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Implementing Authentic Assessment in Project-Based IPAS Learning at Primary School

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Abstract: This study explores the implementation of authentic assessment in project-based Ilmu Pengetahuan Alam dan Sosial (IPAS) learning for fourth-grade students at SDN Sidomulyo 02, Kecamatan Gunungwungkal, Kabupaten Pati. Rooted in the principles of Kurikulum Merdeka, authentic assessment is employed to evaluate students' understanding of energy transformation through hands-on projects. Using a qualitative case study approach, data were collected through classroom observations, teacher interviews, and document analysis. The results reveal that authentic assessment fosters deep conceptual understanding, critical and creative thinking, collaboration, and scientific communication. Students actively engaged in designing, building, and presenting simple energy conversion tools while documenting their learning in reflective journals. Teachers assessed performance using rubrics, observation sheets, and peer/self-assessments, enabling holistic evaluation across cognitive, affective, and psychomotor domains. Despite challenges such as limited time and students' difficulties in structured reporting, the process-oriented assessment encouraged perseverance, problem-solving, and self-reflection. Findings confirm that authentic assessment enhances meaningful learning experiences aligned with 21st-century competencies and supports the development of student agency and learning ownership. This research recommends wider adoption of authentic assessment in primary education, along with teacher training, collaborative planning, and resource provision to optimize implementation.

Keywords: Authentic assessment, project-based learning, IPAS, Kurikulum Merdeka, energy transformation, primary education, student-centered learning.

1. Introductions

Education has always been a cornerstone in the development of high-quality human resources capable of responding to the dynamics of an increasingly complex world. In the Indonesian context, the transformation of educational paradigms is being driven by a need to foster adaptive, creative, and critical-thinking learners who can thrive in the era of globalization and technological acceleration. One of the most notable policy shifts in this domain is the implementation of Kurikulum Merdeka, a curriculum reform aimed at redefining how learning is designed, delivered, and assessed (Samsudi et al., 2024). This curriculum underscores flexibility, contextual relevance, and learner-centered approaches that facilitate the development of students' competencies holistically (Halim et al., 2024; Nurdiyanti et al., 2024).

Kurikulum Merdeka offers significant autonomy to both learners and educators (Ningrum, 2023). It encourages students to pursue learning paths that match their interests and talents, while teachers are given the space to innovate instructional strategies in ways that best suit the learners' needs. Rather than adhering to rigid standards and uniform lesson structures, teachers are expected to design engaging and meaningful learning experiences. This flexibility is not only reflected in the content and method of instruction but also in the way student progress is assessed. Traditional assessment models that focus on rote memorization and standardized testing are deemed inadequate for measuring complex learning outcomes (Bin Mubayrik, 2020; Brown, 2022; Ghosh et al., 2020). As a result, the education system in Indonesia is shifting toward more authentic, competency-based assessment models that reflect the multifaceted nature of learning.

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In this context, assessment is no longer limited to the final output of learning. Instead, it encompasses the entire learning process—including how students construct meaning, solve problems, collaborate with peers, and apply their knowledge to real-world situations. This shift necessitates the adoption of authentic assessment, a comprehensive evaluation model that captures students' performance in realistic contexts. Authentic assessment is particularly suited to fostering 21st-century skills, including critical thinking, creativity, collaboration, and communication (Jopp, 2020; Miserandino, 2025; Thornhill-Miller et al., 2023; Vincent-Lancrin, 2023). These are precisely the skills that modern education seeks to cultivate.

One subject area that lends itself well to authentic assessment is Ilmu Pengetahuan Alam dan Sosial (IPAS), an integrative learning area in Indonesian elementary schools. IPAS combines natural sciences and social sciences, emphasizing inquiry-based and experiential learning processes (Nurbaiti et al., 2025). The contextual nature of IPAS—especially its focus on real-world phenomena—makes it an ideal platform for applying project-based learning and authentic assessment. In particular, project-based tasks such as designing energy conversion models provide opportunities for students to explore scientific concepts while practicing communication, planning, and teamwork.

1.1 Conceptual framework

The theoretical foundation of this research rests on the concept of authentic assessment, which emphasizes evaluation that reflects the complexity and contextual relevance of real-life tasks. Authentic assessment is not simply an alternative to traditional tests; it is a philosophy of assessment grounded in constructivist learning theory. As Wiggins (1998) posits, authentic assessment asks students to perform meaningful tasks that demonstrate the application of essential knowledge and skills. This approach stands in contrast to decontextualized paper-and-pencil tests that often fail to measure learners' ability to transfer knowledge into practice.

In the Indonesian educational framework, authentic assessment is explicitly integrated into Kurikulum Merdeka. It is defined as a systematic and systemic process of collecting, analyzing, and interpreting data that represent learners' performance in real or simulated environments (Nieminen & Boud, 2025). This includes evaluating student products (e.g., projects, portfolios), performances (e.g., presentations, experiments), and reflections (e.g., journals, self-assessments). These forms of assessment provide rich and multidimensional data about how students think, act, and solve problems, aligning with the core principles of the curriculum.

From a pedagogical standpoint, authentic assessment is closely related to project-based learning (PjBL), which is one of the instructional models recommended in the Kurikulum Merdeka framework (Ratih Kusumaningrum et al., 2025). PjBL emphasizes inquiry, student agency, and learning by doing (Malitasari et al., 2022). Project-based learning not only increases student motivation but also develops skills such as research, collaboration, and critical thinking (Isnani, 2023; Loyens et al., 2023; Zhao, 2024). In the classroom, this translates into students engaging in extended tasks that require them to plan, execute, and reflect upon a concrete outcome—be it a scientific model, a written report, or a multimedia presentation.

The relevance of authentic assessment in elementary education has also been explored in recent studies. (Shearer et al., 2021; Sugiri & Priatmoko, 2020) highlighted that such assessments allow students to integrate cognitive, affective, and psychomotor competencies in meaningful ways. They stress that authentic tasks help students see the connection between what they learn in school and how it applies to their daily lives. In this context, IPAS—as a subject that directly addresses environmental and societal issues—provides a fertile ground for embedding authentic tasks that are both engaging and educational.

Despite its advantages, implementing authentic assessment is not without challenges. Many teachers, especially at the elementary level, still lack the training and support needed to design, execute, and evaluate such assessments effectively (Rosyada & Retnawati, 2022; Suwartono et al., 2024; Syaifuddin, 2020). This includes difficulties in preparing rubrics, managing time, providing individual feedback, and aligning tasks with curriculum standards. Moreover, the lack of resources and administrative support often leads to inconsistent practices in the classroom. These challenges underscore the importance of continuous professional development and institutional support in realizing the full potential of authentic assessment in primary education.

1.2 Research objectives

This study aims to explore in depth how authentic assessment is implemented in project-based learning of Ilmu Pengetahuan Alam dan Sosial (IPAS) for fourth-grade students at SDN Sidomulyo 02, Kecamatan Gunungwungkal, Kabupaten Pati. The main focus of the research is to understand how teachers design authentic assessment strategies, carry them out during the learning process, and evaluate student outcomes through project reports themed on energy transformation. The study also seeks to determine the extent to which authentic assessment encourages active student engagement, enhances conceptual understanding, and fosters critical thinking, creativity, collaboration, and scientific communication skills. Furthermore, this research examines the challenges faced by teachers in applying authentic assessment, particularly in terms of contextual task planning, developing appropriate assessment instruments, and conducting fair and meaningful evaluations in alignment with the principles of the Kurikulum Merdeka. By adopting a qualitative approach, this study is expected to provide a comprehensive understanding of authentic assessment practices at the elementary school level and their contribution to improving the quality of IPAS instruction.

2. Methodology

This study utilized a qualitative case study approach to deeply examine the implementation of project-based authentic assessment in IPAS (Natural and Social Sciences) learning for Grade IV at SDN Sidomulyo 02. This method enabled a contextual and holistic investigation of real-world classroom practices. The subjects included the Grade IV teacher and students actively engaged in the assessment process. Data were collected between January and March, primarily during the second and third weeks of February, using three techniques: classroom observation, in-depth interviews with the teacher, and document analysis involving learning guides and student work. Purposive sampling was applied to select student informants who participated directly in project-based learning activities.

Data analysis followed Miles et al. (2014) model of data reduction, data display, and conclusion drawing. To ensure data validity and reliability, the study used source, method, and theoretical triangulation, along with strategies such as prolonged engagement and persistent observation. The research also adhered to the four key trustworthiness criteria—credibility, transferability, dependability, and confirmability. This rigorous methodological framework was employed to provide an accurate and meaningful depiction of how authentic assessment is implemented within the context of Indonesia's primary education system.

3. Findings and discussion

3.1 Input Stage: Planning of Authentic Assessment

The planning stage serves as a foundational element in the implementation of authentic assessment. At SDN Sidomulyo 02, the fourth-grade teacher (AN) began by mapping out the Capaian Pembelajaran (Learning Outcomes/CP) in accordance with the Kurikulum Merdeka. The focus of instruction was on the topic "Transforming Forms of Energy," which is part of the integrated Ilmu Pengetahuan Alam dan Sosial (IPAS) curriculum. The intended outcome was for students to understand, explain, and demonstrate different forms of energy transformation through hands-on, project-based experimentation. Planning was carried out comprehensively—not only structuring learning content and activities, but also designing assessment instruments tailored to the nature of the project. Teacher AN stated:

"I already planned the lesson along with its evaluation rubrics. I also informed the students from the start what would be assessed." (Interview, AN, 10 February 2024)

This approach reflects the principle of assessment transparency and was structured around four key components:

Table 1. Component of authentic assessment

Component	Description
Learning Outcomes (CP)	Students identify and explain forms of energy transformation through experiments and contextual projects.
Assessment Indicators	Ability to design a model/tool, conduct testing, write structured reports, and present results coherently.
Assessment Instruments	Rubrics (project output, collaboration, presentation), observation sheets (attitude, responsibility), reflection journals, peer and self-assessment forms.
Media & Tools	Mini motors, AA batteries, switches, wires, cardboard, glue guns—chosen for safety, accessibility, and functional relevance.

Teacher AN designed rubric-based assessments that aligned with the project's objectives, evaluating aspects such as the accuracy of the energy conversion tool, the clarity of student presentations, the effectiveness of teamwork, and the depth of conceptual understanding. These rubrics were supported by observation sheets to monitor student behavior and attitudes—including initiative, discipline, and cooperation—throughout the project. To deepen reflection and metacognitive awareness, students maintained individual journals detailing their learning journey, challenges, and solutions. Additionally, self-assessment and peer-assessment were incorporated to promote student responsibility and social-emotional growth.

The project was structured in sequential stages: planning the tool's design, assembling the components, documenting the process, writing a final report, giving group presentations, and completing personal reflections. This design allowed for comprehensive assessment across cognitive (knowledge), psychomotor (skills), and affective (attitude) domains, ensuring that learning was evaluated in a holistic and meaningful way. Students were not only judged by the final product but also by their effort, process, and collaboration throughout the task.

To support successful implementation, the teacher prepared age-appropriate tools and materials that were safe, accessible, and conducive to creativity, such as mini motors, batteries, cardboard, and glue. Students were encouraged to customize their projects, instilling a sense of ownership and innovation. Embracing the principle of differentiation, AN grouped students heterogeneously and applied scaffolding techniques to ensure that all students, regardless of ability, could contribute meaningfully and experience success within their own capacity.

3.2 Process Stage: Implementation of Authentic Assessment

The process stage serves as the core of authentic assessment in fourth-grade IPAS learning at SDN Sidomulyo 02. At this phase, learning shifts from teacher-centered instruction to a student-centered, participatory approach where learners actively engage in exploration and reflection through project-based activities. The teacher simultaneously takes on the roles of facilitator, observer, and evaluator to ensure meaningful involvement from each student throughout the learning process.

The implementation began with the formation of small, heterogeneous groups composed of three to four students with assigned roles such as designer, recorder, technician, and presenter. This structure encouraged collaboration and communication skills. Students initiated their projects by designing energy transformation tools, like models that convert electrical energy to motion or light. During this stage, the teacher guided students' critical thinking through prompting questions and structured discussions, enabling them to evaluate problems, consider alternatives, and justify their decisions.

Construction followed the planning stage, with students using simple materials such as mini motors, wires, batteries, and cardboard to build their tools. The teacher observed not just the end result, but also key group dynamics and student behaviors, including cooperation, persistence, and initiative. Challenges encountered during construction—such as malfunctioning tools—served as opportunities for students to demonstrate resilience and reflective problem-solving, essential components of authentic assessment.

To further support this, students documented their learning in individual journals, writing daily reflections on their planning, difficulties, solutions, and project progress. These journals offered valuable insight into student thinking and became authentic tools for assessment beyond final outcomes, reinforcing metacognitive skills and personal responsibility in learning.Teacher AN emphasized the importance of evaluating the learning process rather than focusing solely on final outcomes. As she stated:

"I pay more attention to the process. How the students discuss, how they try to fix things when their tool doesn't work—that's more important than just the final result." (Interview, AN, 15 February 2024)

This perspective underscores the pedagogical belief that authentic assessment should create space for students to experiment, fail, try again, and learn through experience. Perfection in the final product is not the primary goal; rather, the emphasis is on how the process contributes to deeper understanding, character development, and essential skills formation.

Table 2. Authentic Assessment Elements During the Process Stage

Assessment Focus	Indicators Observed	Instruments Used
Collaboration and Role-taking	Active participation in group roles (designer, recorder, technician, presenter).	Observation sheet, teacher notes
Problem-solving and Resilience	Ability to troubleshoot errors, revise designs, and seek solutions.	Teacher feedback, journal reflections
Process Documentation	Daily records of planning, challenges, revisions, and progress.	Student learning journals
Communication and Reflection	Engagement in peer discussions, ability to explain decisions, reflection on learning	Oral questioning, peer-assessment forms
Emotional and Social Behavior	Responsibility, patience, conflict resolution, cooperation	Observation sheet, peer feedback

3.3 Output Stage: Assessment Results and Reflection

The output stage of authentic assessment implementation in the IPAS project at SDN Sidomulyo 02 revealed that the majority of students successfully completed their assigned tasks and met the expected learning indicators. The assessment focused on multiple dimensions, including cognitive understanding, technical skills, collaboration, and reflective thinking. The summary of student performance is presented in the following table:

Table 3. Student Achievement in Authentic Assessment

No	Achievement Criteria	Number of Students	Percentage (%)
1	Completed project report thoroughly	14	82%
2	Performed correct demonstration of the tool	13	76%
3	Explained energy concepts clearly	15	88%
4	Actively collaborated and contributed in groups	12	71%
5	Wrote meaningful daily reflections	11	65%

Teacher AN confirmed the impact of the project on student learning and independence:

"The students became more independent because they wrote their project reports based on their own thoughts—there was no chance to copy. I could also clearly see who was actively engaged and who needed support." (Interview, AN, 15 February 2024)

Despite these successes, several challenges were noted. Some students struggled with writing structured reports, experienced delays in completing tasks, or faced technical difficulties in assembling their tools. Additionally, the teacher found it difficult to observe each student comprehensively due to limited time and class size.

Based on triangulated data from classroom observations, interviews, and student documentation, four key findings emerged, illustrating the broader impact of authentic assessment on learning quality, as visualized in Figure 1 below.

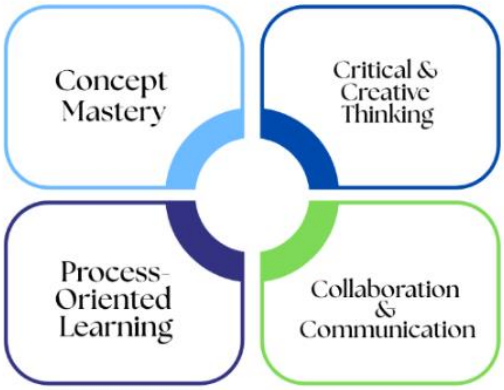

Figure 1. Impacts of Authentic Assessment

1). Deeper Conceptual Understanding (Concept Mastery)

Students demonstrated a solid grasp of energy transformation concepts through firsthand experience. Rather than memorizing definitions, they internalized scientific principles by designing, assembling, and testing energy conversion tools. Many students reported in their learning journals that they "truly understood energy" only after building the tools themselves. This aligns with the experiential learning theory, which emphasizes knowledge construction through meaningful engagement.

2). Development of Critical and Creative Thinking

Authentic assessment encouraged students to think analytically and adaptively. When tools malfunctioned—due to wiring errors, low battery power, or motor failure—students re-evaluated their designs, asked for peer or teacher input, and implemented improvements. Some even added innovations, such as switches or alternative materials, showcasing initiative and flexible problem-solving skills, key components of 21st-century learning.

3). Growth in Collaboration and Scientific Communication

Group-based project work fostered interpersonal collaboration and communication. Students learned to divide responsibilities, present ideas clearly, and engage in peer feedback. Presentations often included diagrams and sketches to explain energy processes, enhancing scientific literacy. These activities n ot only strengthened content knowledge but also developed skills in respectful, structured dialogue and audience engagement.

4). Emphasis on Learning Process over Final Outcome

The implementation of authentic assessment highlighted the value of formative learning. Process-oriented evaluation allowed students to reflect on their learning journey. Those who failed to produce a fully functioning tool were still recognized for perseverance and critical self-reflection. Teacher AN appreciated this approach, stating that:

"I focus more on the process. How students discuss, how they try again when things don't work—that's more important than just the result." (Interview, AN, 15 February 2024)

This perspective created a classroom culture that values effort, learning from mistakes, and continuous improvement—core elements of a meaningful and humanistic education.

4. Discussion

The findings of this study reveal that the implementation of authentic assessment through project-based IPAS learning in the fourth-grade class at SDN Sidomulyo 02 has a positive impact on students' conceptual understanding. Through the experience of designing and testing tools to demonstrate energy transformation, students not only retained theoretical content but were also able to articulate principles of energy based on direct observation and hands-on practice. This outcome illustrates how authentic assessment fosters meaningful, process-oriented learning, consistent with the constructivist approach, which posits that knowledge is constructed through concrete experiences (Nurmikko-Fuller & Hart, 2020)

The implementation of authentic assessment also aligns with the principles of the Kurikulum Merdeka, which emphasizes project-based learning where students are not mere recipients of information, but active participants in planning, executing, and reflecting on their learning (Ramadhani Robi'ah, 2025). The teacher delegated meaningful roles to students in designing their projects, carrying out tasks, and presenting results. By using a range of assessment tools—such as project rubrics, attitude observation checklists, learning journals, and peer assessments—the teacher was able to assess students holistically, covering cognitive, affective, and psychomotor domains.

Beyond conceptual depth, authentic assessment proved to enhance critical and creative thinking skills (Karunarathne & Calma, 2024). During project implementation, students faced technical challenges such as faulty wiring or poorly constructed tools. The teacher observed that students were capable of problem-solving independently by discussing issues within their groups and applying corrections. This supports (Bell, 2010) assertion that project-based learning promotes student initiative and real-world problem-solving abilities.

From a social and emotional perspective, the project encouraged collaboration and scientific communication. Group discussions and presentations provided opportunities for students to listen to peers, divide tasks equitably, and present their work in a structured manner. According to Teacher AN, this process helped develop students' empathy, responsibility, and self-confidence. Furthermore, formative assessments such as learning journals and self-assessments cultivated reflective awareness of their learning process. These findings align with (McFeetors et al., 2021) who found that authentic assessment fosters both social and metacognitive skills in elementary students.

Nevertheless, several challenges emerged during implementation. Time constraints limited the teacher's ability to conduct thorough individual observations, particularly in evaluating the detailed work processes of each student. Some students also struggled with organizing their reports systematically. Despite these challenges, the benefits of authentic assessment far outweigh the drawbacks, as it evaluates not only outcomes but also cultivates independent, reflective learning habits. Therefore, authentic assessment holds significant potential as a more humanistic, contextual, and competency-driven model for primary education in the 21st century.

5. Conclusions and recommendations

The implementation of authentic assessment in the IPAS project-based learning in Grade IV SDN Sidomulyo 02 has proven effective in enhancing students' conceptual understanding, critical thinking, creativity, collaboration, and scientific communication skills. Through hands-on experiences in designing and testing simple energy conversion tools, students engaged more deeply with the learning material and demonstrated meaningful learning outcomes. The integration of various assessment instruments—such as rubrics, reflective journals, peer assessments, and performance observations—enabled teachers to evaluate not only students' final products but also their learning processes. These findings affirm that authentic assessment, when aligned with the Kurikulum Merdeka framework, can foster holistic student development that includes cognitive, affective, and psychomotor domains.

Based on these findings, it is recommended that schools and educators adopt authentic assessment practices more broadly, especially in subjects that lend themselves to project-based learning. Teachers should receive support and training in designing assessment tools that align with real-world tasks and student-centered learning approaches. Additionally, collaborative planning among teachers, adequate time allocation, and availability of learning resources should be prioritized to ensure the successful implementation of authentic assessment. Future research may explore its impact across different grade levels and subjects to further validate its effectiveness and scalability within the Indonesian primary education system.

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Conflict of Interest

Authors declare there is no conflict of interest.

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