



# The Effectiveness of Radek Learning on Critical Thinking and Creative Thinking in the Era of Super Smart Society 5.0

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**Abstract.** Changes in the educational paradigm can improve the quality of human resources. The demands of critical and creative thinking skill are developed through the radek learning model. However, the result of the implementation of radek are not yet known for their affectiveness so that learning outcomes are not maximized. The research is the result of testing the effectiveness of the RADEC learning model on the development of education in the Super Smart Society 5.0 era, namely creative thinking and critical thinking. The research method uses meta-analysis through searching 10 articles on concrete scholars, then analyzed by Normality test, Homogeneity test, Ancova test, and Hypothesis test. The effectiveness of RADEC learning is based on the Ancova test which gets the results of  $f_{count} < f_{table}$  that is  $2.532 < 4.74$  and is significant at  $0.150 > 0.05$  which indicates  $H_0$  is accepted and  $H_a$  is rejected or there is no significant effect between variables. Effect Size analysis results obtained partial eta squared 0.240 and significant 0.150 which shows the RADEC learning model is more effective in developing critical thinking characters compared to the development of creative thinking in order to meet the development of education in the Super Smart Society 5.0 era.

**Keywords:** Creative thinking · critical thinking · era 5.0 · learning · radek

## 1 Introduction

The Super Smart Society 5.0 era was the Japanese government's idea in 2019. The important point of the Society 5.0 era is that humans are able to solve social problems and create new values without losing the noble values according to their beliefs by utilizing technology. Problem solving is based on innovations that emerged in the previous era, the era of the industrial revolution 4.0, namely artificial intelligence, robots, big data, and the internet of things to improve the quality of human life [1]. In the era of society 5.0, humans are required to have leadership skills, language, IT literacy, and writing skills, so that they have a positive impact, but to deal with it requires appropriate educational strategies [2]. Education has an important role because it is able to direct and shape human resources, students, towards the expected competencies as the Among system proposed by Ki Hajar Dewantara, namely a system of freedom to think [3].

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The development of the times provides various demands for paradigm changes, especially education, to improve the quality of human resources which is a form of effort to develop human potential physically, creatively, and on the initiative so that it becomes real and functions in the course of life [4]. In the society 5.0 era, humans are required to adapt to renewable technology in various aspects of life, so they must have a strong character. Character refers to four actions, namely behavior, attitudes, motivation, and skills as the characteristics of each individual that can be obtained and fostered through character education. The essence of character which is the same as moral education is functioned as forming a superior personality with good human character [5].

However, the rapid and sophisticated development of science and technology demands an increase in the quality of education.

The curriculum as an important element in education continues to experience conceptual changes that aim to improve the curriculum according to the needs of the times [6]. Good curriculum management will facilitate the achievement of educational goals, because it serves as a guide for the implementation of learning. The curriculum is oriented to the quality of education. Therefore, teachers have an important role in implementing the curriculum. The 21st century requires educational institutions to have and develop critical thinking and creative thinking skills [7].

Critical thinking skills is a cognitive ability that is persistent and thorough about a belief that can be considered. Critical thinking can be interpreted as part of cognitive skills, namely interpretation, analysis, evaluation, interference, explanation, and self-regulation [8]. 'Critical thinking skills' has many meanings and it is agreed that there is little common understanding in the learning process. Critical thinking skills consists of six main skills, namely interpretation, analysis, evaluation, intervention, explanation, and self-regulation focused on self-assessment [9]. While creative thinking skills is defined as a thinking process that produces various possibilities. Creative thinking skills has 14 basic elements, namely developing humor, fluency, flexibility, original, elaboration, self-concept, imagination, synetic, synergies, sensitive to a problem, tolerance, resourcefulness, testing the results of ideas, self-evaluation [10]. The 21st century with the principle of learning oriented to HOTs requires teachers to bring up HOTs to students, but in its implementation the teacher is tasked with guiding and motivating. Therefore, a teacher must develop appropriate learning strategies, one of which is using the RADEC (Read, Answer, Discuss, Explain, Create) learning model in the implementation of learning.

Stated that the RADEC learning model is an innovative learning alternative whose syntax is easy to memorize so that there are no misconceptions about the innovative learning model [11]. A similar study was conducted by Wahyu Sopandi, Yoga Adi Pratama, and Hany Handayani which resulted in the RADEC learning model being easy to understand and memorize, able to train 21st century skills, and many were interested in researching it [12]. The RADEC learning model is considered to have the ability to train critical thinking, problem solving, communicative, collaborative, and creative thinking skills. The ability to think critically and creatively is basically a manifestation of higher order thinking skills or HOTs [13]. The RADEC learning model can be used as a solution because its syntax is able to develop all HOTs learning principles, namely read, answer, discuss, explain, and create. The RADEC learning model is one of the strong tools to support critical thinking and creative thinking skills, so it is necessary to

measure the improvement of critical and creative thinking through the RADEC learning model.

## 2 Research Method

The study was conducted to determine the effectiveness of RADEC (Read, Answer, Discuss, Explain, Create) learning on critical thinking and creative thinking skills. This study was meta-analysis research. Meta-analysis research is an integrative analysis of research results with the same focus or theme [14]. Meta-analysis is used as a fact based quantitative review system method so, that data analysis requires a combination of statistical result of quantitative research. The systematic review process is carried out through 8 steps, namely 1) research questions, 2) developing research protocols, 3) determining the allocation of the data-base, 4) analyzing research results, 5) selecting quality research, 6) extracting data from individual studies, 7) funnel plot and forest plot, and 8) presentation of research result. Data collection was carried out by searching for articles on Google Scholar using the keywords "Critical Thinking" and "Creative Thinking" which were published from 2015 to 2021 and were limited to only using articles from journals that had been accredited with a minimum of 5. The results of an article search on Google Scholar found 10 articles which then carried out an analysis to determine the level of effectiveness of critical thinking and creative thinking in the RADEC (Read, Answer, Discuss, Explain, Create) learning model. The data analysis used a prerequisite test, namely normality test and linearity test followed by Ancova test using SPSS 24.00 for windows. The results research has drawbacks, the result of dat analysis show a positive overall value so, it is estimated that the result of the selection of articles are of less quality and less biased.

## 3 Results and Discussion

### 3.1 Results

The search result of "The Effectiveness of RADEC Learning on Critical Thinking and Creative Thinking Skills in The Era of Super Smart Society 5.0" are published from 2019 to 2022. The results obtained as many as 10 articles that match the criteria shown in table 1.

Table 1 shows a list of articles obtained 10 articles regarding the RADEC learning model on critical thinking skills and creative thinking skills. Based on Table 1, the RADEC learning model for critical thinking skills is 5 articles, and for creative thinking skills as many as 5 articles which are then analyzed by concluding between the RADEC learning model on critical thinking skills and creative thinking skills. The results of the analysis of the pretest-posttest values of the RADEC learning model on critical thinking skills and creative thinking skills are shown in Tables 2 and 3.

Table 2 shows the increase in pretest-posttest on the application of the RADEC learning model to critical thinking skills. The results of the RADEC model study on critical thinking skills based on Table 2 show the highest percentages in A2, A4, and A3 codes of 44%, 28% and 27%, while the lowest in codes A5 and A1 are 14% and 12%.

**Table 1.** The Search Results of Radece Learning Model on Critical Thinking Skills and Creative Thinking Skills

No	Data Code	Skill	Research
1	A1	Critical Thinking	Yanti Yulianti, Hana Lestari, Ima Rahmawati in 2022 with research tittle " <i>Penerapan Model Pembelajaran Model Pembelajaran RADEC Terhadap Peningkatan Kemampuan Berpikir Kritis dan Berpikir Kreatif Siswa</i> " published in Journal of Cakrawala Pendas.
2	A2	Critical Thinking	H. Handayani. W. Sopandi, E. Syaodih, I. Suhendra, N. Hermita in 2019 with research tittle "RADEC: An Alternative Learning Of Higher Order Thinking Skills (HOTs) Students Of Elementary School on Water Cycle" published in Journal of Physics
3	A3	Critical Thinking	Muhammad Ilham S., Syarifuddin Kune, Rukli Rukli in 2020 with research tittle "The Effect RADEC'S Learning Model Assisted By Zoom Application on Science Critical Thinking Ability During COVID-19 Pandemic Era" published in Indonesian Journal of Primary Education
4	A4	Critical Thinking	Fitri Yanty Muchtar, Nasrah, Muhammad Ilham S. in 2021 with research tittle " <i>Pengembangan Multimedia Interaktif Berbasis I-Spring Presenter Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Sekolah Dasar</i> " published in Journal of Basicedu.
5	A5	Critical Thinking	Dina Kardina, Wahyu Sopandi, Atep Surjana in 2020 with research tittle "Critical Thinking Skills of Fourth Grade in Light Properties Materials through the RADEC Model" published in International Conference on Elementary Education.
6	B1	Creative Thinking	Yanti Yulianti, Hana Lestari, Ima Rahmawati in 2022 with research tittle " <i>Model Pembelajaran Model Pembelajaran RADEC Terhadap Peningkatan Kemampuan Berpikir Kritis dan Berpikir Kreatif Siswa</i> " published in Journal of Cakrawala Pendas.
7	B2	Creative Thinking	Sabila Idzni Suryana, Wahyu Sopandi, Atep Sujana, Lungguh Puri Pramswari in 2021 with research tittle "Creative Thinking Ability of Elementary School Students in Science Learning Using the RADEC Learning Model" published in Journal of Penelitian Pendidikan IPA

(continued)

**Table 1.** (continued)

No	Data Code	Skill	Research
8	B3	Creative Thinking	Dadan Setiawan, Tatat Hartati, Wahyu Sopandi in 2020 with research title "Effectiveness of Critical Multiliteration Model with Radec Model on The Ability of Writing Explanatory Text" published in Journal of Pendidikan Dasar.
9	B4	Creative Thinking	Selfi Rahmi Andini, Yanti Fitria in 2021 with research title "penelitian Pengaruh Model RADEC pada Pembelajaran Tematik terhadap Hasil Belajar Peserta Didik Sekolah Dasar" published in Journal of Besicedu.
10	B5	Creative Thinking	Rizki Ramadani, Liza Murniviyanti, Ali Fakhruhin in 2021 with research title " <i>Efektivitas Model Pembelajaran Radec Terhadap Kemampuan Menulis Teks Eksplanasi Siswa Di Sd Negeri 06 Payung</i> " published in journal of Edumaspu.

**Table 2.** The Pretest-Posttest Value Analysis Results of the Radec Learning Model on Critical Thinking Skills

No	Data Code	Percentage		
		Pretest	Posstest	Increased (%)
1	A1	74	86	12
2	A2	43	87	44
3	A3	61	88	27
4	A4	61	89	28
5	A5	68	82	14
Mean		61.4	86.4	25.0

Table 3 shows the increase in pretest-posttest on the application of the RADEC learning model to creative thinking skills. The results of the RADEC model study on creative thinking skills based on Table 3 show the highest percentages for codes B1, B3, and B4 at 45%, 45% and 38%, while the lowest in codes B5 and B2 are 14% and 12%.

The results of the RADEC model generally showed an increase in students' critical thinking skills and creative thinking skills, so that the effectiveness of critical thinking skills and creative thinking skills was tested based on the RADEC learning model. The results of the effectiveness of critical thinking skills and creative thinking skills based on the RADEC learning model were analyzed using the ANCOVA test which was preceded by the parametric prerequisite test, namely the normality test and homogeneity test. Normality test using Kolmogorov Smirnov and homogeneity test using Levene's test. The normality and homogeneity test showed that the data on critical thinking skills

**Table 3.** The Pretest-Posttest Value Analysis Results of the Radec Learning Model on Creative Thinking Skills

No	Data Code	Percentage		
		Pretest	Posstest	Increased (%)
1	B1	40	86	12
2	B2	61	87	44
3	B3	44	88	27
4	B4	44	89	28
5	B5	47	82	14
Mean		47.2	82.5	35.3

and creative thinking skills were normally distributed and homogeneous because of the sig value ( $> 0.05$ ), so the Paired Sample T-Test was performed. Paired Sample T-Test was used to determine the difference between the average pretest and posttest learning outcomes of critical thinking skills and creative thinking skills. The Paired Sample T-Test test produces a sig value ( $<0.05$ ) which states that there is a difference in the average pretest and posttest learning outcomes of critical thinking skills and creative thinking skills. The results of the Paired Sample T-Test meet the requirements to proceed to the ancova test stage which is used to determine the difference between pretest and posttest scores on critical thinking skills and creative thinking skills data. The results of the ANCOVA test data on critical thinking skills and creative thinking skills are shown in Table 4.

Table 4 shows the average posttest of the RADEC learning model on critical thinking skills of  $86.4 > 82.5$ , which is higher than creative thinking skills. The significant difference in results between the RADEC learning model on critical thinking skills and creative thinking skills is indicated by a significance result of  $0.150 (> 0.05)$ . The estimated parameter value of the RADEC learning model is 13.16, which means that the RADEC learning model for critical thinking skills gets a higher score than for creative thinking skills. The RADEC learning model provides an effective contribution

**Table 4.** The Effectiveness of Critical Thinking Skills and Creative Thinking Skills Based on the Radec Learning Model

Thinking Skill	Average pretest	Average posttest	F	Significance value (Sig.)	Particle Eta Square
Critical thinking skill	61.4	86.4	4.74	0,150(>0.05)	0.240 (estimate parameter 13.16)
Creative thinking skill	47.2	82.5			

to increasing the value of critical thinking skills and creative thinking skills by 24.0% based on the results of Partial Eta Squared.

### 3.2 Discussion

The use of the RADEC learning model has a positive impact on improving students' critical thinking and creative thinking skills [15]. The highest increase is in students' critical thinking skills, while the lowest is in creative thinking skills.

States that critical thinking skills are skills to identify, analyze, demonstrate prior knowledge, make connectivity, and draw conclusions [16–18]. Critical thinking skills is a metacognitive ability as an active, skilled, conceptual intellectual process, analyzing rationally, applying, synthesizing, and evaluating a fact. Critical thinking skills can develop because students are able to conclude the essential knowledge that has been learned so that they are able to assess an event carefully, study it, and validate it in detail. Critical thinking skills can be classified into 4 levels which are shown in Table 5 [19].

Students who have LCTA 3 ability (very critical) based on Table 6 have the advantage of solving problems explicitly, being independent, easily accepting input from others, and not behaving without thinking. While students who are classified as LCTA 0 (not critical) will have an impact on inflexible minds, not easy to accept input from others, not confident, and easy to be lied to. Because LCTA is to see from a few perspectives, judge too quickly or draw conclusions, fail to understand, resist change, often lie to oneself, be closed to other people's input, and think in stereotypes. Critical thinking skills can be improved with the PUCSC model, namely P (Preparation for learning management), U (Understanding and practice), C (Cooperative solutions), S (Sharing new knowledge), and C (Creation of new knowledge).

Creative thinking skills is a high-level skill that is convergent and includes experience, hypotheses, analysis, problem solving, and communication of the facts found. According

**Table 5.** The Effectiveness of Critical Thinking Skills and Creative Thinking Skills Based on the Radek Learning Model

LCTA	Information	Characteristics
LCTA 3	Very Critical	Students clearly identify facts, accurately and clearly express prerequisite knowledge, are able to solve problems based on prerequisite concepts and knowledge, are able to distinguish logical and valid conclusions
LCTA 2	Creative	Students clearly identify facts, accurately and clearly express prerequisite knowledge, are able to explore the argumentation step but are not clear at each stage, are able to distinguish conclusions logically
LCTA 1	Less Critical	Students clearly identify facts, are less precise and unclear in the disclosure of prerequisite knowledge and logical arguments, and problem solving is not based on prerequisite concepts or knowledge.
LCTA 0	Not Critical	Students are unclear, unable, or irrelevant in identifying facts, prerequisite knowledge, and problem solving

**Table 6.** LEVELS OF CREATIVE THINKING SKILLS (TKBK)

<b>LKBBK</b>	<b>Infoemation</b>	<b>Characteristics</b>
TKBK 4	Very creative	Students are able to implement fluency, flexibility, and novelty in solving problems
TKBK 3	Creative	Students are able to implement fluency and novelty or fluency and flexibility in solving problems
TKBK 2	Pretty Creative	Students are able to implement fluency or novelty in solving problems
TKBK 1	Less Creative	Students are able to implement fluency in solving problems

to X. Gu, et al. (2019), creative thinking skills is a collection of various dimensions of the problem, fluency, flexibility, originality, elaboration, and problem solving as a form of self-appreciation that encourages individuals to look at the point of view of innovation to achieve life goals [20–23].

In the world of creative thinking education, it is divided into five levels of TKBK (Tes Kemampuan Berpikir Kreatif/ Creative Thinking Ability Test). The difference in levels is caused by internal factors (gender, age, cognitive learning outcomes, individual cognitive styles, and individual psychomotor outcomes) as well as external factors (learning strategies and environment). Creative thinking skills can be classified into 4 levels which are shown in Table 6 [24].

At the TKBK level 4 (very creative) students are classified as having very creative skills with other characteristics that students are able to provide complex responses using their own sentences, are able to write and communicate knowledge well, are able to properly and smoothly complete assignments, and have made alternative solutions to problems at least 2 gracefully. Several studies show that high creative thinking skills have an impact on increasing learning achievement, easy understanding and problem solving in the 21st century, increasing independence, improving mental health, and easily achieving knowledge competence. However, students with a TKBK level of 0 (not creative) have not been able to carry out abilities such as TKBK 4. Vilda Yulliana Herlina et. al., (2018) researched that 22% of students had a TKBK of 0 [24]. Low creative thinking skills make it difficult for individuals to solve problems, live depending on others, there is no progress in life, and become individuals who fail. The development of the times requires humans to improve quality so that innovation of ideas is needed to solve problems.

The development of science raises the importance of critical thinking skills and creative thinking towards the super smart society 5.0 era. Learning activities that can be empowered are innovative learning, one of which is the RADEC learning model. The RADEC learning model stimulates students to carry out active student activities with 5 syntaxes. First, read supports student literacy by reading lesson material supported by pre-learning questions so that students are more prepared to take part in learning because they have knowledge concepts. Second, the answer is done by giving post-reading questions to determine the competence of students' knowledge so that learning can be focused. Third, discuss is able to improve students' critical-analytical skills so



that the core of learning can be achieved. Fourth, explain is able to improve the ability to evaluate and communicate so as to develop a pattern of thinking for judging. Fifth, create increases students' creativity to realize their ideas. Several studies have shown that the RADEC learning model is able to improve critical thinking and creative thinking skills. However, the RADEC learning model is more effective for improving critical thinking skills because in its implementation stage students do problem solving explicitly and think at higher levels. As in the study of Jumanto et. al., (2018) the RADEC learning model is able to develop students' critical thinking levels [25].

## 4 Conclusion

The RADEC learning model is a learning model adapted to the 21st century that is able to improve critical thinking and creative thinking skills through the stages of reading, answering, discussing, explaining, and creating. Based on research, the RADEC learning model is more effective in improving students' critical thinking as evidenced by the Ancova test on the pretest and posttest types. The initial ability of students' creative thinking before applying the RADEC learning model from the results of the average pretest and posttest was in the medium category with a percentage value of 61.4%, then after applying the RADEC learning model the average value of the pretest and posttest was in the high category with a 86.4%. Characterized by students being more active in class and increasing critical thinking skills, so that the RADEC learning model is effectively used and developed for the Super Smart Society 5.0 era, especially in critical thinking skills.

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