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IMPROVING STUDENTS' LITERACY SKILLS THROUGH THE DEVELOPMENT OF A PROBLEM-BASED LEARNING MODEL BASED ON HOTS

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ABSTRACT

The low achievement of Indonesian students in the Programme for International Student Assessment (PISA) highlights the need for innovative learning models that not only emphasize cognitive aspects but also foster students' character development. This study aims to develop a Problem Based Learning (PBL) model integrated with Higher Order Thinking Skills (HOTS) and character education to improve the literacy skills of elementary school students. The research employed a Research and Development (R&D) approach using the ADDIE development model, which consists of analysis, design, development, implementation, and evaluation stages. The study involved 28 fourth-grade students. The research instruments included validation sheets, observation sheets, student and teacher response questionnaires, and literacy tests covering reading, numeracy, science, and digital literacy. The results indicate that the learning model was considered highly valid with an average validation score of 88.5%. The implementation of the PBL-HOTS-Character model significantly improved students' literacy skills with an average score of 87.5, consisting of reading literacy (88), numeracy (85), science literacy (87), and digital literacy (90). Students' character education also improved with an average score of 73.4. The two-way ANOVA analysis revealed that the learning model, character education, and their interaction had a significant effect on students' literacy, with a determination coefficient of 66.1%. In conclusion, the PBL model integrated with HOTS and character education is effective in enhancing literacy skills while strengthening students' character. This model is highly relevant to support the implementation of the Merdeka Curriculum and the realization of the Pancasila Student Profile.

INTRODUCTION

PISA (Programme for International Student Assessment) conducted by the OECD is an international benchmark for measuring the literacy of 15-year-old students. This assessment covers three main areas, namely reading literacy, mathematical literacy, and scientific literacy. The results of the study show that Indonesian students' achievements in these three areas are still relatively low. Hewi and Saleh (2020) emphasize that PISA

serves as an important benchmark for evaluating the quality of education globally, while Rahmatika, Ihsanudin, and Rafianti (2022) find that Indonesian students' mathematical representation skills in solving PISA-based problems are still low, mainly due to reflective-impulsive cognitive styles that influence problem solving.

In line with this, research by Andriani, Saparini, and Akhsan (2018) highlights the low level of science literacy among junior high school students in South Sumatra based on the PISA framework. This study shows that students still have difficulty relating scientific knowledge to real phenomena. Purnomo and Sari (2021) expressed a similar view, finding that Indonesian students' mathematical literacy is still weak, especially in a scientific context. These findings are in line with the OECD (2019) report, which confirms that Indonesia's low ranking in the 2018 PISA literacy test compared to other countries. This condition shows the need for a learning model that can encourage higher-order thinking skills (HOTS).

The problem of low literacy is closely related to learning practices in schools that still tend to focus on cognitive aspects and memorization alone. In fact, 21st-century education demands a holistic transformation of learning, which is not only oriented towards cognitive outcomes but also shapes students' character. The Ministry of Education and Culture (2021) emphasizes the importance of character education in realizing the Pancasila Student Profile, which includes the dimensions of critical thinking, independence, and global diversity. Thus, the challenges of education in Indonesia are not only limited to improving academic achievement but also shaping character in line with the values of Pancasila.

The Merdeka Curriculum was then introduced as an effort to address these issues by focusing on character building and developing students' potential. Rahmadayanti and Hartoyo (2022) explain that the Merdeka Curriculum is oriented towards developing students' talents and intelligence, rather than solely focusing on academic rankings. In line with this, Faiz, Parhan, and Ananda (2022) state that the new paradigm in the Merdeka Curriculum emphasizes the formation of the Pancasila student profile as the main orientation of education. Marisa (2021) even details the six dimensions of the Pancasila student profile that must be achieved, namely religiosity, independence, mutual cooperation, critical thinking, creativity, and global diversity.

However, the implementation of the Merdeka Curriculum in learning practices still faces obstacles. Wijayanti, Jamilah, Herawati, and Kusumaningrum (2022) found that the rapid development of science and technology has caused character education in schools to be often marginalized. As a result, some students exhibit behavior that is not in line with

character values. This condition is reinforced by Danis and Siregar (2022), who emphasize that strengthening character education requires the support of relevant learning models so that it can be internalized properly by students.

In this context, Problem-Based Learning (PBL) emerges as one relevant learning model alternative. PBL encourages students to learn through contextual problem-solving using scientific stages. Ardianti, Sujarwanto, and Surahman (2021) emphasize that PBL not only develops conceptual knowledge but also critical thinking skills in solving real problems. Research by Susino, Destiniar, and Sari (2024) confirms that the application of PBL has been proven to improve high school students' mathematical problem-solving abilities. Prasetyo, Marzuki, and Riyanti (2019) add that character education can also be built simultaneously in learning by emphasizing teacher role modeling as an important factor.

Furthermore, the main objective of PBL is not only to help students understand concepts, but also to train them to develop critical thinking skills, problem solving skills, and learn to act as independent individuals. Isma, Putra, Wicaksana, Tasrif, and Huda (2022) showed that the application of PBL can improve student learning outcomes. This is reinforced by Yulianti and Gunawan (2019), who found that PBL has a significant effect on students' conceptual understanding and critical thinking skills.

The PBL strategy is also considered important for teachers. Rusmono (2012) emphasizes that problem-based learning is necessary to improve teacher professionalism, as it requires creativity, mastery of the material, and the ability to manage discussions. Furthermore, Taufikin (2017) proves that PBL is effective in instilling character education through stages such as problem identification, hypothesis formulation, and solution determination. Research by Handayani, Minarti, Mulyaningrum, and Sularni (2023) also shows that the application of PBL in science learning in junior high schools is able to realize the Pancasila student profile through activities such as perception, discussion, presentation, and evaluation.

Based on this description, it is clear that the development of a PBL-based learning model integrated with HOTS and character education is of high urgency. This model is not only intended to improve student literacy but also to shape character in line with Pancasila values. Thus, this research is expected to make a real contribution to supporting the implementation of the Merdeka Curriculum, improving the quality of national education, and producing a generation of Indonesian students who are literate, critical thinkers, independent, and have good character.

RESEARCH METHODOLOGY

1. Research Design and Approach

This study uses a research and development (R&D) approach with the aim of producing an innovative learning model based on Problem Based Learning (PBL), Higher Order Thinking Skills (HOTS), and character education. The R&D approach was chosen because it is relevant for developing educational products such as learning models, teaching tools, and assessment instruments that can be tested for feasibility and effectiveness in a systematic manner.

The development model used is ADDIE (Analysis, Design, Development, Implementation, Evaluation). This model is considered flexible, comprehensive, and capable of accommodating various needs in modern learning design. ADDIE is also widely used in the development of media, strategies, and teaching tools because the stages from analysis to evaluation enable the resulting products to be more valid and implementable.

According to Martatiyana, Usman, and Lestari (2023), the ADDIE model can be used effectively in designing digital teaching materials by considering the aspects of needs analysis, media design, development, implementation, and evaluation. Their research proves that ADDIE is capable of producing teaching tools that are suitable for use in elementary school learning contexts.

Meanwhile, Cotter, Yamamoto, and Stevenson (2023) used the ADDIE framework in examining training interventions, particularly in the field of food safety. The results of the study show that ADDIE can be widely applied not only in education but also in various professional training programs. This reinforces the argument that ADDIE is a systematic instructional design framework that can be adapted to various contexts.

Referring to these two studies, the use of the ADDIE model in this study is considered appropriate for designing, developing, and testing the HOTS-based PBL learning model and character education so that it can be implemented practically in the context of elementary schools.

2. Research Subjects

The research subjects consisted of 28 fourth-grade elementary school students. The selection of the research site was based on the school's characteristics, including teachers' readiness to adopt innovative learning practices and the availability of adequate supporting facilities such as well-equipped classrooms, internet access, and multimedia

resources. The support of the school administration and teachers was a strategic factor in ensuring that the implementation of the developed model could run optimally.

1. Research Procedures

The research procedure followed the stages of the ADDIE model as follows:

a. Analysis: Observations and discussions with teachers were conducted to identify learning needs, particularly those related to low literacy levels and weak character education among students.
b. Design: The PBL learning syntax was developed by integrating HOTS and character education. The syntax consisted of five stages: problem orientation, information exploration, analysis–synthesis, solution construction, and presentation–reflection.
c. Development: Learning tools such as lesson plans, student worksheets, digital learning materials, and literacy and character assessment instruments were developed. These instruments were validated by experts in literacy, elementary education, and character education.
d. Implementation: A limited trial was conducted in one small class, followed by a broader implementation in two larger classes.
e. Evaluation: Both formative and summative evaluations were conducted to assess the model's implementation, literacy improvement, and character enhancement among students.

2. Research Instruments

The instruments used in this study were designed to measure the validity, practicality, effectiveness, and impact of the learning model on students' literacy and character education. The main instruments included validation sheets, observation sheets, student and teacher response questionnaires, and literacy ability tests.

The validation sheets were used to assess the feasibility of the learning tools in terms of content, language, and practicality. Validation was carried out by experts in elementary education, literacy, and character education to ensure a high degree of validity before implementation.

The student and teacher questionnaires were used to gather perceptions and acceptance of the designed learning model. These instruments helped determine the practicality and applicability of the model in real classroom settings.

The literacy tests were constructed based on the PISA framework, encompassing four dimensions of literacy: reading, numeracy, science, and digital literacy. These tests

aimed to assess improvements in students' abilities after participating in the PBL-based learning process integrated with HOTS and character education.

To measure higher-order thinking skills, a HOTS test was also used to assess analytical, evaluative, and creative abilities. The test was developed with reference to the revised Bloom's taxonomy, which emphasizes higher-order thinking as a core competency in 21st-century learning.

3. Data Collection Techniques

Data were collected through the following methods:

a. Observation: To record students' activities during PBL-based learning sessions.
b. Tests: To measure students' literacy and critical thinking achievements before and after the intervention.
c. Questionnaires: To gather data on students' and teachers' perceptions of the learning model.
d. Interviews: To explore teachers' views on the implementation process and challenges of the model.
e.

4. Data Analysis Techniques

Data analysis was conducted using both descriptive quantitative and qualitative approaches.

a. Validity Analysis: Expert validation scores were calculated as percentages to determine the feasibility of the learning tools.
b. Effectiveness Analysis: Individual and class mastery levels were measured based on literacy test results.
   - Individual mastery was achieved when students obtained a score ≥ 65%.
   - Class mastery was achieved when at least 85% of students reached individual mastery.
c. Statistical Analysis: Normality, homogeneity, and two-way ANOVA tests were applied to determine the effects of the HOTS-based PBL model and character education on students' literacy improvement, as well as the interaction between both variables.

RESULTS AND DISCUSSION

Research Results

1. Description of the Research Site

The selected school possessed adequate facilities, teachers who were open to learning innovations, and a curriculum aligned with the Merdeka Curriculum implementation. Supporting factors such as well-equipped classrooms, internet access, a digital library, and multimedia tools further strengthened the research site's feasibility.

Teachers involved in the study had received preliminary training on the syntax of Problem-Based Learning (PBL) integrated with character values. This training ensured consistent implementation aligned with the research design. The principal and teachers' support contributed significantly to the research's success, as they perceived the model as relevant to strengthening the *Pancasila Student Profile*.

2. Model Development Process

The model development process followed the ADDIE framework—analysis, design, development, implementation, and evaluation. The PBL syntax comprised five stages: problem orientation, information exploration, analysis–synthesis, solution formulation, and presentation–reflection. Each stage was designed to foster critical thinking while internalizing character values such as responsibility, cooperation, and integrity.

Validation by experts yielded an average score of 88.5% across content, language, and practicality aspects, indicating that the learning tools were highly feasible. After limited trials, minor revisions were made before broader implementation in the experimental class.

3. Model Trial Results

The model trial lasted for six sessions, utilizing contextual problems relevant to students' daily lives. Observations indicated that students actively participated throughout all learning stages—from information exploration to group presentations.
Post-test results showed significant improvement in literacy aspects, including reading, numeracy, science, and digital literacy. The detailed results are shown in Table 1 below.

Table 1. Average Literacy and Character Education Scores

Learning Model	Reading Literacy	Numeracy	Science	Digital	Average Literacy	Character Education
PBL-HOTS-Character	88	85	87	90	87.5	73.4

Table 1 shows that the students' average literacy score reached 87.5, exceeding the mastery criterion. The average score for character education was 73.4, indicating internalization of values such as responsibility, cooperation, and discipline through the learning process.

4. Students' Literacy Post-Test Results

In addition to the average analysis, students' post-test results were broken down into four literacy dimensions, as shown in Table 2 below.

Table 2. Students' Literacy Post-Test Results

Literacy Aspect	PBL-HOTS-Character
Reading Literacy	88
Numeracy Literacy	85
Science Literacy	87
Digital Literacy	90
Average	**87.5**

Table 2 indicates that digital literacy obtained the highest score (90), followed by reading (88) and science (87). This demonstrates that the HOTS-based and character-integrated PBL model encouraged students to critically utilize digital and textual resources in solving contextual problems.

5. Statistical Analysis Results

To examine the effects of the learning model on students' literacy, statistical analyses were performed using normality, homogeneity, and two-way ANOVA tests. The summary is presented in Table 3.

Table 3. Summary of Two-Way ANOVA Results

Source of Variation	df	F-value	Sig.	Description
Learning Model	1	41.048	0.000	Significant effect on literacy
Character Education	1	45.250	0.000	Significant effect on literacy
Model × Character	1	4.586	0.032	Significant interaction

Based on Table 3, the significance values ($p < 0.05$) indicate that the HOTS-based PBL model and character education significantly affected students' literacy performance. Furthermore, their interaction also contributed meaningfully to literacy enhancement. The determination coefficient ($R^2 = 66.1\%$) showed that the model explained more than half of the variance in literacy outcomes.

DISCUSSION

The findings of this study demonstrate that the application of the Problem-Based Learning (PBL) model integrated with Higher Order Thinking Skills (HOTS) and character education effectively improves students' literacy skills while simultaneously reinforcing character formation. This aligns with constructivist learning theory, which emphasizes the importance of active, collaborative, and meaningful learning experiences in developing both cognitive and affective competencies.

In the 21st-century education framework, the characteristics emphasized in this research correspond to three core competencies—self-directed learning, collaboration, and critical thinking—which are integral elements of the 4Cs (Critical Thinking, Creativity, Collaboration, and Communication). Students in modern education are not only expected to master conceptual knowledge but also to apply it reflectively, creatively, and responsibly in real-world situations.

1. Self-Directed Learning

Self-directed learning represents a fundamental characteristic of the *Pancasila Student Profile*, particularly within the dimensions of independence and critical reasoning. In the learning process, students are encouraged to regulate their learning (self-regulation), take initiative, and evaluate their own progress. This study revealed that fourth-grade students showed improved initiative in seeking information, solving problems without full teacher assistance, and expressing opinions based on observation and reasoning. These outcomes indicate that the PBL-HOTS-Character model fosters learner autonomy and self-awareness—key attributes of lifelong learners.

2. Collaboration and Social Interaction

Collaboration, as another critical skill of 21st-century learning, teaches students the importance of teamwork, empathy, and effective communication. Through project- and problem-based activities, students learned to share ideas, appreciate diversity, and complete group tasks cooperatively. This is consistent with the "gotong royong" (mutual cooperation) dimension of the *Pancasila Student Profile*, which emphasizes social responsibility and empathy. Observational data showed that students were able to engage in open discussions, divide group roles fairly, and resolve differences respectfully—demonstrating the internalization of social character values.

3. Critical and Analytical Thinking

Modern education demands that students think critically and analytically when facing problems. Through the problem-solving stages of the PBL model, students were guided to analyze relationships between concepts, test the validity of solutions, and draw generalizations from concrete phenomena. This process supports the "critical and creative thinking" dimensions of the *Pancasila Student Profile*. Students' critical thinking abilities developed progressively through the stages of problem orientation, data collection, data analysis, and reflective evaluation.

The characteristics of fourth-grade students are highly aligned with the goals of the *Merdeka Curriculum*, which positions learners as active agents of knowledge construction. The curriculum promotes differentiated, contextual, and competency-based learning that integrates character development. At this developmental stage, students are in an ideal period to cultivate lifelong learning skills through project-based activities, self-reflection, and collaborative group learning. The results suggest that such learning experiences nurture independent, open-minded, and socially responsible learners.

Moreover, the study's findings reveal that student characteristics supporting independence, collaboration, and critical thinking are strong indicators of successful implementation of the *Merdeka Curriculum*. Learning activities that allow students to explore real-life and culturally relevant problems not only strengthen literacy and numeracy but also foster awareness of *Pancasila* values such as cooperation, responsibility, and social empathy. Consequently, learning becomes more than mere knowledge transfer—it transforms into a process of character building, preparing students to navigate complex challenges in an evolving global society.

The improvement in literacy achievement—an average score of 87.5 across reading, numeracy, science, and digital dimensions—corroborates previous studies by Andriani, Saparini, and Akhsan (2018) and Purnomo and Sari (2021), who highlighted the essential role of literacy mastery in academic success. Additionally, character education reinforcement, with an average score of 73.4, indicates that values such as responsibility, cooperation, and integrity were effectively internalized through the problem-based learning design.

Statistical analysis further supports these qualitative findings. The two-way ANOVA results show that both the PBL-HOTS model and character education, as well as their interaction, significantly influenced students' literacy achievement ($p < 0.05$, $R^2 = 66.1\%$). This reinforces the argument that effective learning should not merely focus on

cognitive dimensions but must also integrate character values as foundational components of intellectual growth.

Overall, the implementation of the HOTS-based PBL model contributes significantly to deepening students' literacy competencies by cultivating critical thinking and self-directed learning skills. The active-learning process allowed students to analyze, evaluate, and construct knowledge reflectively, with data showing average scores of 82.2 in critical thinking, 84.6 in learning autonomy, and 86.5 in collaboration. These results illustrate that problem-based learning activities promote "reading for meaning," evidence-based reasoning, and communication grounded in logical argumentation. Thus, HOTS-based learning strengthens logical reasoning, information literacy, and academic literacy while fostering reflective and analytical thinking—skills essential for the 21st century.

In summary, the integration of HOTS and PBL is an effective pedagogical strategy to develop both cognitive and character dimensions of learning. It enables students to connect knowledge to real-life contexts, evaluate the credibility of information, and communicate their ideas coherently. The model aligns with Indonesia's *Merdeka Curriculum* vision and supports the realization of the *Pancasila Student Profile*, emphasizing critical, independent, and collaborative learners.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the research findings and discussion, several conclusions can be drawn:

1. The HOTS-based Problem-Based Learning model integrated with character education is proven effective in improving elementary students' literacy skills. Post-test results showed an average literacy score of 87.5, encompassing reading, numeracy, science, and digital literacy.
2. Character education also showed improvement, with an average score of 73.4, indicating successful internalization of values such as responsibility, cooperation, integrity, and discipline.
3. Two-way ANOVA results demonstrated that the learning model, character education, and their interaction significantly affected students' literacy achievement, with a determination coefficient (R^2 = 66.1%), explaining more than half of the variance in literacy outcomes.
4. These findings support the *Merdeka Curriculum*'s policy orientation toward forming the *Pancasila Student Profile*. The model not only fosters critical thinking but also strengthens moral and social character aligned with 21st-century educational goals.

Hence, the development of the HOTS-Character PBL model serves as an innovative strategy to address Indonesia's literacy challenges while reinforcing character education in elementary schools.

Recommendations

1. For Teachers and Education Practitioners: Teachers are encouraged to adopt the HOTS-based PBL-Character model in thematic learning. They should contextualize problem scenarios to local student environments and consistently embed character values in every learning activity.
2. For School Leaders and Educational Institutions: School principals should provide ongoing training, mentoring, and resources to facilitate implementation of the model. Institutional support is crucial to enable meaningful, collaborative learning consistent with the *Merdeka Curriculum*'s direction.
3. For Education Offices and Policymakers: The results of this research can serve as a reference in formulating policies to strengthen HOTS- and character-based learning. The model should be integrated into *Sekolah Penggerak* (Driving Schools) and national curricula for wider and sustainable application.
4. For Future Researchers: Since this study was limited to one elementary school level and thematic class, future research should include broader contexts across junior and senior high schools and various subjects. Longitudinal studies are also recommended to assess long-term impacts on literacy and character development.
5. For Educational Technology Developers: This learning model has potential for expansion into digital teaching modules, interactive applications, or teacher guidebooks. Technology-based packaging can extend the model's reach and contribute significantly to improving the quality of education in Indonesia.

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