IMPACT OF CRITICAL THINKING SKILLS ON LEARNING OUTCOME: A REVIEW OF RESEARCHERS' FINDINGS

KONG, M. J.[1] – PEK, L. S.[1*]

[1] *Department of Education and Social Sciences, Universiti Selangor, Selangor, Malaysia.*

**Corresponding author*
e-mail: limsp[at]unisel.edu.my

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Abstract. This paper investigates the findings of seven researchers on the learning outcomes of their research on Critical Thinking skills. Meta-analysis of data gathered from the seven researchers formed the basis of this study. The purpose of applying this approach is to gather diverse views and opinions from diverse participants. This helps to establish a hypothesis and encourages procedures for further studies. This research emphasises the exposure to critical thinking skills that have generated various learning outcomes among students in various academic environments. It also seeks to differentiate whether an effect is present in a study and determine whether it is positive or negative. The varied, diverse approaches of the researchers provided rich data for analysis. The seven researchers were able to elaborate on their respective findings. Upon comparing the various findings, the results appeared to vary on the impact of critical thinking on learning. But analysis of these findings revealed that exposure to critical thinking generally positively impacted learning. Research findings have thus shown a common trend that the teaching of critical thinking skills has an impact on learning. However, problems such as the academic levels of international students or the lack of facilities in rural areas did contribute to the outcomes.
Keywords: *meta-analysis, academic levels, critical thinking skills, learning outcomes*

Introduction

Education stakeholders in any country aspire to equip students with the essential skills needed to live in this century. One of these essential skills is to acquire critical thinking skills. Research findings generally describe critical thinking as the ability to interpret, explain, analyse, make inferences, evaluate, and self-regulate thoughts (Facione, 2011). It is also associated with cognitive thinking skills such as logical thinking and problem-solving abilities. Most researchers relate critical thinking skills as important factors for success in the workplace. This is more so for university graduates seeking a meaningful career in a progressive organisation. Critical thinking skills are reported to gain high points during interviews as they are a much sought-after ability for employers. This perspective is supported by Pearl et al. (2019) as they believe that critical thinkers are problem solvers in a working environment. Critical thinking can be controversial in terms of the different approaches to instruction, and research on it never stops. Researchers on critical thinking may not have agreed on how it is conceptualised, but supporters of critical thinking have already carried out its instruction. Sobkowiak (2016), a strong advocate of critical thinking instruction, believes it can be taught because it is a cognitive skill. Researchers have also explored how different pedagogical practices can foster the development of critical thinking in the different stages of education (Holmes et al., 2015). Other researchers report that critical thinking affects the decision-making process related to real-world problems more than mere intelligence factors (Butler et al., 2017). In addition, critical thinking skills are reported to positively contribute to the teacher's professional identity as it empowers them as mentors. It is

also pointed out that critical thinking skills are used as some of the main objectives in the curriculum of the teacher education program in many countries (Butler et al., 2017).

Critical thinking is one of the most important skills of the twenty-first century, many approaches to its teaching are examined, and different results are offered now and again. This necessitates researching critical thinking once again to update the impact on the learning outcome. The different discourses will only enrich the subject of critical thinking. This paper analyses seven reviews on the different approaches and outcomes in teaching critical thinking or their perspectives on critical thinking. The main emphasis is to discuss the impact of critical thinking and the perspectives of the researchers.

Literature review

For over twenty years, American Educators and politicians have started national programmes of introducing critical thinking as a general objective into the curriculum (Giancarlo et al., 2004). It was then that the Delphi Project started in 1988. The American Philosophical Association financed it, and a team of specialists (philosophers, teachers, psychologists, sociologists, critical thinking specialists, assessment specialists, an economist, a computer science specialist, a zoologist and a physician) gathered to define critical thinking. The official title of this project was Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Delphi defines critical thinking as purposeful, self-regulatory judgment, which results in interpretation, analysis, evaluation, and inference, as well as an explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. Critical thinking is an essential inquiry tool (which also means research, interrogation or question). It becomes increasingly interesting because it unfolds the implications in the personal and social plane of critical thinking, stating that critical thinking is a liberating force in education and a powerful resource in one's personal and civic life. The Delphi Project experts claim that thinking critically is not the equivalent of thinking correctly.

The Delphi Project experts believe that the following cognitive skills represent the main dimensions of critical thinking: Analysis, Interpretation, Evaluation, Inference, Explanation, and Self-regulation. According to these experts, all these cognitive dimensions represent the foundation and specificity of critical thinking. These skills are high-order thinking skills. Having come to a consensus on CT, the Delphi experts have, in a way, encouraged researchers to attempt to apply various effective methods (e.g., class discussions and mentoring) and exemplify instructional practices that contribute to its fostering (Abrami et al., 2015). Tsui (2008) added to the discourse with her views on CT, "There is substantial evidence to suggest that critical thinking can be enhanced by purposeful instruction".

Concept of CT and pedagogy

Despite the advancement of new technologies, textbooks still occupy a great role in language teaching as they provide teachers and learners with useful resources. Good textbook articles integrate critical thinking skills in content, texts, activities, and tasks that challenge learners' capacities and abilities. Integrating critical thinking skills in the syllabus should include activities that encourage debate, investigation and problem-solving. Reading texts should cover different themes and address different thinking

skills as teachers deal with these texts. To make reading more meaningful, questions should target CT skills. Facione (2011) stated that the critical reading section should cover inference which helps students acquire the skills of getting the information, understanding what it suggests, and finally drawing conclusions based on evidence. Understanding persuasion is to understand rhetoric, differentiating fact and opinion, which is the skill of analysis. The ability to make a judgement calls for evaluation. In short, critical thinking is analytical evaluation. An example to encourage CT skills adaptation among teachers is to make students brainstorm (as a teaching model) to generate deeper thoughts. Stimulate analysis by asking students to compare and contrast two short reading texts and encourage discussions to evaluate (or make a judgement) the two items. Other examples include the infusion approaches or even mixed approaches. All approaches involve analytical evaluation, the extension of which includes many other CT values. In general, research on the pedagogy of critical thinking skills should connect a teaching model with the cognitive domain and the medium (content) for integration (*Figure 1*).

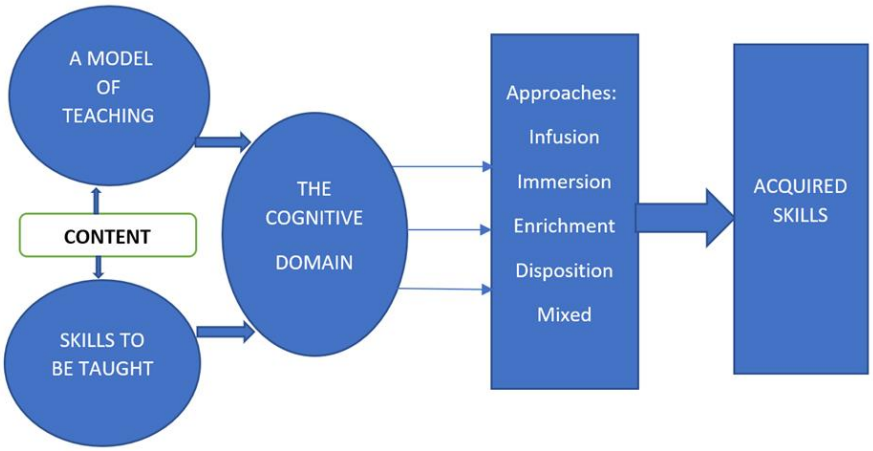

Figure 1. *Conceptual framework of CT and its impacts.*

Common approaches to teaching critical thinking

Deposition approach

While skills can be explicitly taught, teachers can nurture and model dispositions so that students can learn to adopt an identity of critical thinkers. For example, students can be motivated to participate in related topics when given adequate scaffolding and encouragement at the beginning of lessons. This will allow them to experience the intrinsic rewards of critical thinking. Eigenauer (2015) suggests that teachers teach students to practice active scepticism, insisting on the evidence before accepting an idea. He believes this is a very good definition of a critical thinking disposition. Students do not need permission to question but are required to do so. The disposition approach can sometimes be incorporated into all the other approaches to enrich them.

Enrichment approach (general approach)

This is one of the oldest approaches to teaching critical thinking (Sedaghat and Rahmani, 2011), also known as the general approach. The lessons are designed and taught parallel to the existing curriculum. It focuses on teaching critical thinking apart from the specific content of subject matters. In this approach, critical thinking is taught

without specific subject matter content. The more exposure and practice students receive in one academic area, the better they can effectively use their critical thinking skills. Those skills are not necessarily transferable to other areas.

Infusion approach

This is content-based, and the explicit objective is critical thinking. The infusion of critical thinking skills requires deep thought and well-understood subject matter instruction. In addition, the principles of critical thinking skills are made explicit (Abrami et al., 2015). Hence, in an infusion lesson, the teacher seeks to integrate the instruction framework into the lesson content in an explicit manner.

Immersion approach

Critical thinking is not an explicit objective in the immersion approach of a lesson, but the content is. However, subject matter instruction is thought-provoking, and students are deeply immersed. In contrast to the infusion approach, the general principles of critical thinking are not explicit (Abrami et al., 2015). Students are immersed in the content domain without being specifically referred to the principles of critical thinking. In this approach, the students are made aware that they are trained to be deep thinkers.

Mixed approach

The mixed approach combines the general approach with either the infusion or the immersion approach. The course aims to teach general critical thinking principles in which students are encouraged to think critically about the subject. It is taught as an independent track within a specific subject content. Under it, students are involved in thinking instruction, where there is also a separate tract aimed at teaching general principles of critical thinking (Abrami et al., 2015).

Materials and Methods

Meta-analysis is employed to analyse the data of seven research articles on teaching critical thinking skills. This data analysis forms an independent study of the same subject to determine overall trends. The objective of this paper is to synthesise data from a variety of studies in the study of critical thinking. By definition, meta-analysis is a study about studies, and it is used to get an integrated result. In other words, a researcher reviews previously published studies (between 2016-2020) on the specific topic and then analyses the various results to find general trends across the studies. The following table (*Table 1*) summarises the findings of the seven researchers on the impacts of critical thinking on learning regardless of the teaching approach.

Table 1. *Meta-analysis of researchers' findings on CT skills impact on learning outcomes*.

Author(s)	Research objective(s)	Assessment type(s)	Approach(es)	Findings
Baki et al. (2016)	Investigating evidence of CT skills among rural ESL students.	Cornell CT test Quantitative	Nil Content analysis	Lacking exposure to CT skills
Shaheen (2016)	International Students CT skills related to academic performance (ESL)	Semi-structured interviews	Nil	Lacking CT skills

		Qualitative	Interview	
Changwong et al. (2018)	Impact on CT Development by new teaching model (ESL)	MANOVA software Quantitative	- Infusion	CT skills improved learning
Gandimathi & Zarei (2018)	Application of CT skills (ESL) in writing	Qualitative Essay writing AACU rubric Interview	- Enrichment -	CT skills enhanced writing
Saputri et al. (2020)	Impact of New teaching model (EFL) for CT	ANCOVA & LSD test Quantitative	Infusion -	Improved CT skills
Yanning (2017)	Infusion model for teaching CT (EFL) in writing	Pre & Post-test Statistical	- Infusion	Improved CT skills
Itmeizeh & Hassan (2020)	Investigated the need for CT teaching to be used in the curriculum	Questionnaire & Content Analysis	Content analysis	Lack of CT skills; Pedagogy not in the curriculum

Results and Discussion

Baki et al. (2016) carried out a case study of 20 students to determine the critical thinking level of the students in reading. The students found it challenging when faced with CT tasks like figuring out what an assumption is, which requires reasoning skills. Cornell Critical Thinking Test revealed that the students could not decide the credibility of the information they read. The authors suggested that despite the national education agenda, there was insufficient exposure to critical thinking tasks in classrooms. This quantitative research was done on rural Malaysian schools. A study by Shaheen (2016) researched whether international students' critical thinking difficulties were related to academic-level learning experiences in the UK. The study considered the role of previous learning experiences of international students. A sample of 14 teachers was selected from two universities. Semi-structured interviews were applied in this qualitative study. The perspectives of these selected teachers were sought because of their close working experience with international students. Although this manual method was laborious, the author sought a deeper understanding of the learning situation in the UK. Findings suggested that international students viewed critical thinking tasks in their ways. In addition, Changwong et al. (2018) researched a new 5-step model of teaching CT skills development. They were known as PUSCU. A random sampling of 69 secondary students was selected from 500 Bangkok schools for the academic year 2016/2017. Thirty-five students were selected for the experiment group and 34 for the traditional Thai classroom instruction. Before the actual test, a pilot test was carried out on six students. Suggestions were incorporated and fine-tuned. The focus group of 9 'experts' teachers were invited to assist in implementing the exploratory PUSCU model. One-way MANOVA was used to differentiate between control and experimental groups on more than one continuous dependent variable. Results indicated that the experimental group scored better than the control group in academic performance and CT ability skills.

Gandimathi and Zarei (2018) researched 30 Malaysian ESL students taught CT skills by the constructivist approach in writing. Semi-structured interviews were conducted to assess an understanding of CT, and a questionnaire followed this. The application of the AACU rubrics was for the content analysis of essays. The findings indicated that students could write better after learning CT skills. They were able to do reflective

thinking and solve problems. The study by Saputri et al. (2020) researched a new model of learning CT skills for pre-service teachers with different academic abilities. A sample of 107 pre-service teachers was divided into the experiment group, the positive control group and the negative control group. Treatment for the experiment group was the learning model QASEE (questioning, answering, extending and evaluating) and the positive control group's RQA (Reading, questioning and answering). The negative control group followed the convention. Each group was again divided into the upper, middle and lower academic levels. Data was collected from an essay test supported by a critical thinking rubric. It was then analysed using ANCOVA and the LSD test (least significance difference). The result showed that the QASEE learning model improved the critical thinking skills of the pre-service teachers. It further equalised the teachers' critical thinking skills with different academic levels.

Yanning (2017) sought to investigate whether applying Elder and Paul (2020) CT model would help infuse and develop CT skills in writing. A sample of 44 students was divided equally into two groups of students-experimental and control. Pre-test and post-test were assigned to the two groups in essay writing related to problem-solving. The experimental group had earlier received infusion lessons. Results showed that the experimental group scored better on CT skills than the control group. There was a significant positive relationship between CT and students' writing scores ($r=0.89$, $p<0.01$). The positive relationship between CT and writing implied the importance of infusing CT instruction into the curriculum. The pedagogy of CT skills was not even incorporated into the curriculum, and CT skills were lacking in research by Itmeizeh and Hassan (2020). A mixed research design by content analysis and questionnaire, the authors. A 35-point questionnaire was distributed to 35 English Language students, gauging their awareness of CT skills. A content analysis of 79 classroom observations by several English supervisors was assessed. The findings showed that most of the EFL students are unaware of the application of CT skills in their daily task of learning the language. The authors recommended a revamp of the curriculum to incorporate CT skills pedagogy.

Four research papers were reviewed based on the application of CT pedagogy. These papers provide perspectives of the seven researchers in relation to whether or not CT impacts learning. Although five approaches were discussed, the researchers applied only three infusions and one enrichment approach. Changwong et al. (2018) successfully applied a new teaching model as an instrument for CT infusion pedagogy. Similarly, Saputri et al. (2020) applied a new model for infusion lessons. An established model (Elder and Paul, 2020) was used by Yanning (2017) for the same purpose. The enrichment approach in CT pedagogy was the choice of Gandimathi and Zarei (2018), who believed in constructivist learning principles. The author believed CT could be naturally invoked when lessons and topics draw upon students' real-world experiences, and teachers can guide students to facilitate learning. Still, the final outcome was to encourage students to be independent learners. On the contrary, three research papers were reviewed based on the non-application of CT pedagogy. In the research by Baki et al. (2016), the investigation discovered a lack of CT skills among students in rural areas. This was not surprising as there was a lack of exposure to these important skills, probably due to teachers' lack of urgency and awareness of their importance in rural areas. The same goes for research by Shaheen (2016) on the lack of exposure of international students to CT training before enrolling at a UK college. The findings

found that international students had difficulties understanding critical thinking skills. The difficulties were more pronounced at the lower academic levels of the students.

The teachers involved in the research believed that students generally lack CT skills and exposure, considering their previous learning background. It was interesting to note that the students had seemingly not been exposed to CT before enrolling at international colleges. Itmeizeh and Hassan (2020) study investigated whether students possessed CT skills in their daily classroom activities. Content analysis of classroom observations and a questionnaire suggested that the students were unaware of critical thinking skills. Further investigation revealed that teaching CT skills had not been incorporated into the curriculum. That seemed to be the main reason why the students were not even aware of CT. The authors explicitly suggested that the teaching of critical skills can best be learnt by incorporating them into the curriculum despite the varied findings. In the wake of findings by the researchers on critical thinking, it appears undeniably that CT contributes to learning. Its importance is not based on its definition but on its instructional approaches. Three of the four researchers, Changwong et al. (2018), Saputri et al. (2020) and Yanning (2017), applied the infusion approach in the teaching of critical thinking, but Gandimathi and Zarei (2018) applied the general (enrichment) approach in the research. The infusion approach in teaching critical thinking produces positive findings for better learning of the English Language. The enrichment approach, although a more traditional one, produces the same findings. In short, regardless of the approaches to teaching and the method of assessment (quantitative or qualitative), the findings turn positive. As for the research findings of Baki et al. (2016), who did a quantitative assessment on the evidence of CT skills of rural students, the result is negative. She suggested that CT skills were not taught to rural students, and they did not seem to be exposed to it. Although the author did not pinpoint the reasons specifically, it might be that the authorities did not emphasise CT lessons enough.

Interestingly, Shaheen (2016) noted that international students in the UK faced the same problems that the researcher Baki et al. (2016) discovered. They lacked exposure to CT lessons in their home country before enrolment in the UK, more so when they had lower academic levels. Itmeizeh and Hassan (2020), on the other hand, researched whether CT was evident among Palestinian students. 79 English Language supervisors carried observations, and another 32-item questionnaire, adapted from Rezaei et al. (2011), was given to 35 EFL teachers for qualitative type triangulation. It was found that the Palestinian students had no idea at all what CT was about. The review of research findings in this paper shows that there are various teaching approaches to enhance CT skills. However, there is still room to better understand the different approaches to enhancing students' critical thinking skills. One point which stands out in this research is that critical thinking skills positively impact learning; where there is an absence or exposure of CT pedagogy, performance lacks the quality of thinking.

Conclusion

Every CT approach has its strengths and weaknesses, but the most important thing to consider is to use the approach according to the context in which it is used. Reviews differ in certain points, making conducting other reviews necessary to gain accuracy for sound conclusions. On the other hand, reviews agree on certain points that must be considered. In this article, the infusion approach was most frequently used to generate an impact for learning in this qualitative study, allowing a small sample of researchers.

In general (enrichment) approach, the result of a learning impact stays the same. Further research should include findings of the immersion approach, which emphasises the content domain and not CT as an explicit objective. This thought-provoking instruction trains students to immerse deeply in the subject matter and be trained to be deep thinkers. This is quite different from the infusion approach, where the teaching of CT is explicit. The mixed approach is also a choice for some researchers who mix the infusion approach with the immersion approach to get a more comprehensive impact on findings. Finally, it would also be possible for future researchers to include the underrepresented holistic (not mentioned) and disposition approaches.

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Conflict of interest

The authors confirm that no conflict of interest is involved with any parties in this research.

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