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THE IMPACT OF ONLINE MENTORING IN IMPLEMENTING RADEC LEARNING TO THE ELEMENTARY SCHOOL TEACHERS' COMPETENCE IN TRAINING STUDENTS' CRITICAL THINKING SKILLS: A CASE STUDY DURING COVID-19 PANDEMIC

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ABSTRACT

This study aims to describe the impact of online mentoring activities in implementing the RADEC (Read, Answer, Discuss, Explain, and Create) learning model on the competence of elementary school teachers in training students' critical thinking skills. The method was a pre-experiment with a one-group pretest-posttest design involving 25 elementary school teachers in Indonesia. The teachers received online mentoring in implementing RADEC learning model. The research instrument was a questionnaire to measure teachers' knowledge and skills in training critical thinking. The data processing technique was carried out by calculating the mean and the percentage of each item to obtain a description of the teachers' knowledge and skills in training students' critical thinking before and after treatment. The data were analyzed inferentially with a paired sample t-test using SPSS version 22 software to see the impact of the treatment on teachers' competence in training critical thinking. Based on the results of the paired-sample t-test, for both the knowledge and skills aspects, the probability value (sig) was 0.00 <0.05. This result means that there was a significant difference in the knowledge and skills of teachers in training students' critical thinking skills before and after mentoring activities. The study results indicate that the online mentoring in implementing the RADEC learning model improved teachers' competence in training elementary school students' critical thinking skills.

Keywords: critical thinking; teachers' skills to train critical thinking; RADEC learning

INTRODUCTION

There are changes in various fields of life quickly and globally in the 21st century, marked by the development of information and communication technology and computerization (Joyce & Calhoun, 2014; Nakano & Wechsler, 2018). At the same time, people must also have a complete mastery of sciences, technology, engineering, and mathematics (Forawi, 2016; Larsson, 2017). The World Economic Forum (WEF) states that this era is called the industrial revolution 4.0, where the speed of information is supported by communication and computerization technology

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that applies digital media, extensive data analysis, and artificial intelligence (AI) (Tempelaar, 2017). In the era of IR 4.0, humans must have a range of abilities and life skills in facing today's global challenges (Reynders et al., 2020).

According to Trilling & Fadel (2009), everyone in the twenty-first century needs three life skills, dubbed the "21st-century knowledge-skills rainbow", they are as follow: (1) life and career skills (adaptability and flexibility, initiative and self-regulation, social and cultural interactions, productivity, and accountability, leadership and responsibility); (2) learning and innovation skills (critical thinking skills, problem-solving, collaboration, communication, and creativity and innovation); (3) technology skills and information media (information literacy, media literacy and technology, and communication literacy). Meanwhile, according to Wagner (2009), the 21st century requires seven types of life skills, including: (1) critical thinking and problem-solving skills; (2) adaptability and agility skills; (3) leadership and collaboration; (4) a sense of desire, knowledge, and imagination; (5) effective communication skills; (6) initiative and entrepreneurship; and (7) the ability to access and analyze infrared data. Wagner's view (2009) is in line with Care et al. (2012) that the skills needed to work in the 21st century are critical thinking, collaboration, communication, leadership, adaptation skills, innovation, citizenship literacy, entrepreneurship skills, and information literacy skills to access, analyze, and synthesize information.

As stated by Trilling & Fadel (2009), Wagner (2009), Care et al. (2012), and Pellegrino & Hilton (2013), critical thinking is one of the life skills needed in the 21st century. Those skills help humans to organize, solve problems in innovative ways (Triling & Fadel, 2009). Those skills also help humans think logically, rationally and even evaluate receiving information and solving problems (Care et al., 2012). Humans with those skills can analyze information, argue against information and the credibility of data sources, and think logically in various situations to solve problems and make decisions based on facts and relevant evidence.

One way to practice critical thinking skills is through education. In the education world and learning process, teachers are responsible for preparing the quality of human resources with critical thinking skills (Lestari et al., 2020; Setiawan, et al., 2020; Tanti et al., 2020; Suh et al., 2021). Particular approaches to critical thinking characterize different disciplines, and a large part of studying those disciplines means learning to think like an expert of that discipline. All disciplines require you to ask questions, relate theory to practice, find and use appropriate evidence, evaluate, find links, and categorize. However, some instructional techniques are found to assist in the development of critical thinking, such as debates, investigations, and problem-solving (Pellegrino & Hilton, 2013; Huang et al., 2016).

Critical thinking is a skill to think rationally and reflectively to decide what to do or believe (Ennis, 1993). Critical thinking is a thought process that is good thinking that meets the criteria or standard of sufficiency (Nussbaum et al., 2021; Purnami et al., 2021). Critical thinking is a process for applying concepts, analyzing opinions, synthesizing, evaluating information, and making conclusions (Saenab et al., 2021). Critical thinking is also referred to as metacognition or the process of "thinking about thinking" (Tempelaar, 2017). Students do not have an intrinsic ability or capacity for critical thinking. Although some students are inherently interested, they require instruction to absorb knowledge in an analytical, methodical, and open-minded manner (Fajari et al., 2020). Someone who knows is not necessarily able to think critically. Therefore, it is necessary to apply learning content, processes, and assessment methods in training critical thinking, so that students can be confident in expressing opinions and applying critical thinking (Kiumars et al., 2012). Thus, qualified teachers' competence is needed in training students' critical thinking skills, and a teacher must teach students how to think and teach them what to think (Toy & Ok, 2012).

In Indonesia, students' critical thinking skills are still in the low category at the elementary and secondary levels (both lower and upper) and tertiary levels. Indonesia's global competitiveness index in 2016-2017 was rated 41st out of 138 nations, behind Malaysia and Thailand, according to a World Economic Forum (WEF) poll. The degree of education of Indonesian employees has an impact on this finding, particularly in terms of critical and analytical thinking abilities. Because a worker naturally follows formal schooling before looking for a job, pupils' critical thinking abilities at school might reveal the employees' inadequate critical thinking skills (Fajari et al., 2020). Some educational researchers across the level in Indonesia also reported the pedagogical strategies have not been optimal to develop the student's critical thinking skills where teachers did empower students with those skills (Fitriani et al., 2019; Kristiyanto et al., 2020). Their findings corroborated the effort of learning strategies that develop students' critical thinking skills across the level in Indonesia.

Formal education in Indonesia starts at the elementary school level. It is better if critical thinking skills have been instilled from an early age at the elementary school level so that students have the basis for solving tasks or problems in everyday life. Students do not have difficulty practicing critical thinking skills when moving to higher levels such as junior high school, senior high school, and college. However, learning in Indonesia still does not include 21st-century thinking skills. It can be seen from the study data that Indonesia was ranked 64th out of 65 countries in 2012 (OECD, 2013); and ranked 64 out of 72 countries in 2015 (OECD, 2017) based on high-order thinking skills. These results illustrate that the thinking skills of Indonesian students, one of which is critical thinking, are still in the low category (Kusuma et al., 2017). Teachers faced difficulties in developing students' skills in the 21st century.

Kristiyanto et al. (2020) reported four obstacles in training critical thinking in education, especially at the elementary level. Those obstacles are: (1) lack of training; (2) lack of information; (3) initial concepts; and (4) time constraints. First, teachers are not trained in critical thinking methodology. Elementary and secondary school teachers know they will teach students and receive training in teaching methods, but only a little training is devoted to training students' critical thinking skills. Second, some teaching materials have not provided content to practice critical thinking skills (Fawkes et al., 2005). Third, teachers and students have initial concepts of knowledge that can hinder their skills for critical thinking. This initial concept is like not wanting to know the material because you already know, not being open (Shpeizer, 2018). The fourth is time constraints. Teachers often have much material to cover. When the teacher focuses on the material rather than the learning process, the lecture method is faster and easier than integrating project-based learning to train critical thinking skills (Shavelson et al., 2019).

Based on the four obstacles that have been described, reasonable efforts are needed to resolve these obstacles. Providing activities to increase teachers' competence in training students' critical thinking skills is one of them. Teachers' competence improvement activities can be seminars, outreach, training, and workshops. One of the efforts that can be done is training activities/workshop in implementing of learning models that can facilitate teachers to train students' critical thinking skills (Capps & Crawford, 2013). However, teachers' training activities/workshops need to be continued with mentoring activities to implement the learning models in the learning process in schools. The learning model is a new vehicle that can take students to the goals, so it is not enough for teachers to be told what it looks like and how to drive it, but the teachers must also be accompanied to practice until they are proficient in driving it.

One learning model that can train students' critical thinking skills is the Read-Answer-Discuss-Explain-and Create learning model, abbreviated as RADEC developed by Sopandi (2017). Implementing the RADEC model has begun to be developed in Indonesia. Based on the research results of Pratama et al. (2019), Satria & Sopandi (2019), and Karlina et al. (2020), the implementation of the RADEC model improves students' critical thinking skills. It also enhances students' creative thinking skills (Sopandi et al., 2020), multi-literacy skills (Setiawan et al., 2020), and pedagogical competence of elementary school teachers (Sopandi & Handayani, 2019). Learning processes and outcomes are improved as well (Sukmawati et al., 2020).

The RADEC learning model has been introduced to elementary and secondary school teachers through outreach and workshops. The activities and socialization seminars had a positive impact on elementary and secondary school teachers, including: (1) the syntax of the RADEC learning model are easy to remember and understand; (2) RADEC learning model can holistically train 21st-century skills; (3) teachers become interested in implementing the RADEC learning model (Sopandi & Handayani, 2019). However, even though training/workshops have been held, not many elementary school teachers have implemented the results in the learning process. The training/workshops did not make teachers ready to implement the learning model even though they understand it. Thus, it is necessary to assist in implementing learning models for teachers to train students' critical thinking skills. Mentoring activities can be carried out online by utilizing information and communication technology in computers or laptops and connected to an internet connection (Lestari et al., 2020). This online mentoring method is suitable for teachers who work and cannot leave teaching and learning activities and teachers who are currently working from home due to the SARS-CoV-2.

Research on teacher skills to train students' critical thinking has not been done much. In Indonesia, research on critical thinking currently focuses on the application of various learning methods to improve students' critical thinking skills (Sari & Sugiyarto, 2015; Syarifah & Sumardi, 2015; Muskitta & Djukri, 2016; Nugroho, 2017), development of activity sheets for students' critical thinking (Asmawati, 2015; Firdaus & Wilujeng, 2018), developing students' critical thinking instruments (Nawawi & Wijayanti, 2018; Nuryanti et al., 2018), and the development of media and learning based on local wisdom in improving students' critical thinking (Anisa, 2017; Supandi & Senam, 2019).

Based on this explanation, the researcher has conducted a study that comprehensively describes the competence of elementary school teachers in training students' critical thinking before and after online mentoring activities of the RADEC learning model. Furthermore, the descriptive data is used to determine the impact of online mentoring in implementing the RADEC learning model on the knowledge and skills of elementary school teachers in training students' critical thinking skills.

METHODS

Pre-experiment with one group pretest-posttest design was utilized as the study technique (Creswell, 2014). In this study, the therapy involves online mentoring in the implementation of the RADEC learning paradigm. To determine the impact of online mentoring activities, the researcher gathered comprehensive data on elementary school teachers' critical thinking knowledge and abilities before and after treatment. The following table shows the one-group pretest-posttest study design.

Table 1. Research Design One Group Pretest-Posttest

O_1	X	O_2

Information:
O_1: Questionnaire of knowledge and skills before mentoring activities
O_2: Questionnaire of knowledge and skills before mentoring activities
X: Mentoring activities for implementing the online RADEC learning

The research subjects involved were twenty-five elementary school teachers in Indonesia for the 2019-2020 academic year courses selected using purposive random sampling (Creswell, 2014). The research subjects' characteristics were male and female elementary school teachers, had at least two years of teaching experience, had an educational background for elementary school teachers, and had experience in participating in teachers competency development training at the national/international level.

Online mentoring in implementing the RADEC learning model was carried out with the following procedures: (1) mentoring in the preparation of learning devices in Zoom so that there are interaction and discussion between instructors and participants; (2) learning implementation mentoring is carried out through participants sending videos of the learning implementation process carried out by participants before, during and after mentoring; (3) reflection is done in Zoom so that there are interaction and discussion between the instructor and the participants.

The research instrument used was questionnaires of knowledge and teacher skills to train students' critical thinking skills. There are 15 statements in each. The two questionnaires were developed using a 1-4 Likert scale, (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree). The knowledge and skills instruments were developed based on critical thinking indicators, including providing elementary clarification, basic support, making inferences, advanced clarification, and strategies and tactics to identify teachers' critical thinking knowledge (Ennis, 1993). The lattice of the questionnaire instruments of knowledge and teacher skills to train students' critical thinking skills is presented in Table 2.

Table 2 describes the knowledge and skills of teachers to develop students' critical thinking skills. This questionnaire consists of 15 statement items based on five indicators of critical thinking skills according to Ennis (1993): (1) Elementary clarification; (2) basic support; (3) making inferences; (4) advanced clarification; and (5) strategies and tactics. The instrument validity test used content validity to test whether each item of the statement is under the aspects to be measured (Ali & Hayat, 2019). The content validity test focuses on the content of this instrument, whether it is relevant to the purpose of data collection. The statement items are categorized based on their strength. Thus it will appear clear or unclear, effective or ineffective, relevant or irrelevant, functioning or not functioning under the research objectives, so they can be revised or discarded if they are considered invalid. The content validity test can be carried out based on the logical judgment of related experts in the research field so that experts in basic education carried out this research's expert validation method.

Table 2. Questionnaire for Teacher Knowledge and Skills in Training Students' Critical Thinking Skills

Indicator	Sub Indicator	Item	Content Item	
			Knowledge	Skills
Elementary clarification	Ask and answer explanatory questions	1	Critical thinking is students' skill to be able to ask questions in the learning process	Assign students to make questions
		2	Students can answer questions from other students	Assign students to answer questions from friends
	Analyze arguments	3	It is necessary to create a learning climate that allows students to express their opinions freely and to have discussions with other students	Stimulate students to have an opinion
		4	Discussions can go well if students can respond to the opinions of other friends	Comparing one opinion with another opinion
Basic support	Consider the credibility of a source	5	Students' critical thinking skills can be developed by the process of searching for literature sources suggested by the teacher	Directing students to find information from various relevant sources
		6	In learning, students can add other sources apart from the provided resources	Directing students to agree on the sources/literature used to find information in group discussions
	Observe and consider the results of observations	7	Learning involves observation activities to train students' critical thinking	Direct students to evaluate the information obtained whether it is appropriate and following what is needed
		8	The results of observations need to be discussed by students in groups	Ask students to observe and confirm the results of student observations
Inference	Make an induction and consider the result of the induction	9	Students' critical thinking skills can be developed through a conclusion from observations made by students	Ask students to relate the results of the experiment to students' daily lives
		10	Another alternative conclusion from the results of group discussions is needed to train students' critical thinking	Directing students to conclude the group discussion
Advanced clarification	Identify assumptions	11	Learning that involves students "to think logically, rationally and reflectively can train students' argumentative thinking skills.	Directing students to make other alternative conclusions from the results of group discussions
		12	Learning involves students thinking logically, rationally, and reflectively, one of which is through discussion and question-and-answer activities.	Ask students to provide feedback on the results of peer discussions if they agree with the results of peer discussions
		13	Students will be more critical if they have learned the basic concepts in that field.	Ask students to respond to the results of peer discussions if they disagree with the results of peer discussions
Strategy and tactic	Decide on an action	14	Learning that involves students to solve problems can train students' skills to practice ideas/strategies	Ask students to think of alternative ideas/solutions apart from the results of the discussion
		15	Learning that involves students to solve problems can train students' skills to decide from the ideas/strategies developed	Ask students to agree on alternative ideas/solutions apart from the results of the discussion

The readability test was then carried out to see the readability of the questionnaires prepared. The readability test of the questionnaire was carried out on a limited basis to the respondents to test the legibility of the questions and statements. The legibility test was carried out on respondents not involved as research respondents but have the same ability level or various backgrounds (Creswell, 2014). The readability test was carried out on 5 elementary school teachers outside of the research respondents in this study.

The data processing technique was carried out descriptively by calculating the mean and percentage of each item to obtain a description of the knowledge and skills of the teachers in training students' critical thinking skills. The data were analyzed inferentially with a paired sample t-test using SPSS version 22 software to see differences in teachers' knowledge and skills to train students' critical thinking skills before and after online mentoring activities in implementing RADEC. The data were tested for normality first. The normality test aims to determine the sample comes from a normal distribution population. In this study, the normality test using the Shapiro Wilk test with α=0.05.

RESULTS AND DISCUSSION

The teachers' knowledge in training critical thinking skills were analyzed statistically using the paired sample t-test. The test results of data distribution were declared to be normally distributed. Before implementing the RADEC learning model, the probability value is 0.073, and after implementing the RADEC learning model is 0.326. It is bigger α (0.05) (see in table 3).

The teacher's knowledge questionnaire results in training students' critical thinking before and after the online mentoring activities in implementing RADEC model are presented in Table 3. Descriptive statistical data and the paired sample t-test show the following results.

Table 3. Descriptive Statistical Data and Paired Sample t-test Teacher Knowledge in Training Critical Thinking

	Descriptive statistics					Shapiro Wilk		Paired Sample t-test
	N	Mean	Max	Min	Standard Deviation	Statistic	Sig (2-tailed)	Sig (2-Tailed)
Before	25	2.55	2.78	2.35	0.22	0.874	0.073	0.000
After	25	3.77	3.83	3.71	0.12	0.932	0.326	

Table 3 shows that teachers' knowledge in training students' critical thinking after implementing the RADEC learning model (mean = 3.77 and score max = 3.83) is better than before the activity (mean = 2.55 and score max = 2.78). Assuming a probability value (sig) of 0.00 smaller α (0.05), Ho is rejected, and H1 is accepted, meaning that there is a significant difference in teacher knowledge in training students' critical thinking skills before and after online mentoring activities. This result shows that the teachers' knowledge of training students' critical thinking increased after online mentoring activities. The mentoring activities provided can train the cognitive skills of teachers to train students' critical thinking. This finding is in line with the results of previous research, which showed that online mentoring in implementing RADEC learning model enhance teacher knowledge to train students' critical thinking (Handayani et al., 2019; Satria & Sopandi, 2019; Sopandi, 2019; Karlina et al., 2020; Setiawan et al., 2020).

The data obtained was then converted into a percentage to comprehensively see the increase in teachers' knowledge in training students' critical thinking in every aspect. Table 4 shows that the average percentage of teachers' knowledge before mentoring activities was 71% and after mentoring activities increased 19% to 90%. The teachers' knowledge in training students' critical thinking on each indicator has increased after mentoring activities. These findings can be explained from the teachers' learning planning activities before and after the mentoring activities on each critical thinking indicator.

Table 4. Percentage of Teacher Knowledge in Training Critical Thinking Before and After Online Mentoring Activities in Implementing RADEC Learning Model

Critical Thinking Indicators	Before	After
	Percentages (%)	
Elementary clarification	77	95
Basic support	70	90
Making inferences	73	93
Advanced clarification	75	88
Strategies and tactics	69	84
Mean	71	90

Before mentoring activities, the teachers' knowledge in training students' critical thinking can be seen from the learning planning activities in the lesson plan. It has described the teachers' knowledge in training students' critical thinking but has not covered all indicators of critical thinking. It can be seen from the learning indicators, learning methods and models, learning media, and teaching materials. Based on the lesson plan analysis results, the indicators of critical thinking that have emerged are the first indicator (elementary clarification), seen from the way the teacher provides opportunities for students to ask and answer questions given by the teacher after the teacher explains the learning material. The third indicator concludes, seen from how the teacher assigns students to make conclusions on the results of observations and conclusions from the results of group discussions in the lesson plan. Meanwhile, indicators of critical thinking that have not yet appeared are the second indicator (basic support), the fourth indicator (advanced clarification), and the fifth indicator (strategies and tactics).

After the mentoring activities, the teachers' knowledge in training students' critical thinking can be seen from the lesson plan activities. Teachers' skills in setting indicators, learning methods, media, and teaching materials show excellent cognitive skills to train students' critical thinking. Based on the lesson plan analysis results from the preliminary to the closing steps, the teacher facilitates students to be able to explore critical thinking skills from each stage of the RADEC development. On the R (Read) stage, the critical thinking indicator that appears is the second indicator, basic support. On stage A (Answer), the first indicator (elementary clarification) appears. The third indicator, making interferences, concludes discussion activities on stage D (Discuss) to agree on the pre-learning answers that have been answered on the previous stage. On stage E (Explain), there is the fourth indicator, advanced clarification. The last stage, C (Create), the fifth indicator of strategies and tactics, involves students developing ideas/strategies related to the material.

Based on these findings, the RADEC learning model has a positive impact on teachers through learning steps that encourage teachers to gain a high understanding of the lesson plan. Good knowledge and understanding make it easier for teachers to create lesson plans (Alexander et al., 2016). In making lesson plans, the cognitive component significantly improves writing skills and teachers' skills in planning lessons (Dekker, 2020).

The results of the data distribution test of teachers' skills in training critical thinking were declared to be normally distributed. Before implementing the RADEC learning model, the probability value is 0.080, and after implementing the RADEC learning model is 0.200. The result is more significant than α (0.05) (see in Table 5). The questionnaire results on teachers' skills in training students' critical thinking before and after the online mentoring activities in implementing RADEC model are presented in Table 5.

Table 5 shows that the average score of teachers' skills in training students' critical thinking after online implementing of RADEC learning model is 3.78. It is higher than before the activity (2.54). Assuming a probability value (sig) of 0.00 smaller α (0.05), Ho is rejected and H1 is accepted. It means that the research results show significant differences in teachers' skills in training students' critical thinking skills before and after online mentoring activities. It shows that the skills of teachers in training students' critical thinking increased after online mentoring activities in implementing RADEC learning model. Mentoring activities improved teachers' skills to train students' critical thinking skills.

Table 5. Descriptive Statistical Data and Paired Sample t-test of Teachers' Skills in Training Critical Thinking

	Descriptive Statistics					Shapiro Wilk		Paired Sample t-test
	N	Mean	Max	Min	Standard Deviation	Statistic	Sig (2-tailed)	Sig (2-tailed)
Before	25	2.54	2.89	2.50	0.15	0.227	0.080	0.000
After	25	3.78	3.88	3.15	0.12	0.143	0.200	

The data obtained was then converted into a percentage to comprehensively see the improvement in teachers' skills in training students' critical thinking in every aspect. It can be seen in Table 6.

Table 6. Percentage of Teachers' Skills in Training Students' Critical Thinking Before and After Online Mentoring Activities in Implementing RADEC Learning Model

Critical Thinking Indicators	Before	After
	Percentages (%)	
Elementary clarification	75	90
Basic support	71	85
Making inferences	73	88
Advanced clarification	72	86
Strategies and tactics	70	85
Mean	72	87

Table 6 shows that the average percentage of teacher skills before mentoring activities was 72% and after mentoring activities increased by 15% to 87%. The percentage of teachers' skills in training students' critical thinking on each indicator has increased after mentoring activities. These findings can be explained from the teachers' learning implementation activities after the mentoring activities on each critical thinking indicator.

The learning process facilitates all indicators of critical thinking. It can be seen from teachers' skills in training students' critical thinking skills in every step of the RADEC model. On the R (Read) stage, the second critical thinking indicator (basic support) is trained for students. Through reading activities, students can develop their understanding assisted by pre-learning questions made by the teacher. In stage A (Answer), the critical thinking indicator trained is the first indicator, elementary classification, through answering questions facilitated by pre-learning questions made by the teachers. The mentoring activities in implementing the RADEC learning model, on the Read (R) and Answer (A) stages, train the teachers' skills in making pre-learning assignments for students. Each question from the pre-learning can encourage students to learn independently to understand the essential material needed by students. The questions made are low order thinking until high order thinking in the hope that the teacher can master how to make good pre-learning questions that can train students' critical thinking skills.

On stage D (Discuss), the critical thinking indicator that the teacher trains is the third indicator (making interference) through discussion activities to agree on the pre-learning answers that have been answered in the Answer stage. Through mentoring activities, teachers are trained to practice their skills to develop components that must be developed to facilitate students' critical thinking processes. On stage E (Explain), the critical thinking indicator trained by the teachers is the fourth indicator (advanced clarification) through presentation activities conducted by students to present the results of group discussions. Explaining activities in the syntax of the RADEC model can add insight and deepen teachers' skills related to relevant learning methods or media, train thinking skills, and make it easier for students to master learning. In the last stage, C (Create), the critical thinking indicator trained by the teachers, is the fifth indicator of strategies and tactics, involving students to come up with ideas/strategies related to the material. At this stage, the teacher trains his skills to direct and facilitate students to come up with ideas based on the results of their thoughts.

Based on these findings, it can be concluded that the RADEC learning model mentoring activities encourage teachers to develop skills in training students' critical thinking skills. These activities can have a good impact on teachers. Teachers can prepare lessons that facilitate students to build all indicators of students' critical thinking skills so that teacher skills improve and students' critical thinking skills develop (Bonyadi & Zeinalpur, 2014). The results are in line with the results of Sopandi & Handayani (2019), showing that mentoring in implementing the RADEC learning model can increase teacher pedagogical competence. The mentoring activities carried out, in addition to providing a deeper understanding of the RADEC learning model, train teacher skills to implement it and develop teachers' skills to teach students critical thinking (Nussbaum et al., 2021). Mentoring activities for implementing the RADEC model were conducted online using information and communication technology in computer or laptop devices and connected to an internet connection. This online mentoring method is suitable for teachers who work and cannot leave teaching and learning activities and teachers who are currently working from home due to the COVID-19 virus pandemic so that it can be done anytime and anywhere. It is in line with Handayani's (2016) research that online mentoring activities for teachers were effective during the COVID-19 pandemic.

Overall, both the elementary school teachers' knowledge skills in training students' critical thinking skills were included in the very good category after the mentoring in implementing the RADEC learning model. This result is in line with previous studies that implementing the RADEC learning model can help students master subject matter and train students' critical thinking skills (Sopandi, 2017; Karlina et al., 2020). Besides, other studies show that maximizing teachers' pedagogical competence is not enough through socialization activities and workshops. However, mentoring activities are needed to improve teachers' pedagogical competence in training students' critical thinking skills maximally and sustainably (Novianti, 2020). Therefore, related parties or institutions need to disseminate these teacher mentoring activities regularly and continuously.

Obstacles that occur in the field during implementing the RADEC learning model mentoring activities include high motivation to participate in online mentoring activities, adequate facilities, and the willingness of teachers to complete the mentoring process from start to finish. Besides, another obstacle is the habit of teachers who are not used to making pre-lesson questions. When they are assigned to make pre-lesson questions, they still have difficulty, so it takes a long time. From this description, overall, although in its implementation, the mentoring activities still have obstacles that still need to be anticipated, they are proven to improve teachers' competence, both in knowledge and skills, in training elementary school students' critical thinking skills.

CONCLUSION

The study results indicate that the mentoring activities in implementing the online RADEC learning model can increase the knowledge and skills of elementary school teachers to train students' critical thinking skills. Mentoring provides elementary school teachers with the competence to develop all indicators of critical thinking skills in every step of the RADEC learning model. However, this study did not study the realm of attitude as part of competence other than knowledge and skills. Therefore, there should be further research that can study it because teachers' attitudes can also be a factor that influences the sustainability of elementary school teachers to implement the RADEC learning model that trains critical thinking.

REFERENCES

Alexander, K. P., DePalma, M. J., & Ringer, J. M. (2016). Adaptive Remediation and the Facilitation of Transfer in Multiliteracy Center Contexts. *Computers and Composition*, *41*(14), 32–45.

Ali, M., & Hayat, B. (2019). Non-academic factors influencing students' achievement: A study in the Indonesian madrasahs. *International Journal of Learning and Intellectual Capital*, *16*(2), 180–192.

Anisa, A. (2017). Meningkatkan keterampilan berpikir kritis peserta didik melalui pembelajaran IPA berbasis potensi lokal Jepara. *Jurnal Inovasi Pendidikan IPA*, *3*(1), 1–11.

Asmawati, E. Y. (2015). Lembar Kerja Siswa (Lks) Menggunakan Model Guided Inquiry Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Penguasaan Konsep Siswa. *Jurnal Pendidikan Fisika*, *3*(1).

Bonyadi, A., & Zeinalpur, S. (2014). Perceptions of Students Towards Self-selected and Teacher-assigned Topics in EFL Writing. *Procedia - Social and Behavioral Sciences*, *98*(1), 385–391.

Capps, D. K., & Crawford, B. A. (2013). Inquiry-Based Instruction and Teaching About Nature of Science : Are They Happening ? *J Sci Teacher Educ*, *24*(1), 497–526.

Care, E., Griffin, P., & McGaw, B. (2012). *Assessment and teaching of 21st century skills.* Dordrecht: Springer.

Creswell, J. W. (2014). *Four Edition Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. University of Nebraska Lincoln*.

Dekker, T. J. (2020). Teaching critical thinking through engagement with multiplicity. *Thinking Skills and Creativity*, *37*(1), 1–9.

Ennis, R. H. (1993). Critical thinking assessment. *Theory Into Practice*, *32*(3), 179–186.

Fajari, L. E. W., Sarwanto, & Chumdari. (2020). Student critical thinking skills and learning motivation in elementary students. *Journal of Physics: Conference Series*, *1*(1), 1–9.

Fawkes, D., O'Meara, B., Weber, D., & Flage, D. (2005). Examining the exam: A critical look at the California critical thinking skills test. *Science and Education*, *14*(2), 117–135.

Firdaus, M., & Wilujeng, I. (2018). Pengembangan LKPD inkuiri terbimbing untuk meningkatkan keterampilan berpikir kritis dan hasil belajar peserta didik Developing students worksheet on guided inquiry to improve critical thinking skills and learning outcomes of students. *Jurnal Inovasi Pendidikan IPA*, *4*(1), 26–40.

Fitriani, H., Asy'ari, M., Zubaidah, S., & Mahanal, S. (2019). Exploring the prospective teachers' critical thinking and critical analysis skills. *Jurnal Pendidikan IPA Indonesia*, *8*(3), 379–390.

Forawi, S. A. (2016). Standard-based science education and critical thinking. *Thinking Skills and Creativity*, *20*(1), 52–62.

Handayani. (2016). Peningkatan Kompetensi Pedagogik Guru dalam Pembelajaran Jarak Jauh Melalui Pendampingan Sistem Daring, Luring, atau Kombinasi pada Masa New Normal Covid 19. *Jurnal Paedagogy*, *3*(3), 36–40.

Handayani, H., Sopandi, W., Syaodih, E., Suhendra, I., & Hermita, N. (2019). RADEC: An Alternative Learning of Higher Order Thinking Skills (HOTs) Students of Elementary School on Water Cycle. *Journal of Physics: Conference Series*, *1351*(1), 1–7.

Huang, G. C., Lindell, D., Jaffe, L. E., & Sullivan, A. M. (2016). A multi-site study of strategies to teach critical thinking: "Why do you think that?" *Medical Education*, *50*(2), 236–249.

Joyce, B., & Calhoun, E. (2014). The 21st-Century Skills. In *Educational Leadership* (pp. 46–66).

Karlina, D., Sopandi, W., & Sujana, A. (2020). Critical Thinking Skills of Fourth Grade in Light Properties Materials through the Radec Model. *The 2nd International Conference on Elementary Education*, *2*(1), 1743–1753.

Kiumars, A., Ebrahim, M., Mostafa, S., Mohammad, A., & Maboud, O. (2012). The Impact of Guided Inquiry Method of Teaching on The Critical Thinking of High School Students. *Journal of Education and Practice, 3*(10).

Kristiyanto, W., Gunarhadi, & Indriayu, M. (2020). The Effect of the Science Technology Society and the Quantum Teaching Models on Learning Outcomes of Students in the Natural Science Course in Relation with Their Critical Thinking Skills. *International Online Journal of Education and Teaching*, *7*(1), 177–191.

Kusuma, M. D., Rosidin, U., Abdurrahman, A., & Suyatna, A. (2017). The Development of Higher Order Thinking Skill (Hots) Instrument Assessment In Physics Study. *IOSR Journal of Research & Method in Education (IOSRJRME)*, *7*(1), 26–32.

Larsson, K. (2017). Understanding and teaching critical thinking—A new approach. *International Journal of Educational Research*, *84*(1), 32–42.

Lestari, H., Setiawan, W., & Siskandar, R. (2020). Science Literacy Ability of Elementary Students Through Nature of Science-based Learning with the Utilization of the Ministry of Education and Culture' s " Learning House ". *Journal of Research in Science Education*, *6*(2), 215–220.

Lestari, H., Siskandar, R., & Rahmawati, I. (2020). Digital Literacy Skills of Teachers in Elementary School in The Revolution 4.0. *International Conference on Elementary Education*, *2*(1), 302–311.

Muskitta, M., & Djukri, D. (2016). Pengaruh model PBT terhadap kemampuan berpikir kritis dan kemampuan berpikir kreatif siswa SMAN 2 Magelang. *Jurnal Inovasi Pendidikan IPA*, *2*(1), 58.

Nakano, T. de C., & Wechsler, S. M. (2018). Creativity and innovation: Skills for the 21st century. *Estudos de Psicologia (Campinas)*, *35*(3), 237–246.

Nawawi, S., & Wijayanti, T. F. (2018). Pengembangan asesmen biologi berbasis keterampilan berpikir kritis terintegrasi nilai Islam. *Pengembangan Asesmen Biologi Berbasis Keterampilan Berpikir Kritis Terintegrasi Nilai Islam*, *4*(2), 136–148.

Novianti, F. (2020). The Analysis of Early Childhood Teachers' Pedagogical Content Knowledge. *Journal of Educational Sciences*, *4*(2), 368–379.

Nugroho, A. A. (2017). The implementation of collaborative-based guided discovery reviewed from students' analytical thinking skills and social skills. *Jurnal Inovasi Pendidikan IPA*, *3*(2), 128–136.

Nuryanti, S., Masykuri, M., & Susilowati, E. (2018). Analisis Iteman dan model Rasch pada pengembangan instrumen kemampuan berpikir kritis peserta didik sekolah menengah kejuruan. *Jurnal Inovasi Pendidikan*, *4*(2), 224–233.

Nussbaum, M., Barahona, C., Rodriguez, F., Guentulle, V., Lopez, F., Vazquez-Uscanga, E., & Cabezas, V. (2021). Taking critical thinking, creativity and grit online. *Educational Technology Research and Development*, *69*(1), 201–206.

Purnami, W., Sarwanto, S., Suranto, S., Suyanti, R., & Mocerino, M. (2021). Investigation of Science Technology Ecocultural Society (STEcS) Model to Enhance Eco Critical Thinking Skills. *Journal of Innovation in Educational and Cultural Research, 2*(2), 77-85.

Pellegrino, J. W., & Hilton, M. L. (2013). *Education for life and work: Developing transferable knowledge and skills in the 21st century.* In The National Academies.

Pratama, Y. A., Sopandi, W., & Hidayah, Y. (2019). RADEC Learning Model (Read-Answer-Discuss-Explain And Create): The Importance of Building Critical Thinking Skills In Indonesian Context. *International Journal for Educational and Vocational Studies*, *1*(2), 109–115.

Reynders, G., Lantz, J., Ruder, S. M., Stanford, C. L., & Cole, R. S. (2020). Rubrics to assess critical thinking and information processing in undergraduate STEM courses. *International Journal of STEM Education*, *7*(9), 1–15.

Saenab, S., Zubaidah, S., Mahanal, S., & Lestari, S. R. (2021). Recode to re-code: An instructional model to accelerate students' critical thinking skills. *Education Sciences*, *11*(1), 1–14.

Sari, D. S., & Sugiyarto, K. H. (2015). Pengembangan Multimedia Berbasis Masalah Untuk Meningkatkan Motivasi Belajar Dan Kemampuan Berpikir Kritis Siswa. *Jurnal Inovasi Pendidikan IPA*, *1*(2), 153.

Satria, E., & Sopandi, W. (2019). Applying RADEC model in science learning to promoting students' critical thinking in elementary school. *Journal of Physics: Conference Series*, *1321*(3), 1–8.

Setiawan, D., Hartati, T., & Sopandi, W. (2020). Effectiveness of Critical Multiliteration Model With Radec Model on the Ability of Writing Explanatory Text. *EduHumaniora : Jurnal Pendidikan Dasar*, *12*(1), 1–14.

Shavelson, R. J., Zlatkin-Troitschanskaia, O., Beck, K., Schmidt, S., & Marino, J. P. (2019). Assessment of University Students' Critical Thinking: Next Generation Performance Assessment. *International Journal of Testing*, *19*(4), 337–362.

Shpeizer, R. (2018). Teaching critical thinking as a vehicle for personal and social transformation. *Research in Education*, *100*(1), 32–49.

Sopandi, Agustin, M., Gumala, Y., Anggraeni, P., & Rahayu, A. H. (2020). Improving Creative Thinking Ability of Prospective Elementary School Teachers through Read-Answer-Discuss-Explain-and Create (RADEC) Project-Oriented Learning Model. *The 2nd International Conference on Elementary Education*, *2*(1), 1298–1308.

Sopandi, W. (2017). The quality improvement of learning processes and achievements through the read-answer-discuss-explain-and create learning model implementation. *Proceeding 8th Pedagogy International Seminar 2017: Enhancement of Pedagogy in Cultural Diversity Toward Excellence in Education*, *8*(229), 132–139.

Sopandi, W. (2019). Sosialisasi dan Workshop Implementasi Model Pembelajaran RADEC Bagi Guru-Guru Pendidikan Dasar dan Menengah [Dissemination and Implementation Workshop of RADEC Learning Models for Primary and Secondary Education Teachers]. *PEDAGOGIA: Jurnal Pendidikan*, *8*(1), 19.

Sopandi, W., & Handayani, H. (2019). The Impact of Workshop on Implementation of Read-Answer-Discuss-Explain-And-Create (RADEC) Learning Model on Pedagogic Competency of Elementary School Teachers. *Advances in Social Science, Education and Humanities Research*, *178*(ICoIE 2018), 7–11.

Suh, J., Matson, K., Seshaiyer, P., Jamieson, S., & Tate, H. (2021). Mathematical modeling as a catalyst for equitable mathematics instruction: Preparing teachers and young learners with 21st century skills. *Mathematics, MDPI*, *9*(162), 1–20.

Sukmawati, D., Sopandi, W., & Sujana, A. (2020). The Application of Read-Answer-Discuss-Explain-and Create (Radec) Models to Improve Student Learning Outcomes in Class V Elementary School on Human Respiratory System. *The 2nd International Conference on Elementary Education*, *2*(1), 1734–1742.

Supandi, M., & Senam, S. (2019). Mengembangkan keterampilan berpikir kritis dengan game ritual tumpe. *Jurnal Inovasi Pendidikan IPA*, *5*(2), 139–146.

Syarifah, S., & Sumardi, Y. (2015). Pengembangan Model Pembelajaran Malcolm'S Modeling Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Motivasi Belajar Siswa. *Jurnal Inovasi Pendidikan IPA*, *1*(2), 237.

Tanti, Kurniawan, D. A., Kuswanto, Utami, W., & Wardhana, I. (2020). Science process skills and critical thinking in science: Urban and rural disparity. *Jurnal Pendidikan IPA Indonesia*, *9*(4), 489–498.

Tempelaar, D. T. (2017). The role of metacognition in business education. *Industri and Higher Education*, *20*(5), 291–297.

Toy, B. Y., & Ok, A. (2012). Incorporating critical thinking in the pedagogical content of a teacher education programme: Does it make a difference? *European Journal of Teacher Education*, *35*(1), 39–56.

Triling, B., & Fadel, C. (2009). Century Skills. *JOSSEY-BASS A Wiley Imprint*, *Book*, 48.

Wagner, T. (2009). The Global Achievement Gap. *Physics World*, *22*(6), 52.