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Designing Problem-Oriented Teaching Materials to Strengthen Higher-Order Thinking and Critical Thinking Skills in Industrial Economics Learning

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ABSTRACT

Industrial Economics learning requires instructional materials that encourage students not only to understand economic concepts but also to critically analyze economic problems. This study focuses on designing and developing instructional materials that integrate the Problem-Based Learning (PBL) approach with an emphasis on Higher-Order Thinking Skills (HOTS) to strengthen the critical thinking abilities of students at the Faculty of Economics, Universitas Negeri Medan. The study employed a Research and Development (R&D) approach using the ADDIE model, consisting of analysis, design, development, implementation, and evaluation stages. The quality of the developed materials was assessed through expert validation and responses from lecturers and students, while changes in students' critical thinking abilities were examined based on pretest and posttest results. The findings indicate that the developed instructional materials met the required feasibility criteria and received positive responses from both lecturers and students. The Paired Sample t-Test yielded a significance value of 0.000 ($p<0.05$), indicating a statistically significant difference in students' critical thinking abilities before and after the implementation of the instructional materials. These findings suggest that incorporating contextual problems, problem-solving activities, and higher-order cognitive demands into instructional materials can serve as a pedagogical alternative for strengthening critical thinking in Industrial Economics learning. The developed materials therefore offer potential as a learning resource for fostering more analytical and problem-oriented learning.

Keywords: PBL-Based Teaching Material Development, Industrial Economics, Critical Thinking Ability.

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INTRODUCTION

Higher-order thinking has become an essential competency for students because contemporary education is expected to prepare graduates who are capable of reasoning, evaluating information, analyzing complex situations, generating creative solutions, and making responsible decisions. These competencies extend beyond the ability to recall previously learned information. They require students to use knowledge in a reflective and analytical manner when confronted with problems that may not have straightforward solutions. Within this context, Higher-Order Thinking Skills (HOTS) refer to cognitive processes that enable learners to examine information, establish relationships among concepts, evaluate alternatives, and produce appropriate solutions. The conceptual foundation of HOTS can be traced to Bloom's taxonomy (1956) and its subsequent revision by Anderson and Krathwohl, which places higher cognitive processes at the levels of analysis, evaluation, and creation (Sagala and Andriani 2019). HOTS consequently encompasses several interrelated abilities, including problem-solving, critical thinking, creative thinking, reasoning, and decision-making (Widana 2017).

The significance of HOTS lies in its capacity to enable students to move beyond the passive reception of knowledge toward the active construction and application of knowledge. Students with stronger higher-order thinking abilities are better positioned to interpret diverse forms of information, assess the validity of possible solutions, formulate logical explanations, develop persuasive arguments, and make decisions when confronted with uncertain or complicated circumstances. HOTS therefore functions not merely as a cognitive achievement but also as a transferable competency that can be applied across different situations. (Ragab, Kaid, and Sayed 2024) emphasize the importance of HOTS in strengthening students' critical thinking, particularly in processing information and applying knowledge creatively to address problems. The ability to transfer knowledge to unfamiliar contexts is increasingly important in an environment characterized by rapid technological development and changing occupational demands. The dynamics of Industry 4.0, in particular, require graduates who can adapt to new problems rather than merely reproduce established procedures (SANGUR 2024). Differences in social backgrounds, workplace environments, and the nature of problems encountered further reinforce the need for adaptable and context-sensitive thinking skills.

The orientation toward higher-order thinking is also consistent with the direction of Indonesian educational policy. The implementation of the 2013 Curriculum and the subsequent Independent Curriculum has increasingly emphasized student-centered learning, active knowledge construction, and the utilization of diverse learning resources. Minister of Education and Culture Regulation No. 22 of 2016 concerning Process Standards identifies a number of learning principles that provide a foundation for developing HOTS-oriented instruction (Sudana 2018). These principles encourage a transition from teacher-dominated information delivery toward learning in which students construct knowledge through multiple sources. They also promote a movement from isolated forms of learning toward integrated learning and from dependence on predetermined answers toward the recognition that complex problems may involve multiple valid perspectives (Sadat 2020). Such an orientation provides an important pedagogical basis for cultivating students' analytical, evaluative, and creative capacities.

A substantial gap nevertheless remains between the intended direction of educational policy and classroom practice. Learning activities in many educational settings continue to emphasize Low-Order Thinking Skills (LOTS), particularly memorization, factual recall, and basic comprehension (Shabrina, Basthomi, and Zen 2025). This pattern limits opportunities for students to engage with problems that require interpretation, evaluation, synthesis, and independent judgment. The persistence of knowledge-reproduction practices is increasingly problematic because contemporary social and professional environments present challenges that are multidimensional and constantly changing. Education must therefore provide learners with more than the ability to remember information; it must equip them to understand problems, evaluate competing possibilities, and formulate solutions that are appropriate to particular circumstances. (Prakash and Litoriya 2022) argue that learning dominated by LOTS needs to be progressively redirected toward HOTS so that students can respond more effectively to the complexity of real-life situations.

The gap between policy expectations and instructional reality demonstrates that the development of HOTS requires more than curricular reform at the policy level. It also depends on the availability of learning experiences and instructional materials that deliberately stimulate higher-level cognitive processes. Learning materials should therefore expose students to contextual problems, encourage investigation, require the comparison of alternative solutions, and provide opportunities to justify conclusions based on evidence. Such characteristics are particularly relevant in Industrial Economics, where students encounter economic phenomena that are influenced by technological change, market structures, industrial policies, business behavior, and broader socioeconomic conditions. A HOTS-oriented learning environment can consequently bridge the gap between conceptual understanding and the ability to analyze actual industrial-economic problems. The integration of problem-based learning into instructional materials provides a relevant pathway because problems can function as a stimulus for students to activate prior knowledge, investigate new information, evaluate evidence, and construct solutions independently.

In the context of teaching materials, materials development refers to the process of designing, selecting, adapting, and organizing learning resources to facilitate students in achieving learning objectives effectively (Minto 2024). Tomlinson explains that materials development

includes every effort made by teachers, writers, or learners to provide learning resources that optimize knowledge acquisition (Ratnawati and Narimo 2022). Likewise, Busljeta defines teaching materials as instructional media used to deliver learning content systematically (Shehata et al. 2024), while Graves emphasizes that developing teaching materials involves creating or modifying instructional resources and learning activities that support students in achieving expected competencies (Baig and Yadegaridehkordi 2023). In Industrial Economics, learning focuses on understanding industrial market structures, firm behavior, and competition within imperfect markets (Syverson 2017). Considering the increasing complexity of industrial and economic issues, learning materials should facilitate the development of *Higher Order Thinking Skills* (HOTS), particularly critical and creative thinking, so that students are able to analyze and solve real-world problems (Ismeirita et al. 2025). Previous studies have demonstrated the importance of integrating HOTS into learning materials across various disciplines (Aras and Rurua 2026). However, most existing studies primarily discuss the concept and implementation of HOTS, whereas the development of HOTS-oriented teaching materials specifically for Industrial Economics courses based on *Problem-Based Learning* (PBL) remains limited. Therefore, this study develops PBL-based HOTS teaching materials to improve students' critical thinking skills in Industrial Economics learning (Ahmad et al. 2020).

HOTS-oriented learning requires instructional materials that can actively engage students in higher-level cognitive processes. Teaching materials function not merely as sources of information but also as learning resources that assist teachers in organizing meaningful learning activities. The National Competency Training Center defines teaching materials as resources used to facilitate the learning process, including both written and non-written forms (Theelen and van Breukelen 2022). Therefore, instructional materials need to be designed in accordance with the cognitive competencies that students are expected to develop.

Previous studies indicate that appropriately designed instructional materials can support learning effectiveness and the development of specific student competencies. Thematic teaching resources developed by Octavian were found to be effective in supporting learning activities (Apriansyah and Harto 2025). Similarly, (Pambudhi and Retnowati 2017) demonstrated that module-based instructional materials could contribute to the development of students' nationalistic character. These findings indicate that teaching materials incorporating HOTS-oriented activities can serve as an alternative means of developing students' higher cognitive abilities, particularly critical thinking and problem-solving skills.

Based on the foregoing discussion, although previous studies have emphasized the importance of HOTS-oriented learning and teaching materials, limited attention has been given to the development of Problem-Based Learning (PBL)-based HOTS teaching materials specifically for Industrial Economics courses at the university level. This gap indicates the need to develop instructional materials that are not only theoretically appropriate but also empirically proven to improve students' critical thinking skills. Therefore, this study aims to develop PBL-based HOTS teaching materials for Industrial Economics courses at the Faculty of Economics, Universitas Negeri Medan, and to examine their feasibility, attractiveness, and effectiveness in enhancing students' critical thinking skills. Accordingly, the research questions are: (1) How feasible are the developed PBL-based HOTS teaching materials for Industrial Economics courses? and (2) How effective are these teaching materials in improving students' critical thinking skills?

METODE

This study employed a Research and Development (R&D) approach to develop and assess HOTS-oriented teaching materials for the Industrial Economics course. The development process adopted the ADDIE framework, comprising analysis, design, development, implementation, and evaluation stages (Zou et al. 2024).

The developed materials included modules and case studies focusing on Structure-Conduct-Performance (SCP) analysis as one of the topics in Industrial Economics. The research was conducted in the Department of Economics, Faculty of Economics, Universitas Negeri Medan, during the odd semester of the 2023/2024 academic year. The participants were 50 students from two Industrial Economics classes. Data were obtained through expert validation questionnaires, lecturer and student response questionnaires, and pretest-posttest assessments.

The analysis stage identified learning needs and examined the alignment of existing materials with HOTS indicators. The design and development stages involved preparing the

instructional content and learning activities using Microsoft Office and Canva, followed by validation by material and media experts. The implementation stage involved applying the developed materials and measuring students' learning outcomes through pretest and posttest. The evaluation stage examined the feasibility and user responses to the developed materials, particularly those related to SCP analysis.

HASIL DAN PEMBAHASAN

Characteristics of the Instructional Materials

The developed Industrial Economics instructional materials combine the Problem-Based Learning (PBL) approach with Higher-Order Thinking Skills (HOTS), particularly in the topic of Structure-Conduct-Performance (SCP) analysis. The materials were organized according to the five main stages of PBL, allowing students to engage with contextual problems, conduct investigations, develop solutions, and evaluate their findings (Ilham 2023).

The learning process begins by introducing students to authentic phenomena related to SCP analysis, particularly the relationship between industrial market structure, firm behavior, and industry performance. These problems are intended to stimulate students to analyze information, express arguments, and develop critical and creative responses (Khan and Hanif 2019). Students are subsequently guided to identify relevant issues and connect the presented phenomena with the core concepts of SCP. The next stage involves individual and group investigations through structured tasks related to industrial market problems, encouraging students to apply concepts while developing critical and creative thinking.

The learning activities then require students to organize and present the results of their investigations. Through discussion and presentation, students are encouraged to clarify their arguments, communicate findings, and respond to questions from their peers. The final activity involves reviewing both the problem-solving process and the results obtained. This reflection enables students to evaluate the effectiveness of their reasoning and identify aspects that require further improvement.

Another characteristic of the developed materials is the integration of HOTS indicators with student learning characteristics. The materials are designed to encourage critical and creative thinking while simultaneously developing students' collaboration and communication skills. The alignment between these competencies and the PBL approach provides a foundation for designing learning activities that place students in an active role throughout the learning process. Material analysis was subsequently conducted to ensure that the SCP content and learning activities were appropriately integrated with HOTS. Based on these considerations, the instructional materials were designed and developed as presented in Table 1.

Table 1.
Outline of developed teaching materials

Component	Description
Opening Section	Provides an overview of the learning topic, its connection to previously studied materials, learning objectives, required learning media, estimated study time, and introductory motivation to prepare students for the learning activities.
Main Learning Section	Contains a sequence of learning activities organized around specific objectives. This section presents the core concepts, contextual examples, illustrations, tables, diagrams, exercises, problem-solving activities, and feedback to facilitate students' understanding and higher-order thinking.
Closing Section	Summarizes the essential concepts discussed and reinforces the relationship between the topics covered. This section also provides an assessment or evaluation activity to measure students' understanding and achievement of the intended learning outcomes.

Source: Questionnaire, 2023

Development Stage

The development stage resulted in HOTS-oriented Industrial Economics instructional materials designed to respond to the learning demands of the 21st century (Jupri, Tinus, and Wurianto 2025). The product was developed by considering four main criteria: content coverage, presentation quality, readability, and visual design.

a. Product Development

The instructional materials were developed by organizing the Industrial Economics content into a structured learning resource that integrates HOTS-oriented activities. Particular attention was given to the completeness of the material, clarity of presentation, language readability, and graphical elements to ensure that the product was appropriate for student learning.

b. Product Validation

The developed materials underwent a two-stage validation process covering content suitability, language and readability, and presentation aspects. The first validation indicated positive results across the assessed components, showing that the materials had met the basic requirements for content and presentation. Following the initial revision, the product was subjected to a more detailed second-stage assessment. The results of the second validation were subsequently evaluated against the assessment criteria established by BSNP (2010), as presented in Table 2.

Table 2. Expert Assessment of the Developed Instructional Materials

No.	Assessment Component	Mean Score (%)	Category
1	Content Quality	90.20	Very Eligible
2	Language and Readability	88.50	Very Eligible
3	Presentation Quality	92.00	Very Eligible
Overall Average		**90.23**	**Very Eligible**

The results of the second-stage expert assessment indicate that the developed instructional materials achieved an overall score of 90.23%, placing them in the very eligible category. The highest score was obtained for presentation quality (92.00%), followed by content quality (90.20%) and language and readability (88.50%). Although the product had met the required feasibility criteria, several revisions were incorporated in response to the validators' suggestions. The revised version was subsequently prepared for a small-scale trial to further examine its suitability and usability.

Small-Scale Trial Results

Table 3. Results of the Second-Stage Validation

No.	Validation Aspect	Average Score (%)	Category
1	Content Quality	94.10	Very Eligible
2	Language and Readability	100.00	Very Eligible
3	Presentation Quality	98.00	Very Eligible
Overall Average		**97.37**	**Very Eligible**

The small-scale trial results presented in Table 3 indicate that the second draft of the instructional materials achieved a very high level of feasibility, with an overall score of 97.37%. The content, language, and presentation components each met the predetermined eligibility criteria. Minor improvements were nevertheless incorporated based on student feedback, particularly corrections to typing and numbering inconsistencies and the inclusion of data sources for several images. The revised product was subsequently prepared for the next stage of implementation.

Media Validation Results

The visual and technical quality of the Industrial Economics instructional materials was further assessed by two media experts. The assessment focused on the cover and overall content design to ensure that the developed materials were not only functional but also visually appropriate for student learning.

Table 4. Media Validation Results of the Industrial Economics Instructional Materials

No.	Assessment Aspect	Mean Score (%)	Category
1	Cover Design	92.30	Very Eligible
2	Content Design	90.89	Very Eligible
Overall Average		**91.60**	**Very Eligible**

Table 4 shows that the instructional materials obtained an overall media validation score of 91.60%, which falls within the very eligible category. The cover design received a score of 92.30%, while the content design achieved 90.89%. The assessment confirms that the visual presentation was suitable for learning purposes. Revisions were still undertaken to improve the attractiveness

and readability of the materials, particularly through adjustments to color composition, font size, and text positioning.

Effectiveness of the Instructional Materials

The effectiveness of the developed instructional materials was examined through a large-scale implementation using pretest and posttest measurements. The assessment was intended to identify changes in students' mastery of Industrial Economics concepts, particularly the Structure-Conduct-Performance (SCP) topic, following the use of the developed materials.

The assessment consisted of 15 multiple-choice questions. Before being administered, the test items were examined in terms of validity, reliability, discrimination power, and difficulty level to ensure their suitability for measuring students' conceptual understanding. The comparison between pretest and posttest results is presented in Table 5.

Table 5. Results of the Student Concept Mastery Test

Indicator	Pretest (%)	Criteria	Posttest (%)	Criteria
Minimum Score	15	Low	87	Optimal
Maximum Score	40	Low	100	Optimal
Mean Score	28.24	Low	88.87	Optimal

Source: Research Data, 2023

The results in Table 5 demonstrate a substantial improvement in students' conceptual mastery following the implementation of the developed instructional materials. The minimum score increased from 15 in the pretest to 87 in the posttest, while the maximum score rose from 40 to 100. The mean score also increased considerably, from 28.24 to 88.87. This improvement indicates that students demonstrated stronger understanding of the SCP concept after participating in learning activities supported by the developed HOTS-oriented materials.

Learning Completeness and Concept Mastery

The effectiveness of the developed instructional materials was initially examined through students' achievement in the knowledge domain of Industrial Economics, particularly the Structure-Conduct-Performance (SCP) topic. Student achievement was determined by comparing the pretest results with the final learning scores obtained through a combination of assignments and posttest performance. In accordance with the achievement standard applied at Universitas Negeri Medan, the minimum competency threshold in this study was set at 85.

The initial assessment indicated that none of the students reached the established mastery threshold in the pretest. Following the implementation of the developed instructional materials, 38 students achieved the required level of mastery in the final assessment. The resulting classical completeness rate reached 88%, exceeding the predetermined research target of 75%. This finding indicates that the developed materials were able to support the attainment of the expected learning outcomes at the class level.

The N-Gain analysis further demonstrated an improvement of 0.87 in students' knowledge achievement, which falls within the high-gain category. The increase indicates that the learning materials provided meaningful support for students in developing their understanding of SCP concepts. The combination of conceptual explanations, contextual problems, and structured learning activities provided students with opportunities to connect theoretical concepts with industrial-economic phenomena.

The difference between students' pretest and final scores was subsequently examined using a paired-sample t-test with SPSS. The analysis produced a significance value below 0.05, resulting in the rejection of the null hypothesis and acceptance of the alternative hypothesis. The statistical finding confirms that students' mastery of Industrial Economics concepts differed significantly before and after the use of the developed instructional materials.

Student Learning Activities

The effectiveness of the product was also evaluated from the affective dimension through observations of students' learning activities during classroom implementation. The overall mean score for student activity was 3.87, which was categorized as very good. The observation results also indicated progressive improvement across the assessed activity indicators during the learning process.

The improvement in student activity reflects the learning characteristics embedded in the developed materials. Problem-oriented tasks required students to participate in discussions, examine information, respond to questions, and contribute to problem-solving activities. These

learning experiences positioned students as active participants rather than passive recipients of information. The finding supports the view that instructional materials designed around economic problems can create learning conditions that encourage students to engage more actively with course content.

The results are consistent with the study conducted by Nurhidayat, Saptono, and Herlitah, which demonstrated the potential of economic problem-based learning e-modules to improve students' higher-order thinking competencies. Their research also employed the ADDIE model within an R&D framework and found differences in critical thinking performance between students who used the developed learning resources and those who did not (Nurhidayat and Saptono 2021). The present findings reinforce the relevance of problem-based instructional materials for developing higher-level cognitive competencies in economics education.

Development of Critical and Creative Thinking Skills

The HOTS outcomes in this study were assessed through two dimensions: critical thinking and creative thinking. The assessment combined written tests, classroom observations, and mini-research assignments to capture students' ability to apply higher-order cognitive processes to SCP analysis. Pretest and posttest instruments were administered to determine changes in students' HOTS before and after learning with the developed materials. The test items had previously undergone analysis concerning validity, reliability, discrimination, and difficulty levels.

Table 6. Results of the Student Critical Thinking Skills Test

No.	Indicator	Pretest (%)	Criteria	Posttest (%)	Criteria
1	Focusing Questions	25.26	Low	90.23	Ideal
2	Analysing Arguments	27.76	Low	92.54	Ideal
3	Asking and Answering Questions	20.55	Low	97.56	Ideal
4	Evaluating Source Trustworthiness	15.83	Low	88.40	Ideal
5	Deducing and Evaluating Deductive Results	9.76	Low	87.89	Ideal
6	Inducing and Evaluating Inductive Results	26.90	Low	97.30	Ideal
7	Developing and Determining Results from the Model	18.99	Low	81.90	Ideal
8	Defining Terms and Evaluating Definitions	21.25	Low	84.88	Ideal
9	Identifying Assumptions	8.90	Low	86.15	Ideal
10	Determining an Appropriate Action	13.76	Low	83.50	Ideal
11	Case Settlement	11.65	Low	89.00	Ideal
Average		18.23	Low	89.03	Ideal

Source: Research Data, 2023

Table 6 demonstrates a substantial improvement in every critical-thinking indicator. The overall mean increased from 18.23% in the pretest to 89.03% in the posttest. The strongest posttest performance appeared in asking and answering questions, with a score of 97.56%, followed by inductive reasoning at 97.30% and analysing arguments at 92.54%. The lowest posttest score was recorded for developing and determining results from the model at 81.90%, although this indicator remained within the ideal category.The N-Gain score of 0.92 indicates a high level of improvement in students' critical thinking skills. The substantial increase can be associated with the structure of the learning materials, which required students to examine problems, interpret information, evaluate arguments, formulate conclusions, and determine appropriate actions. Such activities are directly connected to the cognitive demands of HOTS and provide students with repeated opportunities to practice analytical reasoning.

The paired-sample t-test further confirmed the observed improvement. The significance value was below 0.05, indicating a statistically significant difference between students' critical thinking performance before and after the implementation of the developed instructional materials. The statistical evidence therefore strengthens the descriptive findings in Table 6 and indicates that the improvement was not merely attributable to random variation.

Table 7. Results of the Student Creative Thinking Skills Test

No.	Indicator	Pretest (%)	Criteria	Posttest (%)	Criteria
1	Fluency	24.56	Low	92.33	Optimal
2	Flexibility	25.36	Low	90.85	Optimal
3	Originality	23.65	Low	95.75	Optimal
4	Elaboration	24.15	Low	85.50	Optimal
Average		24.43	Low	91.10	Optimal

Source: Research Data, 2023

Table 7 indicates a similar pattern of improvement in students' creative thinking abilities. The overall mean increased from 24.43% before implementation to 91.10% after the use of the developed instructional materials. Originality recorded the highest posttest score at 95.75%, followed by fluency at 92.33% and flexibility at 90.85%. Elaboration achieved the lowest posttest score at 85.50%, while still meeting the optimal criterion.

The N-Gain analysis produced a score of 0.92, categorized as high. This result suggests that the learning activities successfully provided students with opportunities to generate ideas, consider alternative approaches, formulate different responses, and elaborate solutions to economic problems. The PBL orientation of the materials encouraged students to approach SCP-related problems from multiple perspectives rather than relying on a single predetermined answer. The paired-sample t-test produced a significance value below 0.05. The null hypothesis was therefore rejected, indicating a significant difference in students' creative thinking performance between the pretest and posttest. The combined evidence from the mean scores, N-Gain analysis, and inferential testing demonstrates that the developed instructional materials contributed positively to the development of both critical and creative thinking skills.

Taken together, the findings show that the integration of PBL and HOTS within Industrial Economics instructional materials generated improvements across conceptual mastery, learning activity, critical thinking, and creative thinking. The results also indicate that the instructional materials function not only as a source of course content but as a structured learning medium that facilitates students' engagement with complex economic problems and higher-level cognitive processes.

DISCUSSION

The novelty of this study lies in the development and empirical implementation of Industrial Economics teaching materials that integrate the Higher Order Thinking Skills (HOTS) approach with Problem-Based Learning (PBL) to improve students' critical thinking abilities at the university level (Darwis and Patimbangi 2024). Unlike previous studies that have predominantly focused on the development of PBL-based teaching materials or e-modules for school-level education and specific subject areas (Saepuloh et al. 2021), this study specifically integrates HOTS and PBL into teaching materials for the Industrial Economics course at the Faculty of Economics, Universitas Negeri Medan (UNIMED). The developed teaching materials are not merely designed to present theoretical concepts but are structured around contextual industrial-economic problems that require students to analyze information, evaluate alternatives, formulate arguments, and develop solutions (Yaseen and Oktavian 2026). Therefore, the innovation of this study is located in the integration of subject-specific Industrial Economics content, higher-order cognitive demands, and the stages of problem-based learning within a single instructional resource designed for higher education (Žerovnik and Nančovska Šerbec 2021).

The results of the study demonstrate that the use of HOTS-oriented Industrial Economics teaching materials based on PBL had a significant effect on students' critical thinking abilities (Rahmanto, Bunyamin, and Wahjusaputri 2025). Students who learned using the developed teaching materials obtained higher posttest scores than students who participated in conventional learning supported primarily by PowerPoint presentations or learning resources that did not incorporate the developed materials. The statistical analysis showed an Asymp. Sig. (2-tailed) value of 0.000, which is lower than 0.05, indicating a statistically significant difference in students' critical thinking abilities following the implementation of the developed teaching materials. This finding indicates that the developed materials function not only as a source of information but also as an instructional instrument that facilitates higher-order cognitive processes. The improvement in students' performance can be associated with the structure of the materials, which requires students to engage with problems, interpret information, analyze relationships, evaluate possible

alternatives, and formulate solutions (Joshi, Desai, and Tewari 2020). Thus, the observed improvement should not merely be understood as an increase in students' learning achievement but also as an indication that the instructional design embedded in the teaching materials supports the development of critical thinking (Bağ and Gürsoy 2021).

The findings of this study are consistent with previous research concerning the effectiveness of PBL-based teaching materials in developing students' critical thinking. Rahmat et al. reported that PBL assisted by e-modules could improve students' critical thinking abilities, demonstrating that the combination of an active learning model and structured digital learning resources can provide stronger opportunities for students to engage in problem-solving activities (Rahmat, Arip, and Nur 2020). Similarly, Nurhidayat et al. found differences in students' critical thinking abilities between students who used PBL-based e-modules and those who did not (Nurhidayat and Saptono 2021). Pitorini et al. also demonstrated that students who learned through PBL-based e-modules showed better critical thinking abilities than students who did not receive the same intervention (Pitorini 2024) (Pitorini 2025). These findings are in line with the present study, in which students who used the developed Industrial Economics teaching materials demonstrated better critical thinking outcomes than those who relied on conventional learning resources. The similarity among these studies may be explained by the common instructional mechanism of PBL, in which students are confronted with problems that require them to actively search for information, identify relevant evidence, examine alternative explanations, and formulate solutions rather than simply receive information from the lecturer (Chen, Kolmos, and Du 2021).

The present findings are also supported by Pujiono et al., who reported that PBL-based e-modules were effective in improving students' critical thinking abilities (Pujiono 2024). Musaad and Suparman likewise emphasized the potential of PBL-based e-modules to develop critical thinking as one of the competencies required in 21st-century learning (Musaad and Suparman 2023). In addition, research on HOTS-oriented learning materials developed through a PBL framework has demonstrated improvements in students' critical thinking and collaborative abilities. Nurhalis et al. found that the integration of HOTS and PBL influenced students' critical thinking and creativity, while research on HOTS-oriented worksheets based on PBL similarly indicated improvements in higher-order cognitive and collaborative skills (Nurhalis, Nuryanti, and Sakung 2024). The convergence of these findings with the results of the present study strengthens the argument that PBL can be more effective when the learning activities are deliberately designed to stimulate higher-order cognitive processes. In other words, the effectiveness of the developed materials is not necessarily attributable to PBL alone, but to the interaction between the problem-based learning structure and the cognitive demands embedded in the HOTS-oriented activities.

The consistency between the present findings and previous studies can also be explained from the perspective of the characteristics of the teaching materials. Abidin and Walida explain that well-designed e-modules can facilitate students' independent learning because the learning content is organized systematically, understandably, and engagingly (Kurniati, Andra, and Wayan Distrik 2021). In the context of the present study, this function is strengthened through the inclusion of contextual problems and learning activities that require students to apply concepts rather than merely memorize them. Savery similarly argues that PBL connects theoretical knowledge with practical problem-solving activities, encouraging students to investigate and develop solutions. Nafiah and Suyanto further emphasize that PBL uses authentic situations as a context for learning, enabling students to develop problem-solving and critical thinking skills (Nafiah and Suyanto 2019). These theoretical explanations help clarify why the developed Industrial Economics teaching materials produced positive learning outcomes (Foster and Stagl 2018). When students are provided with structured learning resources and simultaneously challenged with relevant problems, they have greater opportunities to connect theoretical knowledge with practical situations and to develop arguments based on analysis and evaluation.

Although the findings are generally consistent with previous studies, the present study differs in terms of its educational and disciplinary context (Swarat et al. 2017). Several previous studies have examined PBL-based e-modules and HOTS-oriented teaching materials in mathematics, physics, science, and other school-level subjects, whereas this study focuses on university students enrolled in an Industrial Economics course (Santosa 2024). This distinction is important because Industrial Economics requires students to understand and analyze relatively complex relationships involving market structures, industrial behavior, competition, efficiency, pricing, and other economic phenomena (Devine et al. 2018). Consequently, the problems

presented in the teaching materials require students not only to identify solutions but also to consider competing interests, economic consequences, and alternative interpretations. Differences in educational level, subject characteristics, student experience, and complexity of learning problems may therefore influence the way students respond to PBL-based learning materials (Buus and Pedersen 2021). The findings of this study should consequently be understood within the specific context of higher education and Industrial Economics rather than being generalized without consideration of these contextual differences.

The contribution of this study is therefore not limited to producing an alternative teaching material for the Industrial Economics course (Gjini 2024). More importantly, the study provides empirical evidence that the deliberate integration of HOTS and PBL into subject-specific teaching materials can create a learning environment that supports the development of students' critical thinking abilities (Jazil et al. 2025). The study extends previous research by demonstrating how PBL can be embedded directly within the instructional structure of Industrial Economics teaching materials while simultaneously incorporating higher-order cognitive tasks (Jou and Hao 2026). This provides a more integrated pedagogical approach in which learning content, learning activities, problem-solving processes, and cognitive objectives are aligned. From this perspective, the teaching material serves not simply as a repository of course content but as a pedagogical instrument that guides students through a process of identifying problems, analyzing information, evaluating alternatives, and constructing solutions.

The findings have important practical and academic implications for higher education. For lecturers, the developed teaching materials can serve as an alternative learning resource for implementing Industrial Economics learning that is more problem-oriented, interactive, and focused on higher-order cognitive processes. For curriculum and teaching-material developers, the findings suggest that the quality of instructional materials should not be evaluated solely on the basis of content accuracy, completeness, and attractiveness, but also on their ability to stimulate analysis, evaluation, reasoning, and problem solving. Academically, the findings reinforce the importance of aligning teaching materials, learning models, and cognitive learning objectives so that the instructional process does not remain focused on knowledge acquisition but also develops students' ability to use knowledge critically. Nevertheless, further research is needed to examine the effectiveness of the developed materials across different universities, student characteristics, and Industrial Economics topics. Future studies could employ larger samples, longer intervention periods, comparative experimental designs, and additional measures of critical thinking to determine the durability of the observed effects and the extent to which the skills developed through the teaching materials can be transferred to students' ability to analyze authentic industrial and economic problems.

KESIMPULAN

The development of Industrial Economics instructional materials on Structure-Conduct-Performance (SCP) analysis demonstrates that integrating Problem-Based Learning (PBL) with Higher-Order Thinking Skills (HOTS) can provide a more meaningful learning framework for economics students. The developed materials incorporate contextual problems, analytical tasks, investigation activities, discussion, presentation, and reflection, enabling students to engage more actively with industrial-economic issues and apply theoretical concepts to problem-solving situations. The feasibility assessment confirms that the instructional materials meet the requirements for classroom use. Expert validation, media assessment, and student responses consistently produced very high scores across content, language, presentation, and visual design components. Minor revisions concerning language consistency, numbering, image sources, color composition, font size, and text positioning further improved the quality of the final product. These findings indicate that the materials are not only substantively appropriate but also sufficiently accessible and attractive for students. The effectiveness results provide further evidence of the value of the developed materials. Students' conceptual mastery increased substantially, with the mean score rising from 28.24 in the pretest to 88.87 in the posttest and an N-Gain score of 0.87, categorized as high. Classical learning completeness reached 88%, exceeding the predetermined target of 75%. Student learning activities also achieved a very good average score of 3.87, indicating active engagement throughout the learning process.

The most important contribution of the developed materials concerns the improvement of students' HOTS. Critical thinking increased from a pretest average of 18.23% to 89.03% in the

posttest, accompanied by a high N-Gain score of 0.92. Creative thinking similarly increased from 24.43% to 91.10%, with an N-Gain score of 0.92. The paired-sample t-test results showed statistically significant differences in both critical and creative thinking performance before and after implementation. These findings demonstrate that the integration of PBL and HOTS into Industrial Economics instructional materials can strengthen students' ability to analyse problems, evaluate information, generate alternatives, and formulate solutions. Overall, the developed instructional materials represent a feasible and effective learning resource for Industrial Economics education, particularly for SCP analysis. Their contribution extends beyond improving conceptual achievement by creating learning experiences that foster analytical, critical, creative, and problem-solving capacities. The findings therefore support the use of problem-oriented and HOTS-based instructional materials as an alternative approach to strengthening higher-order competencies in economics education. The findings suggest several implications for further development and implementation. Lecturers teaching Industrial Economics are encouraged to develop complementary instructional materials covering other topics in accordance with the course learning plan (RPS), while maintaining the integration of contextual problems and HOTS-oriented activities. Further refinement of the developed materials is also recommended. Future development can expand the product into digital or interactive formats and incorporate broader applications of PBL and Project-Based Learning (PjBL). Subsequent studies may involve larger and more diverse samples, longer implementation periods, and comparative research designs to examine the sustainability of learning effects and the transferability of the materials to other economics courses and educational contexts.

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