Development of Problem-Based Learning Based Higher Order Thinking Skill (HOTS) Teaching Materials to Improve Student Critical Thinking Ability in Industrial Economics Course At Unimed Faculty of Economics

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Abstract. The development of Problem-Based Learning-based Teaching Materials (HOTS) is extremely much required in increasing the critical reasoning and thinking skills of students taking Industrial Economics courses at the Faculty of Economics, Unimed. The goal of this study is to examine the design specification problem of HOTS teaching materials based on Problem Based Learning in Industrial Economics courses so that they can enhance pupils' capacity for critical thought in the Department of Economics FE Unimed and test the feasibility and attractiveness of HOTS teaching materials based on Problem Based Learning in Industrial Economics courses so that can be able to improve students critical thinking in the Department of Economics FE Unimed. The approach taken in this investigation is a type of research and development (RnD) which uses quantitative research referring to The ADDIE paradigm, customized to meet the demands of research. An expert validation was employed by the data collection device of questionnaire, a lecturer response questionnaire and a student response questionnaire. The results of the development of this research include- (1) The product results of HOTS Teaching Materials are problem-based learning which can be applied as a source of student learning. (2) Based on the findings of the validation and trials, this product has been shown to be both feasible to use and appealing. (3) This product is successful in increasing students critical thinking, by applying Pretest and Post-test assessments which have been processed getting a significance value of 0.000 using the Paired Simple t Test method, which means that Ho is rejected and there is a significant difference between before and after using Teaching Materials (HOTS) Based on Problem Based Learning to Enhance Critical Thinking of students at FE Unimed

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

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1 Introduction

One of the skills that is prioritized for graduating students in each lesson is displaying reasoning, judgment, analysis, creativity, diligence, and attention to detail; being accountable, receptive, and persistent in problem-solving. Higher Order Thinking Skills or commonly abbreviated as the process of thinking at a higher cognitive level with pupils using different existing cognitive concepts and methods and learning taxonomies, like problem solving, is known as HOTS. Bloom Original (1956), and Bloom's revision Anderson & Krathwohl [1]. HOTS is the result of developing previous concepts and methods which comprise the capacity for problem-solving, critical thinking, creative thinking, reasoning, and decision-making.

The main aim of HOTS is ways to raise students' critical thinking skills, particularly in areas like receiving different kinds of information and applying that knowledge to solve problems creatively, constructing explanations and arguing persuasively, and making decisions in difficult circumstances. Students should be able to pick up new skills through HOTS and successfully apply them to novel settings. These skills are undoubtedly necessary for the younger generation to deal with the unpredictable job dynamics of the industry 4.0 era. Because diverse human origins and a range of problem kinds necessitate easy adaptation, the HOTS capacity is highly supportive.

The enactment of the 2013 curriculum and even the independent curriculum should have directed learning to focus on HOTS. Minister of Education and Culture Regulation No. 22 of 2016 concerning content standards explains 14 learning principles, some of which lead to HOTS learning. The principles of learning according to Permendikub No. 22 of 2016 which are in line with HOTS-laden learning are: learners have transitioned from receiving information from teachers to acquiring knowledge through a variety of learning resources; they have also gone from relying solely on teachers to learning from a textual approach, from competency-based learning to content-based learning, from partial to integrated learning, and from emphasizing a single answer to learning with multifaceted truths.

However, in reality the educational practices that occur still do not fully implement these learning principles. Low Order Thinking Skills (LOTS) are still a major component of the education that is being taught in schools. Learning still focuses on memorization, recall, and basic comprehension. Nowadays, people's lives require more learning than that. People need to be able to live in society, and since society's issues are becoming more complicated, education that prepares pupils for society's survival is necessary. Learning containing LOTS must change and lead to learning containing HOTS.

One way that can be used to direct learning is towards activities that contain HOTS. The National Competency Training Center in Prastowo, 2007, explains "teaching materials are all forms of materials used to assist teachers or instructors in carrying out the learning process in class, these materials can be written or unwritten materials"[2]. Preparing instructional materials with HOTS is essential when the aim is learning that leads to higher order thinking abilities. Octavian, determined that the produced themed teaching resources were effective for

instruction. [3]. Meanwhile, Pambudhi and Retnowati, through the instructional resources in the form of modules they developed were able to direct students to have a nationalistic character. Reflecting on the results of this research. Teaching resources loaded with HOTS are an alternative for teaching students to cultivate advanced cognitive abilities [4]

On the basis of the above, the main problem in The development of higher order thinking skills is the focus of this research (HOTS) teaching materials based on problem base enhancing students' critical thinking skills abilities in industrial economics courses at the Unimed Faculty of Economics. with the formulation of problems being: How viable is it? and effectiveness of HOTS teaching materials based on Problem Based Learning in the Industrial Economics Course so that It can enhance pupils' capacity for critical thought in the Unimed FE Economics Department?

2. Literature Review

In the context of teaching materials, development has several meanings. One of them is according to Tomlinson, who states " Anything that writers, educators, or students do to offer sources of language input and to utilize those sources in ways that optimize the possibility of intake is referred to as materials development: Simply said, the provision of knowledge and/or exposure to the language in methods intended to support language acquisition [5]. Meanwhile, the teaching-learning materials are defined as the means by which the required instructional content is presented and transmitted by Busljeta[6]. According to Grave, developing teaching materials can mean creating, selecting or modifying and setting up instructional materials and learning exercises to help students reach objectives that will enable them to reach objectives in the future. [7].

In this research, the creation of instructional resources was completed for industrial economics courses. What is meant by industrial economics are several definitions, including 1. Schmalensee state that Industrial economics is the study of the economy from the supply side, especially about markets in which business companies act as sellers [8], 2. Church &Ware [9]: Industrial organization of science that examines how imperfectly competitive market function, how businesses behave in them, and how they perform. 3. Luis Cabral [10] Industrial organization is a study concerned with the workings of industrial markets, especially the way companies compete with each other. 4. Stigler [11] Industrial Organization is a study that aims to understand the structure and behaviour of industry in an economy, relating to the size and causes of the structure of companies (whether single or several companies, concentrated or not), the influence of the level of concentration on competition, the influence of competition on prices, investment, innovation, etc.

Considering that the problems that arise today are increasingly complex, all students are a prerequisite for possessing high-order cognitive abilities or higher orders thinking skill (HOTS), because thinking at a higher level in the correct context teaches students the habit of thinking deeply, the habit of living life with an intelligent, balanced and accountable approach, in order for students to face and solve problems or issues in everyday life which are becoming more complex day by day along with advances in science and technology[12]. Therefore, in

this research, the development of industrial economics teaching materials is directed at texts that include all HOTS elements, so that the teaching materials developed are based on problem-based learning.

Nowadays, various studies on HOTS are increasingly being carried out and of course according to certain skills or subjects, including Dinni, Husna Nur [13], Winarno, Sunarno and Sarwanto [14], Sofyan, Ali F. [15]. Hasyim, Maylita, Febrika K.A [16], Basic research in the field of HOTS generally tries to define HOTS and determine HOTS criteria based on students' education level, HOTS conception, and mapping of human thinking patterns which are required to always think critically**.**

Student HOTS in this study was measured in 2 (two) aspects, specifically the ability to think critically and creatively. The ability to think clearly is one of the most important things in overcoming obstacles in life. These qualities include the capacity for critical and creative thought as well as problem-solving techniques. [17].

3. Research Methods

The research carried out is research and development (R&D) which intends to produce certain products and evaluate each one's efficacy or test the effectiveness of these products. The development model the five steps of the analyses, designs, development, implementations, and evaluations are done using the ADDIE model. The learning planning process is broken down into multiple parts by the ADDIE model, which employs a systems approach. These steps are then arranged logically into sequences, with the output of each step serving as the input for the subsequent step. [18]

The product developed is HOTS-based Industrial Economics teaching materials developed in this research consisting of modules and case studies. The test time for developing teaching materials will be carried out in the odd semester of the 2023/2024 academic year and is limited to the topic. One of the materials discussed in industrial economics is Structure Conduct Performance (SCP) analysis in order to obtain empirical evidence of the relationship between market structure in industry (Structure), behaviour (Conduct), as well as company performance in an industry as part of Industrial Economics teaching materials. The research location is in the Department of Economics, FE Unimed, with research subjects namely students taking Industrial Economics courses consisting of 2 classes with the number of samples taken being 50 students. The data collection technique in this research is using questionnaires and test instruments.

In the first stage, problem analysis was carried out in industrial economics learning related to teaching materials on the topic of Structure Conduct Performance (SCP) analysis. At this analysis stage, the teaching materials used are analysed regarding their correlation with indicators of achieving high-level thinking skills (HOTS).

During the second phase, the creation of instructional materials was carried out involving several applications such as Microsoft Office and Canva.

In the third stage, the procedure for creating educational resources is completed by media and material professionals, using a questionnaire validation instrument.

In the fourth stage, the implementation process is carried out, namely by using pre-test and post-test instruments to gauge achievement results.

In the final stage, the process of evaluating teaching materials is carried out using a questionnaire regarding the responses of economics lecturers and students' responses to teaching materials, sub-analysis of Structure Conduct Performance (SCP).

4. Results and Discussion

4.1 Results

Results and discussion in studies examining the evolution of industrial economics learning teaching materials with the sub-topic Structure Conduct Performance (SCP) analysis applying the HOTS integrated PBL model to optimize high-level thinking skills including the characteristics, feasibility and efficacy of instructional resources, as well as the achievement of students' high-level thinking skills.

Characteristics of instructional resources or teaching materials

First, the teaching materials developed in this research are characterized by the Problem Based Learning model. This means that the teaching materials on the topics studied based on the development results have been prepared in such a way that they are in accordance with the syntax of the Problem Based Learning model, including 5 (five) stages. These five stages are a needs analysis process for the teaching materials to be developed.

The first stage, namely student orientation, is presented with phenomena or examples related to Structure Conduct Performance (SCP) analysis in order to obtain empirical evidence of the relationship between market structure in industry (Structure), behaviour (Conduct), and performance (Performance) of companies in an industry and students are invited to actively think critically and creatively, express opinions on questions given by the lecturer regarding the authentic phenomena presented.

The second stage, namely organizing students, in which case various more in-depth questions are presented regarding authentic phenomena or examples in the first stage, directed towards the main material that is integrated with the SCP concept.

The third stage, namely carrying out a guiding process in individual and group investigations, by presenting basic tasks and/or procedures integrated with industrial market structure analysis problems which always involve the SCP concept to further foster the spirit of critical thinking and creative thinking in students.

The fourth stage, namely developing and presenting the results, where in the presentation various questions related to the discussion material are presented with the aim of clarifying the report on the results of the discussion which allows students to plan and prepare better and clearer reports, documentation, or models, and share assignments with fellow friends.

The final stage, namely the fifth stage, is carried out by analysing and evaluating the process and results of problem solving, then presenting a reflection or evaluation of the process and results of the student's investigation.

Second, the teaching materials resulting from the development of HOTS integrated characteristics in the SCP analysis concept are adapted to the characteristics of students who are prepared to be able to think critically, think creatively, be able to collaborate and be able to communicate. Based on student characteristics, the Problem Based Learning approach is the basis that will be developed.

Third, material analysis was carried out which was directed at materials with teaching materials that integrated HOTS.

Starting from the above, the design stage of the teaching materials was carried out, where the teaching materials are described in table 1 below:

Table 1. Outline of developed teaching materials

Teaching Materials Section	Description
The introduction	generally contains a brief description of the material information that will be described in the module, the relationship with previous material, outlining the objectives, media (if necessary), the time needed to study the module, motivation/encouragement for learning and so on.
The core module	generally consists of several learning fragments/activities which contain specific objectives, material descriptions, examples, illustrations, tables, diagrams, exercises and feedback.
The closing	usually contains a summary or conclusion, an explanation regarding the previous material, as well as a test that must be taken by students

Source: Questionnaire, 2023

Development Stage

This research and development produced a product in the form of teaching materials containing HOTS-based Industrial Economics teaching materials in accordance with 21st century demands.

a. Product Development

   Product development is carried out using criteria that include content coverage, presentation, readability and graphics.

b. Product Validation Test

   Assessment of the suitability of the developed teaching materials by the validator goes through 2 (two) stages including aspects of material/content suitability, readability/language suitability and appearance/presentation suitability. Phase I validation showed that all items in the assessment instrument received a positive response (Yes/Yes), meaning that they had fulfilled all the content and presentation aspects required in the preparation of teaching materials. The developed teaching materials that have passed stage I are reassessed in more depth in stage II validation, including aspects of

appropriateness of content, language and presentation. The results of the stage II assessment by the validator are presented in Table 2 which are then compared with the assessment criteria according to BSNP (2010).

Table 2. Recapitulation of Phase II Validation by Validator

No	Validation Validator	Average Percentage Score (%)	Criteria
1	Content Aspect	90,20	Very Eligible
2	Language Aspects	88,50	Very Eligible
3	Serving Aspects	92,00	Very Eligible

Source: Questionnaire, 2023

Based on the validation results above, the results of the design for developing teaching materials in draft 1 were declared very feasible, but several revisions were still made to draft 2, before being tested on a small-scale trial based on validator input.

In the small-scale trial, the results obtained were as shown in Table 3. The results of the small-scale trial were used to revise and refine the teaching materials resulting from the development design in draft 2 into draft 3 for further use in large-scale trials.

Table 3. Recapitulation of Phase II Validation by Validator

No	Validation Validator	Average Percentage Score (%)	Criteri
1	Aspect Content	94,10	Very Eligible
2	Language Aspects	100,00	Very Eligible
3	Serving Aspects	98,00	Very Eligible

Source: Questionnaire, 2023

Based on the results of small-scale trials in Table 3, it can be said that the results of the design for developing teaching materials in draft 2 were declared positive, but several revisions were still made based on student input, namely correcting typing and numbering errors, as well as adding data sources to several images.

Based on the results of the development of Industrial Economics teaching materials with the Structure Conduct Performance (SCP) analysis sub-discussion which was validated by two media experts, it can be shown in Table 4.

Table 4. Media Validation Results for Industrial Economics Teaching Materials

No	Assessment Aspect	Mean Percentage Score (%)	Criteria
1	Leather Design (Cover)	92,30	Very Worth It
2	Designs Contents	90,89	Very Worth It

Source: Questionnaire, 2023

Based on Table 4, it shows the average percentage results that fall into the very feasible category. However, several revisions are still being made regarding color design, letter size and letter position to make it attractive to students.

Textbook Effectiveness

Testing the effectiveness of the developed teaching materials was carried out on a large scale trial, using pre-test and post-test, to find out how much students' initial understanding of the concept of Industrial Economics material with the sub Structure Conduct Performance (SCP) before and after learning using the resulting teaching materials. development.

The pre-test and post-test questions consist of 15 multiple choice questions which have been tested and the items analysed from the aspects of validity, reliability, differentiability of questions and level of difficulty of the questions. The average score obtained from the pretest and post-test results for student mastery of concepts can be seen in Table 5.

Table 5. Test results of Student Concept Mastery Test

Values	Pre-Test		Post Test	
	% Values	Criteria	%Values	Criteria
Minimum value	15	Less	87	Optimal
Maximum Value	40	Less	100	Optimal
Average Value	28,24	Less	88,87	Optimal

Source: Questionnaire, 2023

The completeness of student learning in the knowledge aspect of industrial economics courses with SCP analysis material using teaching materials developed in this research is based on the achievement of pre-test scores and final scores in the form of a combination of assignment and post-test scores. The standard achievement score for Unimed students in this research was increased to 85.

The pre-test results showed that not a single student was declared to have completed their studies, while the final post-test scores obtained showed that 38 students were declared to have completed their studies. The classical learning completeness score was 88%, exceeding the research target of 75% and included in the very good criteria.

The N-Gain analysis in Table 5 shows that there is an increase in student learning outcomes in the knowledge aspect of 0.87 and is included in the high category. This proves that the developed teaching materials are effectively used by Unimed FE Economics Department students in improving student learning outcomes in the knowledge aspect.

The results of the pre-test and the final score for students' concept mastery were tested using a t test using a paired sample t test with the SPSS program. The results of the paired sample t test show that the significance is <0.05, meaning that Ho is rejected and H1 is accepted, so it can be concluded that there is a significant difference in the results of students' concept mastery tests before and after using the developed teaching materials.

The second test of the effectiveness of the teaching materials resulting from the development is based on observations of learning outcomes in aspects of student attitudes. The total average

score for student activity in the attitude aspect was 3.87 and was included in the very good criteria, and there was an increase in each indicator of student activity in each lesson after using the developed Industrial Economics teaching materials.

This research is in keeping with the findings of the study carried out by Fachri Nurhidayat, Ari Saptono and Herlitah [19] which stated that the viability of economic problem-based learning (PBL) e-modules; will be able to determine the disparity in students' critical thinking skills between those who utilize and those who do not; in his research, he employs development design from ADDIE for research and development (R&D) methods.Achievement of Higher Order Thinking Skills.

Student HOTS in this study was measured in 2 (two) aspects, namely critical thinking skills and creative thinking skills, where measurements were carried out through test instruments and observations carried out in class as well as through mini research assignments. HOTS pre-test and post-test to find out how much HOTS students have regarding the SCP Analysis material before and after SCP learning using the developed teaching materials. The pretest and post test questions consist of 5 (seven) essay questions which have been tested and the items analysed from the aspects of validity, reliability, differentiability of questions and level of difficulty of the questions. The average score obtained from the pre-test and post-test results of students' critical thinking skills can be seen in Table 6.

Table 6. Results of the Student Critical Thinking Skills Test

No	Indicator	Pre-Test		Post Test	
		% Value	criteria	%Value	Criteria
1	Focusing questions	25,26	Less	90,23	Ideal
2	Analysing arguments	27,76	Less	92,54	Ideal
3	Asking and answering questions	20,55	Less	97,56	Ideal
4	Considering whether the source is trustworthy or not	15,83	Less	88,40	Ideal
5	Deducing and considering the results of the deduction	9,76	Less	87,89	Ideal
6	Inducing and considering the results of induction	26,90	Less	97,30	Ideal
7	Create and determine the results of considerations from the model developed	18,99	Less	81,90	Ideal
8	Define terms and consider definitions	21,25	Less	84,88	Ideal
9	Identifying assumptions	8,90	Less	86,15	Ideal
10	Determining an action	13,76	Less	83,50	Ideal
11	Case Settlement	11,65	Less	89,00	Ideal
Average		18,23	Less	89,03	Ideal

Source: Questionnaire, 2023

Based on the pre-test and post-test results in Table 6, it shows that the average value of students' critical thinking skills is 89.46 and is at optimal criteria. On the other hand, from the

N-Gain calculations, it was also found that the average student was able to show an increase in critical thinking skills of 0.92, which is included in the high category.

On the other hand, based on the t test calculation using a paired sample t test processed with SPSS, it shows a significance level of <0.05, indicating that H1 is approved while Ho is denied. The conclusion from the paired sample t test analysis shows that The findings of students' critical thinking abilities before and after using the created teaching materials show a notable difference.

Meanwhile, the average score obtained from the pre-test and post-test results of students' creative thinking skills can be seen in Table 7.

Table 7. Findings from Students' Creative Thinking Tests

No	Indicator	Pre-Test		Post Test	
		% Value	criteria	% Nilai	Kriteria
1	Fluency	24,56	Less	92,33	Optimal
2	Flexibility	25,36	Less	90,85	Optimal
3	Originality	23,65	Less	95,75	Optimal
4	Elaboration	24,15	Less	85,50	Optimal
Average		24,43	Less	91,10	Optimal

Source: Questionnaire, 2023

The pre-test and post-test results in Table 7 show that the average score for students' creative thinking skills is 91.10 and is at the optimal criteria. The results of the N-Gain analysis also show that the increase in students' creative thinking skills was 0.92 and is included in the high category. The results of the paired sample t test showed a significance of <0.05, meaning that Ho was rejected and H1 was accepted, so it was concluded that there was a significant difference in the results of students' creative thinking skills before and after using the developed teaching materials.

4.2 Discussion

Industrial Economics teaching materials using the HOTS approach based on using problem-based learning to enhance critical thinking skills, the results of the research show that the group of students who were treated using industrial economics teaching materials with the HOTS approach based on Problem Based Learning outperformed the group of students who only used traditional methods with the aid of power points or those who did not use the industrial economics teaching materials that resulted from this development. Based on the results of the posttest carried out, the average posttest score in classes that used teaching materials resulting from the development of this model was higher than those that did not. The difference in students' critical thinking abilities after using this teaching material shows that 0.000<0.05 is the asymptotic significance level (2-tailed). This demonstrates the variations in students' critical thinking abilities before and after using the teaching materials resulting from the development of this model. Given that industrial economics teaching materials are made to support and aid students in learning and reaching learning objectives, it is clear from the

description above that using these resources to teach students has an effect on their process of learning outcomes.

Considering the explanation of the research results above, it can be seen that learning by using industrial economics teaching materials with the HOTS approach based on problem based learning actually affects pupils. This is because teaching materials are designed to facilitate and help students understand concepts and cases related to industrial economics so that they can achieve learning objectives. Apart from that, the use of teaching materials also makes learning interesting and interactive. According to Abidin and Walida, e-modules are instructional materials that can facilitate students' autonomous learning since they are thoroughly, understandably, and engagingly created, Abidin & Walida [20]. This demonstrates that using optimally developed teaching materials can provide good learning for students because case-based teaching materials are more interesting, interactive and enable students to enhance their capacity for critical and creative thought as well as their ability to carry out optimal collaboration to solve various problems because teaching materials are furnished with instructional materials to facilitate students' learning. Apart from that, the role of this teaching material It is impossible to isolate the role of the learning model contained in the teaching material, specifically, problem-based learning. Savery claims that by combining learned theory and practice with problem-solving techniques, problem-based learning can motivate students to carry out study and find solutions.[21]. Consistent with the aforementioned assertion, Nafiyah highlighted that problem-based learning is an instructional approach that use authentic situations as the backdrop for student comprehension, from which students acquire the skills of problem-solving and critical thinking [22]. This explanation leads to the conclusion that students' critical thinking skills can be enhanced by industrial economics teaching materials created with the HOTS approach, which is focused on problem-based learning.

5. Conclusion and Recommendations

Considering the analysis of research results and discussion, the following conclusions can be drawn that industrial Economics Teaching Materials with the subject of Structure-Conduct and Performance Analysis developed for Unimed FE Economics Department students with the characteristics of employing a model of problem-based learning that is integrated with the concept of HOTS material containing indicators of high-level thinking skillsself-sufficient, independent, flexible, intuitive, and self-taught. The developed teaching materials are suitable for use by Unimed FE Economics Department students, based on the results of the validator assessment and positive student responses. The teaching materials resulting from the development are effectively used by students from the Department of Economics, FE Unimed, as evidenced by the knowledge-related learning objectives of pupils who attain standard scores higher than the designated completeness, in addition to the learning objectives of students from the attitude aspect including very good criteria and considering the academic achievements of the students in the aspect during discussion also falls into very good criteria. The developed teaching materials can optimize student HOTS for the Unimed FE Economics Department, as The percentage of students' critical and creative thinking skills activities falls into the ideal category, as demonstrated by the average N-Gain of their critical and creative

thinking skills assessments, both of which are in the high category. outcomes of large-scale trials on positive criteria and small-scale trials on student response surveys.

Recommendations that can be put forward According to the conducted research, the following have been identified: (a) There is a need to develop teaching materials or other forms of teaching materials for Industrial Economics learning by lecturers in Industrial Economics courses for all industrial economics material in accordance with the RPS developed, (b) The results of this research show positive results, but the developed Industrial Economics learning materials or educational resources still need to be refined and developed further, to raise the standard of instruction in education. improving the quality of learning and being able to provide input for developing more innovative and creative Industrial Economics learning materials based on problem-based learning (PBL) and project based learning (PjBL).

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