

The Effect of Science Learning to Improve Critical Thinking Skills of Middle School Students: Literature Study

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Abstract: This study is a Literature Review article which aims to identify the most effective learning model for improving students' critical thinking skills in science learning. A search of literature study articles resulted in twenty-five articles that met the inclusion criteria and were relevant for review. The research results show that there are many learning models that can be applied in science learning to improve students' critical thinking skills. Of the 25 articles reviewed, there were 2 articles with an average critical thinking ability score in the 50-60 range, 3 articles in the 60-70 range, 13 articles in the 70-80 range, 5 articles in the 80-90 range and 2 articles in the range of 90-100. The research results show that the discovery learning model through science practicum activities is the most effective for improving students' generic science skills, characterized by the achievement of an average student score of 92.56.

Keywords: Critical thinking skills; Literature review; Science learning

Introduction

The level of Science & Technology (IPTEK) achieved by a nation is a benchmark to see the extent of the nation's development and progress. Moreover, in this era of globalization, the progress of a nation is largely determined by quality human resources. One means of improving the quality of human resources is through education. Education will shape a person's personality and intellectual intelligence (Muliani & Wibawa, 2019).

In connection with the demand to improve the quality of human resources, the quality of education needs to be improved in all subjects including Natural Sciences (Science) subjects. Science is rational and objective knowledge about the universe and its contents. Science learning is learning that provides opportunities for children to think critically. Science learning will be more meaningful if the learning process uses models/methods of self-discovery (Apriliansi *et al.*, 2019).

21st century education has focused on improving creative competence, critical thinking, cooperation and

communication. This will be a challenge for schools and teachers to find ways to ensure that 21st century competencies can be possessed by students (Azizah *et al.*, 2021). The implementation of comprehensive learning in Indonesia still has problems. This problem is proven by the results of the 2018 Program for International Student Assessment (PISA) survey which shows that Indonesia is far behind other countries, namely ranking 71st out of 79 participating countries (Hewi & Saleh, 2020).

Learning outcomes are largely determined by the quality of learning implementation. The better the activities in learning, of course the learning outcomes achieved by students will be maximized. One of the factors causing the implementation of learning to not be optimal is the use of learning models that are still less varied (Muliani & Wibawa, 2019). Therefore, teacher skills are needed in implementing learning with various learning models that suit the characteristics of the learning material and the results to be achieved (Susilawat *et al.*, 2022). One of the skills that can improve student learning outcomes is critical thinking.

Critical thinking skills are the ability to analyze and evaluate information used to draw valid conclusions

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(Agustine *et al.*, 2020). Critical thinking is an active and systematic cognitive process that aims to evaluate arguments, truth, and richness, as well as provide evidence for the relationship between two or more topics and to accept or reject ideas (Marudut *et al.*, 2020). Critical thinking skills focus more on the learning process rather than just the acquisition of knowledge (Solikhin & Fauziah, 2021).

Academics and educational practitioners have made various efforts to improve students' critical thinking skills. Among the efforts made is implementing learning using various innovative learning models such as *problem based learning* (PBL) (Ningsih, *et al.*, 2022), assisted by *Information and Communication media Technologies* (ICT) (Wulandari, *et al.*, 2019), and various other learning models.

The application of various learning models shows various discoveries. So, the author took the initiative to review various articles that have been published so that the various advantages and disadvantages of these models, approaches and/or learning strategies can be identified so that they can be used as the right choice to implement further learning.

Method

This research is a literature study or literature review of research results that have been published in

various journals. This literature study is limited to science learning articles that have an impact on the critical thinking skills of secondary school level students. The articles reviewed met the inclusion criteria. Inclusion criteria are articles that are relevant to science learning to improve critical thinking skills of secondary school level students. Review articles were obtained from various national journals and international journals related to science teaching to improve science critical thinking skills. These articles are accessed via the internet on the Google Scholar, Science Direct, and Research Gate search pages. The key words are science/physics learning and critical thinking skills. Researchers also limited the articles reviewed to articles from the last five years, namely from 2018 to 2022.

Result and Discussion

As a result of searching for articles in various national and international journals, researchers found 25 articles that met the inclusion criteria. The author summarizes all search results for articles relevant to students' critical thinking skills in science learning in the Table 1.

Table 1. Search results for models, approaches, methods and/or learning strategies to improve critical thinking skills

Writer	Article Title	The Value of Critical Thinking Skills
Adnyani, <i>et al.</i> 2018	<i>7e Learning Cycle Model on Students' Critical Thinking Skills</i>	69.60
Darma, <i>et al.</i> 2018	<i>the Problem Based Learning Model on Critical Thinking Skills for Class VII Middle School Students in Science Learning</i>	73.73
Royani, <i>et al.</i> 2018	<i>The Influence of Practicum-Based Direct Learning Models on Science Process Skills and Students' Critical Thinking Abilities</i>	73.50
Amanda, <i>et al.</i> 2018	<i>Increasing Students' Critical Thinking Abilities in Science Learning Using Learning Models SETS-Based Problems</i>	57.29
Rahmawati, 2018	<i>The Effect of Implementing the Problem Based Learning (PBL) Model on Ability Critical Thinking in Science at SMPN 1 Pakusari Students</i>	75.85
Amalia & Wilujeng, 2018	<i>Contextual Teaching and Learning Model on Critical Thinking Skills of Middle School Students</i>	73.63
Sudarmin, <i>et al.</i> 2018	<i>The use of scientific direct instruction model with video learning of ethnoscience to improve students' critical thinking skills</i>	73.30
Yuliati, <i>et al.</i> 2018	<i>Student's critical thinking skills in authentic problem based learning</i>	89.59
Zaidah, <i>et al.</i> 2018	<i>The effect of physics-based scientific learning on the improvement of the student's critical thinking skills</i>	82.43
Wulandari, <i>et al.</i> 2019	<i>Problem Based Learning Model Assisted by Information and Communication Technologies Against Critical Thinking Skills Student</i>	77.33
Furmanti & Hasan, 2019	<i>The Influence of the Guided Inquiry Learning Model on Ability Critical Thinking, Motivation and Student Activity at SMP N 5 Seluma</i>	80.70

Writer	Article Title	The Value of Critical Thinking Skills
Herawati & Irwandi, 2019	The Influence of the Jigsaw Type Cooperative Learning Model on Learning Outcomes and Students' Critical Thinking in Science Subjects at SMP Negeri 09 Lebong	60.25
Wati, et al. 2019	The Influence of the CORE (Connecting Organizing Reflecting Extending) To Increase Students' Critical Thinking Skills	62.00
Khofiyah, et al. 2019	the Media-Assisted <i>Discovery Learning</i> Model Real Objects on Critical Thinking Ability and Understanding Science Concepts	80.50
Rahim, et al. 2019	The Effect of PjBL Model based on Skill Approach Process to Physics Critical Thinking Ability of High School Students	77.39
Wulandari, et al. 2020	Multimedia-Based <i>Problem Based Learning</i> Models On Critical Thinking Ability and Science Learning Outcomes	77.08
Harahap, et al. 2020	The Influence of Guided Inquiry Methods and Projects on Students' Critical Thinking Ability in Biology HKBP Simantin Pane Private Middle School	79.06
Astra, et al. 2020	The effects of active learning model guided note taking on students' critical thinking abilities in high school	79.04
Diani, et al. 2020	Improving Students' Science Process Skills and Critical Thinking Skills in Physics Learning through FERA Learning Model with SAVIR Approach	76.90
Setiawan & Islami, 2020	Improving Critical Thinking Skills Of Senior High School Students Using The Problem Based Learning Model	90.56
Nirwana & Wilujeng, 2021	Assisted <i>Problem Based Learning</i> Model Science Learning Vee Diagram on Critical Thinking Ability of Middle School Students	83.15
Santoso, et al. 2021	Improving student collaboration and critical thinking skills through the ASICC learning model	77.09
Styawan & Arty, 2021	Inquiry-based learning and problem-based learning: which one has better effect on students critical thinking skills profile of thermochemistry?	57.86
Sari, et al. 2022	<i>the Learning Cycle 7e</i> Learning Model on Collaboration Skills And Critical Thinking Ability Middle School Science Students	78.23
Bahtiar, et al. 2022	The Influence of the Discovery Learning Model Through Integrated Science Practicum Activities On Students' Critical Thinking Ability	92.56

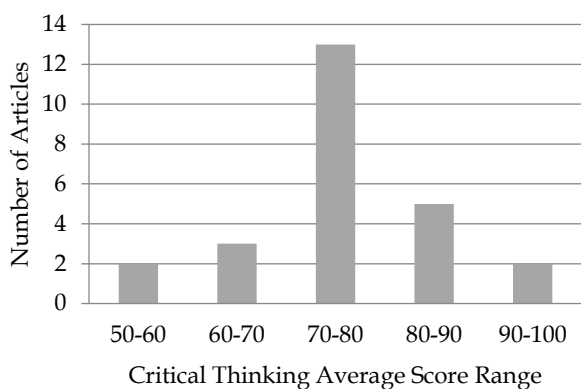


Figure 1. Diagram of the range of average critical thinking scores in the articles reviewed

Based on figure 1, it is known that the distribution of data ranges between the average values of critical thinking abilities that are reviewed. Of the 25 articles reviewed, there were 2 articles with an average critical thinking ability score in the 50-60 range, 3 articles in the 60-70 range, 13 articles in the 70-80 range, 5 articles in the 80-90 range and 2 articles in the 90-100 range. It is known

that the highest number of articles is in the 70-80 range, namely 13 articles with various kinds of learning models applied, including problem based learning, direct learning, contextual teaching and learning models, project based learning, guided inquiry models, guided note models, models FERA learning, ASICC learning model and 7e learning cycle model.

Based on Table 1, it was found that the lowest average score for improving science critical thinking skills was 57.29. This low increase was due to the fact that during learning using the PBM model using the SETS approach, student interest was still low, such as lack of concentration in learning, tended to talk and students were still not used to implementing the problem-based learning model. (Amanda et al., 2018). Meanwhile, the highest score for critical thinking skills found by researchers was 92.56. This achievement shows that improving critical thinking skills is most effectively done by learning using the discovery learning model through science practicum activities.

The application of discovery learning through science practicum activities is effective in improving

learning outcomes including critical thinking skills because students are trained to focus questions in finding or formulating problems from a given case or phenomenon and in practicum activities students are trained to improve their ability to observe or observe (Bahtiar et al., 2022).

Science critical thinking skills in learning can be measured using several indicators, namely focusing questions, defining problems, analyzing arguments, identifying assumptions, observing and considering observations. (Bahtiar et al., 2022).

Conclusion

Based on the literature study that has been carried out, it is found that the learning models that can be applied in science learning are very diverse, one of the most effective learning models in improving students' science critical thinking skills is *discovery learning* through science practicum activities.

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