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The Impact of Combining Brain-Targeted Teaching Model and Students Content Schema in Teaching EFL Critical Reading

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ABSTRACT: This study investigated the effectiveness of combining brain-targeted teaching (BTT) and content schema (CS) in teaching critical reading in one of a private universities in Indonesia. The design was quasi experimental to investigate the effectiveness of combining BTT and CS. The sample was 60 students. The instrument was critical reading test. The data was analyzed by using inferential statistics both pair t-test and independent t-test. The result showed that (1) there is significant different effect before and after taught by combining BTT and students' CS (2) the combining BTT and CS is effective. This finding encouraged other teachers to implement combining BTT and CS as one of the teaching strategies.

KEYWORDS: brain-targeted teaching, students' content schema, critical reading course

1. INTRODUCTION

Teaching EFL Critical reading is challenging for the lecturer because teaching reading as a foreign language is more complicated than teaching reading as the native language. Mlakar (2020) stated that teaching reading as a foreign language (L2) is complex due to cognitive load, linguistic interference, cultural context, motivation, educational resources, reading purposes, and skill transfer. L2 learners must navigate a new phonetic system, vocabulary, and grammatical structures, which can increase cognitive load. Cultural references and nuances may also be challenging for L2 learners (Field, 2019& Frazer et al., 2016). Limited motivation and exposure to the language outside the classroom can slow down reading acquisition. Additionally, L2 learners may need to develop new reading strategies specific to the foreign language.

Critical reading is one of the compulsory courses at English Language Education Department of PGRI Jombang University in East Java, Indonesia. This course is taken in the fourth semester. It is designed for helping students to sharpen their critical reading to improve their academic literacy, and expand their general knowledge. Students will read a variety of texts to improve their analytical, interpretive, and evaluative skills. Larkin (2017) and Karimi &Veisi (2016). Stated that the students analyze, synthesize, evaluate, and create text in all forms to develop new ideas and conclusions in learning Critical Reading. They read the critical reading text from academic articles from the journal, proceedings, and others. As a result, critical reading abilities enable students to get the information they require from a variety of sources. However, as a result of their poor reading skills, many students lack motivation to learn EFL critical reading and it effects the students' reading score (Kweldju, 2015; Karimi&Veisi 2016& Larkin, 2017). Furthermore, to enhance students' critical reading ability, lecturers should use the innovative method in explaining the material. Combining brain-targeted teaching (BTT) and activating students' content schema (CS) is one of the current teaching models that teachers and students need.

The BTT model is based on the idea that students have natural differences in brain function and behavior traits, just as they do in academic skills and personalities. Lecturers gain valuable insight into students' strengths, weaknesses, engagement and behaviors in the classroom by understanding how the brain develops and works and how it influences students' behaviors in the classroom (Trolian, 2018; Srikoon et al., 2017; Zadina, 2015). Some studies of teaching reading by employing BTT method have been conducted by (Rukminingsih, 2021; Nur et al., 2020; Seegers, 2020; Rukminingsih, 2018; Parr, 2016). However, based on the preliminary research which has been conducted at English Language Education Department of PGRI Jombang University by interviewing the students who were taught by BTT, the finding showed that BTT could not be employed in EFL learners easily

while the learners come from the mix ability setting or medium & low ability in English. It is recommendable if the students read the text critically. Whereas, teaching EFL reading is not a simple one because the students need some background knowledge of the passage to comprehend the text.

To cope with this problem, the students' schema needs to be activated. Content schema, (CS) is concerned with the role of prior knowledge and background information
in comprehension. Students ' background knowledge is vital in understanding the reading material (Rukminingsih, 2021; Din, 2020; Grabe &Stoller, 2019). It assists people in developing meanings by linking their prior knowledge to the information offered by the writer in the text. Readers who lack previous information or who fail to engage it while reading will struggle to understand the material (Nur et al., 2020). To allow students to use their schema, reading content must be related to their background knowledge. The prior knowledge of a domain predicts text memory and promotes the ability to make inferences (Ohoiwutun, 2014). Teachers must be able to assign assignments that motivate students to use their prior knowledge.

To fill the research gaps which showed that some previous studies have been conducted the BTT separately with previous studies dealing with students' content schema, this study aims to combine a brain-targeted teaching model and students' content schema activation for EFL critical reading. The BTT method helps students apply their prior knowledge, which is crucial for the reading process. Students with vocabulary knowledge can activate their schema by reading and summarizing the topic. This study is addressed to answer the research questions as the following:

1) Is there any significant different effect before and after being taught by combining brain-targeted teaching method with students' content schema?
2) Is there any significant different effect between the students who are taught by combining brain-targeted teaching method with students' content schema and the students who are taught by conventional method?

This study aims to test the alternative hypothesis (ha) as the following:

1) There is a significant different effect before and after being taught by combining brain-targeted teaching method with students' content schema. (Ha1)
2) There is a significant different effect between the students who are taught by combining brain-targeted teaching method with students' content schema and the students who are taught by conventional method. (Ha2)

2. LITERATURE REVIEW

A. Brain Targeted Teaching (BTT)

Brain-targeted teaching (BTT) is one subset from Brain-Based Learning (BBL). BBL is a comprehensive method that focuses on how the brain naturally learns and is based on current knowledge of its structure and function (Trolian, 2018). According to Sousa (1990:13), brain-based learning involves studying the brain's cognitive capabilities and using best practices in the classroom, rather than only typical neuroscience studies. Understanding the brain's learning process can increase reading comprehension. While BTT is a new teaching model created by Hardiman (2012).

The BTT is one of the teaching methods developed by Hadirman (2011) and it is a part of the neuroscience approach. Hardiman et al. (2012) developed the BTT framework, which provides a framework for teachers in any setting to understand Mind, She described six brain targets that can be used to create learning experiences involving (1) Emotional climate as first target, (2) physical environment, (3) big picture learning design, (4) mastery of content, skills, and concepts, (5) knowledge application, and (6) evaluation and assessment are the six brain targets (Hardiman, 2012). Rather than recommending specific strategies for all teachers, Hardiman et al. (2012) presented a lens for educators and educational leaders to use to assess the alignment between their current practices and their intended outcomes. In this study, BTT method which was employed in six teaching targets adopting from (Rukminingsih, 2021; Seagers, 2020; Rukminingsih, 2018; Parr, 2016; Hardiman et al., 2012; Hardiman, 2011). They are (1) creating the physical environment, (3) designing the learning experience, (4) teaching for mastery of content, skills, and concepts, (5) teaching for knowledge extension and application, and (6) evaluating learning (Hardiman, 2011).

B. Critical Reading

Critical reading is the highest level of comprehension (Ann, 2013). Critical reading has close links to EFL students' competence in reading comprehension. Critical reading strategies refer to a strategy that encourages students to use each of the cognitive processes in the three upper levels of Bloom's Taxonomy, which is commonly associated with critical thinking skills Karimi&Veisi (2016). Critical reading is part of the reading process. It is the analytic process. It can help students become better readers and thinkers because they will be looking at reading as a process rather than a product. In this case, when they are reading, they are

thinking and analysing the text at a similar time Bto identify information and gain a good understanding (Larking, 2017)

C. Content Schema

Activating students' content schema is a teaching method that helps students understand the text more easily. Students are prepared to comprehend the content by activating their prior knowledge. One of the most significant tactics that a teacher can employ before reading to improve comprehension is to activate subject schema or background knowledge (Din, 2020; Grabe &Stoller, 2019) . As the content schema linked with a text develops, readers acquire the ability to comprehend the content (Munsakorn, 2015). Schema activation is a strategy used to activate students' prior knowledge about a topic, enhancing reading comprehension. It involves activities and strategies that connect old and new information, improving decoding and recall abilities. This approach, as defined by Piaget's schema theory, is crucial for effective learning.

3. METHODOLOGY

The design of this research was quasi experimental by using quantitative data to investigate the effectiveness of combining BTT and Content Schema by (1) comparing pre-test and post-test before and after taught by combining BTT and students' content Schema, and (2) comparing post-test between experimental and control in Critical Reading class. A quasi experimental design is applied in cases in which the sample in the population selected cannot be selected randomly (Rukminingsih et al., 2020).

In choosing the research sample, the researcher employed purposive sampling in class. Leavy (2017) stated that purposive sampling is frequently used when the researcher has access to subjects within a specific institution. Quasi- experimental designs typically employ this type of sampling procedure. Two classes were used in this study consisting one class is for experimental class and the other class is for control class involving 30 students for each class. The sampling was chosen to be sampled as they were homogeneous in their critical reading achievement. Experimental and control classes had almost similar scores based on a prior knowledge test. There was no significant difference between the two classes (M Control class = 32.78; SD Control = 12.15; M Experiment = 32.98; SD Experiment = 12.07; F = .076; p = .786).

This research group were from students of English Language Education department in one of the private universities in the forth semester who were taking Critical Reading courses. A total 60 students who participated in this research. The experimental was conducted eight meetings during two months. The experimental class was taught by combining BTT with students' content schema in critical reading class, while the control class was taught by using conventional method.

Course Design

This research was conducted in the Critical Reading course that students learned how to comprehend the highest EFL reading comprehension level. In Critical reading course, the students to read the text critically which is adapted from CEFR C2 and Taxonomy Bloom. It is based on high order thinking skills (Hots) adapted from Bloom Taxonomy(Bloom &Krathwohl 1956; Anderson & Krathwol, 2001). The students are expected to be able to analyze, synthesize, evaluate and create some kinds of text such as conceptual or research-based articles from journals, proceedings, magazines, and IELTS reading tests. They had to be able to comprehend the text by analyzing, synthesizing, evaluating and creating and included topic such as identifying an argument include issues, conclusions, and reasons in the text, interpreting between facts and opinions on texts, assessing the accuracy of evidence given in support of an author's argument, synthesizing ideas on related issues from intertextual sources, evaluating the text and summarizing the text. The course lecturer was an experienced university lecturer. The course was conducted face to face for eight weeks. The syllabus of the course was introduced to the students at the first week in first meeting. In first week, both students from experimental class and control class got the pre-test to measure their background knowledge scores and to ensure that both classes had the homogeneity their background knowledge.

In this teaching strategy, we implemented combining BTT and activate students' content schema in teaching Critical Reading Course. BTT method involving Brain target one: Emotional climate, Brain target two: Physical environment, Brain target three: Learning design, Brain target four: teaching for mastery, Brain target five: teaching for application, Brain target six: evaluation and assessment activating students' content schema was implemented as the following:

In **pre reading**, (1) the lecturer welcomed students warmly in the class to create positive emotional climate (**Brain target 1: emotional Climate for learning**)and the lecturer create the classroom by providing comfortable classroom displays, sound, lighting, scent, and background music, affect learning for high-concentration tasks (**Brain target 2: Physical Learning environment**), then (2) the lecturer asked the students the topic which will be discussed in the text generally with (what, why and how) question words by asking them to search the same topic from other sources at home before coming the class (**activating students' content schema**).

In **whistle reading**, (1) the lecturer asked the students to expand the students' knowledge about the topic through brief discussing related to the topic of the text (**Brain target 3**: **Designing the learning experience),** (2) she asked the students to discuss what the students have written and ask the students to check their comprehension about the text (**Brain target four: teaching for mastery**) (3) she asked the students to comprehend the text by answering the questions about evaluating information by confirming, extend or change their personal view based on the topic of the reading They should explain when they do not agree with information in the text (**Brain target four: teaching for mastery**), (4) the students discussed the answers together in order to enlarge students' comprehension (**Brain target four: teaching for mastery**), (5) the lecturer asked the students to integrate students' knowledge into a greater schema by comprehending text by summarizing the reading passage (**Brain target five: teaching for application**) and (**activating students' content schema**).

In **post reading**, the lecturer gave score and feedback to students' summaries **(Brain target six: evaluation and assessment)** and (2) gave some enforcement the comprehension of the text by asking the students to conclude the lesson today and confirming by the lecturer **(Brain target six: evaluation and assessment).**

Data Processing

Three data sources were used: (a) prior knowledge test, (b) pre-test score, and (c) posttest score. Prior knowledge test was used to measure the homogeneity of experimental class and control class. The result of homogeneity was used to show that both experimental and control class have homogenous background knowledge. Pre-test score was used to compare the students' achievement in experimental class before and after being taught by combining brain-targeted teaching and activating students' content schema in critical reading course. Post-test score was used to compare between the students' achievement in experimental class taught by combining brain-targeted teaching method and students' content schema with the students' achievement in control class taught by using conventional method.

Data Analysis

Quantitative data were analyzed using inferential analysis with the SPSS version. Pre-test was used to determine the effectiveness of combining brain-targeted teaching method and activate students' content schema by comparing the results of pre-test and post-test of Critical reading course in experimental class. Pre-test was given before treatment in experimental class then the treatment was given to the experimental class by combining brain-targeted teaching and students' content schema. After treatment then the post-test was given to the experimental class. The score of the significant difference before and after taught by combining brain-targeted teaching and students' content schema. It was analyzed by paired-samples t-test. The scores of the comparison between students taught by combining brain-targeted teaching and students' content schema and students taught by conventional method in teaching EFL Critical reading. It was analyzed by independent t-test.

4. RESULTS and DISCUSSION

The results are depicted by each of the two research questions.

RQ1: The significant different effect before and after being taught by combining brain-targeted teaching method with students' content schema

Before employing an inferential analysis, the researcher applied a test of normality and homogeneity with the SPSS program.

Table 1. Test of Normality

			Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Combining BTT+CS		Statistic	Df	Sig.	Statistic	df	Sig.
Achievement	Pre-test BTT+CS	Combining	.249	30	.240	.870	30	.278
	Post-test BTT+CS	Combining	.254	30	.239	.815	30	.278

Lilliefors Significance Correction

The result of the normality test showed that the significance achievement of pre-test (0.278) and post-test (0.278) in experimental class taught by combining BTT and CS method was higher than 0.05. It meant that the pre-test and post-test data had normal distributions.

Table 2. Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
.250	1	58	.618

The result of the homogeneity test showed that the significance values of achievement (0.618) were higher than 0.05. It meant that the data was homogenous.

Table 3 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Test BTT + CS	48.8	30	6.28	1.14
	Post Test BTT + CS	82.8	30	10.40	1.89

The paired samples statistics revealed that the mean score in the pretest of combining BTT &CS was 48.8 Meanwhile, in the post-test of combining BTT & CS , the mean score was 82.8. The result depicted that there was an improvement of 34 points by comparing mean scores of pre-test and post-test.

Table 4. Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre Test BTT + CS Post Test BTT + CS	-32.6	12.7	2.26	-38.7	-29.2	-14.85	29	.000

Based on the table output-paired sample test, it was found that significant value (2-tailed) is 0.000 less than 0.05 (0.000<0.05). It means that null hypothesis is rejected and alternative hypothesis is accepted so it can be concluded that there is significant different dealing with the main score of students' achievement between pre-test and post-test. In other words, there is an effect of the use combining BTT & CS strategy to enhance the students' achievement in critical reading course. The mean from paired sample test is –32.6 It shows there is a significant difference between pretest means score is 48.8 and post-test is 82.8 and the significant difference between –38.7 and -29.2 (95% Confidence Interval of the Difference lower and upper). Based on the paired samples statistics and paired samples test results, the mean score in the pretest of the combining BTT &CS method was 48.8. Meanwhile, the post-test average score was 82.8. The results showed 34 points improvement when comparing mean pre-test and post-test scores. According to the table output-paired sample test, there was a significant difference in student achievement before and after teaching using the combining BTT and CS activation method. It demonstrated that the null hypothesis was rejected and the alternative hypothesis was accepted, implying that there is a substantial difference in the main score of students' achievement between the pretest and post-test.

In other words, the implementation of the combining BTT and CS activation methods improved students' performance in the Critical Reading course. It is in line with previous studies on activating students' CS in teaching reading. Content schema (CS) and teaching EFL reading was explored by Munsakorn, (2015) ;), Ohoiwutun (2014), Khanam et al.(2014); Zhu Ann (2013) and Zhao (2012). They claimed that by activating CS, they believe it helps them enhance students' reading speed and gain a better knowledge of literature. BTT method was utilized to lessen student stress when answering a question in front of the whole class (Cane & Cane, 1994) and it was completed with the six teaching brain-targeted steps which can make students better pattern in their brain learn (Rukminingsih, et al., 2021 and Seegers, 2020; Parr, 2016; Hardiman, et al. 2012).

RQ2: The significant different effect between students taught by combining brain-targeted teaching method with students' content schema and students taught by conventional method

Before employing an inferential analysis, we applied a test of normality and homogeneity with the SPSS program.

Table 5. Tests of Normality

	Teaching Method	Kolmogorov-Smirnov[a] Statistic	Df	Sig.	Shapiro-Wilk Statistic	Df	Sig.
Achievement	Combining BTT and CS	.325	30	320	.825	30	.500
	Conventional Method	.256	30	.320	.816	30	.500

a. Lilliefors Significance Correction

The result of the normality test showed that the significance achievement of combining BTT and CS activation (0.500) and teaching method 2, Conventional method (0.500) were higher than 0.05. It meant that the combining BTT and CS method and Conventional method had normal distributions.

Table 6. Test of Homogeneity of Variances

Achievement

Levene Statistic	df1	df2	Sig.
1.540	1	58	.226

The result of the homogeneity test showed that the significance values of achievement (0.226) were higher than 0.05. It meant that the data was homogenous.

Table 7. Group Statistics

	Teaching Strategies	N	Mean	Std. Deviation	Std. Error Mean
Students' CR Achievement	Combining BTT + CS method	30	85.6	10.40004	1.89878
	Conventional Method	30	60.2	12.59447	2.29943

Based on the table above, the descriptive analysis revealed that combining BTT and CS method, the mean score was 85.6. Meanwhile, the mean score of Conventional method was 60.2 The result depicted that there was significant different 25.4 points by comparing mean scores of combining BTT and CS method and Conventional method.

Table 8. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Students' CR Achievement	Equal variances assumed	.772	.385	7.48	58	.000	22.3	2.98	16.36	28.3
	Equal variances not assumed			7.48	55.99	.000	22.3	2.98	16.36	28.32

Based on the table output Independent sample test, it was found that the significant value of Levene's test for equality was 0.385 higher than 0.05, (0.385>0.05) so it could be concluded that the data variance between combining BTT & CS and

Conventional method was homogenous. The equal variance assumed of significant value (2 tailed) was 0.000 which was less than 0.05 (0.000<0.05). It could be concluded that null hypothesis was rejected and alternative hypothesis was accepted. Then the main difference value was 22.3 which showed the significant different mean score between the students' achievement taught by combining BTT and CS method was 85.6 and conventional method was 60.2 (16.36-28.32). The significant difference between 16.36and 28.32 (95% Confidence Interval of the Difference lower and upper).

Based on the paired samples statistics and paired samples test results, the mean score in the pretest of the combining BTT &CS method was 48.8. Meanwhile, the post-test average score was 82.8. The results showed 34 points improvement when comparing mean pre-test and post-test scores. According to the table output-paired sample test, there was a significant difference in student achievement before and after teaching using the combining BTT and CS activation method. It demonstrated that the null hypothesis was rejected and the alternative hypothesis was accepted, implying that there is a substantial difference in the main score of students' achievement between the pretest and post-test.

In other words, the implementation of the combining BTT and CS activation methods improved students' performance in the Critical Reading course. It is in line with previous studies on activating students' CS in teaching reading. Content schema (CS) and teaching EFL reading was explored by Munsakorn, (2015) ;), Ohoiwutun (2014), Khanam et al.(2014); Zhu Ann (2013) and Zhao (2012). They claimed that by activating CS, they believe it helps them enhance students' reading speed and gain a better knowledge of literature. BTT method was utilized to lessen student stress when answering a question in front of the whole class (Cane & Cane, 1994) and it was completed with the six teaching brain-targeted steps which can make students better pattern in their brain learn (Rukminingsih, et al., 2021 and Seegers, 2020; Parr, 2016; Hardiman, et al. 2012).

The significant different effect between students taught by combining brain-targeted teaching method with students' content schema and students taught by conventional method

Based on the descriptive analysis and table output, the independent sample t-test showed that combining the BTT and CS methods obtained a mean score of 85.6. Meanwhile, the mean score for the Conventional method was 60.2. The results showed that there was a significant difference of 25.4 points between the mean scores of the combined BTT and CS method and the Conventional approach. It means that combining the BTT and CS methods with online training is more effective than using the Conventional method.

The results above described that the alternative hypothesis was that combining BTT with students' CS activation method is more effective than using the conventional method in teaching EFL critical reading. Based on the data provided above, it could be inferred that the alternative hypothesis was accepted while the null hypothesis was rejected. Students' CS, or prior knowledge, which stimulated their interest in learning more about the material, had an impact on their capacity for critical reading. It was in line with Alhaisoni, (2017); Ohoiwutun (2014), Khanam et al. (2014) and Zhu and Zhao (2012). They claimed that turning on CS can improve student comprehension of a text and boost their reading speed. Additionally, they were effective in establishing a calm atmosphere with a range of stimulating and captivating activities for the students. The lecturer's warm greeting at the beginning of class helped to relieve tension. Another collaborative BTT method that helps students feel less nervous when answering a question in front of the class is their background knowledge or CS activation (Cane & Cane, 1994). This method is combined with the six teaching brain-targeted steps that help students learn more effectively by improving their brain patterns (Rukminingsih, et al., 2021; Seegers, 2020 Parr, 2016; Hardiman, 2012 et al.).

5. CONCLUSION

The combination of Brain-targeting teaching (BTT) and content schema (CS) activation methods improved students' performance in Critical Reading courses, in line with previous studies. CS activation enhances reading speed and literature knowledge (Alhaisoni, 2017; Ohoiwutun 2014; Khanam et al., 2014; Zhu and Zhao 2012)). Meanwhile BTT reduces stress during class discussions with the six brain-targeted steps aid in better learning patterns (Hardiman, 2011; Hardiman, et al., 2012; Srikon, 2015; Parr, 2016; Seegers, 2020; and Rukminingsih, et al., 2021)..

The combining of (BTT) and (CS) has a statistically significant impact on the students ' achievement in EFL Critical Reading course. Two conclusions were drawn from the results and discussion of the combining BTT and students CS activation compared to conventional method. There was a statistically significant impact on the critical reading comprehension achievement.

Based on the research findings and discussions of the research, conclusions can be drawn as follows:

1. There is a significant difference between pre-test and post-test critical reading scores for the students taught by combining BTT and CS activation method. In the other words, there is a significant difference achievement before and after being taught by combining BTT and students' CS.
2. There is a significant difference in post-test Critical Reading scores between the students taught by combining BTT and CS activation method and students taught by using Conventional method. It shows that the use of combining BTT and students' CS activation more effective than Conventional method in teaching EFL Critical.

The results of this study will guide researchers by having (a) designed the teaching method which considers how the students' brain learn by employing six brain targets in BTT method (b) created insights that activating students' content schema (CS) could support the students' comprehend the text critically, and (c) designed this teaching method to be developed in the future.

In this study, there are some limitations that should be accommodated by other researchers in the future. Firstly, due to the experimental design, the finding of this study only based on the students' score, however, the other researchers need to investigate the combining BTT and CS with qualitative data, such us by using interview or questionnaire to make the triangulation data from different views. Secondly, this study only used thirty students for each experimental and control class because of the limitation of the students total number in the setting of this study. The other researchers in the future may be able to conduct another research with the bigger number of the research sample.

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