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Developing Deep Learning-Based Worksheets to Improve Higher-Order Thinking Skills in Elementary Social Studies

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Abstract

This study aims to develop and evaluate a student worksheet (LKPD) based on deep learning principles to enhance Higher-Order Thinking Skills (HOTS) among fourth-grade students in a madrasah Social Studies context. Employing a Research and Development (R&D) approach with the ADDIE model, the study proceeded through five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The LKPD was validated by experts in content, language, and media, resulting in an overall validity score of 84.6%, indicating high feasibility for classroom use. In the implementation phase, 30 students participated in pretest and posttest activities. Statistical analysis showed a significant improvement in student learning outcomes, with a t-test significance value of 0.000 and an average N-Gain score of 0.32, classified as moderate. Pedagogical features such as differentiated learning strategies, comic-based apperception, and audio-visual integration through QR codes were embedded in the LKPD to target HOTS domains of analysis, evaluation, and creation. Compared to previous studies, this research extends the application of HOTS-based learning materials into the context of Islamic primary education and demonstrates the pedagogical potential of deep learning in fostering critical and creative thinking. These findings support the broader adoption of multimodal, student-centered instructional designs to meet the demands of 21st-century education.

Keywords: deep learning, differentiated learning, higher-order thinking skills, instructional design, social studies, student worksheet

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1. Introduction

In the 21st century, it is essential for teachers and students to have digital competencies (Darmawan & Suparman, 2019; Maghfiroh et al., 2023; Ratih et al., 2021). In 21st-century learning, students are expected to have mastered Higher-Order Thinking Skills (HOTS) (Hernita & Dharma, 2023). High-level thinking skills give someone the opportunity to apply new information and manipulate information to get new possible answers to a case (Hariyatmi et al., 2021). This is because many learning outcomes now require students to possess higher-level cognitive abilities. In Bloom's Taxonomy, as revised by Anderson and Krathwohl, cognitive skills are categorized into remembering, understanding, applying, analyzing, evaluating, and creating. The first three levels are considered Lower-Order Thinking Skills (LOTS), while levels four to six are classified as Higher-Order Thinking Skills (HOTS) (Mahmudi et al., 2022).

Students who have not yet mastered HOTS face various challenges, including anxiety and a lack of confidence when solving

analytical problems. Additionally, they often doubt their ability to tackle evaluative questions and tend to halt their creativity, merely imitating what has been taught without developing their own ideas. This results in a limited approach to problem-solving (Ahmad et al., 2023).

According to the Programme for International Student Assessment (PISA), Indonesia is positioned in the "Low Performance" quadrant in literacy, numeracy, and science. Moreover, the Ministry of Religious Affairs, through the Indonesian Madrasah Competency Assessment (AKMI) in 2021, conducted a nationwide assessment involving 12,805 madrasahs to measure four types of literacy among madrasah students. The results of AKMI showed that the literacy level of madrasah students was at the "needs guidance" and "basic" levels. In fact, 51% of students who took the AKMI test demonstrated a "basic" level of science literacy, indicating that most madrasah students in Indonesia possess a low level of proficiency in science literacy (Herianingtyas, 2022).

These abilities play a crucial role and must be mastered by students in Social Studies learning. Social Studies functions as an essential guide for students as it introduces them to various social issues and aspects of human life. The goal is for students or individuals who receive Social Studies education to possess rational, objective knowledge supported by strong information and facts (Wahyuni et al., 2024). As a result, students or graduates from Social Studies education will have the ability to make wise decisions, seek solutions, and solve problems thoroughly and accurately.

Student Worksheets (LKPD) are a tool for students in the evaluation process, developing their capacity, and improving learning outcomes (Miftah & Setyaningsih, 2022). Student Worksheets are sheets of exercises that students must complete according to pre-determined steps (Kosasih, 2021). According to Trianto, as cited in a book by Neni Triana, LKPD is a guide for students to carry out investigations or solve problems (Triana, 2021). LKPD can serve as a guide for cognitive skill development exercises as well as for the development of all learning aspects, often in the form of experiment or demonstration guides (Izzah et al., 2024). Prastowo, as quoted in Neni Triana's book, defines LKPD as a printed teaching material consisting of summaries, content, and task instructions that students must follow, aligned with the basic competencies to be achieved.

According to Michael Fullan, Joanne Quinn, and Joanne McEachen, Deep Learning is a transformational approach to education aimed at developing six global competencies (6Cs) in students: character, citizenship, collaboration, communication, creativity, and critical thinking (Fullan et al., 2017). There are various ways to bring out students' critical thinking competencies, one of which is by giving different questions than usual, namely by using HOTS questions (Octaviana & Setyaningsih, 2022). In the Academic Manuscript on Deep Learning issued by the Indonesian Ministry of Education, deep learning is defined as an approach that emphasizes the creation of mindful, meaningful, and joyful learning resources and processes. It involves intellectual (cognitive), ethical (moral), emotional (aesthetic), and physical (kinesthetic) engagement in an integrated, holistic manner.

2. Method

This study employed a Research and Development (R&D) approach. The R&D procedure is a research method designed to produce new products or improve existing ones. This approach involves identifying potential problems, designing solutions, validating the design, and ensuring the

developed product's effectiveness and efficiency (Zakariah et al., 2020). The development model used in this research is the ADDIE model, consisting of five interrelated and structured stages: Analysis, Design, Development, Implementation, and Evaluation (Mesra, 2023). In the Analysis stage, the researcher collected information related to the HOTS of Grade 4 students at MI Al-Mursyidiyyah through interviews and HOTS-based sample questions. The researcher also identified the most challenging material for students, aligned with the school curriculum. In the Design stage, the researcher began designing the product in the form of LKPD by combining the results of the needs analysis with theoretical studies and using Canva in the design process. The Development stage involved creating the LKPD based on the selected material and deep learning model, as well as preparing validation instruments to assess the feasibility of the product. In the Implementation stage, the validated LKPD was tested on 30 students to measure improvements in HOTS after using the media. Finally, the Evaluation stage consisted of a comprehensive review of both the process and outcomes to identify shortcomings, with the hope of improving the product in future research (Judijanto et al., 2024; Rayanto, 2020).

3. Result and Discussion

This study analyzed the validity and effectiveness of a developed student worksheet (LKPD) based on deep learning principles to improve Higher-Order Thinking Skills (HOTS) in Social Studies. The findings are organized into four main aspects: validation, data normality, statistical effectiveness, and pedagogical alignment (Kusmaryono et al., 2022).

a. Validity Test Result

The validity assessment of the developed LKPD was conducted to ensure the quality and appropriateness of the learning media before its implementation in the classroom. The validation focused on three key aspects: content, language, and media presentation. This process involved expert judgment from three evaluators with proven expertise in instructional material development, namely: a subject matter expert, a media expert, and a linguist.

Each expert was asked to review the LKPD based on a structured rubric using a Likert scale, evaluating indicators such as content accuracy, language clarity, instructional alignment, visual layout, and media usability. The results of the validation, as summarized in Table 1, show that the LKPD achieved an average score of 92% in the content aspect, 80% in the language aspect, and 83% in the media aspect. These scores indicate that the product is valid in all measured components. The overall mean score of 84.6% falls within the "valid" category, signifying that the LKPD meets the essential quality standards for use as an instructional tool.

The high content validity suggests that the LKPD materials are accurate, relevant to the learning objectives, and aligned with the competencies outlined in the curriculum. The language validity indicates that the instructional text is clear, age-appropriate, and linguistically accessible to fourth-grade students. Meanwhile, the media validity reflects the visual and structural aspects of the worksheet, confirming that the design and layout support student engagement and ease of use.

These findings confirm that the developed LKPD is feasible for classroom application and ready to be tested in a limited field trial to assess its effectiveness in enhancing students' Higher-Order Thinking Skills (HOTS). Furthermore, the involvement of

multidisciplinary validators ensures that the LKPD is pedagogically sound, linguistically appropriate, and visually supportive, thereby increasing its potential impact on student learning outcomes.

Table 1. Validation Result

No.	Validation Category	Average Score	Description
1	Content Validation	92%	Valid
2	Language Validation	80%	Valid
3	Media Validation	83%	Valid
	Overall Average	**84.6%**	**Valid**

b. Data Normality and t-Test Results

Prior to conducting parametric analysis, a normality test was performed to ensure that the data met the statistical assumptions required for the paired t-test. The Shapiro–Wilk test was applied to both the pretest and posttest scores of students who used the developed LKPD. The results indicated significance values of 0.053 for the pretest and 0.056 for the posttest, both of which exceeded the conventional threshold of 0.05. This suggests that the data are normally distributed, thus fulfilling the assumption of normality for further parametric testing (Isnaini et al., 2025).

Table 2. Shapiro–Wilk Normality Test Results

Data Set	Significance Value (p)	Normality Assumption
Pretest	0.053	Normal
Posttest	0.056	Normal

The acceptance of the null hypothesis (H_0) in this context implies that the sample data adequately represent a normal distribution. This validation step is essential because it ensures that the statistical tests used to measure learning gains—particularly the t-test—yield reliable and valid results.

Following the normality confirmation, a paired-sample t-test was conducted to compare students' performance before and after the implementation of the LKPD. The analysis showed a significant difference between the pretest and posttest scores, with a p-value of 0.000 ($p < 0.05$). This result indicates that the intervention had a statistically significant impact on student learning outcomes.

To provide a clearer picture of the score improvement, Figure 1 below presents a bar chart comparing the mean pretest and posttest scores.
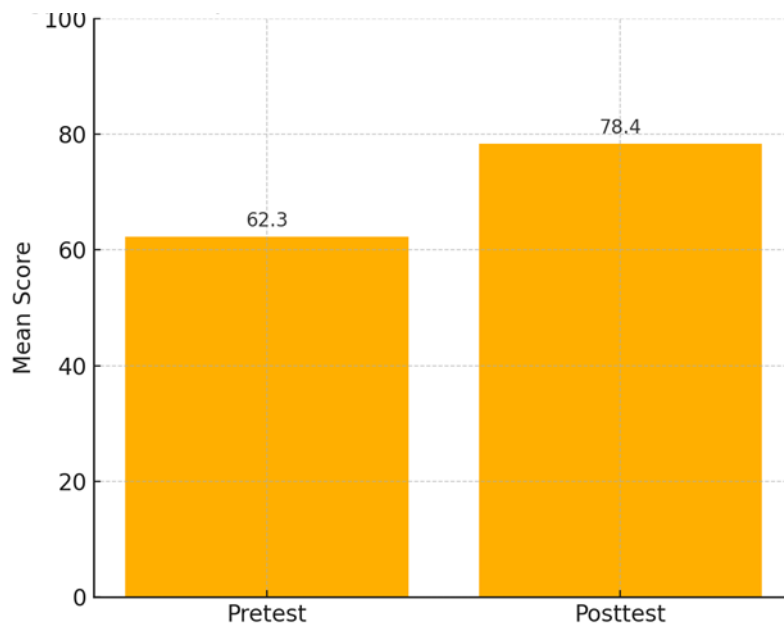
Figure 1. Comparison of Mean Pretest and Posttest Scores

The substantial increase in mean scores demonstrates that students' Higher-Order Thinking Skills (HOTS) improved after using the LKPD. The statistically significant result of the t-test confirms that the observed gain is not due to chance, but rather attributable to the instructional intervention. This aligns with previous research indicating that well-designed instructional materials incorporating inquiry, differentiation, and deep learning strategies can enhance student cognitive performance.

c.   N-Gain Test Result

To assess the magnitude of students' cognitive improvement after the intervention, the normalized gain (N-Gain) test was used. The N-Gain score provides a quantitative measure of the effectiveness of instructional materials in enhancing student learning by comparing the difference between pretest and posttest scores relative to the maximum possible improvement.

The analysis yielded an average N-Gain score of 0.32, which according to the classification by Hake (1999), falls into the "moderate" effectiveness category. This implies that the LKPD based on deep learning principles had a reasonably effective impact on improving students' Higher-Order Thinking Skills (HOTS) in Social Studies (Oktavia et al., 2019).

Table 4. N-Gain Score and Classification

Pretest Mean	Posttest Mean	N-Gain Score	Classification
62.3	78.4	0.32	Moderate

This moderate gain suggests that while students experienced measurable improvement, there is still room for further instructional refinement to achieve higher learning outcomes. It is important to note that the improvement was not only statistical but also pedagogical, as students engaged in analyzing, evaluating, and creating ideas key components of HOTS through structured activities in the LKPD (Tuela & Palar, 2022).

To visually represent this finding, Figure 2 illustrates the position of the obtained N-Gain score within the commonly used

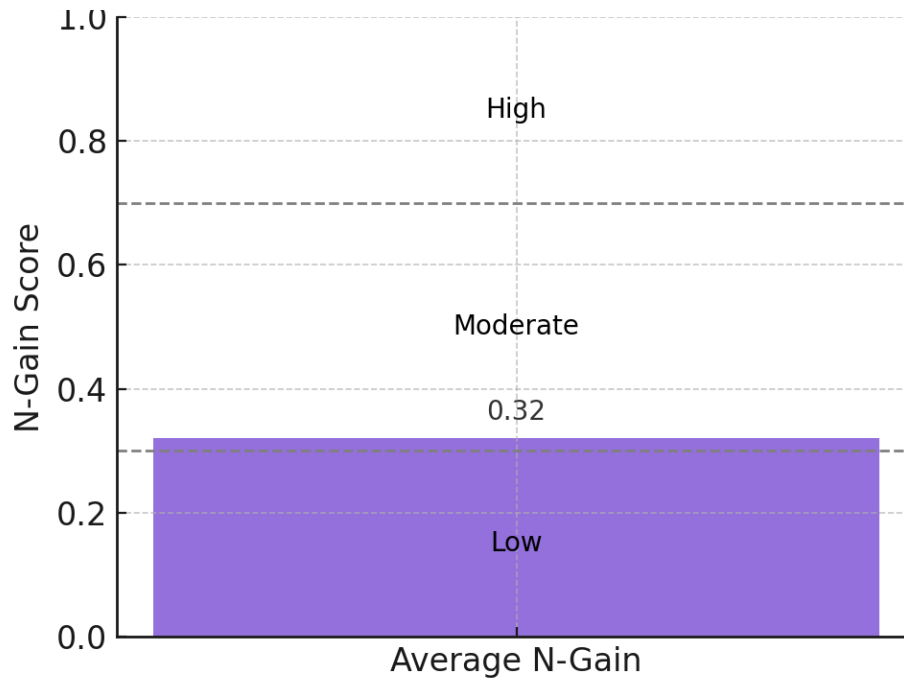classification scale (low < 0.3, moderate 0.3–0.7, high > 0.7).

Figure 2. N-Gain Score Classification

d. Pedagogical Insights: Linking LKPD Features with HOTS Improvement

The observed enhancement in students' Higher-Order Thinking Skills (HOTS) is strongly associated with the pedagogical design of the LKPD, which integrates principles of deep learning and differentiated instruction. Each component of the worksheet was intentionally structured to foster students' engagement across the cognitive, emotional, and behavioral domains.

The learning objectives embedded in the LKPD were formulated using the ABCD model (Audience–Behavior–Condition–Degree), ensuring clarity and alignment with the intended cognitive processes. This structure enabled students to understand the expectations from the outset and contributed to their learning readiness and goal orientation (Budiastuti et al., 2021).

The apperception phase utilized comic-based illustrations presenting relatable social conflicts, which activated students' prior knowledge and emotional involvement. By invoking curiosity and personal relevance, this stage facilitated deeper student engagement, aligning with the "mindful" aspect of the deep learning model (Saidah et al., 2021).

Furthermore, the LKPD incorporated differentiated learning strategies to address the diverse readiness, interests, and learning styles of students (Pitaloka & Arsanti, 2022). These included:

1) Visual representations of content (e.g., diagrams, infographics).
2) Audio-visual aids linked through QR codes to contextual videos.
3) Hands-on activities such as peer interviews using structured interview sheets.

This variety of modalities not only catered to individual learning preferences but also facilitated conceptual understanding and critical reflection.

The progression of cognitive challenge within the LKPD was carefully mapped to Bloom's revised taxonomy, particularly

targeting HOTS domains—analyzing (C4), evaluating (C5), and creating (C6). For example:

1) After watching an instructional video, students were prompted to analyze cause-effect relationships (C4).

2) Evaluation tasks required them to compare perspectives and justify decisions based on evidence (C5).

3) At the end, students synthesized their learning by creating summaries or conceptual maps (C6).

Table 5. Mapping of LKPD Activities to Cognitive Domains

LKPD Component	Activity Type	Cognitive Level (Bloom)	HOTS Classification
Learning Objectives	Goal-setting	C2 (Understanding)	LOTS
Apperception (Comic Conflict)	Reflective discussion	C4 (Analyzing)	HOTS
Video Analysis Task	Inference and explanation	C4–C5	HOTS
Comparison Table	Decision-making and justification	C5 (Evaluating)	HOTS
Summary & Concept Mapping	Creative synthesis	C6 (Creating)	HOTS
Peer Interview Activity	Data collection & evaluation	C3–C5	Mixed (MOTS–HOTS)

This structured scaffolding of cognitive tasks reflects the intentional integration of deep learning elements, where students are not only consuming information but actively constructing, transforming, and applying knowledge in meaningful ways.

These pedagogical design choices collectively contribute to the moderate N-Gain score (0.32) observed in the study. While not yet in the high category, the score reflects a significant step forward in promoting critical and creative thinking among elementary-level learners in the context of Social Studies.

e. Comparison with Previous Research

The findings of this study are consistent with a growing body of literature that emphasizes the effectiveness of integrating higher-order thinking strategies and deep learning frameworks in instructional design. Several prior studies have demonstrated the positive impact of student worksheets (LKPD) and multimedia-based learning tools on enhancing students' critical and creative thinking abilities.

For example, Miftah & Setyaningsih (2022) reported that LKPD integrated with problem-based learning strategies significantly improved students' cognitive achievement in science classes. Similarly, Octaviana & Setyaningsih (2022) found that HOTS-oriented questions stimulated deeper student engagement and independent reasoning across various subject areas. However, these studies predominantly focused on junior high school or general primary settings, without contextualizing the application in madrasah-based Social Studies education, as this study uniquely addresses.

Moreover, while Izzah et al. (2024) developed LKPD embedded with inquiry-based approaches to foster critical thinking, the depth of multimodal engagement (i.e., audio-visual integration, peer collaboration, and personalized reflection) was relatively limited compared to the LKPD designed in this study. In contrast, the current research emphasizes the deep learning triad—mindful, meaningful, and joyful learning—as promoted by the Ministry of Education, and operationalizes it through comic-based apperception, video

analysis tasks, QR-linked digital resources, and creative summarization activities (Kholid & Kurniawan, 2022).

These distinguishing elements mark a notable advancement in instructional design innovation, especially within religious school contexts where integrative and reflective learning is crucial. Additionally, this study contributes to the empirical discourse by employing rigorous validation, normality testing, and quantitative measurement of learning gains (N-Gain), providing robust evidence of pedagogical impact.

Table 6. Comparison with Selected Previous Studies

Author(s) & Year	Context / Level	Instructional Focus	HOTS Strategy	Key Finding
Miftah & Setyaningsih (2022)	Elementary Science Class	LKPD + Problem-Based Learning	C4–C5	Improved test scores and motivation
Octaviana & Setyaningsih (2022)	Middle School (General)	HOTS-Oriented Questions	C4–C6	Increased analytical thinking
Izzah et al. (2024)	Primary Education	Inquiry-Based LKPD	C3–C5	Enhanced student participation
This Study (2025)	Madrasah Social Studies (Grade 4)	Deep Learning-Based HOTS LKPD	C4–C6 (Visual, Audio, Kinesthetic)	Moderate N-Gain (0.32); improved critical & creative thinking

This comparative review underscores the novelty and relevance of the current study in expanding the application of HOTS strategies to underrepresented educational contexts, while offering an evidence-based model for future instructional development in 21st-century learning environments.

4. Conclusion

This study concludes that the development of a Deep Learning-based student worksheet (LKPD) is valid, feasible, and moderately effective in enhancing fourth-grade madrasah students' Higher-Order Thinking Skills (HOTS) in Social Studies. The product underwent rigorous validation by content, language, and media experts, achieving an overall validity score of 84.6%, categorized as "valid." The implementation phase demonstrated a statistically significant improvement in student performance, with a t-test significance value of 0.000 and an average N-Gain score of 0.32, indicating moderate learning gains. The LKPD's instructional design—characterized by differentiated tasks, multimodal learning resources, and integration of deep learning principles—effectively supported cognitive development, particularly in the domains of analysis (C4), evaluation (C5), and creation (C6). Compared to prior studies, this research provides a unique contribution by contextualizing HOTS development within a madrasah-based Social Studies curriculum and operationalizing deep learning through concrete pedagogical strategies. The results affirm the potential of thoughtfully designed instructional materials to foster critical and creative thinking in primary education settings, while also laying the groundwork for broader implementation and further refinement in future studies.

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