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DEVELOPMENT OF E-WORKSHEETS (E-LKPD) FOR SCIENCE IN ELEMENTARY SCHOOLS BASED ON HIGHER-ORDER THINKING SKILLS (HOTS)

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Abstract

This research aims to improve HOTS-based E-Worksheets in Science, test the effectiveness of the E-Worksheets through expert validation, and identify student responses to the development of HOTS-based Science E-Worksheets. This research uses the research and development model, including potential problems, information gathering, product design, design validation, design improvement, and product testing. The research was conducted at SD Negeri Serang 13 with 20 students of 5th grade as subjects for limited testing. The instruments used were questionnaire sheets for module, design, language expert validation, and student responses. The research results indicate that the feasibility of HOTS-based Science E-Worksheets, according to expert evaluations, is considered highly feasible, with a percentage of 92% from material experts, 83.65% from design experts, and 80% from linguists. Students responded positively, with a percentage of 94.6%, categorized as "very good." The development of HOTS-based Science E-Worksheets is highly suitable to use and has received positive responses to be used as teaching materials.

Keywords: E-Worksheets; HOTS; Science; Elementary School

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A. Introduction

Natural Science is a body of knowledge about natural phenomena systematically organized based on observation and experimentation. One of the objectives of science learning in elementary school is to enhance students' skills in investigating the environment, solving problems, and making decisions, as outlined in the Content Standards set by the Ministry of National Education. In the 2013 curriculum, science learning plays a significant role in developing students' abilities.

Therefore, teaching materials are needed to facilitate students in the process of exploration and understanding of science concepts. Students can use Student Worksheets (LKPD) as an alternative teaching material. Student worksheets are one of the learning tools containing material and a set of activities to complete. Generally, student worksheet is used by teachers as a complement to the textbook and is used in the learning process. Student worksheets have a more straightforward structure than textbooks but are more complex because they comprise six components: title, learning instructions, main material, supporting data, tasks or activities, and evaluation. The use of student worksheets in the learning process is essential. With student worksheets, students engage interactively with the teacher and learning resources, providing an enjoyable, efficient, and meaningful learning experience. Moreover, worksheets can enhance students' learning process skills, helping them achieve educational goals.

Based on the needs analysis at SD Negeri Serang 13, the identified issue related to student worksheets (LKPD) is that teachers only provide questions through Google Classroom, and students copy them for submission in the next class. This approach makes it challenging for teachers to train students' process skills and thinking abilities. Therefore, there is a need for student worksheets with a higher-order thinking skill (HOTS) approach.

HOTS refers to thinking skills within the hierarchy of the learning process, occupying the highest position. Rofiah (2018:286) suggests that HOTS involves linking, applying, and connecting knowledge with personal experiences to solve problems. In the context of learning, high-level thinking skills are manifested

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when students relate and transform the problems they encounter with the knowledge they have gained from their own experiences. HOTS not only enhances knowledge but also the skills and attitudes of students. With HOTS, students can solve complex problems and develop creative ideas.

According to the research conducted by Aditama and colleagues in 2019 in a study titled "Development of HOTS-Based Student Worksheets in Mathematics Learning for 5th Grade on Solid Figure Volume at SDN Sentul 1," the results show that the use of worksheets focused on high-level thinking skills (HOTS) received positive responses and can be used as a learning tool. However, Aditama's research only included two high-level abilities in Bloom's taxonomy: analyzing and evaluating skills. Additionally, the learning tools developed cannot be used by students during online learning or studying at home. It needs to be more relevant to the goals of science education, which include process skills development. With the ability to create, students can develop processes by creating something new as a problem-solving solution from something that existed before while adhering to procedural and existing rules.

It is necessary to incorporate technological elements to enable the use of student worksheets in both online and offline learning contexts. E-worksheet is the electronic version of student worksheets, not bound by space and time limitations. The development of E-worksheets involves both technological and pedagogical aspects for teachers. E-worksheets can assist students in learning as long as it is not monotonous. The worksheets presented should vary depending on the content delivery, the tools/technology used to convey information and the efficient packaging of compatible learning styles. Therefore, the researcher chose research titled "Development of E-Worksheet (E-LKPD) in Science Education at Elementary School Based on Higher-Order-Thinking Skill (HOTS)." This research aims to understand how an E-worksheet focusing on HOTS is developed for science education in 5th grade students.

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B. Methods

This research falls into the category of development research using the Borg & Gall research model. However, only 6 out of 10 research procedure steps were used in this research due to limited time and budget constraints. The participants in this research were 20 students of 5th grade from SDN Serang 13, located at Jl. KH. Abdul Latif No. 38, Sumur Pecung, Serang, Banten.

The researcher utilized several data collection techniques: interviews, validation, and student questionnaires. The validation questionnaire for suitability consists of three aspects: appearance, content, and language. In the product validation stage, the appearance was evaluated by design experts, the content by material experts, and the language by linguists. Experts assessed the developed product; the researcher revised it and finally subjected it to testing.

Furthermore, data analysis techniques used in this research include qualitative and quantitative descriptive analysis. Qualitative descriptive analysis was used to assess the feedback, recommendations, and enhancements suggested by validators, drawing from the outcomes of validation sheets and product testing questionnaires to improve the ongoing product development. Meanwhile, quantitative descriptive analysis was used to process data through validation score results, media feasibility questionnaires, and product testing questionnaires.

C. Results and Discussion

The results of the validation of HOTS-based E-Worksheets by material, design, and language experts are as follows:

Table 1
The Results of Material Expert Validation

No	Assessment Aspect	Validation I	Validation II
1	Content Validity	32	35
2	Presentation Validity	22	24
3	HOTS-Based E-Worksheets	35	36
AVERAGE PERCENTAGE		**89%**	**95%**
CRITERIA		**VERY FEASIBLE**	**VERY FEASIBLE**

Based on the information in Table 1, the material expert validator assessment, it can be concluded that the first material expert validator provided a

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feasibility rating of 89%. The second material expert validator presented a feasibility of 95%. The average of the two validators is 92%. Referring to the interpretation category criteria offered by Riduwan (2013:89), it can be concluded that this percentage includes the "very feasible".

Table 2
The Results of Design Expert Validation

No	Assessment Aspect	Validation I	Validation II
1	Device Design	27	26
2	Visual Display	38	35
AVERAGE PERCENTAGE		**86%**	**81.3%**
CRITERIA		**VERY FEASIBLE**	**VERY FEASIBLE**

Based on the information in Table 2 of the design expert validator assessment, it can be concluded that the first design expert validator provided a feasibility percentage of 86%. The second design expert validator provided a feasibility percentage of 81.3%. The average of the two design validators is 84%. Referring to the interpretation category criteria offered by Riduwan (2013:89), it can be concluded that the percentage of 84% is included in the "very feasible" category.

Tabel 3
The Results of Linguists Validation

No	Assessment Aspect	Validation I	Validation II
1	Conformity to Language Rules	11	12
2	Suitability to Student Development	4	4
3	Communicative	12	12
4	Concise	13	12
AVERAGE PERCENTAGE		**80%**	**80%**
CRITERIA		**FEASIBLE**	**FEASIBLE**

Based on the data in Table 3, the linguist's validation assessment, it can be concluded that the first linguist provided a feasibility percentage of 80%. The second linguist also gave the same feasibility rating of 80%. The average of the two linguists is 80%. Referring to the criteria for interpretation categories according to Riduwan (2013:89), it can be concluded that this percentage is included in the "feasible" category.

In this research, the product produced is an E-Worksheet focusing on higher-order thinking skills (HOTS) for the topic of the Human Circulatory

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System. The research took place over 1 month, with research activities conducted from April 1 to April 30, 2023. The development of this HOTS-based E-worksheet is expected to assist students in independent learning, whether guided by a teacher or not. The development process of this E-worksheet involves several stages, including problem analysis, data collection, product design, product design validation, design improvements (revisions), and product testing (on a limited scale).

After evaluating the needs, the researcher found that the current learning materials still heavily rely on existing textbooks and Student Worksheets, which need to be more engaging. Therefore, efforts are needed to develop teaching materials so that students can engage in independent learning more effectively. Another issue identified by the researcher is that the Student Worksheets (LKPD) used by teachers mainly consist of questions provided through Google Classroom and are copied by students, which are later collected during offline meetings. Supported by questionnaire results, teachers rarely implement high-order thinking skills (HOTS) based questions, even though, according to 5th grade teachers, HOTS questions have significant value in sharpening thinking skills. Therefore, the currently used worksheet still needs to improve in assisting students in developing their critical thinking skills in problem-solving, especially in abstract topics.

The teaching material designed in this research is the Student Worksheet that focuses on HOTS (Higher-Order Thinking Skills). This worksheet is a learning material created to train high-order thinking skills. However, the final format sets this worksheet apart from others, where the developed product is an Electronic Student Worksheet (E-LKPD). This HOTS-based E-worksheet is an Android application with several menus, including instructional menu, competency, worksheets, profile, and bibliography. E-worksheet also includes instructional videos and animated images. Because attractive animated images and videos can prevent students from being bored during learning, this is in line with Nadyah's opinion (2016:107), which states that E-LKPD is an interactive

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technology-assisted media that combines images, animations, and videos to prevent student boredom during the learning process.

Furthermore, there are three activities within the E-worksheet in the learning process, where each activity involves active student participation to help the learning process be effective. It aligns with Ibrahim's opinion (Trianto, 2013), which states that the conditions that must be fulfilled for an E-worksheet to be used to its maximum potential and make the learning process effective include: a) Actively involves students in the learning process, b) Highlights the significance of creating an understanding of concepts, c) Presents various stimuli through various types of media and activities that align with the curriculum, d) Foster the development of communication, emotional, moral, and aesthetic skills in students, and e) Individual developmental goals influence the learning experience.

The innovation of the E-worksheet begins with the initial step in the research, which is conducting a problem analysis, including curriculum analysis, needs analysis, and content analysis. This step aims to understand the issues faced in elementary schools. In the next stage, which is the second stage, data is collected through interviews with teachers at SD Negeri Serang 13 to understand the curriculum and syllabus used at the school. The curriculum analysis aims to identify the competencies within the curriculum and understand the extent to which these competencies need to be expanded and explored. This analysis also aims to break down the Core Competencies (KI) and Basic Competencies (KD) in the curriculum into more detailed indicators. After adjusting the suitable KD and indicators for the circulatory system content, the next step is to adjust the product design to fulfill the needs in the field. It aligns with the concept that data collection is vital to ensure that the obtained data meets established quality standards, as Sugiyono (2015) and Widiyana (2016) explained.

After completing the data collection process, the product design development stage begins with creating a storyboard as the initial planning step to facilitate the development of the HOTS-based E-worksheet from beginning to end. Next, the following step is determining a suitable theme or design for the E-worksheet. At this stage, making theme or design choices that align with the E-

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worksheet content is essential. This decision needs to be carefully considered to ensure consistency in developing the E-worksheet from start to finish. Lastly, the final stage in product design development is the production stage, which involves adding the components of the E-worksheet and the images used in both the E-worksheet menu and instructional videos. After the developed product is completed, the product design validation is conducted.

Based on the validation test results conducted by 2 material validators, 2 design validators, and 2 linguist validators, the validation results indicate that the evaluation level includes the categories of "very feasible" and "feasible." The average assessment results from each validator are as follows: content feasibility 92%, design feasibility 83.65%, and language feasibility 80%.

The E-worksheet product received a nearly perfect score of 100%, indicating the need for further improvement to enhance the developed product because there are still some areas for improvement in the E-worksheet regarding content, design, and language. The lack of utilization of the beginning and ending parts of the video in the E-worksheet has resulted in a lack of engagement among students in the learning process, especially in terms of content.

The researcher also identified weaknesses in other aspects, such as using less effective sentences, which may cause students to have difficulty understanding the researcher's meanings. According to Ibrahim, as explained by Trianto (2013:244), E-LKPD should fulfill several construction criteria, including using language that aligns with the student's understanding, clearly structuring sentences, and using simple and brief sentences. Overly complex sentences can help comprehension of instructions or content, while more concise sentences may lead to clarity.

E The E-worksheets focusing on higher-order thinking skills have experienced feasibility testing by experts in content, design, and language, with an average score of 85.22%. This assessment categorizes the E-worksheet as "very adequate." With this average score, the HOTS-based learning materials developed fulfill the standards of good instructional materials suitable for teaching and learning. This E-worksheet also provides easier access for students to learning

materials, allowing them to learn anytime and anywhere, enhancing their higher-order thinking skills through a deeper understanding of various concepts (Adilla, T., 2017; Andriana, E., 2020; Aprianto, C., 2019; Sudibyo, E., 2019; Winarno, dkk., 2015; Intan, F., 2020; Suratmi, et al., 2020).

Furthermore, based on other research findings, E-worksheets can support problem-based learning, where students are presented with challenges or problems that require critical and creative thinking to solve (Findawati & Suprianto, 2014).

After the HOTS-based E-worksheet had been through the revision process and was approved by experts for field testing, the E-worksheet was then used in the learning process. This learning process occurs in two different meetings on different days. In the first meeting on May 24, 2023, the researcher conducted a simulation on how to use Google Meet and the HOTS-based E-worksheet application that had been developed. Then, on the second day, May 25, 2023, the researcher conducted the learning process on the circulatory system using the HOTS-based E-worksheet application through Google Meet with the guidance of the 5A homeroom teacher. As for the student response, it received a score of 94.6%, including in the category of "very good".

E-worksheets can closely relate to the Technological Pedagogical Content Knowledge (TPACK) framework in education. TPACK is a framework that combines knowledge of technology (T), pedagogical knowledge (P), and content knowledge (C) to help educators design practical learning experiences using technology (Arbiyanto, 2018; Mairisiska, 2014; Rahmadi, 2019; Nadhifah, 2022; Kurniasih, et al., 2022).

Based on the previous discussion, the HOTS-based E-worksheet can confidently be used in practical situations. Due to the validation results provided by experts and the positive responses received from students, all of which fulfill the success criteria set by the researcher. With this HOTS-based E-worksheet, students become more proactive, and the learning process becomes more directed. It is in line with the opinions of Irawan (2016:206) and Helmawati (2019), who state that student worksheets serve various functions, including a) enhancing the direction of the learning process, b) improving learning efficiency, c) assessing

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student understanding, d) enhancing the effectiveness of learning aids, e) encouraging active participation of students during learning, f) increasing students' interest in learning, g) fostering students' self-confidence, h) facilitating independent tasks and group work of students, i) optimizing learning time, and j) improving problem-solving skills.

D. Conclusion

Based on the data analysis, the E-Worksheets focused on developing high-order thinking skills (HOTS) for 5th grade elementary school students, which is suitable for learning. It is evidenced by several indicators: the content validity level reached 92%, categorized as "very feasible," and the presentation validity level reached 83.65%, categorized as "very feasible." In comparison, the language validity level reached 80%, categorized as "feasible." Positive responses were obtained from the students during the limited trial, with a percentage of 94.6% as "Very Good." Therefore, it can be concluded that the HOTS-based E-Worksheets received a positive response after being tested.

Based on the findings of this research, several recommendations can be made, such as: a) HOTS-based E-Worksheets can be used as an effective alternative to teach students high-order thinking skills through various activities presented within it. These e-worksheets allow students to understand the material, connect information, identify cause and effect, and develop problem-solving skills with new ideas. b) Developing E-Worksheets with various topics is recommended to become a varied learning source with more up-to-date materials. Furthermore, improvements in design and visuals should also be considered to make the E-Worksheets more engaging and attractive to students.

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