities and instructional media, and optimize formative evaluation and differentiated instruction to accommodate students' diverse abilities and motivational levels in IPAS learning.

Despite its empirical contributions, this study has several limitations. The research was conducted within a limited institutional context and involved a relatively small number of participants, which restricts the generalizability of the findings. In addition, the study employed a qualitative descriptive approach that did not quantitatively measure the impact of teaching strategies on student learning outcomes. Future research is therefore recommended

to involve more diverse school contexts, larger participant samples, and mixed-methods designs that integrate qualitative and quantitative approaches. Such efforts would provide a more comprehensive understanding of the effectiveness of IPAS teaching strategies and strengthen the robustness and generalizability of future findings.

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