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The Effect of Teaching Metacognitive Reading Strategies on the Critical Thinking Skills of Undergraduate Students

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ABSTRACT

Metacognitive strategies have been investigated as facilitating tools for students' reading comprehension. No studies have investigated the effect of systematic teaching of metacognitive reading strategies on students' critical thinking skills. The present quasi-experimental study examined the effect of explicit metacognitive strategy instruction and critical thinking skills of ESL international freshman university students. Data were collected from two homogeneous 25-member groups of experimental and control learners randomly assigned to these groups. The experimental group and control group underwent 14 sessions of training. The results related to critical thinking tests revealed the mean scores of students in the metacognitive group were significantly higher than the mean score of the students in the conventional reading group ($F= 1.3,82.3) = 215.973$. $p <0.001$). Another interesting finding is that teaching metacognitive reading strategies significantly improved students' induction (14.72) and credibility (14.30) skills. The findings provide insights for integrating metacognitive reading strategies and critical thinking skills in higher education contexts.

Key words: Metacognitive Reading Strategies, Reading Comprehension, Critical Thinking Skills

INTRODUCTION

Reading Metacognitive Strategies

Reading is a receptive skill that plays a crucial role in foreign language learning. Academic texts present a new level of lexical difficulty to students as they use specialized writing styles or genres to which many learners may not have been exposed. The last two decades have seen a growing trend toward investigating the importance of reading and teaching different reading strategies to enhance students' reading comprehension (Susanto, 2020; Amir et al., 2019). Though there is little consensus on how many learning strategies are exactly used by learners and how they should be named or grouped. Chamot & O'Malley (1987) and Oxford (2011) have suggested some useful and specific category types: cognitive, metacognitive, and socio-affective. Typical methods for the classroom delivery of metacognitive reading strategy instruction were used, such as the Cognitive Academic Language Learning Approach (CALLA), first introduced by Chamot and O'Malley (1987), and another model by Anderson & Briggs (2011).

A few classifications emphasize 'metacognition' as an essential aspect of strategies, including planning and preparing for reading; and how to monitor, direct and evaluate the use of different reading strategies. Mokhtari & Sheorey (2015) classified metacognitive reading strategies into global, problem-solving, and support reading strategies. Global reading strategies are followed to get the main idea or gist of the text. Problem-solving strategies help the reader tackle the problem while the text becomes difficult. However, support reading strategies are techniques to sustain the reading.

Numerous researchers identified the major role of metacognition in text comprehension and differentiated between good and poor readers (Meniado, 2016; Montaghami & Mahdavi-Zafarghandi, 2016; Bećirovic et al., 2017; Dardjito, 2019; Ajideh & Pouralvar, 2018; Hapsari, 2019; Deliany & Cahyono, 2020; Kung & Aziz, 2020; Manh Do & Le Thu Phan, 2021).

Critical Thinking in Higher Education

In the current challenging educational context, students are required to develop higher-order thinking skills, namely, decision making, critical thinking, and problem-solving (Surlitasari & Premini, 2018; Mbato, 2019; Mbato, 2019; Van der Zanden et al., 2020). Critical thinking refers to the

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selection, analysis, evaluation, reflection, inference, questioning, and judgment (Zanden et al., 2020; Bankole, 2019). Scroll and For (2021) argued that students who can think critically consequently develop the ability to ask appropriate questions, collect and sort this information creatively, and come up with consistent conclusions could critically empower themselves to achieve success. Ali et al. (2020) and Sudha (2018) research revealed how ESL learners could improve their critical thinking skills by integrating critical thinking activities into the classroom. In this study, critical thinking involves the measurement of four aspects of induction, deduction, credibility, and identification of assumption, which are essential and vital to thinking and reasoning (Debes, 2009). In what follows, the researcher explains the aspects of critical thinking skills.

Deductive reasoning starts with the assertion of general rule and proceeds from there to a guaranteed specific conclusion. It moves from the general rule to the specific application. In light of accumulated evidence, inductive reasoning begins with observations and proceeds to a generalized conclusion that is likely, but not certain. Inductive reasoning moves from the specific to the general. Credibility includes the objective and subjective components of the believability of a source or message. Finally, the identification of assumption is an unexamined belief about what we think without realizing we think it. Our inferences are often based on critical assumptions that we haven't thought about' (Ennis, 2007, p. 243-256).

Given the importance of critical thinking skills in university contexts, Cook (2000) thought of reading as a thinking process and emphasized involving the students in discussing the text they have already read while using reading strategies. However, some studies reported low critical thinking skills among university students (Al-Mahrooqi & Denman, 2020; Din, 2020). Several studies confirmed the association of critical thinking with language learning, especially in reading comprehension (Fahim & Bagheri, 2012; Zare & Biria, 2018; Mohseni et al., 2020; Marzban, 2016). They found that reading comprehension was directly related to some components of students' critical thinking skills. However, a systematic understanding of teaching metacognitive strategies contributes to which sub-skills of critical thinking are still lacking. Much less is known about how metacognitive strategy training may contribute to critical thinking skills in EFL learners' reading comprehension. In addition, there have been cases where explicit teaching of metacognitive strategies does not lead to a positive impact on reading comprehension or attainment of critical thinking skills (Gholami et al., 2016). The researcher aimed to teach metacognitive reading strategies and examine whether students' critical thinking skills would enhance after the instruction. Based on this objective mentioned above, the present study attempts to find answers to the following research question.

1. Does explicit teaching of metacognitive strategies affect undergraduate students' critical thinking?
2. Which critical skills will improve as a result of explicit teaching of metacognitive strategies?

The following research hypotheses are formulated:

Ho1: There is no significant difference in the metacognitive group's mean scores for pre-and post-scores concerning induction reasoning.

Ho2: There is no significant difference in the mean scores of the metacognitive group for pre, and post-test concerning deduction reasoning.

Ho 3: There is no significant difference in the mean scores of the conventional group for pre, and post-tests concerning credibility.

Ho 4: There is no significant difference in the mean scores of the conventional group for pre, and post-tests concerning the assumption identification.

LITERATURE REVIEW

A considerable amount of literature has been published on the importance of critical thinking skills in higher education (Surlitasari & Premini, 2018; Mbato, 2019; Van der Zanden et al., 2020; Gandimathi & Zarei, 2018). These studies have found that cognitive skills are central to critical thinking; these skills include recognizing logical fallacies analyzing arguments, distinguishing warranted and unwarranted claims, and identifying and understanding assumptions in scientific-analytical reasoning (Evens et al., 2014). Similarly, Ku & Ho (2010), Fadhlullah & Ahmad (2017), and Meniado (2016) argue that critical thinking skills are developed through metacognition. Their study showed a significant relationship between metacognitive strategy use and critical thinking. Overall, a critical thinker is in charge of his thinking processes, while metacognitive strategies enable such control to occur.

Data from several studies also suggest that there is a relationship between critical thinking and reading (Zanden et al., 2020; Ali et al., 2020; Mohseni et al., 2020). Aghajani (2019) also highlighted the importance of thinking in reading comprehension. They realized that reading is a process of thinking for meaning construction. Some scholars integrated metacognitive knowledge and metacognitive strategies as critical thinking skills into reading comprehension in a "planful and purposeful way to improve readers' comprehension of the text (Aloqaili, 2012).

The combination of principles of critical thinking and schema theory is one of the effective ways to enhance reading comprehension performance (Yildirim, 2011). Critical thinking provides a means to figure out reading text by producing different interpretations through experience and world knowledge. Then an individual suspends the decision until they get more information to accept alternative explanations. Hence, it is concluded that the reader goes through a critical thinking process to comprehend text. Therefore, schema theory offers strong rationales for relating an individual's background knowledge, specific subject area knowledge, and critical thinking (Aloqaili, 2012). This view is supported by Zanden et al. (2020), who used metacognitive strategies to develop students' critical thinking skills. They suggested that instructors should develop observation, analysis, inference, and evaluation processes among students to improve critical thinking skills. In the same vein, Ghanizadeh et al.

(2017) examined the relationship between inference-making and critical thinking to enhance reading comprehension performance. They demonstrated that inferential and reasoning skills were strongly linked to readers' skills to find meaningful connections between information in the text and related background knowledge.

However, much of the research to date fails to investigate how explicit teaching of metacognitive strategies affects particularly which skills of critical thinking. In the current study, the researcher intends to combine CALLA instructional methodology adapted from Anderson's model and teach metacognitive reading strategies of planning, monitoring, and evaluating for comprehending reading and identify their effects on critical thinking skills.

The underlying theories of this study are schemata theory and Bloom's levels of critical thinking. In schemata theory, reading is an active process in which the reader reconstructs meaning from text by connecting old knowledge to the new information they gained. Bloom's levels of critical thinking skills are analysis, synthesis, and evaluation. If the teacher asks students to provide an interpretive thesis statement in a reading context, students will engage in creative and higher-order thinking skills. The students are encouraged to ask some questions regarding text and evaluate the reading text to help them activate a higher level of thinking skills.

METHOD

Research Design and Population

The present study employs a quasi-experimental design, a nonrandomized control group, pre-test, and post-test to examine the effect of using metacognitive strategies on critical thinking skills. In this design, both experimental and control groups received pre-test and post-test, but the groups do not require pre-experimental sampling equivalence (Ary et al., 2010). The population for this study was international undergraduate students who intended to improve their general English and academic literacy skills to meet the requirement of language proficiency at the University Putra Malaysia. According to their placement test results at ELS, participants' level of language proficiency was 106 or B1 intermediate level. In every research design, determining sample size is a fundamental step requiring appropriate planning. For this study, the number of participants in the experimental group was 35, and the control group was 35.

Instruments

This study selected IELTS reading tests from the Cambridge IELTS academic module (Volume 9) as pre-test and post-test because they are standard and reliable. There are two reasons why the researcher has chosen IELTS reading to measure students' reading comprehension. The rationale for choosing the IELTS academic reading tasks is that these texts are standardized reading tests, and their level of difficulty had been meticulously measured before testing. Another reason is that IELTS reading tests are chosen from academic, scientific, and authentic texts. Therefore, the researcher ensures that these reading comprehension texts are validated in terms of authenticity and degree of difficulty. The IELTS reading section includes three different passages and 40 questions designed to test a wide range of reading skills. These include reading for gist, reading for main ideas, reading for details, skimming, understanding the logical argument, and recognizing writers' opinions, attitudes and purpose.

The second instrument in the present study is the Cornell Critical Thinking Test (CCTT). The Cornell Critical Thinking Test, level X, is a standardized test developed by (Ennis 1985) to gauge the level of critical thinking skills. It has been suggested that this test is appropriate for undergraduates and graduates with average language proficiency and less sophisticated thinking skills. The CCTT level X is developed to measure the following skills: Induction, deduction, observation, credibility, and identification of assumptions which are critical and vital to thinking and reasoning (Debes, 2009). CCTT level X consists of 76 multiple choice questions; the required time to complete this test is 50 minutes**.** In this study, CCTT level X was conducted as a pre-test and post-test among control and experimental groups to measure undergraduate students' level of critical thinking skills. The reliability coefficient of CCTT level X ranges from 0.67 to 0.90.

Procedure

Once students signed the consent forms, the researcher administered the reading IELTS test as a proficiency test to 70 students to measure students' reading comprehension performance in experimental and control groups. Afterward, the pre-test of the Cornell Critical Thinking Test Level X (CCTT, level X) was administered to undergraduate students in both groups to gauge their critical thinking skills before conducting the treatment for 50 minutes. Afterward, the researcher played the teacher's role and started teaching IELTS academic reading texts to both groups of control and experimental groups over 14 weeks. The control group received a conventional method of teaching reading strategies such as activating background knowledge, skimming, scanning, identifying main ideas and supporting ideas, etc. The only difference between the two groups was planning, monitoring, and evaluating metacognitive strategies in an experimental group. After completing the intervention, the post-test of IELTS was administered to both groups of students to measure their reading comprehension performance. In the next step, participants in both groups took the CCTT, level X, to measure their level of critical thinking skills.

Data Analysis

To address the research question regarding investigating the effect of explicit teaching of metacognitive strategies on the critical thinking level of international undergraduate students, the researcher ran the normality test using the graphical method and statistical parameters such as skewness and kurtosis. The researcher used the inferential method to evaluate the main research hypotheses, including a two-way repeated measure analysis of variance followed by the

Bonferroni test for mean comparison between the control and experimental group (pre and post-tests). Pearson product-moment correlation coefficient was used to examine the relationship among research variables. Pearson correlation measures the strength of a linear relationship between two variables, and it ranges between -1 and +1 (-1<r<+1).

RESULTS AND DISCUSSION

Descriptive statistics and a two-way repeated measure ANOVA were applied to measure the effect of reading metacognitive strategies on critical thinking skills. As shown in Table 1, the mean of overall critical thinking was improved after the intervention for both control and experimental groups.

The findings for the within-subjects effect of repeated measures of time were significant ($F_{(1.3, 82.3)} = 215.973$. $p < 0.001$, $\eta^2 = 0.774$). These results indicated that the interaction between groups and time was significant statistically ($F_{(1.3, 82.3)} = 98.629$. $p < 0.001$. $\eta^2 = 0.610$) indicated that the changes in overall critical thinking in the two groups were significantly different across times (pre-test and post-test). The main effect of groups was statistically significant ($F_{(1, 63)} = 21.451$, $p < 0.001$, $\eta^2 = 0.672$). The researcher applied a post hoc test (Bonferroni, Table 2) to compare the mean scores to test the related hypothesis.

According to the result of the Bonferroni test, the difference in overall critical thinking scores between pre-test and post-test was statistically different ($p<0.05$) in both control and experimental groups. These results also revealed that the effect size of time in the experimental group ($\eta^2=0.863$) was higher than the control group ($\eta^2=0.267$).

Effect of Intervention on Critical Thinking Subscale

To answer the second research question, what subscales of critical thinking skills improved after the intervention of teaching metacognitive strategies. Since critical thinking has subscales including induction, credibility, deduction, and assumption, the effect of the intervention on each subscale was investigated using descriptive statistics and RM ANOVA. The results are discussed as follows.

Table 1. Descriptive statistics of overall critical thinking score in both groups

Variable	Group	N	Mean	SD
PRE.READING	Experimental	33	28.000	4.023
	Control	32	26.594	3.527
POST.READING	Experimental	65	45.788	5.134
	Control	33	30.313	4.425

The Effect of Teaching Metacognitive Strategies on Induction

It was hypothesized that "There is no significant difference in the mean scores of the conventional group for pre and post-tests concerning the critical thinking induction skill." The descriptive statistics revealed that the induction changes in the two groups were significantly different across times (pre-test and post-test). The main effect of groups was statistically significant ($F_{(1, 63)} = 72.413$, $p < 0.001$, $\eta^2 = 0.535$). A post hoc test (Bonferroni, Table 3 and 4) was applied to test the related hypothesis to compare the mean scores. Table 5 revealed that the effect size of time in the experimental group ($\eta^2=0.771$) was higher than the control group ($\eta^2=0.026$). Therefore, the null hypothesis was rejected.

The Effect of Teaching Metacognitive Strategies on the Credibility

The related hypothesis is referred to as 'There is no significant difference in the mean scores of the conventional group for pre, and post-tests in relation to the credibility of sources. Descriptive statistics for the total score of credibility were conducted and showed (Table 5), that the mean of credibility was improved after the intervention for both control and experimental groups. According to the result of the Bonferroni test, the difference in credibility scores between pre-test and post-test was statistically different ($p<0.05$) in the experimental metacognitive group. In contrast, in the control group, there was no significant difference between the pre-test and post-test ($p>0.05$). Table 6 revealed that the effect size of time in the experimental group ($\eta^2=0.665$) was higher than the control group ($\eta^2=0.134$). Therefore, the null hypothesis was rejected.

The Effect of Teaching Metacognitive Strategies on the Deduction

It was hypothesized that 'there is no significant difference in the mean scores of the conventional group for pre, and post-tests in relation to the critical thinking deduction skill.' Table 7 illustrates descriptive statistics for the total score of deduction, indicated that the mean of deduction was improved after the intervention for both conventional (M= 6.844) and metacognitive experimental (M= 9.576) groups. The post hoc test (Bonferroni) was applied to test the related hypothesis to compare the mean scores.

Table 8 illustrates the result of the Bonferroni test which revealed that the effect size of time in the experimental group ($\eta^2=0.666$) was higher than the control group ($\eta^2=0.244$).

Table 2. Pairwise comparison between pre-test and post-test for overall critical thinking in both control and experimental groups

Group	(I)Test	(J)Test	Mean Difference (I-J)	SE	p value	η2
Experimental	1	2	-17.788*	0.904	<0.001	0.863
Control	1	2	-3.719*	0.918	<0.001	0.267

* The mean difference is significant at the 0.05 level.b Adjustment for multiple comparisons. Bonferroni

Table 3. Descriptive statistics of overall induction score in both groups

Variable	Group	N	Mean	SD
PRE.induction	Experimental	33	8.364	2.316
	Control	32	7.844	2.398
POST.induction	Experimental	65	14.727	2.787
	Control	33	8.031	1.992

Table 4. Pairwise comparison between pre-test and post-test for induction in both control and experimental groups

Group	(I) Test	(J) Test	Mean Difference (I-J)	SE	p value	η2
Experimental	1	2	-6.364*	0.455	<0.001	0.771
Control	1	2	-0.188	0.462	1	0.026

* The mean difference is significant at the 0.05 level.b Adjustment for multiple comparisons. Bonferroni

Table 5. Descriptive statistics of credibility score in both groups

Variable	Group	N	Mean	SD
Pre. Credibility	Experimental	33	9.152	1.822
	Control	32	9.094	1.940
Post. Credibility	Experimental	65	14.303	2.580
	Control	33	10.000	2.170

Table 6. Pairwise comparison between pre-test and post-test for credibility in both control and experimental groups

Group	(I) Test	(J) Test	Mean Difference (I-J)	SE	p value	η2
Experimental	1	2	-5.152*	0.476	<0.001	0.665
Control	1	2	-0.906	0.483	0.196	0.134

*The mean difference is significant at the 0.05 level.b Adjustment for multiple comparisons. Bonferroni

Table 7. Descriptive statistics of deduction score in both groups

Variable	Group	N	Mean	SD
PRE. deduction	Experimental	35	5.970	1.879
	Control	35	5.594	1.701
POST. deduction	Experimental	35	9.576	1.521
	Control	35	6.844	1.834

The Effect of Teaching Metacognitive Strategies on Assumption Identification

It was hypothesized that "There is no significant difference in the mean scores of the conventional group for pre and post-tests with assumption identification." To test this hypothesis, repeated measure ANOVA was applied. Table 9 indicates that the mean of assumption identification improved after the intervention for both control (M=5.438) and experimental (M=7.182) or metacognitive groups. To evaluate these changes, a two-way RM-ANOVA was applied. The researcher applied a post hoc test (Bonferroni) to compare the mean scores to test the related hypothesis.

The Bonferroni test results, as shown in Table 10, indicate a significant difference between the pre-test and post-test ($p<0.05$). These results also revealed that the effect size of time in the experimental group ($\eta^2=0.628$) was higher than the control group ($\eta^2=0.331$).

Discussion

The current study has found that teaching metacognitive strategies positively affects metacognitive strategies. Another interesting finding is that teaching these reading strategies positively affected induction (14.72) and credibility (14.30) skills compared to deduction and identification assumptions. Only a few studies investigated the effect of metacognitive strategies on enhancing critical thinking skills. Much research confirmed the relationship between metacognitive awareness and critical thinking skills. Mohseni et al. (2020), Cakici (2018), and Sadeghi et al. (2014), in three separate studies, investigated the possible relationship between metacognitive awareness and critical thinking skills in a foreign language learning context. They found that metacognitive awareness had a positive correlation with critical thinking skills.

The findings of this study are also in line with Mango's (2010) study, which administered the Metacognitive Assessment Inventory (MAI), with inference, recognition of assumptions, deduction, interpretations, and evaluation of arguments to 240 college students from different universities in the national capital region in the Philippines. The analysis also showed that all underlying factors are significant for metacognition and critical thinking.

CONCLUSION

The present study was conducted to identify the effect of explicit teaching of metacognitive reading strategies on critical thinking skills among international undergraduate students in Malaysia. The results of the present study was supported by Mohseni et al. (2020), Cakici (2018), and Sadeghi et al. (2014). This finding can add a valuable contribution to the existing literature, as barely any scholar has ever dealt with the effect of teaching metacognitive reading strategies on each critical thinking skill component in an experimental study. The results further indicated that teaching metacognitive strategies can improve four components of critical thinking skills, particularly induction and credibility skills. Critical thinking skills help students reflect and evaluate ON what is being read, so they make sound judgments to shape their beliefs. The findings of this study suggest that English teachers and lecturers should integrate critical thinking skills into their syllabi, teaching, reading lists, and assessment procedures to expose undergraduate students directly or indirectly to such skills and teach them how to implement these skills in the professional career opportunities.

Table 8. Pairwise comparison between pre-test and post-test for deduction in both control and experimental groups

Group	(I) Test	(J) Test	Mean Difference (I-J)	SE	p value	η2
Experimental	1	2	-3.606*	0.373	<0.001	0.666
Control	1	2	-1.250*	0.379	0.005	0.244

* The mean difference is significant at the 0.05 level.b Adjustment for multiple comparisons. Bonferroni

Table 9. Descriptive statistics of assumption identification core in both groups

Variable	Group	N	Mean	SD
PRE. assumption	Experimental	35	4.515	1.503
	Control	35	4.063	1.413
POST. assumption	Experimental	35	7.182	1.629
	Control	35	5.438	1.544

Table 10. Pairwise comparison between pre-test and post-test for assumption identification in both control and experimental groups

Group	(I) Test	(J) Test	Mean Difference (I-J)	SE	p value	η2
Experimental	1	2	-2.667*	0.273	<0.001	0.628
Control	1	2	-1.375*	0.277	0	0.331

* The mean difference is significant at the 0.05 level.b Adjustment for multiple comparisons. Bonferroni

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