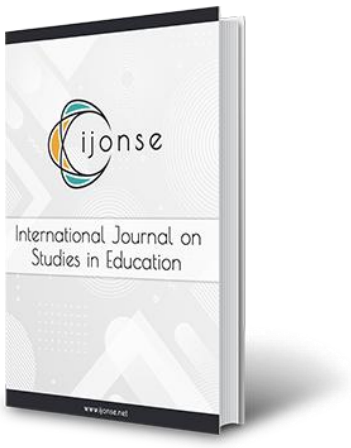

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Efforts to Improve Higher Order Thinking Skills (HOTS) through the Role of Problem-Based Learning (PBL)

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Abstract

Improving Higher Order Thinking Skills (HOTS) is one of the main focuses in vocational education to prepare students to face complex industry challenges in the world of work. This study aims to analyze efforts to improve HOTS through the application of the Problem Based Learning method at SMA Negeri 19 Surabaya. The research method used is Classroom Action Research (PTK) by going through several cycles and implementing the Problem Based Learning method in the learning process. Data were collected through observations, interviews, and HOTS tests before and after the implementation of Problem Based Learning. The results of the study were carried out over two cycles and showed that the application of Problem Based Learning significantly increased the HOTS ability of students from before implementing Problem Based Learning to obtain a score of 65 and after implementing Problem Based Learning to obtain a score of 80, especially HOTS in the aspects of analysis, synthesis, and evaluation. The conclusion of this study is that Problem Based Learning is effective as a learning strategy to improve HOTS at SMA Negeri 19 Surabaya and is recommended to be implemented more widely in the vocational education curriculum at the Vocational High School (SMA) level.

Introduction

Higher Order Thinking Skills (HOTS) are a person's higher-level cognitive abilities that involve analytical thinking, synthesis, and evaluation which are very important in preparing a person, especially a student, to face challenges in an increasingly complex world of work. With these Higher Order Thinking Skills, students will be able to distinguish ideas clearly, solve problems with good arguments, construct explanations through hypotheses and understand complex things more clearly. In the era of globalization and rapid technological development, the need for a workforce that not only has technical knowledge but also the ability to think critically and creatively is increasing. Because the world of work is increasingly dynamic by keeping up with the times, which requires creative things, which can attract consumers. High-level thinking in the bloom taxonomy is a dimension of cognitive processes from low to high levels, students process in their way of thinking to solve a problem both at the level of education and in their respective lives. It is very important for learners to receive HOTS training. This training can support and facilitate high-level learning of students. Higher-order thinking activities are also a great way to help children develop deeper, more critical thinking skills that will help them make judgments and provide

appropriate answers. HOTS is a way of thinking that goes beyond just remembering and repeating knowledge (Pia, 2021). Higher Order Thinking Skills (HOTS) is a concept introduced by Bloom in Bloom's Taxonomy, which includes higher-order thinking skills such as analysis, synthesis, and evaluation. HOTS is important in education because it allows learners to not only recall information but also apply, analyze, evaluate, and create new knowledge.

Thomas and Thorne in Tiwery Badseba (2019) state that thinking at a higher level than simply repeating what others say or memorizing information requires the use of higher-order thinking skills. On the other hand, Resnick, in Tiwery Badseba (2019), describes information, draws conclusions, makes representations, analyzes, and establishes relationships through the use of even the most basic mental processes. Based on the expert opinion above, it is concluded that higher-order thinking skills are a thinking process that goes beyond memorization and repetition of previously learned material, according to the theory that has been put forward above. However, higher-order thinking skills also include the capacity to evaluate, create, and adapt information and previous experience for use in problem-solving and decision-making in new situations. These skills have a direct influence on daily life.

The characteristics of HOTS according to Bloom and Anderson in Helmawati, (2019) are to categorize learning outcomes that are adjusted to graduate competency standards into three domains, namely the cognitive dimension related to mental skills and knowledge, the affective dimension related to attitudes and behaviors, and the psychomotor dimension related to physical abilities or skills. The ability of students to repeat or restate ideas or concepts that they have learned during the learning process is a component of the cognitive dimension. This process involves thinking skills, competence in knowledge acquisition, recognition, understanding, conceptualization, decision-making, and reasoning. According to Bloom, the goal of learning in the cognitive realm is to organize all learning processes into six stages, from the lowest to the highest. Remembering (C1), understanding (C2), application (C3), analysis (C4), assessment (C5), creation (C6), and analysis (C6) (Pudjisaturi. 2018).

Bloom & Kartwolh in Pudjisaturi (2018) divides the affective realm into five categories: acceptance, response, assessment, management, and characterization. He also discussed how the affective dimension relates to attitudes, values, feelings, and emotions as well as the level of acceptance or rejection of an object in learning activities. Psychomotor process ability is the ability to perform tasks involving body parts related to physical (motor) movements, including reflex, basic, perceptive, accurate, complicated, expressive, and interpretive movements. Imitation, manipulation, accuracy, articulation, and naturalization are examples of psychomotor skills (Pudjisaturi, 2018). The low-level thinking skills component of Bloom's taxonomy has three aspects: remembering, understanding, and applying. These three aspects were later perfected by Anderson and Kratwohl. However, the higher-level thinking ability section includes elements of analyzing, evaluating, and creating (Tiwery Badseba, 2019). The ability to disassemble a structure into its constituent parts and understand how the structure is structured is known as analytical skills. The main goal of this skill is to understand global concepts by dissecting or explaining their globalization into more manageable and in-depth components. The reader must recognize the logical steps taken in the reasoning process to reach a conclusion when answering analytical

questions. Operational terms such as "detailing", "diagramming", "identifying", "describing", "connecting", "detailing", and others are indicators of analytical thinking skills (Suryani, 2022).

The antithesis skill of analytical skills is the skill of synthesis. The ability to put components together to create a new shape or arrangement is known as synthesis. In order to produce new concepts that are not clearly expressed in the reading, the reader must synthesize all the knowledge they have learned from their reading material in order to answer the synthesis questions. These synthetic questions offer an opportunity to think consciously and without limits. This ability is the ability to adapt ideas into a variety of new understandings. In order for students to successfully complete the reading assignment and be able to identify many key ideas from the text, they must be able to understand the reading critically. This ability allows the reader to create a pattern of concepts. The purpose of this ability is to enable the reader to understand and apply concepts to new problems or scopes (Suryani D.N, 2022). This ability requires sophisticated reasoning when assessing the value of something using various accepted standards. To demonstrate their evaluation skills, readers must evaluate the value as determined by a set of criteria. According to Bloom's Taxonomy of Learning in, the highest level of cognitive thinking is represented by evaluative skills. At this point, learners must be able to evaluate facts or ideas by combining various cognitive processes. The indicators proposed by such specialists can be solved with the help of universal intellectual standards. Tajudin's opinion, which says that the question "to what extent learners are able to apply intellectual standards in thinking activities" can be used to measure critical thinking skills, supports this opinion. There are universal intellectual standards that need to be followed. Suryani D.N, (2022) Universall Intellectual Standards are standardization that must be applied in thinking that is used to check the quality of thinking in formulating certain problems, issues, or situations. Critical thinking must always refer to and be based on these standards.

The ability to think higher, or HOTS, is essential for teaching and learning. Critical thinking skills are very important for the learning process. A person's way of thinking affects their capacity, speed, and learning success. As a result, there is a link between certain cognitive abilities and learning. Intensive learning in thinking has a beneficial effect on students' academic progress (Ozturk, 2023; Santoso, 2020). Therefore, the development of Higher Order Thinking Skills on learning materials is a crucial aspect in education, especially in Vocational High Schools (SMA) which aims to produce graduates who are ready to work. Based on Permendikbud No. 16 of 2022 concerning Process Standards (Republic of Indonesia, 2022), one of the learning methods that is expected to shape scientific, social behavior and develop curiosity is the Problem Based Learning learning method which emphasizes problem-solving as the core of the learning process where students are required to actively find solutions to the problems given. Problem Based Learning is expected to encourage students to think critically, work together, and develop analytical and synthesis skills, all of which are components of Higher Order Thinking Skills.

Problem Based Learning (PBL) is a learning method that focuses on solving real problems that are relevant to the context of students' lives. Problem Based Learning emphasizes the active role of students in seeking information, discussing, and working together to find solutions. According to Barrows (1986), Problem Based Learning can increase students' motivation to learn and develop critical thinking skills and teamwork skills. A curriculum that emphasizes problem-based learning develops lifelong learning abilities in a critical, open-minded, reflective, and

active learning style, claims Margetson in Santoso (2020). The problem-based learning curriculum improves interpersonal, groupwork, communication, and problem-solving skills more than any other method. By starting work, learners understand concepts and acquire the ability to solve a given situation or problem through inquiry, questioning, and problem-solving. Problem-based learning, as an alternative approach, can help students in developing their critical thinking skills (Hidayati in Santoso, 2020). The learning approach known as "problem-based learning" uses issues as a stepping stone to acquire or apply new information (Savery & Duffy in Sinabang, 2020). Increasing the capacity to apply ideas to new or practical situations, integrating higher-order thinking skills (HOTS) concepts, fostering a desire to learn, and taking responsibility for one's own education and skills development are the main goals of problem-based learning (Norman and Schmidt in Pudjisaturi (2018).

The opinions of experts suggest that problem-based learning, also known as problem-based thinking, is a useful approach for teaching higher-order thinking skills. This approach makes it easier for learners to organize their knowledge about the social world and its environment and helps them process the information that is already embedded in their minds. The characteristics of Problem Based Learning are as follows: 1) Problems are the starting point of learning; 2) Problems must be relevant to the daily life of students; 3) Classes are arranged by level of difficulty; 4) Students are given great responsibility to create and manage the learning process directly; and 5) Students use small groups. 6) Students are required to produce products or give presentations to illustrate what they have learned (Rumini, 2020).

The principles of Problem Based Learning include: 1) The problems presented by teachers are authentic/real, clear, according to the development of students, in accordance with learning objectives, and there are benefits that students get, 2) Actively involving students, 3) Fostering critical reasoning and analytical power of students, 4) Educators as facilitators, 5) Building collaboration (Suyanto, 2023). The Stage of the Problem Based Learning model according to Suyanto (2023) consists of 5 stages, namely: 1) Orientation of students to problems with activities at this stage, teachers explain the learning objectives, necessary logistics, and motivate students so that in the process of solving problems they can actively participate. 2) Organizing students to learn with the teacher stages helps students in making definitions and organizing learning that is associated with the problem to be solved. 3) Individual/group guidance with the stages of students collecting relevant information, as well as carrying out practicum activities in order to solve problems given by the teacher. 4) Development and presentation of the work with this stage students are assisted and guided by the teacher in developing and preparing the results of problem solving. 5) Analysis and evaluation of the process with the stages of students being guided to reflect on the work/investigation and processes that have been carried out.

The Problem Based Learning model has advantages, namely 1) students' problem-solving activities can awaken critical thinking skills. 2) Increasing student activities in the learning process and 3) Students have the opportunity to apply their knowledge to the real world (Daher & Anabousy, 2020; Rézio et al., 2023; Royantoro et al., 2018). The Problem Based Learning paradigm has the following benefits: Students' problem-solving exercises can foster critical thinking skills, students have the opportunity to apply their knowledge to the real world, which increases students' participation in the learning process. (Rumini, 2020). Previous research has shown that the application of Problem Based Learning can increase students' HOTS at various levels of education. For example, research by

Hmelo-Silver (2004) shows that Problem Based Learning is effective in improving students' critical and creative thinking skills. At the high school level, Problem Based Learning can be adapted to the vocational context to provide a more relevant and applicable learning experience.In addition, in the context of vocational education, Problem Based Learning allows students to associate theory with direct practice, thereby strengthening the understanding and application of knowledge. This approach also encourages students to become more independent in learning, improve communication skills, and problem-solving skills systematically.SMA Negeri 19 Surabaya as one of the vocational education institutions in the city of Surabaya has a strategic role in producing a competent workforce. However, the challenge of developing HOTS among students in the learning program is still a major concern. Especially in the Visual Communication Design vocational program, where students need to have critical thinking skills in analysis, synthesis and evaluation in order to produce products that suit consumer needs. This study aims to evaluate the effectiveness of the implementation of Problem Based Learning in improving the Higher Order Thinking Skills of students at SMA Negeri 19 Surabaya, as well as provide strategic recommendations for improving the quality of vocational education.

Method

Research Methods, Design and Instruments

The Classroom Action Research Methodology (PTK) used in this study was made by Kemmis and McTaggart. Classroom Action Research consists of several cycles that include preparation, implementation, assessment, and introspection. Students from certain vocational classes, namely the Visual Communication Design (DKV) program class conducted at SMA Negeri 19 Surabaya, are the subjects for this study. There are two research cycles in this study, with four research stages in each cycle. The Stephen Kemmis and Robyn McTaggart models were used to carry out the phases of Classroom Action Research.

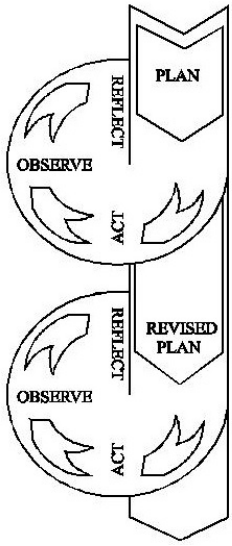

Figure 1. Research Model of PTK Stephen Kemmis and Robyn Mc Taggart in (Arief.Z. A, 2014).

This research was carried out in two cycles, each cycle consisting of four stages, namely planning, acting, observation, and reflecting. At the planning stage, a learning plan and learning strategies used in project-based

learning are prepared. The planned learning plan is practiced at the action stage, while the data collected is in the form of learning outcomes and the division of student discussion groups. The learning implementation approach uses the observation stage to observe the learning process. Then the researcher observed the group discussion process and assessed the learning outcomes of students at the reflection stage to find out the improvement of students' HOTS skills. The Problem Based Learning method is applied in the learning process during a certain period, with adjustments based on the results of reflection in each cycle.

Data is collected through by Observation, observing the the learning process during the implementation of Problem Based Learning. Interviews, conduct interviews with teachers and students to get their perception of the application of Problem Based Learning. And HOTS Test, Measure students' HOTS abilities before and after the implementation of Problem Based Learning. The test is designed based on the high-level Bloom Taxonomy, including analysis, synthesis, and evaluation questions.

Population, Sample and Data Analysis Techniques

The research population is all students of SMA Negeri 19 Surabaya in certain skill programs, for example Computer and Network Engineering. The sample was taken purposively, consisting of two classes selected for each research cycle with the Visual Communication Design vocational program. Where each class consists of 30 students.Quantitative data were analyzed descriptively and comparatively to see changes in HOTS scores before and after the implementation of Problem Based Learning. Qualitative data from observations and interviews are analyzed thematically to support quantitative findings and provide an in-depth understanding of the process of applying Problem Based Learning.

Results

A deliberate and organized effort to help learners develop their skills, which are expected to benefit others as well as society, the country, and the nation, is what is known as education (Amalia et al., 2023). Because student involvement has a big impact on children's success in learning, teachers play an important role in the learning environment (Handayani et al., 2023). Problem-Based Learning is a type of learning strategy that aims to help students develop higher-level thinking skills. The application of the PROBLEM BASED LEARNING learning approach at SMA Negeri 19 Surabaya to improve Higher Level Thinking Skills (HOTS) is discussed in this study. The steps that need to be understood by a teacher to ensure that the learning objectives are appropriate and consistent with expectations, as expressed by Pudjisaturi (2018) as conveyed by the five steps of the problem-based learning model, namely.

Table 1. Steps of the Problem Based Learning Learning Model

Phase	Teacher Activities	Student Activities
Students' views on the problem	The problem to be solved in the group is communicated by the teacher. The issues	The group observes and understands the problems that the instructor has presented

Phase	Teacher Activities	Student Activities
	raised must be relevant. Students can identify problems on their own by using reading materials or worksheets.	or that they have learned from the recommended reading material.
Setting up classrooms for learning	Teachers make sure that everyone is aware of their responsibilities.	Students collaborate and divide work to find the information, supplies, and equipment needed to solve problems.
Guiding individual and group investigations	Teachers help students gather information or resources for their investigation.	Students research topics (find information, sources, and references) for group discussion material.
Creating and exhibiting work products	To ensure that each group's work is ready for presentation, the teacher supervises the discussion and directs the writing of the report.	The group discusses to find solutions to problems, and the final product is exhibited or provided in the form of works.
Analyze and evaluate the problem-solving process	Teachers facilitate presentations and encourage groups to provide feedback and appreciation to other groups. The instructor and students conclude the material.	After each group made a presentation, the other group thanked them. The next step in this activity is to summarize or draw conclusions based on feedback from other groups.

Results of Cycle I Implementation

The implementation of Cycle I at SMA Negeri 19 Surabaya involves the stages of planning, implementation, observation and reflection.

Planning

Planning involves a number of activities, such as: First, making a Learning Implementation Plan (RPP). Teachers use the lesson plan as a guideline to plan the learning process that will be delivered in their learning class. The second step, in the learning process, is the selection of teaching materials that are appropriate and in accordance with the characteristics of students and the environment, and the teacher chooses based on what will be taught to

students. Third, Creating Problem Based Learning Scenarios: Instructors create Problem Based Learning learning scenarios that encourage students to participate in analysis, evaluation, and problem-solving related to the chosen subject. Fourth, Providing Observation Sheets or Observations: To supervise the learning process, teachers make observation sheets.

Implementation

During the initial meeting at SMA Negeri 19 Surabaya, the teacher divided the class into four groups. Each group received a question in the form of a question, which also consisted of a time limit to complete it. The group representatives then discussed the problems they faced based on the questions. Based on the results of the first cycle meeting, the group did not fully understand the problem-based learning model and how the process was, making it difficult for each group as a whole to complete the tasks given by the teacher.

It is known that several groups, especially groups I, II, and IV, are able to do their assignments well based on the results of observations made during the learning process starting from the beginning of the discussion to the presentation of the students. Only group III had difficulty in completing the task, while group I followed the procedure in the problem-based learning model and successfully completed it.The results of cycle I The second meeting showed that the teacher opened the lesson, explained the learning objectives, explained the material, gave questions and gave directions to students to answer the questions. After the learning process of the second meeting ended, each group was instructed to collaborate in their group to find solutions based on the content of the given problem.

Observation

After observing the behavior of students during the learning process, the teacher tries to provide a stimulus to raise HOT questions. Students try to answer questions on their own. The total average result of students is 60 based on the results of the Cycle I test.

Table 2. HOTS Analysis Cycle I

Learner Values	Frequency	Category
95	1	Excellent
80	7	Good
65	14	Enough
50	7	Less
35	1	Very Less

The HOTS analysis table of Cycle I displays the scores of students with varying frequencies. Students who obtained a student score of 95 with a frequency of 1 (3.3%) were included in the very good category, while students who obtained a score of 80 with a frequency of 7 (23.3%) were included in the good category, namely being able to obtain KKM, according to the results of meetings 1 and 2 at SMA Negeri 19 Surabaya, a student

score of 65 with a frequency of 14 (46.7%) included in the sufficient category, The student score of 50 with a fraction of 7 (23.3%) is included in the category of lacking, the student score of 35 with a fraction of 1 (3.3%) is included in the category of very low from the number of students of 30. Thus, the classical completeness of the first cycle of 26.7% has not reached the required classical completeness of 75%. Thus, cycle II is the next cycle that will be carried out by research.

Results of Cycle II Research

Implementation

Teachers at SMA Negeri 19 Surabaya still use project-based learning because it can inspire learners to understand how to solve difficulties in the real world and in the workplace. divided into four groups, each of which works before a representative stands up to discuss their thoughts. Three of the four groups completed their tasks well, while one group had difficulties. However, teachers reported that three groups successfully used business-based learning, including one group that was able to obtain information. Therefore, today's findings are better than the findings at the previous meeting, where three groups at SMA Negeri 19 Surabaya were considered successful in using Problem Based Learning techniques to carry out high-level thinking steps.

Observation

Based on learning outcomes that met the KKM, as many as 27 students met the requirements for student learning completeness based on the results of the Cycle II test. With a classical completeness rate of 75%, Cycle II learning has achieved an overall classical completeness percentage of 90%. There was an average increase of 15 points from Cycle I to Cycle II, with students obtaining an average score of 60 in Cycle I and an average score of 80 in Cycle II. Overall, the data shows that the Problem Based Learning approach has succeeded in improving student learning outcomes.

Table 3. HOTS Analysis Cycle I

Learner Values	Frequency	Category
95	6	Excellent
80	21	Good
65	1	Enough
50	1	Less
35	1	Very Less

Based on the analysis of the HOTS table of the second cycle, the student score of 95 with a frequency of 6 (20%) is in the very good category. Meanwhile, the range of student scores of 80 with a frequency of 21 (70) is in the good category that can achieve KKM. For the score of students in the range of 65 with a frequency of 1 (3.3%) is included in the category of adequate, the value of the range of students is 50 with a frequency of 1 (3.3%) is included in the category of less, the value of the range of students of 35 with a frequency of 1 (3.3%) is included in the category of very less than the number of students as many as 30 students. Based on the results of the above

analysis, the percentage of classical completeness from the results of cycle II was obtained of 90%.

Reflection

In each class at SMA Negeri 19 Surabaya, the goal of improving students' analytical, synthetic, and evaluative skills in using HOTS to solve problems has been achieved. The Problem Based Learning learning model still presents a number of challenges for educators. These challenges include: 1) students are often involved in self-talk during classroom explanations; 2) there are still students who make a fuss when discussing in groups; and 3) students were less involved in discussing the results of other groups even though they only asked questions to group representatives

Discussion

The results of the HOTS test showed a significant increase in the average score of students after the implementation of Problem Based Learning. Before the Problem Based Learning method was used in the learning process, the average HOTS score was 65, and after the Problem Based Learning method was implemented, it increased to 80. This increase between cycle 1 and cycle 2 shows an increase in analytical, synthesis, and evaluative skills among students. Based on field data, the ability of students in these fields has increased significantly after Problem Based Learning was introduced.

The results of observations during the implementation of Problem Based Learning showed that students were more actively involved in group discussions, able to identify problems more deeply, and more creative in finding solutions. Interviews with teachers revealed that Problem Based Learning helps students to be more involved in the learning process and increase their motivation. Students also reported that the Problem Based Learning method made them better understand the subject matter because they had to apply it in a real context. This is in line with the Problem Based Learning approach where students learn and respond to interesting and challenging topics, issues, or challenges over a long period of time to acquire information and skills. The complexity of the project will vary, but everything will be related to the fundamental idea of the world of work (Mistry et al., 2016).

Based on the HOTS analysis, Cycle I displays student scores with varying frequencies. Students who obtained a student score of 95 with a frequency of 1 (3.3%) were included in the very good category, while students who obtained a score of 80 with a frequency of 7 (23.3%) were included in the good category, namely being able to obtain KKM, according to the results of meetings 1 and 2 at SMA Negeri 19 Surabaya, a student score of 65 with a frequency of 14 (46.7%) included in the sufficient category, The student score of 50 with a fraction of 7 (23.3%) is included in the category of lacking, the student score of 35 with a fraction of 1 (3.3%) is included in the category of very low from the number of students of 30. Thus, the classical completeness of the first cycle of 26.7% has not reached the required classical completeness of 75%. Thus, cycle II is the next cycle that will be carried out by research.

Based on the analysis of the HOTS table of the second cycle, the student score of 95 with a frequency of 6 (20%)

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The results of this study are in line with the findings of Hmelo-Silver (2004) which states that Problem Based Learning is effective in improving students' critical and creative thinking skills. In the context of SMA Negeri 19 Surabaya's Visual Communication Design program, the application of Problem Based Learning provides practical benefits in connecting theory with vocational practice, so that students are better prepared to face challenges in the world of work.

The improvement of HOTS through Problem Based Learning is also supported by the improvement of teamwork and communication skills between students. This is important because in the world of work, the ability to work in a team and communicate effectively is a much-needed skill. In addition, Problem Based Learning also encourages students to become more independent in learning, which is an important aspect of their self-development.

Conclusion

This study concluded that the application of Problem Based Learning significantly increased the Higher Order Thinking Skills of students at SMA Negeri 19 Surabaya. The improvement can be seen in the ability to analyze, synthesize, and evaluate students, as well as increase in motivation and involvement in the learning process such as teamwork and establishing good communication between group members and teachers. Therefore, it is recommended that Problem Based Learning be integrated more widely in the learning curriculum in high school, especially in relevant skill programs. Further research can explore the application of Problem Based Learning in various expertise programs and other vocational education institutions to strengthen these findings.

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