Implementation of the Adiwiyata School Program as a Strategy for Building Environmentally Concerned Character Among Students

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ABSTRACT. The Adiwiyata School Program is a strategic policy aimed at fostering a culture of environmental stewardship within the educational environment. This article aims to analyze the implementation of the Adiwiyata program as a strategy for fostering environmentally conscious character among students through a literature review approach. The study begins by examining the basic concept of Adiwiyata, which emphasizes two main principles: participatory and sustainable, and four core components: environmentally conscious school policies, curriculum development, participatory-based activities, and environmentally friendly infrastructure management. Various literatures indicate that the Adiwiyata program has been integrated into educational practices through the development of internal school policies, the integration of environmental values into learning, and the implementation of programs such as waste sorting, waste banks, school gardens, and environmental projects involving the entire school community. This implementation not only creates a clean and healthy learning environment but also serves as a means of internalizing character values through the process of habituation, role modeling, and the cultivation of ecological behavior. The results of the literature synthesis indicate that Adiwiyata has been proven to be able to develop environmentally conscious character traits, such as ecological awareness, responsibility, discipline, and the ability to work together. However, several challenges, such as consistent implementation, limited supporting facilities, and low parental participation, still require attention. This article concludes that the Adiwiyata program can significantly contribute to developing environmentally conscious character, provided it is supported by school commitment, collaboration among the entire school community, and sustainable social support.

Keywords: Adiwiyata, Environmentally Caring Character, Environmental Education

INTRODUCTION

21st-century education positions students not merely as recipients of knowledge, but as learners who must possess competencies such as critical thinking, creativity, collaboration, and communication. These competencies are essential for students to be able to face global challenges, technological change, and the increasingly complex dynamics of the workplace. When 21st-century competencies become learning objectives, traditional assessment systems which often only assess memorization or the ability to repeat questions become inadequate to authentically measure students' abilities in real-world contexts. This raises the need to design assessments that are more relevant to students' real-life situations, reflecting the thinking processes, collaboration, and innovation in learning.(Clamucha & Napil, 2024)

Conventional assessments are often summative, based on written tests that are divorced from students' real-life contexts, and ignore aspects of process and self-reflection. As a result, the resulting assessment data only reflects outcomes, not how students think, act, and develop throughout their learning process. In today's learning environment including the digital and hybrid era assessments that rely solely on question papers or multiple-choice questions are no longer sufficient to comprehensively capture the dimensions of 21st-century competencies. Furthermore, teachers and schools are required to provide relevant feedback, dynamically monitor student progress, and support adaptive learning.

Technological advances and the presence of digital platforms open up significant opportunities for developing authentic, digital-based assessment instruments. Digital instruments enable teachers to design contextual, collaborative, project- or portfolio-based assignments that can measure not only student knowledge but also skills and attitudes in real time. Digital-based assessments also facilitate learning data collection, student competency analysis, and rapid and personalized feedback. In the high school (SMA) context, where students are beginning to be prepared for the world of work, college, and global challenges, the development of authentic digital-based instruments is highly relevant.(Vlachopoulos & Makri, 2024)

However, developing authentic digital-based assessment instruments faces various challenges. Teachers require digital competency and an understanding of authentic assessment design; schools require technological infrastructure and support systems; and students require digital literacy and readiness to participate in authentic, technology-based assignments. Furthermore, the concept of authentic in assessment requires clear definitions and standards so that the instruments developed truly measure 21st-century competencies within a valid and reliable framework. Without adequate preparation, teachers may simply modify old formats to digital formats without changing the essence of the assessment, resulting in no substantial difference from conventional assessments.(Eka et al., 2020)

With this background, the research entitled Development of a Digital-Based Authentic Assessment Instrument to Measure 21st-Century Competencies of High School Students is important and timely. This study aims to explore the literature and examine key concepts related to authentic assessment, digital instruments, and 21st-century competencies in the high school context. The results are expected to provide a foundation for the development of systematic, theory-based, and practical instruments that can be adapted by teachers and schools in the digital learning era. Thus, the resulting instrument will be not only innovative but also relevant and contribute to improving the quality of learning and assessment in high schools.

METHOD

This research employed a library research method, reviewing various relevant scientific sources, such as national and international journal articles, textbooks, proceedings, and educational policy documents related to authentic assessment and 21st-century competencies. Data collection involved selecting sources directly related to the research theme, particularly publications within the last five years to ensure the freshness of the information. Each piece of literature was analyzed based on the research's primary focus: the concept of authentic assessment, digital instruments, and the 21st-century competency framework at the high school level.

Data analysis was conducted using content analysis techniques, with steps including theme identification, concept categorization, comparison of findings across the literature, and theoretical synthesis. This approach enabled researchers to understand patterns and trends in previous research, while simultaneously building strong arguments regarding the urgency and direction of developing digital-based authentic assessment instruments. The results of the analysis were then systematically compiled to produce a comprehensive overview of how digital instruments can be designed, utilized, and integrated to measure 21st-century competencies in high school students.

RESULT AND DISCUSSION

Characteristics of Digital-Based Authentic Assessment in the Context of 21st Century Competencies

Digitally based authentic assessment represents a significant transformation from traditional approaches. Authentic assessment no longer focuses solely on what students know, but also on how they can implement, transform, and apply that knowledge in real-world contexts. This approach aligns with the 21st-century competency framework, which emphasizes critical thinking, creativity, collaboration, and communication skills. Several studies have shown that authentic instruments utilizing technology can foster students' decision-making and new idea development skills. With digitalization, authentic assessment can also include electronic portfolios, digital simulations, and online collaborative projects that reflect real-world challenges.(Mahmood & Saleem, 2024)

Key characteristics of digitally based authentic assessment include the relevance of tasks to real-world contexts, the use of technology as an assessment medium, collaboration between students, reflection on the learning process, and real-time feedback. Digital platforms allow for the automatic recording of student work, allowing teachers to assess not only the final product but also the process through more transparent digital rubrics. Recent research confirms that authentic assessment practices contribute to strengthening 21st-century competencies, despite challenges such as infrastructure readiness and teacher training. Therefore, the characteristics of digital instruments need to be designed comprehensively so that they don't simply transfer old formats to digital media, but truly renew the essence of assessment itself.

In the context of 21st-century competencies, authentic digital assessment offers advantages in measuring aspects that were previously difficult to assess, such as remote collaboration, cross-platform communication, creativity in digital works, and media and technology literacy. Recent studies have shown that the use of authentic technology-based tools can improve critical thinking, innovative thinking, interpersonal and intrapersonal skills, global citizenship, and media literacy. For example, students can be given a collaborative assignment to design a digital campaign on a social issue, which is then assessed not only on the final product, but also on the process of collaboration, discussion, revision, and reflection.(Mcarthur, 2023)

Digitizing instruments also allows for more dynamic data collection and analysis. Digital platforms can record student activities, collaborative interactions, product revisions, and even time logs. All of this data serves as authentic evidence of 21st-century competencies. Assessment no longer stops at a final score but becomes a series of meaningful learning processes. This approach emphasizes the importance of understanding the social meaning of assignments, their relevance to real life, and how students execute them as members of society.

Despite offering many advantages, developing authentic digital-based instruments still requires special attention to several aspects: student and teacher digital readiness, equitable access to technology, task design that truly measures competency, and assessment rubrics that can evaluate both process and product equally. There remains a gap between potential and practical implementation, as some educational institutions remain fixated on traditional approaches. Therefore, the characteristics of good authentic digital assessments must include effective technology integration, relevance to real-world contexts, digital collaboration, metacognitive reflection, and ongoing evaluation to truly measure 21st-century competencies validly and reliably.(Long et al., 2024)

Relevant Digital Authentic Assessment Models and Instruments for High School Students

Authentic digital-based assessment offers a variety of instrument models that are highly relevant for high school students. One widely used instrument is the digital portfolio, or e-portfolio. This is a platform for students to collect evidence of learning outcomes, collaborative assignments,

self-reflection, and various digital products that demonstrate 21st-century competencies such as creativity, collaboration, and communication. Research by (Garcia, 2025) demonstrated that digital portfolios developed directly by students through a project-based learning approach can increase ownership and learning effectiveness. This instrument is particularly suitable for high school because it allows developmental teachers to continuously integrate student product processes, not just the final product. Furthermore, the use of integrated electronic rubrics makes the assessment process easier, more transparent, and more focused on reflection and metacognition.

Another widely used model is project-based assessment based on digital platforms. In this model, students collaboratively work on real-world projects using applications, websites, or other digital media. Research findings by (Mutiara et al., 2025) indicate that using platforms such as Google Docs, Canva, Padlet, and similar tools helps students produce work that demands creativity, technology utilization, and contextual problem-solving. At the high school level, this model is highly relevant because students already possess basic digital skills, allowing authentic projects to be designed that are more challenging and closer to their real-life experiences.

Electric rubrics are also a crucial element in authentic digital assessment. Digital rubrics enable a more consistent, transparent assessment process, and can be monitored by both teachers and students in real time. (Nieminen et al., 2023) emphasized that digital rubrics should encompass both process and product assessments, and provide rapid and meaningful feedback. In the high school context, digital rubrics can be integrated with platforms such as Microsoft Forms, Google Forms, or the school's LMS, allowing evaluations of the learning process to be documented and reused for reflection and learning improvement. Thus, digital rubrics serve not only as assessment tools but also as learning media.

Furthermore, digital tools that support collaboration and communication are also crucial for high school students.(Ubaidillah et al., 2025) research on the use of digital portfolios in Arabic language learning revealed that students who worked collaboratively on digital platforms and compiled their results into e-portfolios experienced improved communication and teamwork skills. In the high school context, such instruments can be implemented through collaborative group assignments, multimedia presentations, peer assessments, and collaborative reflections. All of these activities can be assessed using specialized digital instruments, allowing for authentic evaluation of the collaborative process.

When selecting and developing authentic digital-based assessment instruments for high schools, aspects of technological readiness, student digital literacy, and teacher competency must also be considered. (Ferini et al., 2025) research demonstrated that authentic digital platform-based instruments are valid and reliable when accompanied by appropriate rubric design and teacher training in providing digital feedback. This reinforces the point that the effectiveness of digital instruments depends not only on the technology but also on the readiness of the educational ecosystem.

However, several challenges remain in developing authentic digital assessment instruments in high schools. A systematic review by (Vlachopoulos & Makri, 2024) confirmed that most authentic assessment research still focuses on higher education and has not yet reached the high school context. Therefore, instrument development must be tailored to the characteristics of high school adolescents, ranging from the level of task complexity, the type of technology used, to the assessment burden for both teachers and students. With appropriate design, the combination of digital portfolios, project-based assessments, and electronic rubrics can be a powerful instrument for measuring 21st-century competencies authentically and meaningfully.

Implications and Challenges of Implementing Digital Authentic Assessment in High School

The implementation of digital-based authentic assessments in high schools has significant positive implications for the quality of learning. Through digital instruments, teachers not only assess final results but can also explore students' learning processes in greater depth from how they observe, reason, and collaborate to producing tangible products relevant to real-life contexts. Juanda's research also confirms that authentic assessments designed to measure 21st-century skills are capable of capturing critical thinking, creativity, collaboration, and communication skills that have been difficult to capture with traditional tests. (Juanda, 2022)At the high school level, this enables teachers to more accurately map students' strengths and weaknesses as a basis for planning subsequent learning.

Another implication is the increased role of assessment as a basis for learning improvement. Digital authentic assessments go beyond grade reporting and become a crucial tool for developing more targeted remedial programs, enrichment programs, and counseling services. Nurhaliza's findings demonstrate that teachers utilize authentic assessment results to design teaching strategies tailored to students' real needs. (Hs, 2021) With the support of digital platforms, mapping learning outcomes can be done more quickly and systematically, providing teachers with robust data to make pedagogical decisions, rather than relying solely on intuition.

However, implementing digital authentic assessment presents unique challenges for high school teachers. Many teachers still view authentic assessment especially digital-based assessment as complex and time-consuming. (Baharudin, 2012) Various studies show that teachers often encounter difficulties in developing rubrics, designing truly relevant authentic assignments, and managing assessment evidence in a structured manner. Setiawati also found that teachers' understanding of the concepts and principles of authentic assessment is not yet fully developed, resulting in field practices often inconsistent with theory. (Setiawati & Marsakawati, 2024) Therefore, strengthening teachers' pedagogical and assessment competencies is a determining factor in the success of digital authentic assessment.

The next challenge relates to infrastructure readiness and technology access. Digital authentic assessment requires the availability of devices such as laptops or devices, a stable internet connection, and adequate learning platforms. In reality, not all high schools especially those in rural areas have equitable infrastructure. Wulandari noted that the success of digital learning and assessment is greatly influenced by network quality and the availability of student devices. (Wulandari et al., 2021) Without adequate infrastructure support, digital authentic assessment has the potential to become an additional burden rather than an innovation that facilitates the learning process.

From a student perspective, digital literacy and learning maturity are also crucial. Not all students have the same abilities when it comes to managing digital assignments, uploading artifacts, or collaborating online. Furthermore, digital distractions such as social media and games can reduce students' focus when working on authentic platform-based assignments. Research on prospective chemistry teachers shows that although digital assessments can measure the ability to observe, interpret, and predict more authentically, fostering independent learning skills and academic ethics is still necessary to prevent students from simply pursuing instant grades. (Lukman et al., 2023) This is especially relevant in high school, given that students' independent learning is still developing.

On a more optimistic note, if these challenges can be overcome, authentic digital assessments can open up vast opportunities for innovation. The integration of technology allows the use of learning analytics, digital portfolios, real-world projects, and interactive media to measure 21st-century competencies in a richer and more contextual way. (Vlachopoulos & Makri, 2024) Vlachopoulos's study confirms that technology in authentic assessment can increase the relevance of assignments to the real world while providing more comprehensive evidence of learning. (Juanda, 2022)Similarly, Juanda's study emphasized that well-designed authentic assessments can

be a key gateway to more deeply assessing and strengthening 21st-century skills. For high schools, this presents an opportunity to develop a more visionary assessment system, aligned with curriculum demands and current developments.

CONCLUSION

The development and implementation of digital-based authentic assessment instruments serve as an essential response to the educational demands of the 21st century, where students are expected not only to master knowledge but also to demonstrate higher-order competencies such as critical thinking, creativity, collaboration, and communication. The literature clearly shows that conventional assessments are no longer sufficient to capture these complex competencies, as they focus predominantly on outcomes rather than the learning processes. Digital technologies, therefore, provide transformative opportunities by offering platforms that allow teachers to design contextual, collaborative, and process-oriented assignments that authentically reflect real-world challenges faced by students.

This study highlights that digital-based authentic assessments possess key characteristics that strongly support the development of 21st-century competencies. Through instruments such as digital portfolios, project-based assessments, and electronic rubrics, teachers can more accurately monitor learning progress and provide timely, personalized feedback. Digital tools also enable assessment practices that capture both product and process, including students' collaboration patterns, reflection, creativity, and problem-solving. These features make digital authentic assessment an effective and meaningful way to evaluate student learning holistically.

However, the findings also emphasize significant challenges that must be addressed to ensure successful implementation. Teacher readiness remains a major concern, as many still lack sufficient digital skills and understanding of authentic assessment design. Infrastructure disparities, especially in schools located in rural or under-resourced areas, continue to hinder equitable implementation. Student digital literacy, along with potential distractions and ethical concerns such as plagiarism or misuse of AI tools, also presents barriers that must be carefully managed. These challenges indicate that adopting digital authentic assessments requires not just tools, but also systemic support, training, and digital culture building.

Despite these obstacles, the opportunities presented by digital authentic assessments are substantial. When properly designed and supported, they can improve the quality of learning, enhance the relevance of assignments to students' real-life contexts, and provide richer and more comprehensive evidence of learning. Digitalization also opens avenues for data-driven decision-making, allowing teachers and schools to refine instructional strategies based on detailed analytics and student performance trends. This positions digital authentic assessment not merely as an evaluation tool, but as a transformative component of 21st-century pedagogy.

In conclusion, the development of digital-based authentic assessment instruments is both timely and necessary in preparing high school students to thrive in a rapidly changing world. A well-designed digital authentic assessment system can bridge the gap between educational goals and real-world demands by authentically measuring complex skills, supporting adaptive learning, and integrating technology meaningfully into the learning process. For these instruments to be effective, schools, teachers, and students must be supported with adequate training, infrastructure, and policies that ensure ethical, valid, and reliable assessment practices. With the right ecosystem, authentic digital assessment can become a powerful driver of educational innovation, contributing significantly to improving the quality and relevance of learning in high schools.

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