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Enhancing Critical and Creative Thinking through Research-Based Learning: The CCTRbL Model's Impact on Student Abilities

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ABSTRACT

Developing critical and creative thinking skills is essential for prospective teachers to meet 21st-century education demands. However, these skills remain relatively low among teacher education students. This study investigates how higher education institutions can design learning experiences to foster these competencies, focusing on the Creative and Critical Thinking in Research-based Learning (CCTRbL) model. This study employed an action research approach based on a modified Burn model, comprising five stages: (1) Identifying, (2) Planning, (3) Intervening, (4) Observing, and (5) Reporting. The participants were 27 teacher education students. Data were collected using an integrated critical and creative thinking assessment rubric for evaluating students' research-based paper tasks. Data analysis utilized categorical descriptive techniques and percentage calculations. The findings indicate that the CCTRbL model effectively enhances students' critical and creative thinking skills, with scores of 68.29 and 65.18, respectively, categorized as high. This suggests that the implemented model positively impacts students' ability to think critically and creatively. The study demonstrates that integrating critical and creative thinking in a research-based learning framework is beneficial for teacher education programs. The findings suggest that the CCTRbL model can be adapted for use at different educational levels with modifications suited to subject-specific requirements. The CCTRbL model is a promising approach to fostering critical and creative thinking skills in teacher education. It is recommended for broader application in primary, secondary, and higher education to enhance students' cognitive abilities and professional competencies.

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1. INTRODUCTION

The need to cultivate critical and creative thinking skills among prospective teachers has become a central focus of 21st-century education worldwide. This study examines the effectiveness of the Creative and Critical Thinking in Research-based Learning (CCTRbL) model in fostering these essential

skills among pre-service teachers in Indonesia. The research aligns with both global and national educational frameworks that emphasize 21st-century competencies. One of the most recognized frameworks, developed by the Partnership for 21st Century Learning (P21), highlights the 4Cs—Critical Thinking, Creative Thinking, Communication, and Collaboration—as fundamental skills for students to thrive in modern society (Partnership for 21st Century Learning, 2019). Despite this recognition, there remains a gap in teacher education programs, where structured opportunities for developing these skills are often limited.

The CCTRbL model integrates project-based learning with structured critical and creative thinking activities, ensuring that pre-service teachers develop and apply these skills within both classroom settings and real-world teaching experiences. This model builds upon and refines existing learning approaches by incorporating adjustments tailored specifically for prospective educators. Additionally, frameworks such as the Assessment and Teaching of 21st Century Skills (ATC21S), developed by the University of Melbourne in collaboration with Cisco, Intel, and Microsoft, further emphasize the importance of Ways of Thinking (creativity, critical thinking, problem-solving, metacognition), Ways of Working (communication, collaboration), Tools for Working (information and ICT literacy), and Living in the World (citizenship, career readiness, and cultural competence) (Global Partnership for Education, 2020).

In Indonesia, these global perspectives are echoed in the Indonesian Partnership for 21st Century Skill Standards (IP-21CSS), which integrates the 4Cs with additional dimensions of Character Building and Spiritual Values. The alignment between these frameworks underscores the importance of critical and creative thinking as fundamental competencies for future educators. However, a significant challenge remains in ensuring that Indonesian teacher education institutions effectively implement these skills within their programs. While research highlights the necessity of equipping pre-service teachers with these competencies, the ability of educational institutions to meet this demand remains inconsistent. Nonetheless, Indonesia's large and dynamic population presents an opportunity—if the nation can successfully integrate 21st-century skills into education, it can enhance its global competitiveness.

What sets the CCTRbL model apart from other pedagogical approaches is its integration of project-based learning not only within university coursework but also in practical teaching experiences. Pre-service teachers engage in structured activities that require them to apply critical and creative thinking in real classroom settings, ensuring they can effectively nurture these skills in their future students. This aligns with findings from the Organisation for Economic Co-operation and Development (OECD), which identifies three key dimensions of 21st-century learning: information, communication, and ethical and social influence—all of which are essential for global engagement (Ananiadou & Claro, 2009). However, reports from the National Education Standards Agency (BNSP) indicate that both teachers and students in Indonesia remain unfamiliar with structured pedagogical models designed to develop higher-order thinking skills (Gradini E., 2019).

Given these challenges and opportunities, this study explores the impact of the CCTRbL model in fostering critical and creative thinking among pre-service teachers. By integrating structured learning experiences with real-world teaching applications, the model seeks to address the existing gaps in teacher education and contribute to the broader goals of 21st-century skill development in Indonesia.

The logical implications of the demands of 21st-century learning for learning systems at all levels, from primary and secondary to higher education, to have 21st-century life skills, especially the ability to think critically and creatively integrated with communication and teamwork skills, are severe. Higher education institutions (HEIs) with teacher education programs must design lectures to equip prospective teachers with critical and creative thinking skills. If done, this provision is very strategic for completing the education program and later developing their professional duties as teachers.

Critical thinking skills encompass the ability to analyze, assess, evaluate, reconstruct, and make decisions that result in rational and logical actions (King, Goodson, & Rohani, 2010). These cognitive processes are applied across various subjects, content areas, and problems through systematic analysis,

evaluation, and proficient reconstruction (Papp et al., 2014). Critical thinking skills can be measured through Critical Thinking Indicators: The capability to associate, investigate, interpret, and examine claims, arguments, evidence, and data using a rational thought process to decide whether to believe it or not and to find the best solutions (Afandi, Sajidan, Akhyar, & Suryani, 2019). It can also be measured using a rubric modified from the FRISCO model (Ennis, 1993), through focus, supporting reason and reasoning, organisation, convention, and integration (Zubaidah, 2018).

Creative thinking skills refer to the ability to generate original ideas, discover novel concepts, and develop diverse solutions to problems. These skills involve producing innovative, varied, and unique ideas (Leen, Hong, Kwan, & Ying, 2014). Additionally, creative thinking is often associated with creativity, which is considered a fundamental aspect of education and a key component in designing learning strategies to address various challenges (Khuziakhmetov & Gabdrakhmanova, 2016). Individual success will be obtained by students who have creative skills. Successful individuals will make this world better for everyone (Zubaidah S., 2016). Creative thinking skills can be measured using Greenstein's (2012) model, which is modified into a self-learning progress log book rubric. The rubric includes curiosity, flexibility, and originality (Zubaidah S., 2018). Fluency: being able to provide several alternative ideas; Flexibility: selecting various ideas based on certain considerations; Originality: having unique, original, own ideas; and Elaboration: being able to provide detailed explanations of ideas. This ability to think critically and creatively needs to be supported by skills to express thoughts, ideas, knowledge, or new information in writing and orally (National Education Association, 2010). Likewise, it is necessary to design learning that can train teamwork in making decisions to achieve common goals (Greenstein, 2012).

The experience of implementing learning to foster critical and creative thinking skills in schools identified with High Order Thinking Skills (HOTS) based learning is still not optimal. The research results in the field found that teachers and students are not accustomed to working on HOTS questions even though HOTS questions have long appeared in mathematics textbooks at school (Gradini, Firmansyah, & Noviani, 2018). Likewise, teachers' ability to design and implement HOTS assessments still needs to be improved. (Gradini E., 2019). In terms of teachers, most of the learning that is carried out is teacher-centred. As a result, students cannot optimally master 21st-century skills (Redhana, 2019).

The Primary School Teacher Education Study Programme (PS PGSD), Satya Wacana Christian University (UKSW), as a teacher education institution, has made efforts to play a role in meeting the demands of 21st-century learning, especially in equipping students to complete the undergraduate education programme, as well as equipping them as prospective primary school teachers. In the early stages, PS PGSD's efforts were made by developing a learning model that could foster critical and creative thinking skills under CCTRbL (Critical and Creative Thinking in Research-based Learning). Its development uses 10 (ten) stages of The Systematic Design of Instruction (Dick, Carey, & Carey, 2009).

The initial CCTRbL model was developed with the United Board for Christian Higher Education in Asia (UBCHEA). The CCTRbL model has been copyrighted by the Ministry of Law and Human Rights under number EC00202230586, dated May 19 2022. Although it is not an entirely new research-based learning model, it differs from previous models. Various development studies on research-based learning (RBL) learning models have been conducted. For example, RBL with research-oriented (RO), research-based (RB), research-tutored (RT) and research-led (RL) syntax for engineering students found that this RBL model is effective in fostering student thinking skills (Noguez & Neri, 2019). Likewise, a comparative study of the impact of research-based and non-research-based lectures found that students who attended research-based lectures had higher levels of reasoning (Eagan Jr. et al., 2013). From the three models, it appears that the RBL syntax, like most research-based models, is a research step in general, while in CCTRbL, there is a contextualisation step on the course material and student context.

The problem formulation in this research is as follows: (1) how is the implementation of the CCTRbL model in improving creative and critical thinking skills; (2) what are the learning outcomes of the CCTRbL model?; and (3) what is the impact of learning from the CCTRbL model?

2. METHODS

This study employs an action research approach. In the context of education, action research refers to a systematic investigation conducted by educators within the teaching and learning environment to gather insights into school operations, instructional practices, and student learning processes. Its primary objective is to equip teacher-researchers with a structured method for addressing challenges in the classroom, enhancing student learning outcomes, and improving teaching effectiveness (Gay, Mills, & Airasian, 2021). The action research model used is the Burn (1996) model, which has been modified to be relevant to educational research, with the steps: 1) Identifying; 2) Planning; 3 Intervening; 4) Observing; 5) Reporting (Andanti, Sulasmono, & Mawardi, 2019). The identifying stage is finding facts about research subjects in the field to see what learning problems occur. The Planning stage is the stage of preparing an action plan. The Intervening stage is the stage of implementing the action. The observing stage is the stage of observation and assessment of learning. The reporting stage is the stage of making reports. The identifying, planning, and intervening stages have been carried out during the preparation of the research design and action design. In contrast, the Observing and Reporting stages will be presented in the research results section. The research stages are described in several processes, namely 1) implementation of the CCTRbL model; 2) measuring the level of learning outcomes; and 3) measuring the impact of the implementation of the CCTRbL model.

The participants in this study were 27 students of the Elementary School Teacher Education (PGSD) study programme who took the Curriculum and Learning course in Elementary School in the even semester of 2022/2023. The techniques and instruments used were test and non-test techniques. The research utilized several instruments, including test questions to assess student learning competencies, rubrics for evaluating critical and creative thinking skills integrated into group paper assignments—adapted from Zubaidah with necessary modifications (Zubaidah S., 2018)—and observation sheets to monitor learning activities. Zubaidah's instrument was selected due to its alignment with the study's objectives, with appropriate modifications made to suit the research context.

The test instrument is free description questions, totalling ten questions, with an even weight. Each question is 10%. The measurement results were compared with the following categories: Very high = $\geqslant$ 81; High = 61-80; Fair = 41-60; Low = 21-40, and Very low = $\leqslant$ 20. The rubric instrument for critical and creative thinking skills uses a 5-scale semantic scoring (1 to 5), totalling 5 items. Scoring is done by calculating the score obtained divided by the maximum score multiplied by 100%. The measurement scores were compared with the following categories: Very critical/creative = $\geqslant$ 81; Critical/Creative = 61-80; Quite critical/creative = 41-60; Less critical/creative = 21-40, and Very less = $\leqslant$ 20. The learning activity observation sheet instrument is a checklist of whether or not lecturer and student activities are carried out based on 7 (seven) learning steps using the CCTRbL model. Specifically, the rubric instrument for assessing critical and creative thinking skills has tested the validity and reliability of the instrument using SPSS. The test results showed the Cronbach's Alpha reliability level of 0, 851 and 0.788. The level of instrument validity coefficient seen from the Corrected Item-Total Correlation number moves between 0.547 to 0.741 and 0.298 to 0.693. These two instruments' reliability and validity levels show reliable and valid categories so that they can be used for data collection in the field.

Data analysis techniques used include categorical descriptive techniques, percentages, and correlation tests. Data on learning outcomes level of critical and creative thinking skills were percented and categorised. Furthermore, multiple correlation tests were conducted to see the correlation coefficient between critical thinking ability, creative thinking ability and student learning outcomes. The last analysis was performed to study the factors in the CCTRbL learning syntax that effectively foster critical and creative thinking skills.

3. FINDINGS AND DISCUSSION

According to Burn, the results of this research will be presented in the fourth and fifth stages, namely, observation and reporting. In the Observing and Reporting stages, data on the Implementation

of learning using the CCTRBL model, the degree of activity of the learning process, the results of measuring critical thinking skills, creativity and learning competencies, the findings of the correlation between critical thinking skills, creativity and learning outcomes; and the findings of growing critical and creative thinking skills through the CCTRbL model.

3.1 Learning Implementation using the CCTRbL model

As stated in the method section, the implementation of the CCTRbL learning model was applied to the curriculum and learning in elementary school courses, which focused on innovative learning design. The expected final abilities are 1) being able to identify problems in the preparation of learning designs in primary schools, 2) being able to analyze the gap between the guidelines and the practice of preparing learning designs in primary schools, 3) being able to examine the factors that cause the problem of low quality of learning designs; 4) being able to develop innovative learning designs to overcome problems.

The results of the observation of the learning process (Table 1) conducted by the observer showed that the 7 (seven) syntaxes of the CCTRbL learning model were all implemented. Syntax 1: students in small group discussions, four people determine the problems in preparing learning designs and choose cases to be solved. Followed by searching for literature sources via the internet. Syntax 2: Group work to formulate the main problems in preparing learning designs in elementary schools selected based on task signs followed by discussion to strengthen the choice of alternative solutions hypothetically.

Table 1. Learning Implementation observation results using the CCTRbL model

CCTRbL Syntax	Learning Activities	Applicability	
		Yes	No
1. Preliminary study and literature review	Small group discussions @ four people determine the problems in the preparation of learning designs and choose cases to be solved. Continue to search for literature sources through the internet.	√	
2. Problem and Hypothesis Formulation	Group work to formulate the main problem of learning design in the primary school selected based on the assignment guidelines, followed by discussion to consolidate the choice of alternative solutions hypothetically.	√	
3. Data collection Data processing	Draft lesson plans to address the issue of low-quality lesson plans and test them.	√	
4. Data analysis and interpretation	Work in groups to analyse and interpret data from group work.	√	
5. Contextualisation of learning materials	Finalise the drafting and submission of innovative learning design tasks.	√	

Source: Primary data from observation

Syntactic 3: Draft lesson plans to solve the problem of low-quality lesson plans and test them. Syntactic 4: Working in groups to analyse and interpret data from group work. Syntactic 5: Finalise the preparation and submission of the innovative learning design assignment.

Table 2. Degree of Activity in the Group Learning Process

CCTRbL Syntax	Learning Activities CCTRbL Syntax Compliant	Degree of Learning Process Activity Score 1= very less, 2 = less, 3 = average, 4 = high, 5 = very high								
		G1	G2	G3	G4	G5	G6	G7	average	%
1. Prior Studies and Literature Review	Small group discussions @ four people determine the problems in preparing learning designs and choose cases to be solved. Continue to search for literature sources through the internet.	4	4	5	4	4	3	3	3.9	77
2. Problem and Hypothesis Formulation	Group work to formulate the main problem of learning design in the primary school selected based on the assignment guidelines, followed by discussion to consolidate the choice of alternative solutions hypothetically.	4	5	5	4	5	4	4	4.47	89
3. Data collection and hypothesis testing	Draft lesson plans to address the issue of low quality lesson plans and test them.	5	5	5	4	4	4	4	4.4	89
4. Data analysis and interpretation;	Work in groups to analyse and interpret data from group work.	5	5	5	4	4	4	4	4.4	89
5. Contextualisation of lecture material	Finalise the drafting and submission of innovative learning design tasks	5	5	5	5	5	5	5	5.0	100
	Sum	23	24	25	21	22	20	20		
	Average	4.6	4.8	5	4.2	4.4	4	4	4.4	
	%	92	96	100	84	88	80	80		88.6

Source: Primary data from observations that have been processed

The effectiveness of a learning model to achieve learning objectives depends on the consistent implementation of the syntax of the learning model. CCTRBL, as a learning model, certainly has goals and syntax or systematic learning steps to achieve goals. Regarding lecturers/teachers, consistency in implementing learning syntax guarantees the achievement of learning objectives. This view aligns with the results of research conducted by Mawardi & Mariati (Mawardi & Mariati, 2016), which states that applying a coherent learning model will provide good learning outcomes. In this research on implementing the CCTRBL learning model in Curriculum and Learning lectures in SD, observation data was obtained that all syntax of the CCTRBL learning model was 100% implemented. This means that the implementation of learning using the CCTRBL model will be able to foster students' critical and creative thinking skills. Research conducted by Waseso and Fuadi found that the implementation

stage of a learning model in lectures consistently by what is written in the RPS and SAP both the sequence of activities will effectively achieve lecture objectives (Waseso & Fuadi, 2020).

3.2 Degree of Learning Process Activity

The degree of activity of the learning process is the intensity of the learning process in groups (@ four students) shown by each group (Table 2). The average percentage of student intensity in small group discussions of four people determines the problems in preparing learning designs and selecting cases to be solved. Followed by searching for literature sources via the internet, the number is 3.9 (77%). In group work, activities to formulate the main problems of preparing learning designs in elementary schools selected based on task signs, followed by discussions to strengthen the choice of alternative solutions, hypothetically reached an average of 4.4 (89%). In the activity of drafting learning designs to solve the problem of the low quality of learning designs that have been prepared and tested, the average is 4.4 (89%). Working in groups to analyse and interpret data from group work also reached an average of 4.4 (89%). While finalising the preparation and collection of innovative learning design tasks, all groups reached 5 (100%). The percentage of this activity, when averaged, is in the very high category.

From the student's point of view, the effectiveness of a learning model in achieving learning objectives depends on the degree of student activity in participating in learning according to the syntax of the learning model. Whether the activity is carried out individually or in groups. The findings in the research describe that the degree of learning activities carried out by students moves between 77% and 100%. If averaged, the degree of activity is 88.8%, including in the very high category. This very high student activity will impact the achievement of learning objectives. This view is in line with the results of research by Fadhilatunisa, D., Fakhri, M. M., & Rosidah, R. (2020), which states that in the experimental group, blended learning lectures designed by lecturers were able to increase student learning activities to reach the good category. This situation further impacts increasing the average value (mean) of student learning outcomes.

Conversely, the control group had no decrease in the mean learning outcomes (Fadhilatunisa, Fakhri, & Rosidah, 2020). Similar research results were also stated by Dewi, L. V., Ahied, M., Rosidi, I., & Munawaroh, F. (2019 who found that increasing student activity greatly supports the achievement of learning objectives because in the learning process, students do not just sit in class receiving lessons, but they form an active experience both mentally and socially (Dewi, Ahied, Rosidi, & Munawaroh, 2019). The results of this study are also supported by the findings of (other) research Nuraini, N., Fitriani, F., & Fadhilah, R., which states that there is a positive relationship between student learning activities and student learning outcomes with r count of 0.67. This means that an increase follows the increase that occurs in the student learning activity variable in the learning outcome variable (Nuraini, Fitriani, & Fadhilah, 2018).

3.3 Impact of CCTRbL Learning Model Implementation

The impact of the implementation of the CCTRbL Learning model can be seen from the measurement of critical thinking skills, creativity and learning competence. The measurement uses assessment rubric instruments and test questions. The complete data is shown in Tables 3, 4, 5 and 6.

Table 3. Descriptive data of students' critical thinking skills level

Statistics	Critical Thinking Skills	Creative Thinking Skills	Learning Competence
Minimum score	60	50	60
Maximum score	76	75	84
Average	68.29	65.18	71.51

Table 3 shows that the average critical thinking ability reached 68.29, with a maximum score of 76 and a minimum of 60. Creative thinking ability reached 65.18, with a maximum score of 75 and a

minimum of 50. While learning competence reached 71.51, with a maximum score of 84 and a minimum of 60.

Table 4. Frequency distribution of students' critical thinking skills level

Interval	Category	Critical thinking skills		Creative thinking skills		Learning competence	
		f	%	f	%	f	%
≥ 81	Very high	0	0	0	0	2	7
61- 80	High	20	74	17	63	24	89
41- 60	Average	7	26	10	37	1	4
21- 40	Less	0	0	0	0	0	0
≤ 20	Very less	0	0	0	0	0	0
Total		27	100	27	100	27	100

Table 4 shows that in the very high category, none of the students had critical and creative thinking skills at this level. There were only two students (7%) whose learning competence reached this level. In the high category, the critical thinking skills of 20 students (74%), creative thinking skills of 17 students (63%), and learning competence of 24 students (89%). In the moderate category, critical thinking skills of 7 students (26%), creative thinking skills of 10 students (37%), and learning competence of 1 (4%). There were no student achievements in the less and significantly less categories.

Tables 6 and 7 map the impact of CCTRbL implementation in fostering critical and creative thinking skills. Table 6 shows that all learning activities according to syntax numbers 1 to 5 affect all aspects of critical thinking skills in all groups, although the indicators that appear vary. It seems that activities according to CCTRbL syntax number 5 (Finalise the preparation and collection of innovative learning design tasks) have the most impact on the growth of critical thinking skills as evidenced by all indicators of critical thinking skills 1 = Focus; 2 = Supporting reason & Reasoning; 3 = Organization; 4 = Convention; and 5 = Integration are all visible.

Table 6. Implementation of CCTRbL and its Impact on student's critical thinking skills

Learning Activities CCTRbL Syntax Compliant	Indication of Critical Thinking Ability *1= Focus, 2 = Supporting reason & Reasoning, 3 = Organization, 4 = Convention, 5 = Integration*						
	G1	G2	G3	G4	G5	G6	G7
1. A small group discussion of four people will be held to determine the problems in preparing learning designs and choose cases to be solved. Continue to search for literature sources through the internet.	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2
2. Group work to formulate the main problem of learning design in the primary school selected based on the assignment guidelines followed by discussion to finalise the choice of alternative solutions hypothetically.	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2
3. Draft lesson plans to solve the problem of low-quality lesson plans and test them.	3	3	3	3	3	3	3
4. Work in groups to analyse and interpret data from group work.	2,4	2,3,4	2,3,4	2,3,4	2,4	2,4	4

5. Finalise the preparation and submission of the innovative learning design assignment	1,2,3, 4,5	1,2,3, 4,5	1,2,3, 4,5	1,2,3, 4,5	1,2,3 ,4,5	1,2,3, 4,5	1,2,3, 4,5

Table 7 shows that all learning activities according to syntax numbers 1 to 5 have an impact on all aspects of creative thinking skills in all groups, although the indicators that appear vary. It seems that the activity according to CCTRbL syntax number 5 (Finalise the preparation and collection of innovative learning design assignments) has the most impact on the growth of creative thinking skills as evidenced by all indicators of critical thinking skills 1 = Fluency; 2 = Flexibility; 3 = originality; and 4 = Convention are all visible.

Table 7. Implementation of CCTRbL and its impact on students' creative thinking skills

Learning Activities CCTRbL Syntax Compliant	Indication of Creative Thinking Ability *1= Fluency, 2 = Flexibility, 3 = Originality, 4 = Convention*						
	G1	G2	G3	G4	G5	G6	G7
1. Small group discussion @ four people to determine the problems in preparing learning designs and choose cases to be solved. Continue to search for literature sources through the internet.	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2
2. Group work to formulate the main problem of learning design in the primary school selected based on the assignment guidelines followed by discussion to finalise the choice of alternative solutions hypothetically.	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2
3. Draft lesson plans to solve the problem of low-quality lesson plans and test them.	3	3	3	3	3	3	3
4. Work in groups to analyse and interpret data from group work.	3,4	3,4	3,4	3,4	3,4	3,4	3,4
5. Finalise the preparation and submission of the innovative learning design assignment	1,2, 3,4	1,2, 3,4	1,2, 3,4	1,2, 3,4	1,2, 3,4	1,2, 3,4	1,2, 3,4

The results of the multiple correlation test between critical and creative thinking skills and learning outcomes are shown in Table 5. The correlation coefficient between the learning outcomes variable and essential skills of thinking is 0.852, while the learning outcomes variable and creative thinking skills is 0.783. Theoretically, the contribution of critical thinking ability to student learning outcomes is more significant than the ability to think creatively. The R square number is 0.744, indicating that critical and creative thinking skills jointly contribute 74.4% of student learning outcomes, and the rest (23.6%) comes from other variables.

Table 8. Correlation data between critical and creative thinking skills and learning outcome competence

		Learning outcomes	Critical	Creative
Pearson Correlation	Learning outcomes	1.000	.852	.783
	Critical	.852	1.000	.962
	Creative	.783	.962	1.000
Sig. (1-tailed)	Learning outcomes	.	.000	.000
	Critical	.000	.	.000
	Creative	.000	.000	.
N	Learning outcomes	27	27	27
	Critical	27	27	27
	Creative	27	27	27

** Correlation is significant at the 0.05

Table 9. Summary Result

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.863(a)	.744	.723	3.591

a Predictors: (Constant), Creative, Critical

b Dependent Variable: Learning outcomes

The results of this action research study found that the average level of critical thinking ability, creative thinking ability and competence of student learning outcomes were 68.29, 65.18 and 71.51, respectively. All data are in the high category. This shows that the CCTRbL model effectively fosters critical thinking skills, creative thinking skills, and competence in student learning outcomes. In terms of teachers/lecturers, the CCTRbL learning model is effective because the learning syntax designed by teachers/lecturers is implemented as designed.

The effectiveness of the CCTRbL learning model can be analysed based on the contribution of each activity according to the learning syntax in fostering critical thinking skills. Implementation of learning syntax 1, namely Preliminary Study and Literature Review through small group discussions to determine problems in the preparation of learning designs that will be solved through literature studies, contributes to fostering the ability to express ideas or issues clearly. Implementing Syntactic 2, namely Problem Formulation and Hypothesis, with group work activities to formulate the main problem of preparing learning designs in elementary schools selected based on task signs followed by discussions to strengthen the choice of alternative solutions hypothetically also contributes to fostering the ability to express ideas or problems clearly. Implementing the 3rd syntax, namely Data collection and hypothesis testing through the activity of preparing draft learning designs to solve the problem of low-quality learning designs that have been prepared and testing them, contributes to fostering the ability to provide clear, reliable and credible reasons and evidence. Implementation of the 4th syntax, namely, Analysis and interpretation of data through the activity of working in groups to analyse and interpret data from group work, contributes to the ability to arrange ideas that are logically connected from planning to conclusion. Implementing the 5th syntax, namely Contextualisation of lecture material through the finalisation of the task of preparing innovative learning designs, contributes to fostering the ability to express ideas logically and whether the truth of the writing is consistent with the assigned task.

The implementation of CCTRbL steps contributes to fostering students' critical thinking skills, as evidenced by all indicators of essential skills of thinking. Focus, Supporting reason & Reasoning, Organisation, Convention, and Integration appear in the analysis. This finding proves Zubaidah's theory, which states that research-based learning can foster the ability to investigate, interpret, and examine opinions, arguments, evidence, and data using a rational thought process to decide whether

to believe and find the best solution. (Zubaidah, 2018). This finding is also supported by various other studies, including Susiani, T. S., Salimi, M., & Hidayah, R., who examined Research Learning (RBL): How to Improve Critical Thinking Skills, found that ..the results of the research indicate that the implementation of research-based learning (RBL) can develop critical thinking skills. It is proven by the fact that the students could show their interpretation, analysis, evaluation, inference and explanation abilities" (Susiani, Salimi, & Hidayah, 2018). Similar research was reported by Suyatman, S., & Chusni, M. M, who found that learning by applying the Research-Based Learning model (RBL) model can foster analytical-critical thinking skills on the concept of energy in the medium category so that alternative learning strategies are needed to improve the ability of prospective teachers in science learning (Suyatman & Chusni, 2022). Likewise, the research report of Ahdika, A. found that about 89.41% of students were satisfied and interested in the RBL learning system, the average final scale of students' scores was 3.3 out of 4, and 84.44% of students were able to conduct research with a critical scientific framework (Ahdika, 2017). Although this research is different, the essence is the same, namely that the RBL learning model can foster students' critical thinking.

The successful implementation of the CCTRbL learning model in fostering creative thinking skills can also be analysed based on the contribution of each step of the model and indicators of creative thinking skills. Implementing learning syntax 1, namely Preliminary Study and Literature Review through small group discussions to determine problems in the preparation of learning designs that will be solved through literature studies, contributes to fostering the ability to provide several alternative ideas. Likewise, the implementation of Syntactic 2, namely Problem Formulation and Hypothesis with group work activities to formulate the main problem of preparing learning designs in elementary schools selected based on the task signs followed by discussion to solidify the choice of alternative solutions hypothetically also contributes to being able to provide several alternative ideas. Implementing the 3rd syntax, namely Data collection and hypothesis testing through the activity of drafting learning designs to solve the problem of low-quality learning designs that have been prepared and testing them contributes to fostering the ability to select various ideas based on certain considerations. Implementation of the 4th syntax, namely Data analysis and interpretation through the activity of working in groups to analyse and interpret group work data, contributes to fostering the ability to come up with unique, original, own ideas; and being able to provide detailed explanations. Implementing the 5th syntax, namely Contextualisation of lecture material through the activity of finalising the task of preparing innovative learning designs, also contributes to fostering the ability to come up with unique, original, own ideas and provide detailed explanations.

As in the critical thinking ability variable, the implementation of CCTRbL appears to contribute to fostering students' creative thinking abilities, as evidenced by all indicators of creative thinking abilities Fluency, Flexibility, Originality, and Convention. This finding proves Zubaidah's theory, which states that research-based learning can foster the ability to discover new things that have not existed before, is original, develops a variety of new solutions to each problem, and involves the ability to generate new, varied, and unique ideas. The findings of this study are in line with the research of Gita, R. S., & Waluyo, J., who examined the implementation of RBL-STEM in Improving Students Creative Thinking Skills and found that the application of the RBL learning model with a STEM approach can improve students' creative thinking skills in solving problems of utilising chitosan as a natural preservative for processed meat (Gita & Waluyo, 2023). This research is also supported by the results of Wahyuni, S. I., & Farisi, M. I., who found that the application of research-based learning can improve the creative thinking skills of elementary school students in solving "polemics" problems (Wahyuni & Farisi, 2020). Likewise, Nazula, Dafik & Slamin's research on The profile of students' creative thinking skills found that the creative thinking skills of students who were treated with the application of RBL increased from 26% of the excellent category to 43% of the excellent category. Based on the post-test scores, the experimental class was superior to the control class. The results of the Independent Sample T-test test showed a significance value of 0.000 ($p \leq 0.005$), which indicated that there was a difference between the experimental class and the control class (Nazula, Dafik, & Slamin, 2019).

Further analysis using multiple correlation techniques between the critical and creative thinking skills level and learning outcomes competencies shows R square data of 0.744. This means that the level of student learning outcomes is contributed jointly by critical and creative thinking skills by 74.4% and from other variables by 23.6%. The flow of thought that critical thinking skills contribute to student learning competencies can be explained as the competence of student learning outcomes is formed by essential thinking activities, in the form of activities through analysis, evaluation, reconstruction, and then making decisions that lead to rational and logical actions. This view is in line with the opinion of Komariyah, S., & Laili, A. F. N who stated that critical thinking can be interpreted as a process of using thinking skills actively and rationally with full awareness and considering and evaluating information, intending to make decisions (Komariyah & Laili, 2018).

Students accustomed to doing mental activities to analyse and evaluate information will be honed in their ability to understand the lecture material presented by their doses to master the lecture material. Thus, this line of thought strengthens the finding that critical thinking skills contribute to student learning competence. This finding is supported by research by Safitri, W. C. D., & Mediatati, N. who found that the application of the Discovery learning model can foster critical thinking skills which will further improve learning outcomes (Safitri & Mediatati, 2021). Similar research conducted by Nugrahaeni, A., Redhana, I. W., & Kartawan, I. M. A. also produced findings stating that the application of the Discovery learning model as one of the families of research-based learning models fosters students' critical thinking skills in the very high category by 54% of the total number of students, the high category by 30%, and the medium category by 8%. This data's findings were significantly positively correlated with student learning outcomes (Nugrahaeni, Redhana, & Kartawan, 2017).

A slightly different study conducted by Devi, P. S., & Bayu, G. W found that the results of the analysis of students' critical thinking skills showed that the percentage of students' critical thinking skills was in the critical criteria of 80.57% of students, then at the second meeting of cycle I increased to very critical to 88.5% at the second meeting of cycle II. On the learning outcome variable, it was found that the class average score after the action from the original 62.1% increased to 79.3% at the time of the post-test. This figure does not show a significant positive correlation between critical thinking ability and learning outcomes (Devi & Bayu, 2020).

In the creative thinking ability variable, the line of thought that creative thinking ability contributes to student learning competence can be explained that student learning competence is formed due to the ability that has been trained to find new ideas that are varied and unique and trained to develop various new solutions to each problem. This finding is in line with Cintia, N. I., Kristin, F., & Anugraheni, I. (Cintia, Kristin, & Anugraheni, 2018), which states that learning using the discovery learning model as a family of scientific models is proven to foster creative thinking skills and learning outcomes. Other findings that support this research include research conducted by Manurung, A. S., Halim, A., & Rosyid, A, who examined the Effect of Creative Thinking Ability on Learning Outcomes and found a positive contribution between the variables of creative thinking ability and mathematics learning outcomes statistically tested (Manurung, Halim, & Rosyid, 2020). Similar research was also reported by Nuriadin, I., & Perbowo, K. S., who examined the correlation of creative thinking skills with learning outcomes and found that there was a significant relationship between creative thinking skills and student mathematics learning outcomes with a contribution of 31.2% (Nuriadin & Perbowo, 2013). Although there are similar research results, it turns out that there are studies that contradict the results of this study, namely Wahyuni, A., & Kurniawan, P., who examined the relationship between creative thinking skills and learning outcomes found an R square value of 0.225 and insignificant. This means there is no significant positive correlation between creative thinking skills and student learning outcomes (Wahyuni & Kurniawan, 2018)

4. CONCLUSION

Based on descriptive data and frequency distribution, the CCTRbL model effectively enhances students' critical and creative thinking skills, placing them in the high category. This conclusion is supported by average scores of 68.29 and 65.18, respectively. Additionally, multiple correlation tests indicate a strong relationship between learning outcomes and both critical (r = 0.852) and creative thinking skills (r = 0.783). The cognitive skills collectively account for 74.4% of learning outcomes, while the remaining 23.6% is influenced by other factors. These findings highlight the importance of integrating the CCTRbL model into educational practices to enhance critical and creative thinking. Future research should explore strategies to optimize the model's effectiveness, particularly in addressing external factors influencing learning outcomes. Longitudinal studies could investigate its long-term impact on students' cognitive development and adaptability across different educational contexts. Additionally, experimental research comparing CCTRbL with other pedagogical models could provide further insights into its relative efficacy. Thus, continued implementation and refinement of the CCTRbL model are recommended to further strengthen students' cognitive skills and improve learning outcomes.

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