

Innovative Learning in Improving High-Order Thinking Skills and Communication Skills: A Systematic Review

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Abstract: This study aimed to overview learning strategies to create learning innovation that can improve students' high-order thinking and communication skills in science learning. This research was classified as a systematic review. The data used in this study was secondary. This study's 15 secondary data sources consist of books, proceedings, and scientific articles in reputable journals. The data analysis using Miles & Huberman analysis technique. Data analysis includes data reduction, data presentation, and conclusion. The result of this study is that problem-based learning and inquiry-based instruction is learning strategies that can improve students' high-order thinking skills. The learning strategy that can improve students' communication skills is problem-based learning. High-order thinking skills and communication skills can influence each other. It was hoped that with this research, innovative learning centered on learning models and learning media could be developed so that students have high-order thinking and communication skills with good categories in future education.

Keywords: Innovative learning; High-order thinking skills; Communication skills

Introduction

The skills needed in the 21st century are closely related to high-order thinking skills, which are indispensable in preparing students to face global challenges (Bahri et al., 2021). This is supported by the research results showing that the demands of an increasingly advanced globalization era must prepare quality students, namely students who are aware of scientific literacy, have good values, good attitudes, and have high-order thinking skills (Ramlawati et al., 2014).

High-order thinking skills involve thinking students at a high cognitive level, not just memorizing and restating general information (Ichsan et al., 2019). The primary purpose of high-order thinking skills is to improve students' thinking skills at a high level, especially those related to the ability to connect, manipulate, and transform knowledge and experience that they already have for critical and creative thinking to make decisions and solve complex problems (Intan et al., 2020).

High-order thinking skills are essential for students and must be applied in various aspects of knowledge. Teachers are expected to develop students' high-order thinking skills by no longer telling students about something directly without first finding out, so students must be able to dig up information and process it (Wendy, 2013). Teachers must be able to read various phenomena, challenges, problems, and developments that exist to plan and implement a series of lessons that lead to high-order thinking skills (Boholano, 2017).

The results of an international study from the Program for International Student Assessment (PISA) show that the high-order thinking ability of Indonesian students was ranked 38 out of 40 participating countries in 2000. However, in 2006 the number of participating countries increased; Indonesia is ranked 50th out of 57 countries. Meanwhile, in 2009, Indonesia was ranked 60th out of 65 countries, and in 2012 it was rated 64th out of 65 countries. Therefore, it can be said that the high-order thinking ability of Indonesian students is still low.

High-order thinking skills can affect students' communication skills (Oktavia et al., 2020). This is in line

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with (Nielsen, 2013), who found that scientific activities are closely related to communication skills which can be the basis of scientific knowledge because communication is one of the essential elements of the nature of science. Therefore, students with high-order thinking skills and reasonable scientific inquiry have higher communication skills.

Communication is an effort to provide and convey information, thoughts, and behaviors among individuals or groups (Güven, 2013). Communication skills include verbal and non-verbal communication, message processing, listening, and responding effectively (van der Vleuten et al., 2019). Communication skills are the essential skills that individuals must master during physical development and human mental growth (Nugroho et al., 2018). Through communication, students can convey all their thoughts to others, both orally and in writing (Ayu, 2018).

Good communication skills can increase students' enthusiasm for learning and discipline in problem-solving with high-order thinking skills (Rochmawati et al., 2019). Others can easily understand students' spoken and written language. Understanding mathematical symbols, graphs, tables, and images efficiently in a study requires understanding that is part of communication skills. Therefore, to have good communication skills, students must hone themselves by transferring information to others using various forms of oral and written communication (Şenler, 2014).

Communication skills are one of the soft skills components that greatly determine a person's success, so communication skills are learned at all levels of education (Mustikawati et al., 2018). Communication skills are vital in developing superior and character human resources (Yenice et al., 2022). Communication skills can not only lead students to be capable in academic aspects. Still, they will affect various aspects of student development, one of which will make students accepted by the social environment in which they are located (Ahmad et al., 2021).

Science is a scientific discipline consisting of knowledge, activities and methods for observing and understanding nature analytically and carefully by paying attention to every existing phenomenon and connecting with other phenomena to solve problems and form new knowledge (Chutami et al., 2021; Kartini et al., 2022). Science is a product, process, and scientific attitude. Science is the primary and most important thing needed to create, manage and process objects scientifically with the help of technology, informing decision-making about socio-scientific issues so that everyone must respect the value of science (Nugraheni et al., 2020).

Based on this background, we need a learning innovation with a strategy that can integrate high-order thinking and communication skills to improve them.

Therefore, this study aimed to overview the learning innovation model that can improve students' high-order thinking and communication skills in science learning.

Method

This research is classified as library research. Library research is conducted by collecting library data, recording, and processing materials from the literature without conducting field research (Zed, 2014). Library research focuses on analyzing and answering the formulation of research problems by seeking various information about theories, laws, principles, and ideas that are then processed as research data.

The data used in this study is secondary data. Secondary data is not obtained from direct observation by applying the documentation method. There were 15 secondary data sources in this study consisting of books, proceedings, and scientific articles in reputable journals, which were accessed on databases such as <https://scholar.google.co.id>, <https://doaj.org>, <https://elsevier.com>, <https://tandfonline.com>, <https://onlinelibrary.wiley.com>, and <https://iopscience.iop.org>.

The data were then analyzed using the Miles & Huberman analysis technique. Data analysis includes data reduction, data presentation, and conclusion drawing. The data are grouped into high-order thinking skills and communication skills. The research stages are 1) selecting topics relevant to the research, formulating objectives, and formulating problems to be discussed. 2) conduct a review by reading the article's abstract about the research topic. The data are descriptive information such as author, publication year, topic, research type, and findings. 3) analyze the article according to the purpose and formulation of the research problem. Finally, 4) write the review results according to the research topic (Snyder, 2019). The detailed procedure can be seen in the figure 1 below.

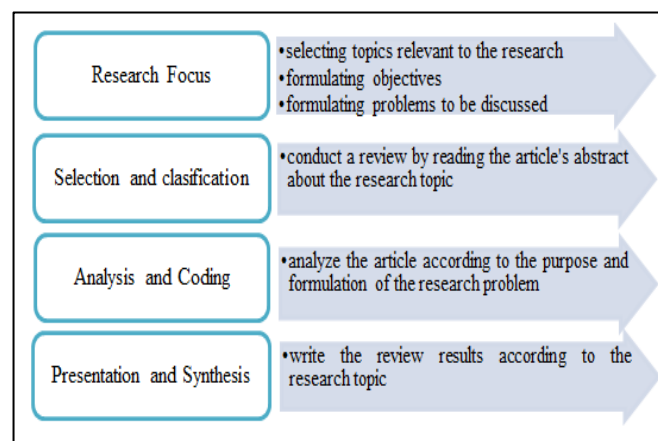


Figure 1. The detailed procedure

Result and Discussion

The fundamental thing in learning science is the process of discovery. Science learning in the process is emphasized by providing a direct experience so that students can explore and make sense of the conditions and natural phenomena around them as a form of competency development by carrying out trial activities (Justi, 2009; Pratiwi et al., 2019). Learning science helps student master concepts and their interrelationships to solve problems in everyday life with a scientific attitude that is not just knowing and memorizing but must understand and understand these concepts by connecting the interrelationships of one idea with another (Ichsan et al., 2022; Usman et al., 2021).

Students' higher-order thinking skills and communication skills in science learning can be improved through mobile-based learning that can help students explore knowledge. Learning approaches that are compatible with mobile-based learning are collaborative learning, inquiry learning, project-based learning, problem-based learning, game-based learning, and flipped classroom learning (Afikah et al., 2022).

The learning strategies that teach high-order thinking skills are problem-based learning, instruction-based inquiry, discussion, reflection, practice, and concept mapping. The strategy that can significantly improve high-order thinking skills is discussion activities, both at the class level and at the trim group level, especially with questions developed by the teacher, use of problems, and examples of implementing solutions (Goodsett, 2020).

Three concepts intersect with high-order thinking skills in teaching: disposition, metacognition, and transfer. The results showed that the best way to teach high-order thinking skills on the concept of disposition is to model student behavior. Give challenging assignments, direct students to observe other skilled people in solving complex problems, and encourage them to persist in tasks. Difficult or solve problems. Metacognition activities are a crucial element of high-order thinking, an instructional strategy encouraging students to use cognitive abilities. Students get opportunities to apply the knowledge they have acquired. The biggest obstacle in learning high-order thinking skills is the problem of transference or concept transfer. Some students can train and involve their high-order thinking skills in the learning transfer process from the teacher, but some students can't; they need time and activities several times to get involved. This can be caused because students have different memory abilities. The ability to use critical thinking skills requires specific strategies. The teacher must present learning that triggers students to explore their knowledge by linking the concepts they have obtained previously.

Several learning strategies have proven effective in improving students' high-order thinking and communication skills in learning. One of the learning models is problem-based learning (PBL). PBL is a teaching method involving students in small groups directed to consider problems collaboratively. PBL, in the process, is related to everyday life and depends on real-life situations that students likely face in academic and non-academic fields. This enables students to relate the phenomena that occur to the knowledge studied, and students are in the application and role phase.

Like the PBL model, the instruction-based inquiry model asks students to answer questions posed by the teacher so that students can create and answer their questions. This learning model helps students identify gaps and misconceptions in their knowledge. If students are given guidance and examples to generate their questions and answers, such as by demonstrating high-order thinking skills, it will be effective in learning. In line with research by Irwanto et al., (2019), the inquiry-based learning model has a significant effect on improving high-order thinking skills. The results showed that the value of $\text{sig} < 0.05$ is $0.000 < 0.05$; thus, the inquiry learning model's application affects students' high-order thinking skills.

One of the strategies to improve students' high-order thinking skills and communication skills is concept mapping. Concept mapping is a learning method that encourages students to think at a higher level. They have to use and expand their thinking about a topic by identifying previous knowledge and new knowledge gained through experience so that it is found to be related to generating new concepts. The form of concept mapping is an argument map or tree that allows students to display or see the relationship between material, problem-solving, and evidence with the help of various graphics to communicate it. In concept mapping, students must draw meaningful relationships with prior knowledge and practice remembering frequently.

In research about learning assessment, assessments that can be used are multiple-choice questions, open-ended questions, and feedback questions. The online discussion was the most appropriate teaching method to improve high-order thinking skills in online learning (Goodsett, 2020).

Problem-based learning is also the key to improving students' communication skills. It can be seen from the research of Aslan (2021), about the effect of problem-based learning on students' communication skills. It was found that the communication ability of students who studied with problem-based learning was higher in students who studied with teacher-centered learning. It can be seen that there was a significant difference between the adjusted communication skills post-test scores according to the students' pre-test scores

[$F(1, 42) = 4.647, p < .05; 95\% \text{ CI}$]. Research about the effect of problem-based learning models on students' understanding of concepts and verbal communication skills also shows a significant impact. The percentage of contribution of the PBL model to improving students' communication skills was 33.17%, with $P = 0.000 < 0.05$ of the significance level. This shows the positive effect of applying the PBL model though still in the medium category (Nangku et al., 2019).

High-order thinking skills cannot be separated from communication skills; both are interrelated and influence each other. Research by Oktavia & Ridlo (2020), high-order thinking skills in project-based learning are in students' communication skills. It was found that the triangulation data showed that students with high-order thinking skills had communication skills that reached the aspect of analyzing arguments. Students with moderate-level thinking skills can achieve simple explanation aspects, while students with lower-level thinking skills only achieve the question-focusing factor. Therefore, project-based learning can encourage students to be able to communicate verbally and improve their high-order thinking skills in problem-solving.

The study found that developing audio-visual learning media based on Contextual Teaching-Learning (CTL) improved students' high-order thinking skills. This media is considered valid, with the gain score analysis showing that the gain score of the experimental class student's high-order thinking ability was 0.71, higher than the control class was 0.51 (Sarwinda et al., 2020). The results of research on learning media found that inquiry-based science learning media can improve students' high-order thinking skills. The media is valid and effective in enhancing students' high-order thinking skills (Uswatun et al., 2015).

The results of the research review explain that it is essential for students to have high-order thinking skills. There are several reasons why HOTS is necessary for students: 1) HOTS can develop student's thinking skills and interests, 2) HOTS helps the decision-making process, 3) HOTS helps students in presenting strong opinions, 4) HOTS helps students think broadly from various points of view to respond to problems well, 5) HOTS helps students generate ideas in completing assignments, 6) makes students more active and participates in discussions (Heong et al., 2012; Lestari, 2017).

The revised Bloom's taxonomy in revealing student's high-order thinking skills in the cognitive domains C4 - C6, analyzing (C4), evaluating (C5), and creating (C6) has been used in many kinds of literature (Anggraini et al., 2019; Lestari, 2017; Mawardi et al., 2020; Risna et al., 2019). There are three cognitive processes in analyzing; differentiate, organize and decipher. Two cognitive processes in evaluating,

checking, and critiquing. Three cognitive processes in creating, creating, planning, and producing. Students' analysis will be faced with a phenomenon to formulate problems and propose hypotheses (Anggraini et al., 2019). In the evaluating section, students will be faced with questions that are solved by discussing in groups in class. Students will design an experiment or design work independently in the creating area. Each student has a different level of intelligence which will impact the selection of strategies, techniques, and learning models.

Students' understanding of learning is deepened and enhanced by group discussions (Douglas et al., 2012). Students practice their communication skills during group discussions by actively participating in problem-solving and interacting with group members. Students not only listen to the lessons from the teacher but are also involved in the question and answer process when the teacher explains the lesson. Some benefits of group discussions for students are: practicing communication skills, improving critical thinking skills, practicing collaborative skills, getting different views, and learning to defend their opinions. In addition, group discussions can allow each student to give ideas so that groups can solve problems together.

The components of learning innovation designed to improve students' high-order thinking skills are problem-based learning, learning resources, scaffolding, case studies, and exercises. After learning with the learning innovation component, the student's high-order thinking ability experienced a significant increase from previous learning. Students are asked to provide opinions about the details of learning innovation that is being developed, and students give good and high ratings (Kwangmuang et al., 2021).

Conclusion

The literature study shows that the learning strategies that can improve students' high-order thinking skills are problem-based learning and inquiry-based instruction. The learning strategy that can improve students' communication skills is problem-based learning. High-order thinking skills and communication skills can influence each other. This research is limited to searching the literature on learning strategies and media to improve high-order thinking skills. In addition, this research recommends developing appropriate learning innovations that can improve students' high-order thinking and communication skills and create other variables such as collaborative skills, critical thinking skills, creativity, and student motivation.

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