



# An investigation of developing Indonesian elementary school students' critical thinking skills: A literature review

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## Abstract

Critical thinking as a 21st-century skill is needed by students to anticipate today's global changes and is very relevant to the implementation of the elementary school curriculum in Indonesia. This research discusses the implementation of the scientific approach to improving elementary school students' critical thinking skills. This research aimed to explain the concept of critical thinking, scientific approach, and development of critical thinking skills through the scientific approach in elementary school students' learning. This study used a qualitative approach with a literature review. Data were obtained from various references related to the research topic. The data analysis technique used is the Miles & Huberman technique which includes data reduction, data display, and conclusion drawing/verification. The research reveals that (a) critical thinking involves skills and dispositions in thinking; (b) the scientific approach in the 2013 curriculum involves observing, asking questions, gathering information, associating, and communicating; and (c) the average score of students' critical thinking engaged in the scientific approach-based learning is higher than the score of students engaged in the conventional learning. Accordingly, the scientific approach can improve students' critical thinking skills in elementary school. Based on these findings, it is recommended that elementary school teachers implement the scientific approach in the learning process to improve elementary school students' critical thinking skills.

**Keywords:** Critical thinking; curriculum; learning; scientific approach.

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## 1. Introduction

The 2013 curriculum that applies to education in Indonesia has adopted and implemented a scientific approach in the learning process. The application of the scientific approach is expected to improve the quality of the learning process and student learning outcomes. Improving the quality of education can be achieved through academic and life skills orientation. The implementation of the scientific approach in the learning process needs to be well designed so that students can

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build their knowledge, skills, and attitudes (Musfiquon & Nurdyansyah, 2015). Thus, it provides a broad, real and meaningful learning experience for students. The scientific approach in learning facilitates students to build skills, attitudes, and knowledge actively through scientific procedures such as observing, formulating problems and hypotheses, collecting and analyzing data, and drawing correct and logical conclusions. The learning process with the scientific approach can provide students with learning experiences in constructing this knowledge, skills, and attitudes so that they have meaningful learning. A study conducted by Suryani, Renda & Wibawa (2019) concludes that there was a significant influence of the scientific approach on the fifth-grade students' mastery of science concepts because they could actively construct those concepts facilitated by their teacher.

Twenty-first century skills require a learning process that emphasizes the discovery and development of knowledge, skills, and attitudes both designed by teachers and implemented independently by students (Redhana, 2019). The learning process follows the procedures of the scientific approach (Pohan & Dafit, 2021) so that both the process and learning outcomes will be more meaningful for students. Various studies have found that the scientific approach improves 21st-century skills of elementary school students. For instance, Rohaeti and Koswara (2018) finds out that students who received treatment with the scientific approach developed better critical thinking skills than those taught conventionally in learning. Likewise, Rudyanto (2016) in his research shows that students involved in learning with the scientific approach and discovery learning models had better creative thinking skills than those who studied only through expository learning models. This is in accordance with Maisoka (2019) which states that when students are able to maximize critical thinking, students are able to make decisions and assess complex situations or problems.

However, it turns out that there are many problems related to the implementation of the scientific approach in elementary school students' learning process (Lubis, Haidir & Rusadi, 2019). These problems are more on the inability of teachers to implement the scientific approach in the learning process. The teacher carries out the learning process not in accordance with the 2013 curriculum procedures as the national curriculum in Indonesia. Many teachers do not optimally apply the scientific approach in the learning process. This fact is stated in the following studies. Ayuni (2016) stated that there are 30.9% of teachers who have a low level of understanding of the scientific approach. Yuliati (2017) concluded that the application of a scientific approach combined with problem-based learning can improve students' critical thinking skills but the increase is still in the moderate category. The findings of Mulyasari & Sudarya (2017) show that students have difficulty in asking questions because students are not able to compose correct sentences, even though asking is one aspect of the

scientific approach. The results of other studies also found that in integrated thematic learning the teacher did not understand the design of scientific-based learning, did not apply a scientific approach, and tended to be teacher-centered (Abhyasari, Kusmariyatni & Agustiana, 2020).

Although there are problems and obstacles in the implementation of the scientific approach, especially the understanding and ability of teachers to implement it in various learning activities, it is believed that the scientific approach can develop the 21st-century skills of elementary school students. It is very important and urgent that teachers must have adequate knowledge, both about competencies as elementary school teachers and about scientific approaches and critical thinking skills that must be mastered by students. This research is relevant for elementary school teachers because it provides a fairly complete description of these concepts. If the teacher has the right knowledge about the scientific approach and critical thinking skills, this knowledge will help the teacher apply the scientific approach to develop students' thinking skills. The teacher designs a learning process based on a scientific approach or combines a scientific approach with various strategies and learning methods to improve student's critical thinking skills. Therefore, the subject of this research is how the implementation of the scientific approach can improve elementary school students' critical thinking skills. This study research to describe (1) the concept of critical thinking skills, (2) the concept of a scientific approach, and (3) the development of critical thinking skills through a scientific approach for elementary school students. Researchers believe that a correct and broad understanding of the implementation of the scientific approach in the learning process will help elementary school teachers in developing students' critical thinking skills.

## **2. Method**

The current study drew on a qualitative approach with a literature review. Qualitative research is an approach to explore and understand the meaning contained in a social or human reality (Creswell & Creswell, 2018). A qualitative approach is used in this study to explore and understand the concept of the 2013 curriculum in Indonesia and the application of the scientific approach in various scientific literatures. The literature review is used to collect information and data relevant to the problem and research objectives. The literature relates to the scientific approach, critical thinking skills, as well as various research articles on the implementation of the scientific approach in the learning process to improve critical thinking skills of elementary school students. The library method is used to examine various relevant literatures, books, articles, previous research results,

in particular to provide a theoretical basis and obtain answers to the problems being studied. Articles, books and repositories can be found through an online search. Researchers typed the word curriculum 2013, scientific approach, critical thinking skills on Google Scholar. Researchers also obtained books and repositories by visiting the school library.

The data analysis technique follows Miles & Huberman (1994) which states that qualitative data analysis consists of three streams of concurrent activities, namely data reduction, data display, and conclusion drawing/verification. Qualitative data analysis activities are carried out interactively and continuously until all the required data is complete. In data reduction, researchers search for and select relevant data, classify, direct or focus data on research problems, discard unnecessary data, and organize data so as to facilitate data display. In this research, the display data is done in the form of a brief description, dan the relationship between data categories. The display data is done in the form of a descriptive narrative to describe the research topic. Conclusions are drawn based on display data. Several conclusions were obtained when display data. The conclusions drawn describe the answer to the research problem.

### **3. Results**

The results of this study are explained in three parts, namely critical thinking skills, scientific approach, and developing critical thinking skills through the scientific approach.

#### *3.1. Critical thinking skills*

Critical thinking is one of the 21st-century skills. Elementary school students are in dire need of 21st century skills to face the challenges of the 21st-century world that is globally active, digitally transformed, moving forward collaboratively, developing creatively, seeking competent and fast human resources in adopting today's changes (Singh, Ja'afar & Mostafa, 2020), and needed by students both to learn and to live their lives. Another viewpoint identifies 10 competencies that Copenhagen Business School students need to have to be successful in future jobs. They include the ability to inspire and engage people, integrate customer insights into decision making, communicate one's message persuasively both internally and externally, communicate strategies to set a clear direction of the organization's future, support the organization's strategies and be responsible for their implementation, handle unclear and ambiguous situations, handle the complexity of expectations of various stakeholders, access information from various areas of business, and use big data

(such as sales data and social media data) to analyze customers (Human Capital Analytics Group, 2017).

Critical thinking in the context of the knowledge domain according to the taxonomy of Anderson & Krathwohl (2001) includes the ability to analyze, evaluate and create. Critical thinking relates to the tendencies and skills to engage in activities with reflective skepticism (McPeck, 1990). Similar to this point of view, critical thinking is a tendency and skill to engage in mental activities and those with reflective skepticism that focuses on deciding what to believe or do (Sosu, 2012). Critical thinking skills are thinking rationally (reasonably) and reflectively in making decisions based on what is believed or done (Ennis, 2011). Critical thinking is reaching conclusions according to goals and knowledge (Paul & Elder, 2012), leading to self-assessment and self-regulation to carry out analysis and interpretation, conclusions and explanations through evidence, methods, criteria and concepts that form the basis of assessment (Facione, Giancarlo & Gainen, 1995). By thinking critically, students are able to analyze various events and conditions faced accurately and are able to determine the right decisions, analyze the advantages of knowledge logically (Birgili, 2015).

Critical thinking skills are evaluative and produce critical judgments. Critical thinking encourages students to self-correct, and become more sensitive to the context of their lives (Trimawati, Kirana & Raharjo, 2020). Students who think critically have the ability to interpret, analyze, evaluate, make decisions, explain, and self-regulation (Heard, Scoular, Duckworth & Teo, 2020). Interpretation relates to the meaning of various situations and student experiences according to the correct criteria and procedures. The analysis is concerned with the ability to identify the inferential and actual relationships of these various situations and experiences. Evaluation is related to the ability to assess the truth and reliability of thought or point of view in accordance with predetermined criteria (Magdalena, Fauzi & Putri, 2020). Decisions are related to the ability to identify the elements needed to draw logical conclusions, determine hypotheses, information, minimize risks from various data or information. Explanation relates to the statement of the results of thinking and reasoning, showing evidence that supports reasoning, and presenting convincing argumentative reasons. Self-regulation is related to self-awareness to monitor various student activities, instruments and media used, as well as the results achieved by students.

Critical thinking is an interconnected process that includes five components consisting of (a) basic knowledge of what students know and believe that is needed in order to be able to see the contradictions that occur; (b) an external event as a stimulus that evokes the feeling of contradiction; (c) personal character

that comes from the basic knowledge of an individual to become her/his character; (d) feelings of contradiction or divergence as those that represent motivational factors that require other critical thinking stages; and (e) resolving contradictions that cover all aspects of critical thinking because an individual tries to solve contradictions including various steps taken (Al-Ghadouni, 2021).

### *3.2. Scientific approach*

The scientific approach was first introduced in America. This approach emphasizes more on laboratory methods. The scientific approach involves the ability to process scientifically such as observing, asking, trying, processing, presenting, concluding, and creating. The scientific approach is directed at the acquisition of knowledge, attitudes, and skills (Mulyasari & Sudarya, 2017). The scientific approach emphasizes a student-centered approach to bring active participation and involvement in the learning process facilitated by the teacher (Rostika & Prihantini, 2019). Therefore, in the scientific approach, the teacher designs and implements the learning process so that students actively form knowledge, skills, and attitudes through scientific stages in order to develop twenty-first-century skills.

A scientific approach is a learning approach in the 2013 curriculum that applies in Indonesia. The learning approach can be interpreted as a perspective on a learning process carried out to accommodate and inspire the implementation of learning methods. Minister of Education and Culture Regulation number 22 of 2016 clearly states that the characteristics of learning in the 2013 curriculum are strengthened by a scientific approach in the implementation of integrated thematic learning. The scientific approach is implemented in learning activities in the core activity phase. Teachers can integrate various models and learning methods that are relevant to a scientific approach. Activities in the scientific approach can be more varied according to the models and methods applied by the teacher. For example, the scientific approach does not always start with observing activities but can be started with trying activities (Sari, Pulungan & Hawa, 2021).

The learning process in the 2013 curriculum is scientifically based and applies a scientific approach. Students actively explore concepts and knowledge directly with the help of teachers to develop knowledge, attitudes and skills. Teachers can facilitate students to correct the knowledge, attitudes, and skills that have been mastered through the learning process (Suradi, Nilawati & Aryati, 2021). The scientific approach in the 2013 curriculum is relevant to several learning theories in elementary schools, such as the learning theory developed by Bruner, Piaget, and Vygotsky. Through the application of a scientific approach, teachers facilitate students to develop attitudes (affective domain), skills (psychomotor domain), and

knowledge (cognitive domain) which are the goals of the 2013 curriculum in Indonesia (Musfiqon & Nurdyansyah, 2015). Through the scientific approach, students can conduct observations, ask questions and reason as well as convey the attitudes, skills, knowledge they have acquired in learning activities (Rhosalia, 2017).

The scientific approach as an approach in learning activities has characteristics, namely student-centered; process skills; stimulation of higher-order thinking skills; and student character development. The scientific-based learning process includes the stages of observing, asking, trying, processing, presenting, concluding, and creating (Wina, Hindarto & Prasetyo, 2017). It is important to understand that the stages of this scientific approach are not steps or learning cycles but student learning experiences. Therefore, the scientific learning process completes the exploration, elaboration, and confirmation process in the 2006 curriculum with the stages of observing, asking, reasoning, trying, and communicating (Deswita, Kusumah & Dahlan, 2018).

The scientific approach in the learning process is designed so that students can construct knowledge, skills and attitudes actively through observing activities (to identify or find problems), formulate problems, determine hypotheses, collect and analyze data, draw conclusions, and communicate results or findings. The scientific approach helps students to understand knowledge, learning materials that can be obtained from anywhere and anytime without depending on the teacher (Handini, Hidayatullah, Ahkyar, & Gunarhadi, 2019). In fact, the scientific approach is the implication of a list of steps or ways that produce reliable knowledge.

In Minister of Education and Culture Regulation number 81 A of 2013 appendix IV regarding general guidelines for learning, which is then explained in the 2013 curriculum implementation training materials by Center for Professional Development of Educators (Sufairoh, 2016), it is stated that the scientific approach in the learning process consists of five main learning experiences: observing, asking, gathering information, associating, and communicating. First, observing is an activity for students to read, hear, listen, and see (without or with tools). Second, asking questions is an activity for students to express what they want to know about certain objects, processes, and events. Third, collecting information (from various sources such as books, observing) which will be used as material to be analyzed and concluded by students. From this activity, students can verify the hypothesis. Fourth, associating, is an activity for students to analyze data (with the help of certain tools) and connecting with other data so that students can conclude something from the hypotheses formed previously. Fifth, communicating is an activity for students to convey their findings to their

friends. These findings were obtained through previous activities. This communication activity is an activity for students to explain hypotheses and be responsible for their findings.

### *3.3. Developing critical thinking skills through the scientific approach.*

Critical thinking consists of critical thinking as a skill and critical thinking as a disposition (Sosu, 2012). Critical thinking as a skill is called critical thinking skill. Meanwhile, critical thinking as a disposition is called a critical thinking disposition. Therefore, critical thinking is a combination of these two important components (Ennis, 2011). Critical thinking skills are related to the ability to do critical activities such as analyzing, synthesizing, correcting, and making decisions or judgments (Delamain & Spring, 2021). Critical thinking disposition is related to habits or tendencies to think critically (Syahfitri, Firman & Sriyati, 2019). Students who have a strong critical thinking disposition also have consistent internal motivation to develop and use critical thinking skills (Mahmoud, 2012). The characteristics of critical thinking disposition are critical openness and reflective skepticism (Sosu, 2012). Critical openness is the tendency of students to be active in creating new ideas, critically evaluating existing ideas, and modifying existing thinking with believable evidence or facts (Rowe, 2006). Meanwhile, reflective skepticism is the tendency of students to learn to reflect on their past experiences and actively question the evidence or facts they receive. According to Sternberg & Halpern (2020), the characteristics of critical thinking skills involve having a learning orientation, solving problems creatively, focusing mentally, and having cognitive integrity.

The scientific approach needs to be implemented both in planning and learning implementation because it can stimulate various abilities possessed by students, including critical thinking skills. The scientific approach develops logical thinking skills, curiosity and improves the critical thinking skills of elementary school students (Lieung, 2019; Pratiwi, 2014). Critical thinking disciplines and activates intellectual abilities to build knowledge, synthesize, implement, and evaluate it through the process of observation, reflection, reasoning, and communication in the learning process (Zubaidah, 2010). In this context, critical thinking involves (a) identifying the thoughts, arguments, and conclusions of others; (b) verifying various scientific evidence from different perspectives; (c) analyzing ideas or arguments and scientific evidence that contradicts correctly; (d) being able to see things implied behind the surface that forms inaccurate assumptions; (e) analyzing various methods and techniques to form more interesting concepts and knowledge; (f) exploring and analyzing various problems in an orderly and structured manner based on deep scientific logic; (g) drawing conclusions about



the truth of arguments based on valid and reliable evidence; and (h) presenting knowledge and arguments in a structured and logical manner to give confidence to others (Cottrel, 2005). Critical thinking is a rational, reflective, and integrative thinking pattern to describe what is obtained and implemented. Critical thinking indicators include skills in interpreting, the ability to give explanations in an explanatory manner, and being able to evaluate and self-regulate (Wakhidah, 2018). In other words, critical thinking skills are abilities that need to be possessed by students to achieve intended educational goals. Through scientific steps or procedures in a scientific approach, students can develop critical thinking skills in learning activities.

Many studies in elementary schools show findings of the effect of implementing a scientific approach on students' critical thinking skills in the learning process. For example, during the implementation of learning with a scientific approach, the dominant students' mathematical critical thinking dispositions that appear are self-confidence, curiosity, and the search for the truth of science (Wijayanti et al., 2017). Furthermore, there are studies that reveal that (a) the critical thinking disposition of students who took learning with the REACT model approach (relating, experiencing, applying, cooperating, transferring) achieved the individual Minimum Mastery Criteria; (b) the critical thinking disposition of students who participated in learning with the REACT model approach achieved the classical Minimum Mastery Criteria; (c) the critical thinking disposition of students with the REACT model approach in learning is higher than the critical thinking disposition of students with conventional approaches in learning (Wulandari, Dwijanto & Sunarni, 2015).

Syarifuddin (2018) in his research asserts that there was a significant positive effect of the scientific approach on students' critical thinking. Rusnah & Mulya (2018), through Classroom Action Research, discover that students' thinking skills improved in the aspects of giving simple explanations, building basic skills, making inferences, making further explanations, and managing strategies and tactics through the scientific-based approach. Handriani, Harjono & Doyan (2017) Handriani, Harjono & Doyan (2017) in testing the hypothesis of the post-test data of students in the experimental class found the influence of the scientific approach on student learning outcomes. The average score of the experimental class using the scientific approach was higher than the control class using the expository learning model. Furthermore, Sanjaya (2019), through quasi-experimental research, explains that there was an average difference between pre-test and post-test of 15.8, which means that there was an increase in students' critical thinking skills after the implementation of scientific approach-based learning. Research by Agustin, Fadiawati & Tania (2016) shows that there was an increase in students' critical thinking skills both in the experimental class

and the control class after the scientific approach was implemented. However, the increase in students' critical thinking skills in the experimental class was higher than in the control class. Then, the average *n-gain* on the t-test shows that students' critical thinking skills in the experimental class were higher than students in the control class. This study concludes that the scientific approach applied to the experimental class could improve students' critical thinking skills. Likewise, research by Septiasari, Dantes & Suastra (2020) reveals differences in fifth-grade students' critical thinking skills and science learning using a reciprocal learning model compared to students learning with a scientific approach. Kusumah (2019) through classroom action research concludes that the application of a scientific approach in learning to improve students' critical thinking skills in natural science subjects.

#### **4. Discussion**

Various findings in the research results show that the scientific approach can improve students' critical thinking skills in elementary schools. These findings are in line with Zahra (2017) who said that the application of a scientific approach in the classroom can improve students' critical thinking skills, be more involved in the process of learning activities, and arouse students' curiosity to develop their various reflective abilities. The scientific approach can help students find and construct their knowledge facilitated by the teacher.

With a scientific approach, learning becomes more meaningful for students if they experience what they learn for themselves. The scientific approach can improve students' critical thinking skills because it is supported by learning tools designed with the approach (Asta, Gede & Widianana, 2015). For example, observing activities using scientific worksheets can serve as a guide for students' practical activities to be more focused and measurable. Scientific worksheets can also assist teachers in guiding students through the planned scientific stages. In addition, it also helps teachers create a learning climate

Critical thinking skills as reflective abilities can be developed effectively when teachers apply a scientific approach in the learning process. The application of the scientific approach will encourage students to analyze and evaluate logical, correct, and relevant arguments (Stobaugh, 2013; Redhana, 2019). Critical thinking skills have several indicators including formulating problems, determining decisions and solving strategies, and assessing predetermined decisions or solutions (Azizah, Sulianto & Cintang, 2018).

The ability of elementary school students to improve critical thinking skills through the scientific approach is in line with Santrock (2011) which states that critical thinking contains reflective, productive, and evaluative thinking both in

solving learning problems and problems in everyday life. Critical thinking competencies that must be taught to students are the ability to reason effectively, use systems thinking, make judgments and decisions, and solve problems.

## **5. Conclusions**

After describing the theoretical findings, the researcher concludes as follows: (a) the implementation of the 2013 curriculum in Indonesia aims to develop critical thinking skills as a 21st-century skill in elementary school students; (b) critical thinking of elementary school students can be in the form of dispositions and/or skills; (c) the scientific approach can improve the quality of the learning process and student learning outcomes, (d) the application of the scientific approach in student learning is carried out through observing, asking, trying, reasoning, and communication activities; and (e) teachers can also combine the scientific approach with strategies or other methods relevant to it so that it is more effective in developing critical thinking skills of elementary school students.

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