Effectiveness of REACT Learning Based on Inquiry Learning Toward Students Critical Thinking Skills

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Abstract

This research aims to determine the effect of inquiry learning-based REACT learning to improve students' critical thinking skills. This research is a type of quantitative research with a meta-analysis approach. The data source comes from an analysis of 14 national and international journals published in 2020-2023. Data search process by searching the Google Scholar, ScienceDirect, ERIC and IEEE databases. Data collection techniques are direct observation and documentation. Data selection uses the PRISMA method which consists of identification, screening, eligibility and inclusion. Data analysis by calculating the effect size value from each relevant study with the help of JSAP software. The research results show that there is a positive influence of inquiry learning-based REACT learning on students' critical thinking skills with an average effect size value (ES = 0.872) in the high category. The findings explain that REACT learning based on inquiry learning is effective for improving students' critical thinking skills at school.

Keywords: REACT learning; Inquiry Learning; Effect Size; Meta-analysis

INTRODUCTION

Critical thinking is a type of skill that is very important for students to have in facing the industrial revolution 4.0 (Elfira et al., 2023; Ichsan et al., 2023). Critical thinking skills are critical thinking skills that are critical in student development, enabling students to effectively analyze, evaluate, and synthesize information (Maison, 2022; Nurtamam et al., 2023). Students who have critical thinking skills tend to be better able to deal with academic challenges and everyday life situations in a more thoughtful way (Kanmaz, 2022). Furthermore, students who have critical thinking skills involve the ability to question information, recognize underlying assumptions, and understand the implications of an idea or decision (Rahman et al., 2023; Fradila et al., 2021; Priyambodo et al., 2023). Students who are able to think critically also tend to be more open to different points of view, promote constructive dialogue, and develop a deep understanding of various concepts (Suyatno et al., 2023; Alharbi, 2022).

In fact, what happens in school is that students' critical thinking skills are still relatively low in the learning process (Supriyadi et al., 2023; Chusni et al., 2020; Hidayah

et al., 2020). The low critical thinking skills of students can be seen in the results of TIMSS research In 2015 the critical thinking skills of Indonesian students in the fields of science and mathematics obtained a score of 396 lower than the international average score of 500 (Rahman et al., 2023; Zulyusri et al.,2023; Suryono et al., 2023; Sofianora et al., 2023). In addition, in the learning process the teacher encourages students to think critically in solving a problem (Iqbal et al., 2023; Suryadi et al., 2021). Not only that, teachers choose learning models that are not right to encourage students' critical thinking skills (Oktarina et al.,2021; Poppy et al., 2020). So, there needs to be a learning model that can grow students' critical thinking skills.

Learning *Rrelating, Experiencing, Applying, Cooperating, And Transferring* (REACT) is one of the learning models that can foster students' critical thinking skills(Zahra et al., 2020; Wulandari et al., 2015). The REACT model is learning that promotes engagement and application of concepts in student learning experiences (Putri et al., 2019). REACT learning can involve students more actively and encourage student cooperation in learning (Sitorus et al., 2023). The REACT learning model is designed to develop students' higher-order thinking skills (Quainoo et al., 2021; Putra et al., 2023). REACT learning consists of 5 stages of these activities, students are trained to connect material with real experience (relating), directly involved in experiments or observations (*experiencing*), apply learned concepts in new situations (applying), work together to solve complex problems (cooperating), and transfer knowledge to create creative products (transferring). REACT is very relevant to the demands of the 21st century because it encourages students to actively construct knowledge, collaborate, and create by utilizing technology (Quainoo et al., 2021).

Furthermore, the REACT model can be linked to the inquiry leaning model. The inquiry-based learning model is a learning approach in which students are encouraged to discover and understand the concepts learned through the process of asking and finding out independently or in groups (Sreejun &; Chatwattana, 2023). The role of inquiry-based learning teachers is to facilitate and guide, not present knowledge directly (Manishimwe &; Shivoga, 2022). Inquiry-based learning begins with the teacher provoking students' curiosity about a particular topic, then letting students formulate their own investigative questions (Khasawneh et al., 2023; Daniel et al., 2022). Inquiry-based learning can encourage students to learn actively and independently (Aidoo, 2022; Bakirci et al., 2022).

In previous research Liu et al (2020) the REACT model had significantly higher critical thinking scores than conventional learning control groups. Research by Westwood (2021) suggests REACT learning inquiry to improve critical thinking skills. The results showed that the gain in critical thinking scores of students taught by inquiry-based REACT was higher than just taught by REACT or inquiry alone. There is a positive influence of the collaboration between the two. Many studies on REACT learning have not found the effect size of inquiry-based learning REACT. Based on this, this study aims to determine the effect of inquiry-based REACT learning to improve students' critical thinking skills.

RESEARCH METHOD

The research method to be used is meta-analysis, in the form of quantitative synthesis of previous research results related to the influence of the inquiry-based REACT model on students' critical thinking skills. Meta-analysis is a research approach that analyzes and collects previous research that can be analyzed quantitatively (Tamur et al., 2021; Razak et al., 2021; Zulkifli et al., 2022). This study population includes all experimental and quasi-experimental studies on elementary to high school students who apply inquiry-based REACT learning by measuring critical thinking skills as a dependent variable. The research sample is represented in a large number of effect sizes obtained from these previous studies that have been published in 2020-2023 accessed through the databases google scholar, ScienceDirect, ERIC and IEEE. The sampling technique to be used is purposive sampling based on certain inclusion criteria. Data analysis using a random effect model to determine how big the average effect size of the REACT-inquiry implementation is to improve critical thinking skills. Statistical data analysis with Comprehensive Meta-analysis (CMA) application. The effect size value criteria related to the influence of the inquiry-based REACT model on students' critical thinking skills can be seen in Table 1.

Table 1. Effect Size Value

Effect Size (ES)	Category Effect Size
$0.0 \leq ES \leq 0.2$	Small
$0.2 \leq ES \leq 0.8$	Medium
$ES \geq 0.8$	Large

RESULT AND DISCUSSION

Based on the results of searching data through google scholar, ScienceDirect, ERIC and IEEE databases related to obtaining the influence of inquiry-based REACT learning to improve students' critical thinking skills, 14 relevant articles were included in meta-anbalisis. The data entered in the meta-analysis calculated the effect size value which can be seen in Table 2.

Table 2. Effect Size Research Data

Article Code	Year	Variable	Effect Size	Category Effect Size

Article 1	2023	Critical Thinking	1.12	High
Article 2	2023	Critical Thinking	0.71	Medium
Article 3	2022	Critical Thinking	2.05	High
Article 4	2023	Critical thinking	1.02	High
Article 5	2022	Critical Thinking	0.73	Medium
Article 6	2021	Critical thinking	0.69	Medium
Article 7	2021	Critical Thinking	0.93	High
Article 8	2021	Critical thinking	0.49	Medium
Article 9	2023	Critical Thinking	1.20	High
Article 10	2023	Critical thinking	0.49	High
Article 11	2023	Critical Thinking	0.37	Medium
Article 12	2021	Critical thinking	0.97	High
Article 13	2023	Critical Thinking	1.13	High
Article 14	2022	Critical thinking	0.82	High
Average value of effect size			0.908	High

Based on Table 2, the highest effect size value is 2.05 with height criteria and the lowest effect size value is 0.49. In addition, there are 5 articles that have a high criterion effect size value and 9 articles that have a medium criterion effect size value. Furthermore, the average effect size of the 14 journals analyzed was 0.908 with high effect size criteria. These results conclude that inquiry-based REACT learning has a significant influence on students' critical thinking skills. This research is in line with Mawarni et al., (2019) learning with REACT positively influences students' critical thinking skills. Research results Kurniasih (2017) REACT learning Helps students learn actively so as to foster critical thinking skills in learning. In this context, the inquiry-based learning approach REACT emphasizes direct student learning experience, the application of concepts in real situations, and cooperation between students (Sari &; Nugroho, 2021). Through these steps, students

are invited to be actively involved in the learning process, encouraging them to develop deeper understanding and strong critical thinking skills (Jannah &; Supardi, 2020).

Furthermore, Inquiry learning in REACT learning provides opportunities for students to ask questions, investigate, and develop their own understanding. This process encourages students to think critically as they must identify problems, gather information, and analyze data to achieve a deeper understanding (Hidayat et al., 2021). Furthermore, REACT inquiry-based learning fosters collaboration between students also plays an important role in improving critical thinking skills, as students can share ideas, ask questions, and find solutions together (Hidayat et al., 2021). Furthermore, analyzing the effect size based on education level related to the effect of inquiry-based learning REACT learning on students' critical thinking skills. The results of effect size analysis based on education level can be seen in Graph 1.
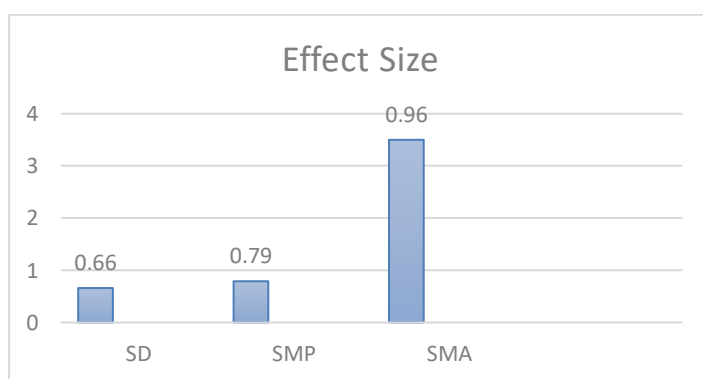
Based on graph 1, the effect size value at the elementary level is 0.66 (Medium), SMP is 0.79 (Medium) and SMA is 0.96 (High). These results explain that the application of inquiry-based learning REACT learning has a significant influence on critical thinking skills based on education level. At the educational level at the high school level, students are able to develop thinking skills and analyze something in solving problems. This finding is in line with Piaget's theory of cognitive development (Santrock, 2011) where the ability to think abstractly, analytically, evaluatively, and critically increases in formal operational years in adolescence (high school). In addition to thinking patterns, the effectiveness of REACT-inquiry is also influenced by differences in learning characteristics at each grade level, readiness for independent learning, and the complexity of the subject matter. The guided inquiry strategy in REACT learning is more suitable for operational concrete thinking students (elementary and junior high), while the free open inquiry inquiry model is more suitable for the cognitive characteristics of high school students who have good abstract and independent thinking skills (Cahyono et al., 2017; Karima et a., 2014).

CONCLUSION

Based on the results of this study, it can be concluded that there is a positive influence of inquiry-based REACT learning on students' critical thinking skills with an average value

of effect size (ES = 0.908) with high categoi. The findings explain that inquiry-based REACT learning is effective for improving students' critical thinking skills in school. The greatest influence is shown at the SMA level. The results of this meta-analysis study provide empirical evidence on the benefits of applying the inquiry-based REACT learning model to develop students' 21st century skills, especially critical thinking skills effectively at all levels of education from elementary to high school. The recommendation of this study is that the integration of inquiry-based REACT learning needs to be considered in future curricula.

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