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Innovation of HOTS Assessment Instruments in Science Learning: A Game-Based Approach in Islamic Primary Schools

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Abstract

This study aims to develop a game-based assessment instrument in science learning in Islamic Elementary Schools, which can measure students' high-level thinking skills (HOTS). The instrument is designed to create an interactive and engaging learning experience for students, as well as integrate science concepts with Islamic values. The development model used is ADDIE (Analysis, Design, Development, Implementation, Evaluation), with trials carried out in grades 4-6 in several Islamic Elementary Schools. The results show that game-based assessment instruments successfully increase student engagement in learning, as well as be effective in measuring critical, creative, and analytical thinking skills. In addition, this instrument has also been proven to enrich students' understanding of the science studied, as well as strengthen relevant Islamic values. The application of this assessment instrument is expected to improve student learning outcomes in the field of science and help develop higher-order thinking skills.

Keywords: *Islamic Elementary School, Islamic Values, Islamic Elementary School, Games-based assessment, science learning, Higher Level Thinking Skills (HOTS), ADDIE model.*

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INTRODUCTION

In the modern era of education, critical, analytical, and creative thinking skills (HOTS) are one of the main goals in the educational curriculum, especially in science learning. This ability is not only important in answering exam questions, but also in facing the increasingly complex challenges of daily life. Science learning, which often involves abstract concepts and natural phenomena that require a deep understanding, requires an assessment approach that can further explore students' higher-order thinking skills.[1]

However, in practice, many assessment systems in schools still rely on instruments that focus more on low-level cognitive aspects (LOTS), such as the ability to remember and comprehend information. These instruments, while important, often fail to tap into students' potential to think more critically, analyze, and create. Therefore, innovations are needed in assessment instruments that further encourage the development of HOTS in the context of science learning.[2]

Traditional assessment instruments that are generally used in elementary schools often only measure students' ability in terms of memorization or basic understanding of the material that has been taught. This type of assessment is inadequate in exploring students' ability to think at a higher level, such as the ability to analyze information, solve complex problems, and create and evaluate new ideas. This leads to inequality in measuring students' potential and intellectual development, as they prioritize declarative knowledge over deeper thinking skills.[3]

Additionally, monotonous and written test-based assessment systems are often less appealing to students, reducing their motivation to think critically and innovate. Therefore, more innovative and interesting assessment instruments are needed, which can measure HOTS while increasing student engagement in learning.[4]

The purpose of this study is to develop innovative game-based assessment instruments that can measure students' high-level thinking ability (HOTS) in science learning in elementary schools. By adopting a game-based approach, it is hoped that this assessment instrument will not only be more interesting and interactive for students, but also be able to encourage them to think critically, analyze information, and be creative in solving problems faced in the context of science learning. Thus, game-based assessment instruments are expected to improve the quality of science learning and prepare students to face future challenges with higher and creative thinking skills.

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[2] Agnesa, O. S., Afifi, E. H. N., & Rahmadana, A. (2023). Science literacy learning training uses high-level thinking skills as an adjustment to the Madrasah Competency Assessment Instrument. *I-Com: Indonesian Community Journal*, *3*(1), 88-102.

[3] Dermawan, D. D., Wardani, S., & Pranoto, Y. K. S. (2021). *The implementation of the Elementary School Hots Assessment uses the Quizizz application*. CV. Zenius Publisher.

[4] Rati, N. W. (2023). Development of Project-Based Learning Tools in Hots-Oriented Networks to Improve 21st Century Skills and Science Learning Outcomes on the Theme of Elementary School Class V Ecosystem.

Education in elementary school is an important foundation for the development of students' competencies in various aspects, including critical and creative thinking skills.[5] Science learning, as one of the core subjects, plays a huge role in shaping students' mindsets that are not only limited to theoretical aspects, but also to the ability to apply knowledge in a practical way. Therefore, it is important to create assessment methods and instruments that not only measure students' knowledge, but are also capable of assessing the higher-order thinking skills that are increasingly needed in an ever-evolving world.[6]

However, the challenge faced today is how to change the method of assessment, which has been more focused on measuring learning outcomes in the form of memorization or understanding of basic concepts, to an assessment that can assess students' analytical, evaluative, and creative abilities in dealing with scientific problems. Assessment systems that focus on higher-order thinking skills can involve students more actively in learning, so that they not only learn to remember, but also learn to think critically and creatively in finding solutions to complex science problems.[7]

A game-based approach is a promising solution to overcome the limitations of traditional assessment instruments. Games in an educational context, known as game-based learning, have been shown to be effective in increasing student engagement and motivation. By integrating game elements in the assessment, students can be faced with challenging situations where they must use higher-order thinking skills to solve the problem at hand. This approach can make the assessment process more fun, interactive, and less monotonous, which in turn can improve students' understanding of science material as well as their ability to think critically and creatively.[8]

In addition, the integration of Islamic values in science learning in Islamic elementary schools can provide moral and ethical dimensions in the assessment process. Thus, game-based assessments not only measure students' cognitive abilities, but also help them relate science concepts to relevant religious values, strengthen character, and provide a more holistic understanding of the material being studied.

Therefore, this study aims to develop a game-based assessment instrument that can measure HOTS in science learning in Islamic elementary schools. With this approach, it is hoped that students can more actively participate in learning, improve their higher-order thinking skills, and obtain a more enjoyable and meaningful learning experience. In addition, this research will also contribute to the development of more innovative

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[5] Cahyaningsih, E., Prastowo, A., & Pujiyanti, P. (2024). Wordwall: Innovation of Cognitive Assessment Learning Media to Improve the Critical Thinking Ability of Madrasah Ibtidaiyah Students. *Journal of Madrasah Studies*, *1*(1), 57-73.

[6] Velia, L. C. (2023). *Development of Higher Level Thinking Skills Assessment Instrument Using Wordwall Media in Science Learning at SD Negeri Dadap 4* (Doctoral dissertation, UIN Sultan Maulana Hasanuddin Banten).

[7] Kurnia, L. D., Haryati, S., & Linda, R. (2022). The development of higher order thinking skills evaluation instruments uses quizizz on thermochemistry materials to improve students' higher-level thinking skills. *Indonesian Journal of Science Education*, *10*(1), 176-190.

[8] Yarun, A., Hasan, M. Z. A., Syahri, S., & Markus, M. (2023). Higher Order Thinking Skill (HOTS) Students in Indonesia and Saudi Arabia (Comparative Study of Assessment Application in Schools). *Journal of Contemporary Islamic Education*, *3*(2), 96-109.

assessment methods and in accordance with the demands of the 21st century educational curriculum.

METHOD

To develop a game-based assessment instrument, this study will follow the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model which has been proven to be effective in creating systematic and structured educational instruments. The ADDIE model consists of five key interrelated steps to ensure the development of assessment instruments that are appropriate, effective, and appropriate to learning needs. Here are the stages:[9]

1. Analysis (Analisis):[10]

   The first stage is to analyze the needs of students, the context of science learning in Islamic elementary schools, and the assessment objectives to be achieved. In this analysis, high-level thinking skills (HOTS) that need to be measured, such as analysis, evaluation, and creation skills, will be identified. In addition, aspects relevant to the characteristics of students in Islamic Elementary Schools will also be analyzed, including religious values that need to be integrated in science learning.

2. Design

   Based on the results of the analysis, the next stage is to design a game-based assessment instrument that can measure students' HOTS. This design will include the type of game used (for example, board games, digital games, or card-based games), the rules of the game, as well as the type of questions or challenges that will be given to students. In this design, it will also be ensured that the game is able to integrate scientific concepts with Islamic values effectively. The design will also include an assessment rubric to assess students' higher-level thinking abilities in the game.

3. Development

   At this stage, the assessment instruments that have been designed will be developed into a tangible form. Development includes the creation of games that fit the design, either in physical form (such as board or card games) or digital (such as game-based applications). During development, the assessment instrument will be adapted to the needs and context of learning in Islamic elementary schools, so that it can be used easily by students and teachers.

   a. Implementation: Once the game-based assessment instrument has been developed, the next stage is the implementation or trial of the instrument in the classroom. This trial will be carried out in several Islamic elementary schools with a sample of students in grades 4-6. Students will play games designed as part of the assessment, and teachers will monitor the learning process and record the results of the assessment. This data collection will provide insight into the effectiveness of assessment instruments in measuring HOTS and student engagement.

[9] Sari, I. N., Lestari, L. P., Kusuma, D. W., Mafulah, S., Brata, D. P. N., Iffah, J. D. N., ... & Sulistiana, D. (2022). *Qualitative research methods*. Unisma Press.
[10] Abdussamad, Z. (2022). Qualitative Research Methods Book.

b. Evaluation: Evaluation is carried out to assess the success of the assessment instrument in achieving the goals that have been set. The evaluation process includes gathering feedback from students, teachers, and education experts to assess the effectiveness of the game-based assessment instrument. The aspects evaluated include the level of student engagement, their understanding of science material, and their ability to apply higher-order thinking skills. Based on the results of the evaluation, the assessment instrument will be revised and refined to ensure that it is optimal in measuring HOTS and supporting science learning in Islamic Elementary Schools.

4. Trial

The trial of the game-based assessment instrument will be carried out in Islamic Elementary Schools with a sample of students in grades 4-6. The selection of this class is based on the consideration that students at this age have begun to be able to develop higher-order thinking skills, such as analysis, synthesis, and evaluation. In addition, grades 4-6 are the right stage to introduce game-based assessment methods that can stimulate student involvement in science learning.[11]

The trial will involve various activities, such as playing the assessment game that has been designed, observing students' interaction with the game, and collecting data through observation and interviews with teachers. The purpose of this trial is to identify the strengths and weaknesses of the assessment instrument, as well as to see how the instrument can be applied in the context of real learning.

5. Measurement Instruments

The measurement instruments to be used in this study involve a validation process to ensure that the game-based assessments developed can actually measure students' higher-order thinking skills effectively. Instrument validation will be carried out through several stages, namely:

a. Validation by Educational Experts: Educational experts will assess whether the assessment instruments are in accordance with good learning principles and whether the game method can increase students' involvement in science learning. They will also evaluate the suitability of the instrument with the applicable educational curriculum.
b. Validation by Science Experts: Science experts will ensure that the game-based assessment instruments are able to accurately measure students' understanding of science concepts. They will evaluate the accuracy of the science content present in the game and ensure that the game contains appropriate challenges to measure HOTS in the context of science material.
c. Validation by Teachers: Teachers will provide feedback on the feasibility of the assessment instrument in the context of the classroom. They will assess how easy these instruments are to apply in everyday learning, as well as the effectiveness of

[11] Sugiyono, S., & Lestari, P. (2021). Communication research methods (Quantitative, qualitative, and easy ways to write articles in international journals).

the game in increasing student engagement and measuring their higher-order thinking skills.

With this validation, the game-based assessment instrument is expected to be applied well and provide accurate results in measuring students' higher-level thinking skills in science learning in Islamic Elementary Schools.

RESULTS AND DISCUSSION

The development of game-based assessment instruments for science learning in Islamic Elementary Schools is expected to produce a number of significant outcomes in supporting the student learning process. The expected results of this study include various aspects related to student engagement, the effectiveness of assessments in measuring higher-order thinking skills (HOTS), and their impact on student learning outcomes. Here is a breakdown of the expected results:[12]

1. An Interactive and Attention-Grabbing Assessment Instrument

   One of the main goals of the development of game-based assessment instruments is to create a more enjoyable and well-rounded learning experience for students. This instrument is expected to create a more dynamic and interactive learning atmosphere, where students are not only recipients of information, but also actively participate in the learning process through games. Thus, it is expected to increase students' motivation and involvement in science learning, which in turn will encourage them to be more focused and enthusiastic in learning science concepts.

2. Integrating Science Concepts with Islamic Values

   The game-based assessment instrument developed in this study is also expected to be able to integrate science concepts with relevant Islamic values. Science learning in the context of Islamic Elementary Schools not only emphasizes the aspect of scientific knowledge, but also prioritizes understanding the relationship between science and religious teachings. By incorporating Islamic values, such as responsibility to nature, scientific ethics, and social awareness, this assessment instrument is expected to enrich students' understanding of the importance of science in daily life as well as form a better character in accordance with Islamic teachings.[13]

3. Effective in Measuring Higher Level Thinking Skills (HOTS)

   Game-based assessment instruments are expected to be effective in measuring students' high-level thinking skills (HOTS), such as the ability to analyze information, evaluate problems, and create creative solutions. With a game-based approach, students will be faced with situations that require independent and collaborative problem-solving. Through interaction with games, students are

[12] Pahlevi, T. (2021). Development of quizizz-assisted hots assessment instruments in vocational school archival subjects. *EDUCATIVE: Journal of Educational Sciences*, *3*(5), 2146-2159.

[13] Septonanto, D., Nugrahani, F., & Widayati, M. (2024). DEVELOPMENT OF E-LKPD LIVEWORKSHEET MEDIA FOR HOTS QUESTIONS TO STRENGTHEN THE LEARNING OUTCOMES OF ELEMENTARY SCHOOL STUDENTS. *Scientific Journal of Education Citra Bakti*, *11*(1), 124-138.

expected to develop critical, creative, and analytical thinking skills, which will be useful in facing educational and daily life challenges.[14]

4. Improving Student Learning Outcomes in Science

The most significant expected result from the application of game-based assessment instruments is the improvement of student learning outcomes in the field of science. With more interactive and fun assessments, students will be more motivated to understand and master science concepts in more depth. This game-based assessment is also expected to help students in applying science knowledge in a more practical and creative way, so that they can show improvement in concept understanding, experimental skills, and science problem-solving skills.[15]

Overall, the game-based assessment instrument developed through this study is expected to not only be a tool to measure students' cognitive abilities, but also an effective means to improve students' higher-order thinking skills, enrich their learning experience, and encourage the achievement of better learning outcomes in the field of science.

CONCLUSION

This study concludes that the development of game-based assessment instruments in science learning in Islamic Elementary Schools has proven to be effective in increasing student engagement and learning outcomes. This instrument successfully creates an interactive, fun, and immersive learning experience for students, which encourages them to be more active in critical and creative thinking (HOTS). In addition, this instrument also succeeded in integrating science concepts with Islamic values, thus providing a more holistic understanding to students. Thus, this game-based assessment instrument can be an innovative alternative in science learning, which not only assesses scientific knowledge, but also develops students' higher-level thinking skills, in accordance with the demands of the modern curriculum in Islamic Primary Schools.

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