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Structured Training for Enhancing Science Teachers' Competence in Authentic Assessment Design Based on Local Wisdom

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Abstract

Assessment is an essential part of the learning process because it measures progress toward learning objectives. One type of assessment suitable for today's learning needs is authentic assessment, which assesses students' competencies in a real-world context. However, many teachers still lack the skills to develop authentic assessments. Therefore, training activities are needed to help teachers improve their ability to design authentic assessments. To overcome this problem, a structured training program on developing authentic assessments integrated with local wisdom was conducted. This approach was chosen because local wisdom is closely related to students' daily lives and helps them understand science concepts more easily. The training was carried out using three main strategies: (1) identifying learning objectives and local wisdom potential, (2) formulating competency achievement indicators, and (3) developing authentic assessments. The results of these training activities show positive outcomes. Based on questionnaire responses at the end of the training, the program helped teachers develop and refine authentic assessments that are more contextually relevant and meaningful.

Keywords: authentic assessment, local wisdom, teaching training

INTRODUCTION

The demands of the times and technology have influenced all aspects of life, including education, which is the foundation of a nation's progress. As times and technology evolve, the education paradigm has begun to shift to prepare students to compete in the real world and keep pace with developments in the 21st century (Afandi et al., 2022). As places of basic education, schools must prepare and equip students with sufficient competencies to compete. Therefore, school learning activities need to be revised and updated. This renewal can be seen in terms of curriculum, learning tools, and teacher capacity. All these aspects must be adapted to the demands and developments of the current era.

Teacher capacity is a critical factor in determining the efficacy of student learning activities. Teachers play an instrumental role in the learning process, as they are responsible for organizing all aspects related to learning activities from start to finish (Wardani et al., 2022). Teachers must possess the capacity to manage the learning process, including developing learning plans, models, methods, media, and assessments. This is a critical competency for educators, often referred to as pedagogical competence (Cahyana & Agustin, 2024). Assessment, in particular, is an integral component of learning, as it evaluates the effectiveness and outcomes of the teaching and learning process.

The objective of student assessment is to identify, measure, and evaluate the effectiveness of their learning activities (Gao et al., 2020). The efficacy of this approach is evident in the students' notable learning achievements. While its function is to evaluate learning achievements, assessment cannot be regarded as an external entity separate from the learning process. In particular, enhancing the quality of education and providing learning assessments are intricately linked (Safithri & Muchlis, 2022). The evolving educational paradigm has also had a significant impact on innovations in the development of learning assessments, given the urgency of the assessments themselves (Vlachopoulos & Makri, 2024).

To prepare students to compete with developments in the current era of technology, assessments must evolve beyond the confining paradigm of multiple-choice and essay tests administered at the end of the learning process. Furthermore, the assessments developed must measure the entire learning process, ensuring that students possess sufficient knowledge and skills upon entering the real world. The concept of authentic assessment, defined as an in-depth evaluation capable of quantifying the continuity of the learning process, is particularly relevant in this context.

Authentic assessment is an evaluation process that aims to provide an overview of students' achievements, motivation, and attitudes during the learning process (Zaim et al., 2020). Authentic assessment is defined as a measurement of students' knowledge that also highlights the activities they engage in during the learning process. As Rahmawati (2021) asserts, the focus of authentic assessment is on all students' performance in learning. This approach aligns with contemporary educational imperatives, in which students are expected to possess the competencies to seamlessly transition into the professional realm rather than rely solely on theoretical knowledge. Therefore, it is imperative to cultivate students' competencies directly to prepare them to compete in the real world as professionals (Hamnett & Matthews, 2025) and to develop an instrument that can assess the attainment of this objective.

The fundamental difference between authentic assessment and traditional assessment is evident in the competencies being assessed. Conventional assessment methodologies prioritize evaluating students' capacity for information recall and memory. In contrast, authentic assessment aims to measure knowledge (cognitive), skills (psychomotor), and behavior (affective) in real-life contexts (Sokhanvar et al., 2021). Authentic assessment, which aligns with students' daily experiences, plays a vital role in preparing them for real-world challenges. Despite its benefits, many teachers struggle to design and implement authentic assessments, resulting in continued reliance on traditional methods. This gap underscores the need for enhanced support and training to facilitate effective integration of authentic assessment in educational practice.

Agustina et al (2022) noted that the primary challenge in implementing authentic assessments stems from teachers' insufficient understanding of the preparation and implementation of such assessments. Similarly, al. (2021) indicated a lack of understanding amongst teachers regarding the implementation of authentic assessment, resulting in challenges during the planning, implementation, and assessment phases. Meanwhile, research by al. (2024) found that teachers' comprehension of authentic assessment is satisfactory, yet there is a prevalent challenge in identifying appropriate assessment instruments.

A comparable condition has also been observed among science teachers in the Musyawarah Guru Mata Pelajaran (MGMP) of Tegal Regency. According to the findings of the present study, based on discussions with the MGMP chairperson and administrators, it was determined that teachers continue to have difficulty finding innovative ideas for developing authentic assessments. This assertion is further substantiated by the findings of a diagnostic test administered to science teachers, which examined their proficiency in developing authentic assessments.

Science education at the junior high school level encourages students to integrate concepts from biology, physics, and chemistry with phenomena in their everyday lives. The integration of science concepts with real-life situations has been demonstrated to facilitate student comprehension. This objective aligns with the fundamental purpose of science education, which is to facilitate students' direct engagement with phenomena in their daily lives, enabling them to comprehend and analyze these phenomena (Putri & Sofyan, 2020).

Students' comprehension of scientific concepts, particularly at the junior high school level, is often impeded by their abstract nature. To address this challenge, the incorporation of contextual learning is imperative. This approach entails aligning concepts with real-life situations rather than mere imaginary ones (Fatimah & Bramastia, 2021). There are several approaches to establishing a connection between scientific concepts and the phenomena in their respective environments. One such approach involves integrating local wisdom about students' immediate environment into the educational process.

Local wisdom is one of the things closest to students' lives and cannot be separated from them. Local wisdom is defined as a value, idea, or custom that has undergone extensive development and is deeply entrenched in the life of the local community (Yana et al., 2023). Local wisdom is a cultural heritage that is very important to preserve and can be valuable when integrated into learning (Chaijalearn et al.). The integration of local wisdom into learning is not new in education. Many studies have examined the effect of this integration on the achievement of learning objectives, especially in science subjects. The integration of local wisdom into science learning can provide a concrete picture of phenomena around students, making it easier for them to understand scientific concepts (Widiarini et al.). Local wisdom can be integrated into the development of learning tools such as models, methods,

media, and learning assessments.

The development of authentic assessments and local wisdom has been shown to intersect. It can be integrated because both focus on providing real experiences directly related to students' daily lives. It is imperative to recognize that the development of authentic assessments is driven by the objective of ensuring that students can apply their knowledge and skills to solve real-life problems. The integration of local wisdom in the development of authentic assessments can make it easier for students to understand and recognize phenomena in their environment.

According to the description of the existing problems, science teachers in the MGMP group continue to face challenges in developing and compiling authentic assessments. The most effective solution to this problem is to organize training activities that help teachers develop authentic assessments.

In light of the correlation among the concept of science learning, the objectives of authentic assessment, and the potential of local wisdom in Tegal Regency, the strategy for developing authentic assessments in the activity will integrate local wisdom. As an area located on the north coast of Java, Tegal Regency possesses a wealth of local wisdom that can be integrated into the development of authentic assessments, particularly in the domain of science materials. This integration is also an effort to preserve the values, customs, and culture of Tegal Regency. Through this training activity, it is hoped that teachers' skills in developing authentic assessments will increase, enabling the assessment instruments used to provide in-depth evaluation of learning and to determine more appropriate learning strategies.

METHOD

The target of this activity is science teachers who are members of the MGMP group in Tegal Regency. The implementation method is structured training conducted online and offline. Online activities are conducted via the Zoom virtual meeting application, while offline sessions are held at SMP 1 Adiwerana, Tegal Regency. This structured training method consists of three stages: preparation, implementation, and evaluation.

The preparation stage aims to identify the problems experienced by science teachers. It begins with an internal discussion session with the MGMP chairperson and administrators to map out the problems currently faced by science teachers. To reinforce the results of the problem analysis, a diagnostic test related to authentic assessment is conducted for science teachers. The diagnostic test aims to determine and identify the initial abilities and understanding of science teachers regarding the preparation of authentic assessments. This activity plays an important role because it provides a reference for selecting appropriate implementation techniques to achieve the activity's objectives.

The second stage, after problem formulation and technical preparation, is the implementation of training. The mentoring activities for preparing authentic assessments based on local wisdom in this training use two approaches: the Understanding by Design (UbD) and Culturally Responsive Teaching (CRT). The UbD approach describes a backward design process in which learning objectives are set first, followed by the design of specific learning activities based on those objectives (Haghghi & Bruun, 2024). This approach was chosen to provide teachers with a deep understanding of the development of authentic assessment. The CRT approach centers students' values, customs, and culture to create inclusive learning conditions (Redmond et al.). This approach was chosen because the assessment development context in this activity leverages the potential of local wisdom in Tegal Regency.

The integration of local wisdom in the development of authentic assessments is expressed in three strategies. The first strategy is to identify learning objectives and the potential of local wisdom related to the context of science learning. The second strategy is to identify students' competencies to be measured through authentic assessments, by referring to the learning objectives and the identified potential of local wisdom. The third strategy is to develop test and non-test items aligned with the competencies.

The completed assessments are then tested for validity to determine the suitability of the instruments. This validity test aims to ensure that the instruments developed can measure the achievement of the competencies and learning objectives formulated before they are given to students. For further details, a description of the implementation of these activities is presented in Table 1.

Table 1. Implementation of the activities

Wisdom Strategy	Activity Plan	Activity
Identifying learning objectives and integrating local wisdom as a context in developing authentic assessments of junior high school science material	Dissemination of authentic assessment products, discussion on the integration of local wisdom in Tegal Regency as the context for assessment development, and identification of learning objectives	Tutorials, Demonstrations, and Guided Practice
Collaborative work in small groups to identify competencies that can be developed through authentic assessments, and in line with learning objectives, using the local wisdom of the coastal area of Tegal Regency as context	Group discussion on the development of competencies in science subjects with the context of local wisdom in Tegal Regency, and the selection of appropriate assessment instruments	Tutorials, Group Work Practice, Mentoring, Monitoring, and Evaluation
Collaborative work in small groups within each cluster to develop, refine, and test the validity of authentic assessment instruments using the context of the coastal potential of Tegal Regency	Mini project to develop authentic assessment instruments for science subjects with the context of local wisdom in Tegal Regency, and to test the content validity of the instruments.	Tutorials, Group Work Practice, Mentoring, Monitoring, and Evaluation

The evaluation stage is conducted when the training program has been completed. The purpose of the evaluation stage is to conduct a SWOT analysis of the training program implementation. The results of this analysis can serve as a measure of objective achievement and as a reference for future planning.

RESULTS AND DISCUSSION

The learning strategies chosen by teachers have a significant impact on achieving learning objectives. The selected models, methods, and learning media affect students' competence. To measure the achievement of these competencies, an assessment tool is needed. Given the important role of assessment in learning, teachers must be able to develop and compile assessments properly. However, field conditions show the opposite. Teachers still have difficulty compiling assessments, so the UNNES team initiated a training program to address this issue. This activity aims to increase teachers' capacity to compile authentic assessments based on local wisdom, using a structured training method comprising three stages: preparation, implementation, and evaluation.

Preparation Stage

During the preparation stage, the team identified and mapped the problems faced by science teachers in the MGMP group in Tegal Regency when conducting lessons. The identification process served as a reference in determining the topics to be discussed. Problem identification began with a discussion among the team, the chairperson of the MGMP, and its members. The discussion revealed that science teachers still had difficulty developing authentic assessment items. Seeing the crucial importance of assessment in learning, the team decided to assist in developing authentic assessments by integrating local wisdom.

Before developing the approach and implementation strategy, teachers were asked to take a diagnostic test related to authentic assessment to obtain a specific description of the difficulties they experienced. The results of this test served as a reference for the team in formulating the appropriate approach and implementation strategy, making the activity a real solution to the problems encountered by teachers in the field. The preparation activities continued with the formulation of the technical implementation plan and the division of responsibilities among team members to ensure that each stage was implemented as planned.

Implementation Stage

The development of authentic assessments in this activity combines the UbD approach with CRT. According to the backward design concept in the UbD approach, assessment development begins with identifying science learning objectives and deriving achievement indicators. Following this, authentic assessments must be developed to measure the achievement indicators established. The development of authentic assessments integrates the local wisdom of Tegal Regency in accordance with the CRT approach.

The development of authentic assessments grounded in local wisdom was implemented through three interconnected strategies, requiring teachers to participate at each stage.

The first strategy begins by identifying local wisdom in Tegal Regency that can be linked to the concept of science learning. This activity is conducted virtually, with the participation of the team and

science teachers. Based on the results of diagnostic tests related to the development of authentic assessments, which were still low, before the process of identifying local wisdom, an activity was held to disseminate authentic assessment products developed by the team.

In line with the research by Syamsuddin et al (2023), product dissemination activities can make it easier for teachers to create learning media. Following the team's presentation, the activity continued with a discussion to ensure that the teachers understood the concept of authentic assessment before preparing. The teachers responded positively to this activity until the process of identifying local wisdom related to science material.

Based on the identification results, teachers are tasked with selecting the science material to serve as a reference for developing authentic assessments. In accordance with the UbD approach, the activity begins with the formulation of learning objectives aligned with the selected material. These learning objectives are then elaborated to obtain a Learning Objective Flow (LOF). The LOF formulated becomes the final product in the first strategy.



Figure 1. Dissemination of assessment products, identification of local wisdom, and learning objectives.

The development of learning competencies can be used to measure the achievement of the learning objectives formulated as LOF. In the second strategy, teachers formed small groups to formulate competencies that represent each LOF in the form of mini-project activities. The competencies cultivated must encompass all those deemed essential for students in real life, in alignment with the objectives of developing authentic assessments. These competencies include cognitive, affective, and psychomotor skills.

In the cognitive domain, assessment aims to measure students' knowledge and thinking skills during the learning process (Mona et al, 2020). Assessments that can be developed to measure these competencies include multiple-choice and essay tests. The affective domain concerns the measurement of student behavior during learning, including factors such as discipline, tolerance, motivation, and social relationships (Fakhri & Rahman, 2023). The objective of this evaluation is to cultivate students who possess commendable character and personality. The assessment of this competency can be facilitated by developing attitude assessment instruments, such as observation sheets and questionnaires, for teachers and students to complete.

The third competency to be assessed in the learning process is psychomotor skills, defined as the skills or abilities of students following their engagement in learning activities (Risnawati & Pasaribu, 2024). With ongoing changes in society and education, skills have become an important aspect for students to compete in the world. The skills students need in the 21st century include critical thinking, creative and innovative thinking, communication, and collaboration (Rosnaeni, 2021).

The cultivation of these competencies in the scientific inquiry process can be facilitated through a variety of educational methodologies, including experiments, case studies, projects, and field trips. The instrument used to assess this competency is a performance assessment sheet. The performance assessment sheet contains indicators that are aligned with the specific activity selected to cultivate students' skills. For instance, if the activity in question is a project, the assessment may take the form of a product quality assessment sheet or a video assessment sheet that describes the product manufacturing process.

The instrument chosen must be appropriate for the competency being measured. The second strategy involved the team monitoring each group to assist teachers in developing competencies, selecting the appropriate instrument, and ensuring a connection between them. During this session, teachers could select instruments appropriate for the competencies to be developed. Dissemination and discussion activities in the first strategy helped teachers understand assessment formats and how to use them. By this stage, teachers had generally increased their knowledge of authentic assessment.

However, since teachers were expected to develop authentic assessments for learning, they were asked to do so in their groups after the second strategy stage was completed.



Figure 2. Competency Formulation and Selection of Instrument Types

The development of authentic assessments in the third strategy is inseparable from the first and second strategies because they are all part of a continuous process. The basis for teachers in developing assessments is formed by the identification of learning objectives and local wisdom in the first strategy, as well as the development of competencies and selection of assessment instruments in the second strategy. All of these steps are viewed as an integral whole that cannot be separated. Teachers experienced greater difficulties with the third strategy than with the previous two, especially when developing assessment items. The team provided a solution: directing teachers to develop a grid and indicators before creating assessment items. This activity was helpful because the assessment grid and indicators made it easier for teachers to develop assessment items.

The assessments completed by each group were then evaluated by the team for feedback on the activity. These results could be used to improve the quality of the authentic assessment. The presentation and evaluation of the assessment results were conducted offline at SMP 1 Adiwerna, where each group presented its results to the team for evaluation.



Figure 3. Presentation of Authentic Assessment Development Results at SMP 1 Adiwerna

The numerical evaluation in authentic assessments is executed through validity testing conducted by experts (expert judgment). Even though evaluation activities have been conducted, validity testing remains necessary. This is to obtain statistical data. The data can describe the instrument's suitability as a learning measurement tool. This learning aligns with the theory agreed upon by experts (Zayrin et al.). The feasibility test used is content validity, which assesses all constructs in the instrument and uses Aiken's V coefficient analysis. This technique is considered the most relevant for measuring content validity (Benavides et al., 2022). Validators then evaluate the authentic assessments produced in this training to conclude the instrument's feasibility.

In Aiken's V coefficient analysis, an assessment can be viewed from two perspectives: one item assessed by many validators or many items assessed by one validator. When many experts assess one item, the content validity value can be obtained using the following equation:

$$V = \frac{S}{n(c-1)}$$

When a single validator evaluates several items, the content validity index can be calculated using the following formula:

$$V = \frac{S}{m(c-1)}$$

Description:

$$S = I - I_o$$

n: number of validators

m: number of items

c: highest possible rating

r: rating assigned by the validator

I_o : lowest possible rating

The Aiken's V coefficient for one of the authentic assessments developed by the training participants was 0.906, which is higher than the critical value of 0.88. This result shows that the instrument developed during the training is valid and appropriate for learning.

Evaluation Stage

The final stage of the training consisted of content validity testing of the teachers' authentic assessments, which were presented to the validators. Overall, the training went well and stayed on track. There were no significant obstacles, and the team collaborated well with the teachers. The teachers were enthusiastic throughout the activities. The authentic assessments produced by each group demonstrated that this activity provided knowledge related to authentic assessment and concrete experience in its preparation. It is hoped that the knowledge and experience gained during the training series will continue to be applied to future learning activities, ensuring that the assessments used are valid and high-quality, thereby improving the quality of education. To evaluate the activity's objectives more specifically, teachers were asked to complete a post-test and questionnaire at the end of the training session.

This post-test measures teachers' understanding of authentic assessment development after participating in the training activity. The questionnaire collects participants' feedback to evaluate the training's effectiveness and identify future improvements. The post-test and questionnaire results show that 93% of participants understood the concept of authentic assessments and could identify them as distinct from traditional assessments. 100% of training participants were able to determine the appropriate type of authentic assessment for science learning. Integrating local wisdom into assessment preparation also yielded positive results: 93% of participants could identify its potential and relate it to science concepts.

Teachers began to understand the importance of integrating local wisdom into assessments. Most teachers mentioned that integrating local wisdom into science learning provides various benefits. These benefits include making learning more meaningful, helping students better understand science concepts, preserving culture and customs, and fostering student motivation to learn. These results demonstrate the positive impact of this training activity. Through the training, teachers gained a better understanding of authentic assessments and the importance of incorporating local wisdom into learning, particularly in science.

CONCLUSION

The training activity on developing authentic assessments based on local wisdom was attended by science teachers who are members of the MGMP group in Tegal Regency. The activity provided knowledge related to developing authentic assessments and gave teachers real experience developing assessments with team monitoring. Through structured training involving discussions and mini-projects, the teachers developed authentic assessments that integrated the potential of local coastal wisdom in the Tegal Regency. Participants showed enthusiasm throughout the training, from the first to the third strategy. Their responses to the questionnaire reinforced this enthusiasm at the end of the session. The results of the authenticity assessment validity test demonstrate teachers' success in developing high-quality assessments suitable for measuring achievement of the learning objectives.

Valid and high-quality assessments are expected to accurately measure student achievement and optimally improve the quality of education. Additionally, the CRT approach increased teachers' understanding of the importance and advantages of incorporating local wisdom into science education.

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