HOTS-Based Digital Worksheets as Interactive Assessment in Sciences Learning for Elementary School Teacher Education

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ARTICLE INFO	ABSTRACT
Article history: Received : 19-05-2024 Revised : 20-11-2024 Accepted : 29-11-2024 Published : 02-12-2024	*This study was conducted because lecturers must be able to be more creative by carefully preparing Digital Worksheets for students, because they meet the criteria for basic competencies that must be mastered by students. The purpose of the article is to describe the implementation of HOTS-based Digital Worksheets as an interactive assessment in basic science learning for elementary school teacher education, identify supporting and inhibiting factors, and describe efforts to optimize supporting factors and efforts to overcome inhibiting factors. This study uses a descriptive qualitative research method, by describing a phenomenon as it is without manipulation. The research design chosen is a case study, meaning that the research is focused on one selected event or phenomenon in depth. The subjects of this study were 34 elementary school teacher education study program students who were in semester I. The sampling technique was purposive sampling. Data collection techniques are observation, interviews and document studies. Data validity techniques are technical triangulation and source triangulation. The results of this study is 71% of students felt that teaching materials with new innovations or in other forms. Form can increase students' interest in studying learning material.*

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1. INTRODUCTION

The 21st century or what is known as the knowledge age era is an era where efforts to do these things are carried out to meet the needs of society based on knowledge. Efforts to meet these needs can be found in the fields of education, economy, human resource development and industry (Diana & Hisar, 2021). Changes in human lifestyle in the 21st century, such as science and technology. Technology

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requires humans to have skills, one of which is learning and innovation skills so that they are able to participate in developments in the 21st century.

Based on the formulation of The Assessment and Teaching of 21st Century Skills (ATC21S) Project, the thinking skills framework which is a competency needed in the 21st century, consists of problem solving, creativity and innovation, critical thinking, and decision making (Rokhim et al., 2020). Based on previous research, we have developed an assessment using Higher Order Thinking Skills based on environmental problems (HOTS-AEP) for students (Budiastuti et al., 2023). This instrument has the function of measuring student knowledge based on various environmental problems that occur. Previous research has shown that measurements using HOTS-AEP for students are generally still in the low category, so they need to be improved (Hayati et al., 2020; Hernández-Campos et al., 2020).

Yusra et al. (2023) shows that assessment is a difficult aspect of education, because of the varied nature of assessment, teachers find it difficult to plan and carry out this procedure effectively. Activities carried out in order to measure students' high order thinking skills (HOTS) abilities are called measurements or assessments. Assessment is a process of systematically collecting data or information about an attribute, person or object, in the form of qualitative or quantitative data about the number, condition, ability or progress of an attribute, object or person being assessed, without referring to a decision (Budiastuti et al., 2023). This assessment is carried out to determine the extent to which the success of a lesson can improve students' high-level thinking abilities. Apart from that, everything related to education and the learning process cannot be separated from measurement or assessment activities (Susanti et al., 2023).

Conceptually, digital-based assessment is digital media that is interconnected or integrated to help lecturers interact with students, which includes electronic text, graphics, moving images and sound. The digital context includes digital interactive television, the internet, interactive games, and telecommunications. Digital is very useful when used in the current situation, where most of the learning process is carried out online as an implementation of government policy (Aditya et al., 2021). Therefore, digital-based teaching materials are really needed by lecturers to educate students about this time.

Digital worksheets are work guides that make it easier for students to participate in electronic learning activities that can be accessed via desktop computers, notebooks, smartphones and cell phones. Digital worksheets are also a solution for giving assignments to students. Digital worksheets consist of sheets containing tasks that students must complete. These assignments can be academic assignments or practical assignments. Worksheets are designed using computer-based technology (Sari et al., 2020).

Digital worksheets have many advantages, one of which is saving paper as the material used to print worksheets. Based on literature studies, digital worksheets make the learning process more enjoyable. Digital worksheets also visualize concepts so they are easy to understand and can be used independently anywhere and at any time (Fuadi et al., 2022).

Usually universities only use conventional standard-based worksheets for students. Digital worksheets are usually taken directly from textbooks, which may not necessarily align with student characteristics. Therefore, one way to support the teaching and learning process is to utilize digital worksheets to make learning activities more interesting and encourage student participation throughout the learning process (Nasrullah et al., 2021) .

Learning materials should be in interactive digital format (Zainil et al., 2023) more efficient and effective in terms of access, including audio, images, videos and documents while increasing student interest, motivation and skills (Laksono et al., 2023; Muhamad Dah et al., 2024). Such tools are valuable because they have been proven to actively engage students in learning activities (Salehudin et al., 2021; Soncin & Cannistrà, 2022).

This assessment allows lecturers to provide feedback on student learning, monitor progress and determine learning. An example of its application is formative assessment. Meanwhile, assessment as learning has almost the same function as assessment for learning, is formative and takes place during the learning process. The difference is that this assessment involves students actively in assessment activities. The assessment aims to diagnose students' basic abilities. If we look at the process of implementing this assessment, it includes assessment as learning and if we look at it from the point of view of its usefulness, diagnostic assessment includes assessment for learning (Handini et al., 2022).

The development of digital worksheets can use various applications, one of which is using digital worksheets which are available for free on Google. This application can be accessed online so it can be accessed to facilitate learning. Research conducted by Khotami et al. (2023) using worksheets can improve learning outcomes. Results from research Hediansah & Surjono (2019) concluded that the development of digital worksheets can be used to make it easier for students to understand learning material.

Apart from that, digital worksheets are a means to help and facilitate understanding of lesson material, to increase student activity in improving learning achievement (Noveria et al., 2023). Lecturers must be able to prepare digital worksheets for students carefully because digital worksheets must meet at least the criteria relating to whether or not students must master the basic competencies. Digital worksheets have a loose and open form and format, but at least have the following components: identity, expected learning/achievement indicators, substance and performance questions following the learning objectives and strategies set to improve learning activities (Preminger et al., 2024; Trinh et al., 2019).

HOTS-based digital LKS innovation is very important for basic science learning, especially for PGSD students. With this approach, students understand science concepts in depth and are skilled in critical and creative thinking, which are the main provisions in teaching the next generation. In addition, integrating technology in learning increases the relevance of education to the needs of the times, so that students are ready to face the challenges of the modern world of education.

2. METHOD

This research uses descriptive qualitative research methods. The descriptive qualitative method describes the process of the situation experienced without engineering over time and captures the natural relationship between the researcher and the informant (Sutopo, 2002). Researchers emphasize detailed, complete and in-depth sentence descriptions that describe the actual situation to support data presentation. Research site was conducted at STKIP Muhammadiyah Blora with the target of first year Elementary school teacher education study program students, totaling 34 students. The time of this research is October to December.

This research uses a case study approach. The case study approach is research tied to a specific context without generalizations. The case study approach identifies in detail and in-depth the conditions that occur in the field (Izhar et al., 2022). In-depth interviews in this study were semi-structured because this method allows new questions to arise due to the sources' answers so that information gathering can be carried out in more depth during the session. This research uses a sample of research subjects. The sample used was some students. The sampling technique uses purposive sampling. According to Ananda & Fadhilaturrahmi (2018) There are three data collection techniques: observation, interviews, and document study. A case study research design examines a problem through a case consisting of a single unit. This single unit can mean one person or a group affected by an issue. The research procedure is explained in Figure 1.
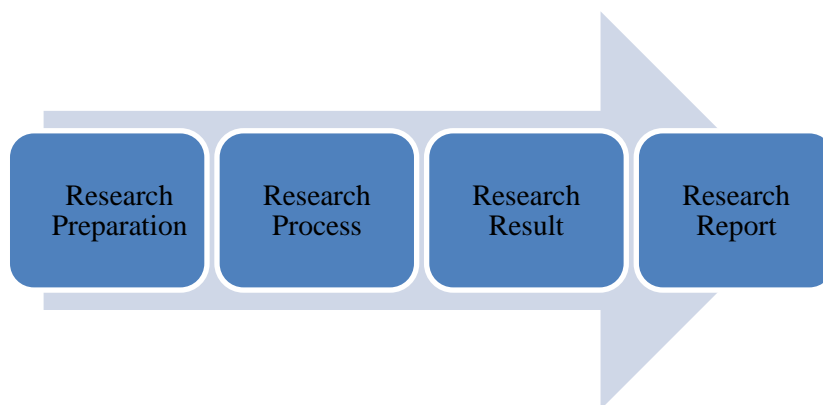

Figure 1. Research Procedure

According to Miles dan Huberman (Sugiyono, 2010), data analysis activities are carried out interactively and continue continuously until they reach a saturation point. Data analysis in this research is data collection, data reduction, data presentation, and drawing conclusions.

3. RESULTS & DISCUSSION

3.1 Results

Based on the results of interviews regarding the analysis of needs for teaching materials in elementary schools, varied answers were obtained from the two lecturers interviewed. Lecturers have never given live worksheet-based assignments. The dominant lecturer gives assignments that are available in textbooks or printed digital worksheet. Using live worksheet-based makes it easier for lecturers because it can display teaching materials and assignments in the form of images and videos, saving time and money. Then the use of live worksheet-based makes it easier for students to do assignments online anytime and anywhere as long as they are connected to the internet network.

Table 1. Student Sample Data Based on Class and Gender

	Gender		
Semester	**Male**	**Female**	**Total**
1	7	29	**34**
Total	7	29	**34**

Data regarding the needs analysis for developing Interactive Assessments show that there were 34 respondents, 7 male students, and 29 female students on the Muhammadiyah Blora College of Teacher Training and Education campus.

Table 2. Data Results Response to Student Needs

Respondent	Total Score (n)	Maximum Score (N)	Percentage $P = \frac{n}{N} x100\%$	Category
23 Students	71	100	69 %	Strongly Agree
11 Students	32	100	31 %	Agree

The results of the student needs analysis are as follows: 29% of students felt that using book teaching materials from the government was sufficient, but 71% of students felt that teaching materials with new innovations or in other forms were needed to increase students' interest in studying learning material. Lecturers' lagging behind in using learning media makes learning seem old-fashioned, so lecturers think learning is boring.
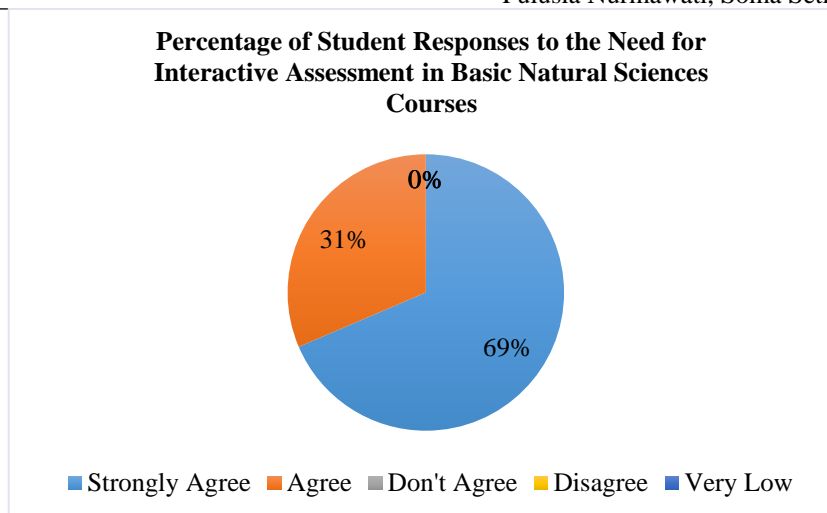
Figure 2. Percentage of Student Responses to the Need for Interactive Assessment

Based on the results of interviews with lecturers with the initials B.S.P, when teaching Basic Natural Sciences, they use interactive assessments in the form of description tests during the question and answer process. The lecturer also teaches the Basic Concepts of Indonesian language course so that some of the questions will be made into paragraphs in cursive writing on environmental topics.

Implementing e-learning, after human resources and facilities and infrastructure have been improved and are running well, the third factor is what kind of e-learning model will be implemented. Is it just limited to sharing teaching materials on the internet, questions and answers on the internet, discussions via the internet, or is it really a substitute for face-to-face in class or even used as a complement to face-to-face in class? This implementation model is very difficult to find which one is the best. There are several methods used in implementing e-learning. The method to be used is adjusted to its function.

One use of learning media is the use of worksheet applications as a lecturer's tool in creating student worksheets. Worksheets are one of the supporting tools in planning learning which contain questions and information that must be answered by students. Worksheets have a conceptual purpose, namely as a tool to help students remember the material they have studied. The worksheet also contains various types of questions to practice students' thinking. A lecturer presents questions on a worksheet for students to complete. Worksheets are given to students through a worksheet application to find out what goals are achieved in learning.

Advantages of using a worksheet application: (1) Improving student learning outcomes and enjoyable learning outcomes will increase learning outcomes so that learning is not boring; (2) Train students' cognitive thinking values in solving the questions in the application worksheet; (3) The worksheet application is easy to use anytime and anywhere; and (4) Worksheet applications can present words, numbers, notations, pictures and diagrams.

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Figure 3. Figure of an interactive worksheet

Electronic worksheets are categorized as interactive worksheets because they combine text, images, and animations, and require user control to utilize them. Students can answer evaluation questions on the live worksheet. The filling method is directly on the worksheet link. First example, on the worksheet page, there are questions about the theory of the formation of galaxies, the solar system, and the universe. Questions can be in the form of problem sentences, then filling in is done. Second example, in the material of various galaxies, it is better to use image visualization to find out the galaxy referred to in the question. The role of lecturers as supporters to implement new innovations in assessment.

Table 3. Research Novelty Findings

Data Collection Technique	Results
Observation	Lecturers use student worksheets as learning evaluations. The student worksheets used are still printed and not colored. Apart from that, the evaluation questions do not contain HOTS and are not electronic assessments. However, the contents of the material and assignments on student worksheets are following the learning objectives that have been set based on HOTS.
Interview	Lecturers experience limited time in developing electronic student worksheets; Apart from that, lecturers need to increase their use of technology.

3.2   Discussion

3.2.1 Implementation of HOTS-Based Digital Worksheets as Interactive Assessments in Basic Natural Sciences Subjects for Elementary School Teacher Education Study Program Students

Based on research results through interviews and observations, lecturers must innovate in learning, especially learning media. In fact, there are many innovations that can be carried out by lecturers, such as developing teaching materials, learning media, lesson plans and worksheets. Students agreed that they liked the Basic Natural Sciences lectures, but another opinion from 20 students felt that there was a need for teaching materials in new innovation or electronic form to make it easier for students to access learning. Electronic teaching materials are teaching materials that, judging from their form, are included in the category of interactive teaching materials because they combine text, images and animation, and require user control to utilize these teaching materials. The benefit of electronic teaching materials is that it makes it easier for students to access teaching materials anywhere and anytime. So learning activities do not only occur in the classroom.

3.2.2 Supporting and Inhibiting Factors for Implementing HOTS-Based Digital Worksheets as Interactive Assessments in Basic Natural Sciences Subjects for Students in Elementary School Teacher Education Study Programs

Human Resources (HR), in e-learning method learning, the most important factor is the human aspect. An important human resource is the human side. HR plays the most important role because human resources can be both subjects and objects in e-learning method learning. This means that the readiness of human resources, such as teachers or students, has a big influence on the successful implementation of e-learning. Infrastructure, the involvement of human resources in e-learning is absolutely necessary, but human resources who are reliable and willing to learn are not enough, adequate infrastructure is needed that supports the achievement of learning objectives. E-learning absolutely relies on the learning process on the availability of infrastructure that is reliable and has good reliability.

3.2.3 Efforts to Optimize Supporting Factors and Overcome Inhibiting Factors to Implement HOTS-Based Digital Worksheets as Interactive Assessments in Basic Natural Sciences Subjects for Students in Elementary School Teacher Education Study Programs

Responsive Teaching Approach by exploring literature studies. Based on the theoretical review that has been carried out, the development of HOTS-based student electronic worksheets for courses requires a solid approach based on theory. Initial analysis is very important to understand the definition of student electronic worksheets and the meaning and implementation of HOTS in interactive assessments.

The development of student electronic worksheets has been adapted into an electronic format, which students can access and use via computers or other electronic devices. Student electronic worksheets are designed to assist students in the learning process by providing guidance, exercises, and structured learning activities in digital form. Student e-sheets are not simply digital versions of

traditional worksheets but are tools that have the potential to stimulate student engagement, encourage creativity, and expand the accessibility of learning. Understanding is the main basis for designing effective and relevant electronic devices in student worksheets

4.   CONCLUSION

The use of HOTS-based digital worksheets through descriptive qualitative research has shown effective results for developing interactive assessments for elementary school teacher education students. The novelty of this research is that it suggests developing a digital lecture evaluation tool in the form of HOTS-based digital worksheets that are flexible for use in Basic Natural Sciences lecture practice, both online and offline. Interactive facilities and easy access as well as appropriate stages of use are based on evaluation questions and stimulate students during lectures.

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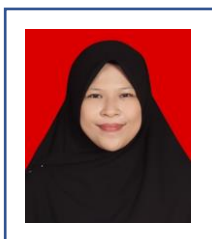
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