

Gender Differences in Critical Thinking through RADEC, Problem-based Learning, and Direct Instruction Learning Models

Dadan Setiawan *

* PGMI, Fakultas Ilmu Tarbiyah dan Keguruan, IAIN Syekh Nurjati Cirebon, Indonesia E-mail <u>dsetiawan@syekhnurjati.ac.id</u>

Ari Yanto **

** PGSD, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Majalengka, Indonesia E-mail <u>ari.thea86@gmail.com</u>

Siti Nurhalimah **

** Pendidikan Profesi Guru, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Swadaya Gunung Djati, Indonesia E-mail <u>nsitinurhalimah94@gmail.com</u>

Submitted: 2024-06-29 Revised: 2024-07-03 Accepted: 2024-08-13

ABSTRACT

Critical thinking skills are essential for education and everyday life. Gender is an important component that influences students' critical thinking. However, we still lack understanding of how gender, critical thinking, and learning strategies interact with each other. This study aims to analyze gender differences in critical thinking and evaluate how effective RADEC, PBL, and Direct Instruction learning models are in improving students' critical thinking skills. This research used experimental method with 3x2 factorial design. The sample of this study was 45 fourth grade elementary school students, consisting of 21 male students and 24 female students. Data were collected through a critical thinking skills test consisting of ten essay questions that had been validated by experts. After the application of the learning model, the critical thinking skills test was given to students. To measure critical thinking ability. The data were analyzed using two-way analysis of variance (Two-Way ANOVA) with the help of SPSS IBM 29. The study found that gender differences affected students' critical thinking skills in learning Natural and Social Sciences (NSP). Female students obtained higher scores than male students. The results showed that the RADEC learning model proved to be more effective compared to other models in improving students' critical thinking skills.

Keywords: Critical thinking ability, gender difference, RADEC, PBL, DI Model.

ABSTRAK

Kemampuan berpikir kritis sangat penting untuk pendidikan dan kehidupan sehari-hari. Gender adalah komponen penting yang mempengaruhi pemikiran kritis siswa. Namun, kita masih kurang memahami bagaimana gender, pemikiran kritis, dan strategi pembelajaran berinteraksi satu sama lain. Penelitian ini bertujuan untuk menganalisis perbedaan gender dalam berpikir kritis dan mengevaluasi seberapa efektif model pembelajaran RADEC, PBL, dan Direct Instruction dalam meningkatkan kemampuan berpikir kritis siswa. Penelitian ini menggunakan metode eksperimen dengan desain factorial 3x2. Sampel penelitian ini sebanyak 45 siswa kelas IV sekolah dasar, yang terdiri dari 21 siswa laki-laki dan 24 siswa perempuan. Data dikumpulkan melalui tes kemampuan berpikir kritis yang terdiri dari sepuluh soal essai yang telah divalidasi oleh ahli. Setelah penerapan model pembelajaran, tes kemampuan berpikir kritis diberikan kepada siswa. Untuk mengukur kemampuan berpikir kritis. Data dianalisis menggunakan analisis varians dua jalur (Two-Way ANOVA) dengan bantuan SPSS IBM 29. Studi ini menemukan bahwa perbedaan gender memengaruhi kemampuan berpikir kritis siswa dalam pembelajaran Ilmu Pengetahuan Alam dan Sosial (IPAS). Siswa perempuan memperoleh skor yang lebih tinggi daripada siswa laki-laki. Hasil menunjukkan bahwa model pembelajaran RADEC terbukti lebih efektif dibandingkan dengan model lain dalam meningkatkan kemampuan berpikir kritis siswa.

Kata Kunci: Kemampuan berpikir kritis, perbedaan gender, model RADEC, PBL, DI

INTRODUCTION

Students' critical thinking skills in Indonesia show a concerning level (Fernandes et al., 2024; Mildawani et al., 2022). Many students have difficulty in analyzing information in depth, evaluating arguments, and solving complex problems (Sinaga et al., 2022). They are more likely to take information for granted without questioning its veracity or seeking supporting evidence (Harmawati et al., 2024). When faced with situations that require logical reasoning, many students have difficulty connecting the concepts they have learned with real problems. The ability to ask critical questions and challenge assumptions is also still limited (Affandy et al., 2024).

The poor scores of Indonesian students on international examinations like PISA, particularly in the areas of reasoning and problem-solving, are indicative of their deficient critical thinking abilities (OECD, 2023). This is supported by the results of other studies showing that the ability of Indonesian students to solve problems that require critical thinking and reasoning skills is still low (Sinaga et al., 2022). The empirical data shows that the critical thinking skills of elementary school students in Indonesia are still relatively low, which can be caused by various factors, such as the quality of learning, teacher competence, and an education system that does not support the development of critical thinking skills. Given the importance of critical thinking skills in school and daily life, this condition is quite worrying (Hwang et al., 2023). Critical thinking skills are one of the important competencies.

Not only is this a significant issue for Indonesian education, but it is also a primary emphasis of education systems in many other nations (Ren et al., 2020; Santos-Meneses & Drugova, 2023). This occurrence has prompted global education changes aimed at helping pupils acquire higher-order thinking abilities (Wang & Chen, 2023).

Students' low critical thinking abilities are caused by some factors, including an education system that is still too rote-oriented, classroom management that discourages students from asking questions and thinking critically, a culture that discourages critical attitudes, and a lack of teacher preparation in critical thinking techniques (Maor et al., 2023; Song et al., 2024).

The importance of critical thinking as one of the 21st century skills that students must master to face increasingly complex global challenges that require individuals to have the ability to understand the complexity of information, be able to critically analyze information, sort through increasing information resources, and evaluate their reliability (Fong et al., 2017; Voogt & Pareja Roblin, 2023). Therefore, in this era of global transformation, it emphasizes every individual to have high-level thinking skills and the ability to understand and evaluate information that continues to grow (Anggraeni et al., 2023).

Interpretation, analysis, assessment, inference, explanation, and self-regulation are all fundamental components of critical thinking abilities (P. . Facione, 1990). Academic success is among the real-world outcomes that critical thinking may predict (Barta et al., 2022), including academic achievement (Hwang et al., 2023). It is possible to teach and improve critical thinking abilities (Butler, 2012; Halpern, 2014). Educators and researchers have worked hard to create critical thinking curricula (bayram et al., 2019; Hsu et al., 2022).

Gender differences as a factor influencing critical thinking ability have been the subject of intense scientific research and debate over the past few decades (Zhao et al., 2024). There are gender disparities in pupils' critical thinking skills, according to recent research (N.-Y. Liu et al., 2019; Y. Liu & Pásztor, 2022; Preiss et al., 2013; Sk & Halder, 2020). Therefore, this study raises a major concern about potential gender differences in critical thinking and strategy use in learning.

There are two approaches to teaching critical thinking in the classroom, namely the subject approach and the general skills approach (Ayçiçek, 2021; Ennis, 1987; Gul et al., 2010). Whether or not critical thinking instruction is incorporated into a curriculum subject is what separates the two methods. Since every topic in the curriculum may teach critical thinking, this study uses the subject method to increase students' critical thinking skills in the classroom.

There are several learning models that are considered an effective way to teach and develop critical thinking in elementary school students, including the Read, Answer, Discuss, Explain, and Create (RADEC) learning model, the Problem-based Learning (PBL) model, and the Direct Instruction model. The steps of these learning models are believed to encourage students' critical thinking.Previous research on critical thinking in elementary schools has been conducted such as research on analyzing students' critical thinking skills in PkN learning (Dicky Dermawan & Maulana, 2023), improving critical thinking skills through problem-based learning (Hussin et al., 2018; Razak et al., 2022), improving critical thinking skills through the RADEC learning model (Pratama et al., 2019; Satria & Sopandi, 2019), improving critical thinking skills with direct instruction learning (Ku, 2014; Yeh, 2009).

From these previous studies, no one has examined the effectiveness of learning models in improving students' critical thinking skills and gender differences in critical thinking. Therefore, this study aims to analyze the effect of the three models, and gender differences in critical thinking as a moderating variable.

METHODS

Methods and Design

The experimental technique was the research strategy employed in this investigation. This is due to its desire to determine how learning models affects critical thinking abilities with regard to gender disparities. This study employed a Factorial Design 3x2 research design. Three independent variables – the RADEC learning model, the Problem Based Learning (PBL) model, and the Direct Instruction (DI) learning model – made up the study's variables. Gender is the study's attribute variable, and it is divided into two categories: (1) Male gender and (2) Female gender. Students' critical thinking abilities in elementary school are the dependent variable.

Population and Sample

The population of this study were 4th grade students in SDN Ciremai Giri, Cirebon City. Purposive sampling was used in this study's sample selection process. There were 45 samples in this study, 21 of whom were male and 24 of whom were female.

Data Collection Technique

This study tool consists of ten exam questions that are of the descriptive kind. The questions focus on the following critical thinking skill indicators: (1) analytical capacity, (2) synthesis ability, (3) problem solving ability, (4) conclusion ability, and (5) evaluation ability. First, content validity analysis of this exam was conducted by professionals in the field of basic education.

The data collection procedure of this study was given a critical thinking skills test after learning in each group using the RADEC model, PBL Model, and Direct Instruction Model. **Data Analysis**

Descriptive and inferential statistics were used to assess the study's data in order to ascertain how the three models affected the fourth-graders' critical thinking abilities. Two inferential methods, namely two-way variance analysis (Two Way Anova), were employed in this study to ascertain the impact of two or more variables on the dependent variable. Researchers utilized SPSS IBM 29 for Windows to make study data analysis easier.

RESULTS AND DISCUSSION

Results

From the results of data analysis on the acquisition of critical thinking skills of grade V elementary school students who learn using RADEC, Problem Based Learning (PBL), and Direct Instruction (DI) learning models based on gender, namely male and female. The following authors present the output table of data processing results through the two-way anova test assisted by the SPSS IBM 29 for windows application.

		Value Label	Ν		
Model	1	RADEC	15		
	2	PBL	15		
	3	DI	15		
Gender	1	Male	21		
	2	Female	24		

Table 1. Between-Subjects	Factors
---------------------------	---------

From table 1 above, it is known that the total number of samples is 45 students, where in each class of students who are given learning as many as 15 students. The total number of male students who became the sample of this study was 21 students and the number of female students was 24 students.

Table 2. Descriptive Statistics					
Model	Gender	Mean	Std. Deviation	Ν	
RADEC	Male	81.25	15.309	7	
	Female	91.41	9.412	8	

Fable 2.	Descriptive	Statistics
----------	-------------	------------

Model	Gender	Mean	Std. Deviation	Ν
	Total	86.67	13.124	15
PBL	Male	83.04	9.350	7
	Female	89.84	6.629	8
	Total	86.67	8.474	15
DI	Male	68.75	15.729	7
	Female	81.25	12.939	8
	Total	75.42	15.212	15
Total	Male	77.68	14.600	21
	Female	87.50	10.587	24
	Total	82.92	13.418	45

Table 2 indicates that there are 45 pupils total, with 21 males and 24 women split into two gender categories. Male students have an average critical thinking score of 77.68, whereas female students have an average score of 87.50. This demonstrates that female students have a higher average critical thinking capacity than do male pupils.

		Levene	161	160	6.
		Statistic	dfl	df2	51g.
Results	Based on Mean	1.055	5	39	.400
	Based on Median	.712	5	39	.618
	Based on Median and with	.712	5	22.835	.620
	adjusted df				
	Based on trimmed mean	1.077	5	39	.388

From table 3, it is known that the sig value for the error variance equality test using the Levene test is 0.400. Because the value of Sig. = $0.400 > \alpha = 0.05$, the variance of all data analyzed is homogeneous, so the assumption of homogeneity in the two-way anova test is met. **Table 4. Tests of Between-Subjects Effects**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	2407.087ª	5	481.417	3.405	.012	
Intercept	305580.357	1	305580.357	2161.032	<,001	
Model	1290.272	2	645.136	4.562	.017	
Gender	1080.357	1	1080.357	7.640	.009	
Model * Gender	61.105	2	30.552	.216	.807	
Error	5514.788	39	141.405			
Total	317304.688	45				
Corrected Total	7921.875	44				

a. R Squared = .304 (Adjusted R Squared = .215)

Table 4 displays the significance value of the relationship between the learning model and students' development of critical thinking abilities, the impact of gender on students' development of critical thinking abilities, and the relationship between the learning model and students' development of critical thinking abilities.

Table 4's one-way anova test's SPSS output indicates that the sig (significance) value is 0.017, meaning it is less than 0.05 (α). H0 is rejected and H1 is accepted, indicating that RADEC, PBL, and DI models have a significant impact on students' development of critical thinking abilities. Then, in relation to how gender affects elementary school students' critical thinking abilities, it is known that the sig (significance) value is 0.009, which indicates that the effect is smaller than 0.05 (α), meaning that H0 is rejected and H1 is accepted. Therefore, it can be concluded that gender differences have a significant impact on students' development of critical thinking abilities.

However, based on SPSS output on the two-way ANOVA test in Table 4, the effect of the learning model and sex or gender on elementary school students' critical thinking skills reveals a sig (significance) value of 0.807, meaning greater than 0.05 (α). H0 is accepted and H1 is rejected, indicating that there is no difference in the effect of the learning model and gender on elementary school students' acquisition of critical thinking skills.

Discussion

Based on the results of the research conducted, it was found that the average score of critical thinking skills of female students was higher than that of male students, both in learning using RADEC, Problem Based Learning (PBL), and Direct Instruction (DI) models. Specifically, the critical thinking skills score of female students who received RADEC model showed the highest result of 91.41 compared to students who received PBL and DI model.

The significance value (sig.) for the one-way ANOVA test analysis, which was carried out with SPSS software, was shown to be 0.009. The significance value is less than the designated threshold of significance (α), which is set at 0.05. Rejecting the null hypothesis (H0) and accepting the alternative hypothesis (H1) is the choice that can be taken.

The results show that sex-based differences have a significant effect on how well learners can improve their analytical reasoning skills. Within the parameters of this study, the information points to a clear difference in the cognitive processing capacities of male and female participants in the classroom.

According to the findings, female students often exhibit higher levels of analytical reasoning proficiency than their male peers. This discrepancy might be caused by a number of things, such as different cognitive maturation processes, different learning styles, and different degrees of intrinsic drive that are exclusive to each gender group. Moreover, the pedagogical strategy that prioritizes the development of critical analysis skills (RADEC) has demonstrated exceptional efficacy in augmenting the analytical proficiencies of female pupils. This is in contrast to other teaching strategies (PBL and DI), which emphasize improving conceptual understanding and comprehension.

The RADEC learning approach has a substantial impact on students' critical thinking abilities, according to the study findings gathered. The information gathered from statistical testing suggests this. It has been demonstrated that using this learning technique, pupils' critical thinking abilities greatly increase. Students' critical thinking abilities are methodically developed via the learning phases in the RADEC model, which include reading and comprehending the content, responding to questions, discussing to assess and evaluate comprehension, clarifying concepts, and producing products or solutions. This is consistent with pertinent studies showing that using the RADEC paradigm to teach can help pupils develop their higher order thinking abilities (Handayani et al., 2019; Lestari et al., 2022; Satria & Sopandi, 2019; Sopandi, 2017).

This research implies that one useful tactic for fostering students' critical thinking abilities is the incorporation of the RADEC model into educational activities. This skill is crucial for educating pupils to deal with difficulties and challenging situations in the future (Pratama et al., 2019).

According to the summary given above, the PBL approach has a big impact on students' critical thinking abilities as well. It has been demonstrated that PBL, with its emphasis on problem solving and the application of information in a real-world setting, enhances students' capacity for critical analysis, evaluation, and decision-making. Studies show that PBL may foster student engagement and improve critical thinking abilities by allowing for the autonomous investigation of difficult ideas (Ceker & Ozdamli, 2016; Razak et al., 2022; Santos-Meneses et al., 2023). PBL is the term for autonomous learning through the solution of irregular or unstructured questions or tasks. Students' ability to self-regulate to find previous knowledge and produce new knowledge on their own can be improved by non-routine challenges (Y. Liu & Pásztor, 2022).

PBL is therefore useful in fostering self-regulated learning to raise the caliber of instruction. This is due to PBL's strong emphasis on enhancing self-regulation abilities via imaginative learning and higher-order thinking (Hidajat, 2023).

Then, the Direct Instruction model also has a significant effect on students' critical thinking skills, the DI model which focuses on direct teaching by systematically providing knowledge to students, also has significant implications for critical thinking skills. Although the approach is more structured, this method helps students understand information more clearly and in detail, which in turn allows them to better analyze information. This Direct Instruction model is a structured approach according to (Yeh, 2009) which states that this approach provides a structured framework and is able to produce meaningful and systematic learning experiences. This approach is designed to get students involved and concentrated in achieving the desired learning outcomes, especially for groups that have a learning orientation towards factual knowledge (Ku, 2014). Based on research conducted by (Normore et al., 2024) that this model emphasizes interaction between teachers and students in each stage of learning, so that in this interaction stage it provides opportunities for students to dialogue and think critically to solve problems.

RADEC learning model is more effective than other models in developing students' critical thinking skills. this is because the learning stages encourage students to have the ability to understand complex information, provide opportunities for students to analyze, require students to explain the concepts they understand, and create something to solve problems. this is in line with Facione's view that learning stages that train students to be able to understand complex information, analyze, evaluate, explain, and create solutions to problems can develop students' critical thinking skills because this is the essence of critical thinking (P. a. Facione, 2011; Fong et al., 2017; Hwang et al., 2023).

This study has limitations, namely the main limitation in this study, namely the limited sample size or small sample size. A small sample may limit the generalizability of the study results to a larger population. Therefore, the results of the study may not accurately reflect the true variation in the student population. Furthermore, the study may not have considered individual variations in students' initial abilities and development of critical thinking skills. Internal factors such as students' motivation, emotional intelligence, and individual needs may be variables that are not fully controlled. Then, if the assessment of students' critical thinking skills involves subjective aspects or teacher judgment, there is a potential for assessment bias that can affect the results of the study.

Based on the shortcomings and limitations of the research described above, the implications of this research are: First, the results of this study contribute to the development of learning theory by providing insight into the effect of learning models (RADEC, PBL, DI) on students' critical thinking skills. The findings can be used to enrich and expand the understanding of learning mechanisms and processes that can improve students' critical thinking skills of this study can contribute to the theory of thinking skills by providing empirical evidence of the impact of such learning on the development of students' critical thinking skills.

CONCLUSION

From the research findings previously described, the conclusions in this study are as follows:

- Learning with RADEC, PBL, and DI models has a major impact on students' development of critical thinking abilities. Compared to the PBL and DI models, learning using the RADEC model has a greater and substantial impact on students' development of critical thinking abilities.
- 2. Gender inequalities have a notable impact on primary school children' critical thinking abilities. According to this research, female students acquire critical thinking abilities at a higher rate than male pupils..
- 3. The way that gender and learning models interact to influence primary school kids' development of critical thinking abilities is the same. The critical thinking abilities of pupils are significantly impacted by both gender and the learning paradigm, but not significantly by both factors together. This indicates that there is no mutual influence between the impact of gender and the learning model on students' critical thinking skills.

Suggestions in this study are for future researchers, it is necessary to use a sample in a larger size and need to explore not only critical thinking skills but need to be seen from the aspects of learning motivation and learning styles of students so that the research results are more comprehensive.

REFERENCES

Affandy, H., Sunarno, W., Suryana, R., & Harjana. (2024). Integrating creative pedagogy into problem-based learning: The effects on higher order thinking skills in science education. *Thinking Skills and Creativity*, 53, 101575. https://doi.org/10.1016/j.tsc.2024.101575

Anggraeni, D. M., Prahani, B. K., Suprapto, N., Shofiyah, N., & Jatmiko, B. (2023). Systematic

review of problem based learning research in fostering critical thinking skills. *Thinking Skills and Creativity*, 49, 101334. https://doi.org/10.1016/j.tsc.2023.101334

- Ayçiçek, B. (2021). Integration of critical thinking into curriculum: Perspectives of prospective teachers. *Thinking Skills and Creativity*, 41, 100895. https://doi.org/10.1016/j.tsc.2021.100895
- Barta, A., Fodor, L. A., Tamas, B., & Szamoskozi, I. (2022). The development of students critical thinking abilities and dispositions through the concept mapping learning method A meta-analysis. *Educational Research Review*, 37, 100481. https://doi.org/10.1016/j.edurev.2022.100481
- bayram, D., Kurt, G., & Atay, D. (2019). The Implementation of WebQuest-supported Critical Thinking Instruction in Pre-service English Teacher Education: The Turkish Context. *Participatory Educational Research*, 6(2), 144–157. https://doi.org/10.17275/per.19.18.6.2
- Butler, H. A. (2012). Critical Thinking Assessment predicts real world outcomes of critical thinking. *Applied Cognitive Psychology*, 26, 721–729. https://doi.org/10.1002/acp.2851.
- Ceker, E., & Ozdamli, F. (2016). Features and characteristics of problem based learning. *Cypriot Journal of Educational Sciences*, 11(4), 195–202. www.cjes.eu
- Dicky Dermawan, D., & Maulana, P. (2023). Analisis Berpikir Kritis Pada Pembelajaran PKN di Sekolah Dasar. *Jurnal Elementaria Edukasia*, 6(4), 1671–1579. https://doi.org/10.31949/jee.v6i4.7153
- Ennis, R. H. (1987). A taxonomy of critical thinking disposition and abilities. In J. B. Baron & R. J. Sternberg (Eds.), Teaching thinking skills: Theory and practice. *New York, NY.*, 9–26.
- Facione, P. . (1990). The California Critical Thinking Skills Test--College Level. Technical Report# 1. Experimental Validation and Content Validity. *The Evaluation of Worldwide Digital Reference Services in Libraries*, 147. https://doi.org/10.1016/b978-1-84334-309-7.50014-x
- Facione, P. a. (2011). Critical Thinking : What It Is and Why It Counts. *Insight Assessment, ISBN* 13: 978-1-891557-07-1., 1–28. https://www.insightassessment.com/CT-Resources/Teaching-For-and-About-Critical-Thinking/Critical-Thinking-What-It-Isand-Why-It-Counts/Critical-Thinking-What-It-Is-and-Why-It-Counts/PDF
- Fernandes, R., Willison, J., & Boyle, C. (2024). Characteristics of facilitated critical thinking when students listen to and speak English as an additional language in Indonesia. *Thinking Skills and Creativity*, 52, 101513. https://doi.org/10.1016/j.tsc.2024.101513
- Fong, C. J., Kim, Y., Davis, C. W., Hoang, T., & Kim, Y. W. (2017). A meta-analysis on critical thinking and community college student achievement. *Thinking Skills and Creativity*, 26, 71–83. https://doi.org/10.1016/j.tsc.2017.06.002
- Gul, R., Cassum, S., Ahmad, A., Khan, S., Saeed, T., & Parpio, Y. (2010). Enhancement of critical thinking in curriculum design and delivery: A randomized controlled trial for educators. *Procedia Social and Behavioral Sciences*, 2(2), 3219–3225. https://doi.org/10.1016/j.sbspro.2010.03.491
- Halpern, D. F. (2014). *Thought And Knowledge: An Introduction To Critical Thinking Fifth Edition*. Taylor & Francis.
- 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). https://doi.org/10.1088/1742-6596/1351/1/012074
- Harmawati, Y., Sapriya, Abdulkarim, A., Bestari, P., & Sari, B. I. (2024). Data of digital literacy level measurement of Indonesian students: Based on the components of ability to use media, advanced use of digital media, managing digital learning platforms, and ethics and safety in the use of digital media. *Data in Brief,* 54, 110397.

https://doi.org/10.1016/j.dib.2024.110397

- Hidajat, F. A. (2023). A comparison between problem-based conventional learning and creative problem-based learning on self-regulation skills: Experimental study. *Heliyon*, 9(9), e19512. https://doi.org/10.1016/j.heliyon.2023.e19512
- Hsu, F.-H., Lin, I.-H., Yeh, H.-C., & Chen, N.-S. (2022). Effect of Socratic Reflection Prompts via video-based learning system on elementary school students' critical thinking skills. *Computers & Education*, 183, 104497. https://doi.org/10.1016/j.compedu.2022.104497
- Hussin, W. N. T. W., Harun, J., & Shukor, N. A. (2018). Problem Based Learning to Enhance Students Critical Thinking Skill via Online Tools. *Asian Social Science*, 15(1), 14. https://doi.org/10.5539/ass.v15n1p14
- Hwang, J., Hand, B., & French, B. F. (2023). Critical thinking skills and science achievement: A latent profile analysis. *Thinking Skills and Creativity*, 49, 101349. https://doi.org/10.1016/j.tsc.2023.101349
- Ku, K. Y. L. (2014). Integrating direct and inquiry-based instruction in the teaching of critical thinking: *An intervention study.* 42, 251–269.
- Lestari, H., Ali, M., Sopandi, W., Wulan, A. R., & Rahmawati, I. (2022). The Impact of the RADEC Learning Model Oriented ESD on Students' Sustainability Consciousness in Elementary School. *Pegem Egitim ve Ogretim Dergisi*, 12(2), 113–122. https://doi.org/10.47750/pegegog.12.02.11
- Liu, N.-Y., Hsu, W.-Y., Hung, C.-A., Wu, P.-L., & Pai, H.-C. (2019). The effect of gender role orientation on student nurses' caring behaviour and critical thinking. *International Journal of Nursing Studies*, *89*, 18–23. https://doi.org/10.1016/j.ijnurstu.2018.09.005
- Liu, Y., & Pásztor, A. (2022). Effects of problem-based learning instructional intervention on critical thinking in higher education: A meta-analysis. *Thinking Skills and Creativity*, 45, 101069. https://doi.org/10.1016/j.tsc.2022.101069
- Maor, R., Paz-Baruch, N., Grinshpan, N., Milman, A., Mevarech, Z., Levi, R., Shlomo, S., & Zion, M. (2023). Relationships between metacognition, creativity, and critical thinking in self-reported teaching performances in project-based learning settings. *Thinking Skills and Creativity*, 50, 101425. https://doi.org/10.1016/j.tsc.2023.101425
- Mildawani, M. M. T. S., Murti, T. R., Maryatmi, A. S., & Abraham, J. (2022). A psychological model of competitive behavior: social comparison as a mediator of the critical thinking, self-efficacy, and adaptation ability prediction among college students. *Heliyon*, 8(12), e12205. https://doi.org/10.1016/j.heliyon.2022.e12205
- Normore, G. P., Leibovitch, Y. M., Brown, D. J., Pearson, S., Mazzola, C., Ellerton, P. J., & Watt, G. (2024). Investigating the impact of critical thinking instruction on writing performance: A multilevel modelling analysis of relative gain data in the Australian national assessment program. *Thinking Skills and Creativity*, 53, 101546. https://doi.org/10.1016/j.tsc.2024.101546
- OECD. (2023). PISA 2022 Results Factsheets Indonesia. In *Oecd* (Vol. 1). https://oecdch.art/a40de1dbaf/C108.
- 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. https://doi.org/10.29103/ijevs.v1i2.1379
- Preiss, D. D., Castillo, J. C., Flotts, P., & San Martín, E. (2013). Assessment of argumentative writing and critical thinking in higher education: Educational correlates and gender differences. *Learning and Individual Differences*, 28, 193–203. https://doi.org/10.1016/j.lindif.2013.06.004
- Razak, A. A., Ramdan, M. R., Mahjom, N., Zabit, M. N. M., Muhammad, F., Hussin, M. Y. M., & Abdullah, N. L. (2022). Improving Critical Thinking Skills in Teaching through

Problem-Based Learning for Students: A Scoping Review. *International Journal of Learning, Teaching and Educational Research*, 21(2), 342–362. https://doi.org/10.26803/ijlter.21.2.19

- Ren, X., Tong, Y., Peng, P., & Wang, T. (2020). Critical thinking predicts academic performance beyond general cognitive ability: Evidence from adults and children. *Intelligence*, 82(August), 101487. https://doi.org/10.1016/j.intell.2020.101487
- Santos-Meneses, L. F., & Drugova, E. A. (2023). Trends in critical thinking instruction in 21stcentury research and practice: Upgrading instruction in digital environments. *Thinking Skills and Creativity*, 49, 101383. https://doi.org/10.1016/j.tsc.2023.101383
- Santos-Meneses, L. F., Pashchenko, T., & Mikhailova, A. (2023). Critical thinking in the context of adult learning through PBL and e-learning: A course framework. *Thinking Skills and Creativity*, 49, 101358. https://doi.org/10.1016/j.tsc.2023.101358
- 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). https://doi.org/10.1088/1742-6596/1321/3/032102
- Sinaga, P., Setiawan, W., & Liana, M. (2022). The impact of electronic interactive teaching materials (EITMs) in e-learning on junior high school students' critical thinking skills. *Thinking Skills and Creativity*, 46, 101066. https://doi.org/10.1016/j.tsc.2022.101066
- Sk, S., & Halder, S. (2020). Critical thinking disposition of undergraduate students in relation to emotional intelligence: Gender as a moderator. *Heliyon*, 6(11), e05477. https://doi.org/10.1016/j.heliyon.2020.e05477
- Song, Y., Roohr, K. C., & Kirova, D. (2024). Exploring approaches for developing and evaluating workplace critical thinking skills. *Thinking Skills and Creativity*, 51, 101460. https://doi.org/10.1016/j.tsc.2023.101460
- Sopandi, W. (2017). the Quality Improvement of Learning Processes and Achievements Through the Read-Answer-Discuss-Explain-and Create Learning Model Implementation. *In Proceeding 8th Pedagogy International Seminar, 8*(September), 132–139.
- Voogt, J. M., & Pareja Roblin, N. N. (2023). Curriculum and 21st century skills. In *International Encyclopedia of Education(Fourth Edition)* (pp. 49–55). Elsevier. https://doi.org/10.1016/B978-0-12-818630-5.03007-4
- Wang, X., & Chen, J. (2023). The Investigation of critical thinking disposition among Chinese primary and middle school students. *Thinking Skills and Creativity*, 101444. https://doi.org/10.1016/j.tsc.2023.101444
- Yeh, Y. C. (2009). Integrating e-learning into the direct-instruction model to enhance the effectiveness of critical-thinking instruction. *Instructional Science*, *37*(2), 185–203. https://doi.org/10.1007/s11251-007-9048-z
- Zhao, P., Liao, X., & Yao, Y. (2024). Gender differences in critical thinking and strategy use in English writing from sources among Chinese EFL undergraduates. *Thinking Skills and Creativity*, 52, 101547. https://doi.org/10.1016/j.tsc.2024.101547