The Effectiveness of Authentic Assessment Instrument Based on Higher Order Thinking Skills Integrated with Character Education

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Abstract
This research aims to examine the effectiveness of the authentic assessment instrument based on Higher Order Thinking Skills (HOTS) integrated with character education on the theme "Heat and Its Transfer" to enhance the learning outcomes of fifth-grade students at SD Muhammadiyah Purworejo. A quantitative approach using the Quasi-Experimental method was employed, involving two groups: the control group and the experimental group. The authentic assessment instrument based on HOTS integrated with character education was implemented in the experimental group, while the control group used conventional assessment instruments. The results showed that the use of the authentic assessment instrument based on HOTS integrated with character education significantly improved the Higher Order Thinking Skills (HOTS) of the students. The average HOTS score in the experimental group was higher than that in the control group after the intervention. Furthermore, the use of this instrument also influenced the improvement of students' character. The analysis results demonstrated a significant improvement in the experimental group compared to the control group. Therefore, it can be concluded that the authentic assessment instrument based on HOTS integrated with character education is effective in enhancing HOTS and character of fifth-grade students on the theme "Heat and Its Transfer." This research has significant implications in the field of education, providing a foundation for the development of learning approaches that promote high-level thinking skills and students' character. It is recommended that this approach be implemented more widely in the learning processes of schools to support students' development in various aspects of learning.

INTRODUCTION
In the context of the education curriculum in Indonesia, Curriculum 2013 emphasizes the development of Higher Order Thinking Skills (HOTS). Higher Order Thinking Skills (HOTS) refer to the ability to connect, manipulate, and transform existing knowledge and experiences critically and creatively to make decisions in solving problems in new situations (Wahyuningsih et al., 2018). HOTS demands students to possess the four learning skills known as the 4Cs: communication, collaboration, critical thinking, creative, and innovative (Eriansyah & Baadilla, 2023; Fitri et al., 2019). In the context of high-level thinking, students are expected to have the ability to think logically, critically, creatively, and solve problems independently (Setiawati & Asmira, 2019). High-level thinking skills are crucial for success in both professional and academic workplaces and are highly relevant in overcoming challenges that often undermine students' confidence in academic environments (Carroll & Harris, 2020).

Numerous researchers, such as Heffington & Coady (2023), Madhuri et al. (2012), Vidergor (2018), and Virranmäki et al. (2021), have devoted their attention to enhancing Higher Order Thinking
Skills (HOTS). These skills, often regarded as the pinnacle stages in Bloom’s taxonomy or similar frameworks, encompass Analysis, Evaluation, and Creation, or, in traditional terms, Analysis, Synthesis, and Evaluation (Brookhart, 2010). This approach involves integrating digital tools and resources chosen by students to facilitate various aspects of the learning process, including goal setting, material selection, and ultimately, assessment (Reinders, 2014). The utilization of HOTS-based assessment methods aims to cultivate students’ critical and creative thinking abilities. Early training in creativity equips children with the skills needed to tackle problems effectively (Jahra, 2022), while critical thinking fosters structured analysis to comprehend the connections between ideas and facts (Sae & Radia, 2023). Through this approach, students are prompted to engage with provided information, conduct thorough analyses, and validate their findings (Pangestika & Cahyaningsih, 2022). Such an approach establishes a robust foundation for nurturing students' advanced cognitive abilities, which are indispensable for success across various domains of life.

In Indonesia, the implementation of Curriculum 2013 not only prioritizes the development of Higher-order thinking skills but also focuses on behavioral aspects or character education reinforcement. Character education refers to noble values internalized as thought patterns, which are then reflected in positive everyday behavior (Wibowo, 2019). The importance of character education demands that these values be instilled in students from an early age, with the goal of forming strong characters, enabling them to face various challenges in life. As stated by Syarif & Rahmat (2018: 87), the planting of character education starts and is emphasized at the elementary education level. Character education is very important to be given from an early age to form good students. Character education can be achieved through learning activities guided by teachers at school (Sahiri & Faturahman, 2022). Values such as creativity, patriotism, religiosity, tolerance, appreciation of achievements, discipline, hard work, honesty, independence, love of reading, democracy, curiosity, nationalism, friendship, peace, responsibility, concern for the environment, and society are values that should be taught to shape students' characters.

The importance of character education is reinforced by the fact that Curriculum 2013 emphasizes the enhancement of high-order thinking skills, along with character reinforcement, and the adoption of a comprehensive and thorough assessment system. Therefore, an assessment approach that can encompass all these aspects is needed, which is through authentic assessment. Authentic assessment is one of the assessment models that focus on learning activities carried out, not just assessing the final learning outcomes (Fitri & Maunah, 2013). As expressed by Agustin et al. (2022), this approach requires adequate facilities and infrastructure support to enhance education on Higher-order thinking skills and character reinforcement. Thus, authentic assessment serves not only as an evaluation tool but also as an instrument to guide learning processes oriented towards developing high-level thinking and good character in students.

Based on observations and interviews at SD Muhammadiyah Purworejo, it was revealed that Higher-order thinking skills (HOTS)-based learning has not been maximally applied by teachers. In the pre-test results for 10 fifth-grade students, the average score obtained was still below 70, at 60, indicating that students' high-level thinking abilities are still relatively moderate. Character education, which should be an integral part of learning activities, has also not been optimally implemented because it is not considered part of the aspects assessed in learning assessments. Teachers tend to focus more on the knowledge aspect (cognitive) and overlook other aspects, especially the attitude aspect (affective) that includes instilling students' character.

Teachers currently still use conventional assessment types, as they are considered more effective and easy to use, although they realize that these assessments are less effective in supporting students' development and improving learning outcomes after teaching. Furthermore, teachers do not have a strong understanding of the concept of authentic assessment, let alone authentic assessment instruments based on HOTS and integrated with character.
Seeing these issues, previous research has developed an Authentic Assessment Instrument based on HOTS Integrated with Character on the theme "Heat and Its Transfer" in the fifth-grade elementary school by Rahmawati (2022). The research concluded that the developed assessment instrument is highly suitable for use, with a validity score from three validators of 3.61 and a reliability score of 95.3% in the Percentage Agreement (PA) reliability test, indicating high reliability. However, this product has not been tested for its effectiveness in the learning process. In this viewpoint, assessment, teaching, and learning are intricately interconnected, constituting integral components of the pedagogical process. Feedback is employed to refine the learning cycle within this framework. Authenticity, within this paradigm, is recognized as a crucial element in the design of assessments that enhances both learning and employability (Sambell et al., 2013; Bloxham, 2015). Therefore, the researchers are interested in testing the effectiveness of this Authentic Assessment Instrument based on HOTS Integrated with Character in the context of learning at SD Muhammadiyah Purworejo.

METHODS

This research utilized a quantitative approach with the Quasi-Experimental method. The Quasi-Experimental method was employed because the researcher could not control all relevant variables in the existing situation. In this study, there were two groups: the control group and the experimental group. The research design applied was the nonequivalent control group design, where both groups were not randomly selected (Sugiyono, 2019). The aim of this quasi-experiment was to obtain information by conducting an actual experiment in a situation where not all variables could be manipulated or controlled.

This study involved two classes: the control class and the experimental class. In the experimental class, the researcher used an authentic assessment instrument based on HOTS integrated with character, while the control class used conventional assessment instruments. The trial was conducted by administering a pretest before the application of the assessment instrument and a posttest after the application of the assessment instrument. This was done to measure the Higher Order Thinking Skills (HOTS) and character abilities of students before and after the application of the assessment instrument.

The data from pretests and posttests were then descriptively analyzed based on the independent variables, namely Higher Order Thinking Skills and character, to determine changes in students’ learning outcomes before and after the trial. The research data were analyzed using inferential statistics, including t-tests and N Gain tests. The t-test was used to assess significant differences between the control and experimental groups after the treatment. The N Gain test was used to measure the improvement in students’ learning outcomes from pretest to posttest.

This analysis was conducted using the SPSS 21 statistical software. The t-test was performed using a simple linear regression test model to determine whether there was a significant influence of using authentic assessment instruments on the independent variables, namely HOTS and character, in students. Thus, this research combined descriptive analysis and inferential analysis to evaluate the effectiveness of the authentic assessment instrument based on HOTS integrated with character in enhancing students’ learning outcomes.

RESULTS AND DISCUSSION

Result

The research results indicate that the pretest scores in both classes show the same average values, although the scores displayed in figure 2 clearly differ between the control and experimental groups. Based on this data, it can be seen that the average pretest score obtained by the control class is 48.4 with a minimum value of 34.4 and a maximum value of 68.8. Similarly, in the experimental class, the average pretest score is 50.6 with a minimum value of 34.4 and a maximum value of 71.9. In contrast, the posttest results show a notable difference between the two classes. In the control class, the average posttest score is 59.4 with a minimum value of 40.6 and a maximum value of 75.
Unlike the control class, the experimental class exhibits a significant increase in the average posttest score, reaching 81.3 with a minimum value of 62.5 and a maximum value of 93.8.

1. High Order Thinking Skills (HOTS)

The research findings on students’ HOTS reveal a difference between the control and experimental classes, as presented in figure 1.

![Figure 1. Comparison of Higher Order Thinking Skills (HOTS) between Control and Experimental Classes](image)

Based on figure 1, it can be observed that the average assessment scores for HOTS in both classes differ. After accumulating the average scores from pretests and posttests, the average HOTS score in the control class is 54, equivalent to 2.14 on a scale of 4, indicating a sufficient level (C). Meanwhile, in the experimental class, the average score is 66.5, equivalent to 2.66 on a scale of 4, signifying a good level (B).

2. Character

The acquisition of students’ character scores was obtained through observation during learning activities, as presented in figure 2.

![Figure 1. Comparison of Character between Control and Experimental Classes](image)

The students’ character in both the control and experimental classes is relatively good, indicating that the students in the 5th grade of SD Muhammadiyah Purworejo possessed the character
traits expected of elementary school children before the study. However, with the use of the integrated character assessment instrument, it directed and matured the characters outlined in the instrument to be better than before. These characters include 1) religiosity, encompassing prayer activities, greeting others politely, speaking respectfully, and respecting those engaged in worship; 2) nationalism, involving respecting teachers and peers, adhering to school rules, and preserving the school environment; 3) independence, comprising punctuality, self-reliance, completing responsibilities responsibly; 4) mutual cooperation, involving helping each other, teamwork, school cleaning activities, respecting others' opinions; and 5) integrity, encompassing adherence to rules, honesty, and bravery. The character analysis showed an average difference of 12.08 on a scale of 100, indicating that the experimental class's character observation results were higher than the control class's. The experimental class received an average score of 3.1 on a scale of 4, indicating a good level (B), while the experimental class received an average score of 3.6 on a scale of 4, signifying a very good level (SB).

3. Effectiveness of Authentic Assessment Instrument Based on Higher Order Thinking Skill

T-test was used to prove one dependent variable by two independent variables using SPSS 21. Given the known significance value of 5% with a sig. of 0.00 < 0.05, the decision-making basis was established. The T-test results conclude that Ho is rejected and Ha is accepted, meaning that the independent variables collectively have a significant impact on the dependent variable. The Independent Sample T-Test results for the HOTS variable are presented in Table 1.

<table>
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<th>Model</th>
<th>Standardized Coefficients</th>
<th>Beta</th>
<th>t</th>
<th>Column 3</th>
</tr>
</thead>
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<td>Authentic Assessment Instrument</td>
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</table>

Dependent Variable: HOTS

The determination of the t-table value for a 5% significance level is 1.73406. The calculated t-value obtained using SPSS is 12.941. Comparing the calculated t-value with the t-table value, since the calculated t-value (12.941) is greater than the t-table value (1.73406), Ha is accepted, and H0 is rejected. Based on this hypothesis test, it can be concluded that the "Authentic Assessment Instrument Based on Integrated Higher Order Thinking Skills and Character is effective for Grade V students in Theme 6: Heat and Its Transfer."

Furthermore, the results of the Independent Sample T-Test for the HOTS variable are presented in Table 2.

<table>
<thead>
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<th>Model</th>
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Dependent Variable: Character

The determined t-table value for a 5% significance level is 1.73406. The calculated t-value obtained using SPSS is 2.174. Comparing the calculated t-value (2.174) with the t-table value (1.73406), since the calculated t-value is greater than the t-table value, Ha is accepted, and H0 is rejected. Based on this hypothesis test, it can be concluded that the "Authentic Assessment Instrument Based on Integrated Higher Order Thinking Skills and Character is effective for the character of Grade V students in Theme 6: Heat and Its Transfer."

Based on both Table 1 and Table 2, the t-test was conducted for the dependent variable against each independent variable. Both tests resulted in a significance level in the t-test with a
significance value of $0.00 < 0.05$. Therefore, based on the t-test results, it can be concluded that $H_0$ is rejected, and $H_a$ is accepted, indicating that the independent variables collectively have a significant effect on the dependent variable.

The students' learning outcomes were analyzed to outline the overall results of the pretest and posttest. The summary of N-Gain scores is presented in Table 3.

<table>
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<th>Mark</th>
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<th>Post-test</th>
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</thead>
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<tr>
<td></td>
<td>Control Class</td>
<td>Experimental Class</td>
</tr>
<tr>
<td>Lowest</td>
<td>34.4</td>
<td>34.4</td>
</tr>
<tr>
<td>Highest</td>
<td>68.8</td>
<td>71.9</td>
</tr>
<tr>
<td>Average</td>
<td>48.8</td>
<td>50.6</td>
</tr>
</tbody>
</table>

Based on Table 3, the increase in scores from pre-test to post-test for the control group indicates an average score improvement of 10.6 points (from 48.8 to 59.4). On the other hand, the experimental group experienced a significant average score improvement of 30.7 points (from 50.6 to 81.3). After the intervention, students in the experimental group achieved significantly higher post-test scores compared to the control group (81.3 vs. 59.4). This suggests that the teaching approach used in the experimental group was more effective in enhancing the understanding and knowledge of the students on the theme "Heat and Its Transfer" compared to the approach used in the control group.

In other words, the use of the authentic assessment instrument based on integrated Higher Order Thinking Skills and character successfully enhanced the understanding and learning outcomes of the students significantly in the theme "Heat and Its Transfer." Students in the experimental group demonstrated a greater improvement in learning outcomes compared to the control group, affirming the effectiveness of this teaching approach.

**Discussion**

Based on the research findings, a significant difference exists between the control group and the experimental group. Although the pre-test results in both groups showed similar average scores, the post-test results indicated a significant improvement in the experimental group. In the experimental group, the post-test results showed a considerably higher average score compared to the control group, demonstrating the effectiveness of the authentic assessment instrument based on Higher Order Thinking Skills and integrated character.

The research results demonstrate that the use of authentic assessment instruments based on Higher Order Thinking Skills and character significantly enhances students' Higher Order Thinking Skills (HOTS). The average HOTS scores in the experimental group (66.5) were higher than the control group (54) after the intervention. The t-test results indicate that the integrated HOTS-based authentic assessment instrument significantly influences the improvement of students' HOTS. Therefore, the research hypothesis stating that the "Authentic Assessment Instrument Based on Integrated Higher Order Thinking Skills and Character is effective for fifth-grade students' HOTS on Theme 6: Heat and Its Transfer" is accepted. These findings align with the research conducted by Ashford-Rowe et al. (2014), stating that authentic assessment can develop Higher Order Cognitive Skills. Authentic assessment also emerges as a model that can enhance employability skills, such as problem-solving skills (Wu et al., 2015), autonomy (Swaffield, 2011), and motivation (Gulikers et al., 2008).

Authenticity is understood as realism, contextualization, and problematization in teaching and assessing curricular content (Benner et al., 2009; Raymond et al., 2013). Realism involves linking knowledge with everyday life and work, contextualization characterizes situations where knowledge can be applied analytically and thoughtfully, and problematization invokes a sense that what is
learned can be used to solve a problem or meet a need. Thus, authentic assessment aims to integrate classroom activities with real-world scenarios, replicating tasks and performance standards faced by professionals in the workforce (Wiggins, 1990).

Authentic assessment is an assessment approach that emphasizes the collection of authentic and relevant information about students' abilities in the real world (Adisel et al., 2022; Marfuah & Febriza, 2019). Forms of authentic assessment include projects, portfolios, observations, and tasks that simulate real-life situations (Pratiwi et al., 2019). Authenticity has been identified as a key characteristic of assessment design that promotes learning. Authentic assessment aims to replicate tasks and performance standards typically found in the world of work and has been found to positively impact student learning, problem-solving skills, autonomy, motivation, self-regulation, and metacognition; abilities highly related to employability (Villarroel et al., 2018).

In the fifth grade of SD Muhammadiyah Purworejo, authentic assessment involves the application of learned concepts in real-world situations. This helps students deepen their understanding of these concepts and comprehend how they relate to each other (Mega & Madani, 2023). Authentic assessment provides a more real and relevant context for students. By applying concepts in situations similar to the real world, students can see the meaning and relevance of what they learn (Sugrah, 2019). In assigned authentic tasks, students are required to analyze information, evaluate solutions, and make decisions. This stimulates the development of analytical and evaluative skills, which are part of Higher Order Thinking Skills (Giarti, 2015).

However, it is important to note that the effectiveness of authentic assessment in enhancing HOTS can be influenced by various factors, including task design, teacher support, and the learning environment. With proper implementation, authentic assessment can be an effective tool in improving students' Higher Order Thinking Skills.

The research results also show that the use of integrated authentic assessment instruments based on Higher Order Thinking Skills and character can influence the improvement of students' character. The N-Gain character scores in the experimental group (3.6 on a scale of 4) indicate a significant improvement, while the control group obtained a character N-Gain score of 3.1. The t-test results show that the integrated HOTS-based authentic assessment instrument and character significantly influence the improvement of students' character. Therefore, the research hypothesis stating that the "Authentic Assessment Instrument Based on Integrated Higher Order Thinking Skills and Character is effective for fifth-grade students' character on Theme 6: Heat and Its Transfer" is also accepted.

Tasks in authentic assessment conducted in the fifth grade of SD Muhammadiyah Purworejo emphasize students to manage their time, plan, and implement projects or tasks. Through this experience, students can develop personal responsibility and self-management skills (Wicaksana, 2020). Additionally, projects or tasks in this authentic assessment involve collaboration and communication among students. Such collaboration can help students develop social skills, understanding of others' perspectives, and effective teamwork (Septikasari & Frasandy, 2018). Tasks in authentic assessment demand creative and innovative thinking. Through the development of these skills, students can hone characteristics such as perseverance, resilience, and courage in exploring new ideas. Authentic assessment, especially when associated with relevant projects, can help students see the connection between school lessons and real-life situations. This can shape a positive attitude towards learning and provide intrinsic motivation to learn.

Although authentic assessment can contribute to the development of students' character, it is essential to note that this is just one aspect of a holistic approach to shaping character. Other factors, including explicit character education, the school environment, and family support, also play a crucial role in shaping students' character comprehensively.
CONCLUSION

Based on the data analysis and statistical tests, it can be concluded that the use of the authentic assessment instrument based on integrated Higher Order Thinking Skills (HOTS) and character is effective in enhancing the Higher Order Thinking Skills (HOTS) and character of Grade V students in the theme "Heat and Its Transfer." The results of this research support the proposed research hypotheses. This study has significant implications in the field of education. The use of authentic assessment instruments based on integrated HOTS and character can assist teachers in improving students' learning outcomes in terms of higher-order thinking skills and character development. Therefore, it is recommended that this approach be implemented more widely in the learning processes of schools.

This study contributes by demonstrating that the utilization of authentic assessment instruments based on Higher Order Thinking Skills (HOTS) significantly enhances students' higher-order thinking skills. The research findings provide empirical support for the effectiveness of authentic assessment instruments in stimulating the development of higher-order thinking skills, which are key competencies in education. The results of this study can serve as a foundation for further research and application in the context of primary school learning. The integration of authentic assessment instruments based on HOTS and character can be adopted by teachers and schools to enhance the quality of education. Thus, this research makes a substantial contribution in the educational context, aiding the holistic development of students through the improvement of higher-order thinking skills and character formation.

REFERENCES


