Journal of Pan-Pacific Association of Applied Linguistics, 23(2), 59-84.
https:// doi.org/10.25256/PAAL.23.2.4

Awareness of Critical Thinking Attitudes and English Speaking Skills: The Effects of Questions Involving Higher-order Thinking[*]

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Akatsuka, Y. (2019). Awareness of critical thinking attitudes and English language skills: The effects of questions involving higher-order thinking. *Journal of Pan-Pacific Association of Applied Linguistics, 23*(2), 59-84.

This study examines Japanese students' awareness regarding critical thinking (CT) attitudes and their attention to building their speaking skills in an EFL context to determine effective CT approaches. The study began with a literature review of CiNii articles and studies from the Web of Science database regarding CT theories and educational approaches. It examined critical thinking approaches in EFL contexts as well as foreign-language approaches of International Baccalaureate® (IB) programmes. The review indicated that critical thinking can be fostered when students are asked questions that require higher-order thinking skills (HOTS) in EFL courses. Then, EFL lessons were organised based on the theories and approaches examined in the review. Participants included 22 Japanese senior high school students. Various higher cognitive level questions were posed to the participants. Additionally, students were required to prepare and present academic presentations and answer discussion questions after the presentation. To ascertain students' awareness of attitudes toward CT, the Critical Thinking Attitudes Scale was used, and students' reflective essays were analysed using the co-occurrence network of words in the KH Coder. To measure students' speaking skills, their performance on speaking tasks was analysed by two International Baccalaureate's examiners. The results indicate that the improvement of CT attitudes and speaking skills is significant regardless of English proficiency level. These findings suggest that if EFL teachers ask HOTS questions, students would become aware of critical thinking attitudes and acquire English speaking skills by answering the questions in a Japanese EFL context.

Keywords*:* critical thinking (CT), infusion approach, higher-order thinking skills (HOTS), International Baccalaureate (IB), text analysis

[*] This study was supported by a Grant-in-Aid for Scientific Research (JSPS KAKENHI: 19H00036).

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1 Introduction

Upon reviewing the Japanese senior high school EFL context, many EFL teachers intend that the most important priority of EFL courses is to develop students' English proficiency; however, fostering critical thinking (CT) attitudes in EFL courses take a lower priority. Saito (2018, reported in Okuyama 2018) indicates that although EFL teachers are interested in an approach to foster critical thinking attitudes in EFL courses, a majority of senior high school EFL teachers do not focus on fostering CT in their classes. In recent years, the Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT) has been under pressure to foster students with critical and creative thinking skills at the senior high school level. For instance, at high school level in the revised Course of Study (Japanese national curriculum to be launched at high school level in 2022), the importance of CT is identified in terms of nurturing citizens who can tackle complex issues in a diverse society. However, approaches to teaching and learning to foster CT attitudes in EFL courses at senior high schools have not been yet established in Japan. For this reason, this paper focuses on developing an effective approach to foster CT attitudes in the senior high school EFL context.

This study aims to establish effective CT approaches in the Japanese EFL context in terms of the development of both CT attitudes and English speaking skills. To this end, recent studies regarding CT education and foreign-language learning were examined and summarised. Secondly, CT approaches that included questions related to high order thinking skills (HOTS) were conducted and discussed by analysing the participants' awareness of their attitudes toward CT as well as their speaking skills.

2 Literature Review

The importance of fostering CT has been recognised both domestically and globally. CT education initially began in the US in the early 20th century[1], and is presently found in several countries and regions, particularly at schools in western countries and some international schools around the world[2]. In the

[1] Higuchi (2013) indicates that the origin of critical thinking is credited to the ancient philosopher Socrates; however, in the academic context, American researcher Dewey, J (1910) pioneered the concept of critical thinking.

[2] For instance, Tanaka (2015) reports major policies and practices in Australia, Singapore, and Thailand. Furthermore, some international, private and government schools offer IB, which is an internationally recognized programme aimed at fostering learners' critical and creative thinking skills (International Baccalaureate Organization, 2017).

Japanese school[3] context, Article 51 of the School Education Law indicated that fostering wholesome CT at the senior high school level is significant for individuals regardless of whether the school is private or government In addition, the importance of fostering CT for students has been widely discussed in numerous Japanese reports and studies (e.g., Kusumi & Michita, 2015; Ministry of Education, Culture, Sports, Science and Technology, 2011).

As the importance of fostering CT is increasingly being recognised, the number of studies on CT has been gradually increasing in recent years. According to Higuchi (2013), the volume of CT studies found in CiNii Articles and Scopus has almost doubled in the previous decade. In the following section, first, CT are defined, followed by examining how CT are fostered. Second, the theoretical background of CT and L2 relationships is discussed. Third, the relationship between CT and the Japanese EFL context is examined.

2.1 Definition of critical thinking

Although the term critical thinking has been widely used, a decisive definition is yet to be determined, and individual definitions vary (e.g., Ennis, 1962; McPeck, 1990). In Japan, the word critical (in Japanese *hihan*) is sometimes regarded to have a negative connotation and can be used in the context of placing blame. However, as Michita (2015) claims, the concept of CT should be understood as involving logical, reflective, and objective thinking based on evidence, rather than on assumption. Paul and Elder (2002) define CT as a way of thinking to reform the quality of self-thinking, elaborating that critical thinking includes skills for self-guided, self-disciplined thinking and high-level reasoning in a fair-minded way. Brookfield (1987) states that acquiring CT develops learners' reflective thinking so that they can focus on their assumptions and find other ways of inquiry. Thus, the definitions of CT vary, and the term has not been academically defined yet. However, the common framework of CT suggests the ability of metacognitive thinking.

Furthermore, CT is not a simplistic mechanical skill, but encompasses higher cognitive skills such as judgement, analysis, and synthesis (Halpern, 2007). These skills are classified as HOTS in the thinking pyramid model developed by Bloom, Engelhart, Furst, Hill, and Krathwohl (1956), which was later re-organised by Anderson and Krathwohl (2001). Although lower order thinking skills (LOTS) questions can simply require finding necessary information in an assigned text, HOTS questions seem to require advanced

[3] In Article 1 of the School Education Law, the definition of "school" is provided. All private and government schools are authorised by the law. All schools as defined by Article 1 must follow the Course of Study. However, most international schools are not considered Article 1 schools, and thus, do not follow the Course of Study.

cognitive thinking. The following are some examples of HOTS questions: "What are good foods for maintaining your health?"; "Should schools prohibit students from playing online games?"; "If schools prohibit online game playing, will the ban be effective in protecting teenage students?" These questions require students' judgement, analysis, and synthesis, which in turn requires students to be thinking respondents.

Some studies indicate that asking HOTS-level questions can foster CT. For instance, Kennedy, Fisher, and Ennis (1991) state that high-level skills such as analysis, synthesis, and evaluation are often representative of CT and deepen learners' skills. King (1994) reports that the levels of knowledge construction and thinking are influenced by the cognitive level of questions.

2.2 Critical thinking attitudes and approaches to foster CT

CT comprises mainly two aspects: cognitive (skills) and affective (attitudes) (Ennis, 1987). The differences between CT skills and CT attitudes have been discussed in the psychological field. For instance, Perkins (1992) states that *abilities* that enable one to apply one's knowledge to judge, think about, and decide something with regard to a meta-cognitive view point are categorised as skills. Perkins (1992), on the contrary, states that the *desire* or *willingness to* apply one's knowledge to judge, think about, and decide something with regard to a meta-cognitive view point can be defined as attitude.

In the field of psychology, improving cognitive skills requires long-term practice, and it is not easy to change these skills (e.g., Kardash & Scholoes, 1996; Toplak & Stanovich, 2002) For instance, Stanovich and West (1997) state that the cognitive aspect can be transformed through long-term training, whereas the affective aspect can be transformed through short- or mid-term training. These claims suggest that in an educational field that includes EFL classes, transforming CT skills requires long- or mid-term practice, whereas transforming students' CT attitudes requires short-term practice. In this study, due to the short-term length of the course term and the aims of the course—that is, to foster a critical thinking mindset—rather than fostering skills, the practice of fostering CT attitudes was conducted and analysed in terms of effectiveness.

Hirayama and Kusumi (2004) characterised CT attitudes as follows: 1) awareness of the importance of thinking logically and trying to apply logical thinking actively, such as trying to persuade someone with logic; 2) open-minded inquiry, such as learning from others; 3) unbiased objectivity; and 4) evidence-based thinking.

To measure these attitudes, some studies (e.g., Toplak & Stanovich, 2002; Hirooka, Ogawa, & Motoyoshi, 2000) attempted to create scales. Although these scales aimed to reveal one of the aspects of CT attitudes, they did not succeed at revealing the CT attitudes entirely. However, based on these previous studies, Hirayama and Kusumi (2004) developed a scale to

measure the attitudes as a whole; the scale's reliability and validity were analysed, indicating it to be an appropriate measurement in the educational field. Therefore, in this study, the Critical Thinking Attitudes Scale developed by Hirayama and Kusumi (2004) is applied to analyse the effects of CT approaches.

Some studies discussed how CT attitudes are fostered at school. For instance, Michita (2015) claims that critical thinking education is mainly captured 1) when and where it is conducted, and 2) using a framework or viewpoint to foster the CT of learners. Ennis (1989) categorised these qualities as: 1) a general approach (teaching CT itself in a special set course), 2) an infusion approach (teaching CT with content instruction), and 3) an immersion approach (teach CT but not explicitly). For giving learners the opportunity to think critically, Michita (2015) recommends discussions, brainstorming, and expressing ideas and thoughts through persuasive speeches, presentations, and writing. Michita (2015) further recommends receiving comments or objective critiques from others to reconstruct ideas and thoughts in the learning process.

In light of the L2 context, in recent years, how CT skills and attitudes are fostered and embedded in the ESL/EFL context has been discussed among L2 practitioners and scholars (e.g., Davidson & Dunham, 1997; Thompson, 2002). Davidson and Dunham (1997) state that to foster CT skills in the L2 context, students' HOTS must be promoted. MacBride and Bonnette (1995) point out that promoting HOTS can positively influence learners' language proficiency achievement in the EFL context. Liaw (2007) reveals that enhancing HOTS facilitates learners' higher language proficiency levels. Above all, these studies suggested that if EFL teachers facilitate students' HOTS in EFL courses, their language proficiency levels will improve. Nonetheless, no previous studies have revealed the effective approaches to teaching HOTS in the Japanese EFL context.

Some studies attempted to reveal the relationship between the level of second language proficiency and CT skills achievement. Koda (2005) points out that a lack of L2 proficiency reduces the ability to enhance higher-order skills such as discourse processing. Floyd (2011) states, "since students studying in an L2 struggle to perform at the same level as they are capable of in their first language, their difficulties in CT must be at least partly attributable to language difficulties" (p. 290). To prove this statement, Floyd conducted a research on whether Asian university students can foster CT skills, and concluded that the level of second language proficiency and achievement of CT skills are correlated with each other. In the Japanese EFL context, Manalo, Watanabe, and Sheppard (2013) also supported Floyd's claim, illustrating that TOEIC scores and CT proficiency are strongly related with each other.

Considering the L2 literature reviewed above, it is suggested that through enhancing HOTS, learners' CT skills and L2 proficiency are fostered. In addition,

L2 proficiency level is correlated with the achievement level of CT skills. However, all these studies focused on the CT skills and did not discuss these from the perspective of fostering CT attitudes. Based on the study by Stanovich and West (1997) discussed in section 2.2, the potential of fostering CT attitudes in the Japanese EFL context must be examined, in addition to determining whether the level of language proficiency is related to CT attitudes.

2.3 Japanese EFL context in light of fostering critical thinking

Focusing on fostering CT in the Japanese EFL context at the senior high school level, most studies indicate its weakness and insufficient practice in EFL courses. For instance, some studies show that most Japanese EFL textbooks do not focus on HOTS. Kawano (2016) analysed Japanese EFL textbooks used in Japanese 'English Communication II' courses in high schools and found that all questions and tasks were displayed based on Anderson and Krathwol's (2001) taxonomy. Kawano concluded that the questions involving HOTS in the textbooks were comprise 0-6%. Furthermore, Magoku and Erigawa (2019) analysed Japanese EFL textbooks used in Japanese 'English Expression I' classes in high schools, concluding that 81% of the textbook content is related to learning grammar and sentence structure, and 15% of the content is based on CT. The study shows that although 'English Expression I and II' are intended within the Course of Study to engage students' CT skills, most Japanese EFL textbooks do not focus on HOTS-level questions and activities.

According to Saito (2018, reported in Okuyama, 2018) if textbooks do not sell well at schools, the publishing companies do not profit. This comment is aimed at high school EFL teachers, as it is believed that most EFL teachers at Japanese high schools focus on grammar and structure rather than fostering CT. To this end, Akatsuka (2018a) indicated that over 80% of students in a Japanese university had participated in a teacher-centred grammar and explanation style in EFL lessons when they were in senior high school. Koike (2013) reported that Japanese English education was originally developed in the Japanese EFL context, which differs from other countries.

However, these situations have slightly changed in recent years in the Japanese EFL context. MEXT promotes the fostering of students in senior high schools, who can actively engage in the global society with their critical and creative thinking skills. MEXT states that the EFL courses offered at senior high schools should be essential in fostering these students. To realise the fostering of global citizen, implementing the International Baccalaureate (hereafter IB) Diploma Programme offered by the IB Organisation—a non-profit organisation based in Switzerland—at schools has been promoted by MEXT in recent years. MEXT aims to establish 200 IB-authorised schools throughout Japan by 2020. In addition, MEXT has examined the IB

programmes referring to the reform and overall development of Japanese education (MEXT, 2012).

The 'English B' course for learning English as an additional language—offered by the International Baccalaureate Diploma Programme—aims to methodically and rigorously enhance the CT skills of students (International Baccalaureate Organization, 2014). A principal characteristic of the English B education methodology is that it emphasises students' activities that are analytical, evaluative, and creative. Analysis, evaluation, and creation fall under the rubric of the so-called HOTS, and a key feature of the English B course is that these HOTS are taught alongside the so-called LOTS, such as memorisation, understanding, and application.

Furthermore, when the learning material used in the English B course is compared to course material approved by the MEXT, the following differences are evident:

(1) The material and topics covered are different. Many of the MEXT-approved textbooks are centred on the study of articles, and there are cases where the practical use of learning a topic is unclear. Conversely, in English B, the students come across a range of different text forms (newspaper articles, blogs, letters, pamphlets, etc.), and are required to utilise these forms by way of writing.

(2) The learning material for English B not only includes questions to check students' understanding of English texts (an understanding of factual relation) but also includes numerous questions that require students to express their own opinions or positions on a topic, or questions that foster debate on a topic with fellow students.

By comparison, the main characteristic of MEXT-approved textbooks is that they have many questions centred on encouraging an understanding of the textbook's content, such as questions whose answers can be found in the provided text. This suggests that this difference may have an influence on the development of students' CT attitudes. Thus, the practice in the present study refers to English B of the IB Diploma Programme and an arranged rubric to measure students' speaking skills.

3 Research Method

3.1 Research questions

The foremost aim of this study is to answer the question: Through asking HOTS-level questions, to what extent do students' CT attitudes and speaking skills improve in the Japanese EFL context? To answer this question, the following research tasks were set up:

1) Through an infusion approach (Ennis, 1989) in EFL courses, to what extent do students' CT attitudes improve or are not revealed?

2) Through an infusion approach (Ennis, 1989) in EFL courses, how much do students' speaking skills improve or are not revealed?

3.2 Programme setting

The course analysed in this study aimed at fostering students' academic-level English skills, especially speaking skills. Therefore, all students in the course will go on to enrol at research universities and will be required to acquire English skills relevant in an academic setting. Programme setting were applied as follows.

First, elective EFL lessons were conducted for Year 12 students in a Japanese private school. The lessons were conducted for two connecting class hours (one class hour is 50 minutes, totalling 100 minutes) in one week for a duration of 15 weeks. During each lesson, the concept of critical thinking and skills for thinking critically were explained explicitly using the applied infusion approach of Ennis (1989). During each lesson, a variety of actual texts such as news articles and blogs from English-speaking countries were displayed. The length of each text is approximately 800 words. Various topics were covered in the practice, such as ethics, lifestyle, and global issues. Some texts[4] were retrieved from the textbooks of English B of the IB Diploma Programme.

Second, students were required to read a text during each lesson. After completing their reading, students then discussed the text in pairs or groups and answered a variety of HOTS questions displayed by the teacher. A sample of HOTS questions that students were asked after reading the text '*Liquidising goldfish not a crime'* are:

- To what extent can we say that the claim of the judge, 'The fish were killed "instantly" and "humanely"', is objective (or subjective)?
- Which sentences in the text are facts or assumptions? Why do you think so?
- What is the difference between blending fishes for cooking and killing one for an exhibition?
- To what extent does this episode affect the regional cultural background?
- If the same episode happened in Japan, how would citizens react?

When the practitioner created HOTS questions, the questions listed in textbooks of English B of the IB Diploma Programme are referred.

Third, students were required to give presentations (15 minutes per presentation, 10 minutes for discussion). Although students could decide what to discuss, the topic had to be related to the course content. The presentations were also required to include a research question and its answer. After giving their presentations, all students were required to ask some questions to the speakers.

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[4] An example of the actual text displayed by a teacher in the lesson can be found here: BBC News (2003). Liquidising goldfish 'not a crime' Retrieved from http://news.bbc.co.uk/2 hi/europe/3040891.stm

At the end of the programme, students were required to write a reflective essay. Many CT researchers (e.g., Elder & Paul, 2005; Kusumi & Michita, 2015) state that metacognition and reflective thinking are important factors for CT. Therefore, as a culmination of an infusion approach to CT in the EFL course, the instructor conducted the activity of writing a reflective essay. Students wrote reflective essays on A4-sized sheets (between one and two pages in length) in English and submitted the essays to the learning management system. The essay required students to engage in self-assessment by freely writing what they learned and felt about the course, and how they considered the course to have transformed them. Austin, Gregory, and Chiu (2008) indicated that opportunities to reflect and self-assess may be associated with improvement of students' performance in tasks related to CT.

3.3 Participants

Twenty-two private senior high school students (fifteen males and seven females) participated in this project from April 2019 to July 2019. The school is located in the Kanto region of Japan. Students' English levels varied between CEFR (Common European Framework of Reference for Languages) [5] and C1 (proficient user) and A2 (basic user). The average English proficiency level was CEFR B1 (independent user). Seven students (five males and two females) had studied abroad (over one year) in English instruction-based schools, while others had taken EFL education only in the Japanese context. During the course, students were asked to use only English. All 22 students participated in the programme. The instruction of the course was conducted by a Japanese EFL teacher who participated in the IB workshop and obtained a certificate of attendance. Thus, the teacher clearly understood the characteristics of the IB Diploma Programme English B.

3.4 Material

To measure students' CT attitudes and speaking skills, the Critical Thinking Attitudes Scale (Hirayama & Kusumi, 2004) was used in before and after the programme. As the original scale is written in Japanese, students were required to answer the scale in Japanese. The scale attempts to measure four areas of CT attitudes: awareness of logical thinking, inquiry mind, objectivity, and valuing evidence. Scores for some items indicated by an asterisk (see Appendix A) are reversed; that is the scores are calculated reversely. Previous studies (e.g., Floyed, 2011; Manalo, Watanabe, &

[5] CEFR descriptors are indicated by the Council of Europe (2019). Global scale - Table 1 (CEFR 3.3): Common reference. Retrieved from levels https://www.coe.int/en/web/common-european-framework-reference-languages/table-1-cefr-3.3-common-reference-levels-global-scale

Sheppard, 2013) indicate that the level of learners' L2 proficiency is corelated to achieve CT skills. Although the correlation between L2 proficiency and CT attitudes have not revealed, the participants' data was analysed depending on their English proficiency to see if there were any significant differences. The participants were categorized into two groups according to their GTEC Test score. The test record shows CEFR level of each test-taker. Participants took the test in April 2019, before attending the course. If students were in A2 level, they were categorized in low-proficiency level (n=9). If students were in B1, B2 and C1 level, they were categorized in high-proficiency level (n=13).

In addition to the measurement of CT attitudes, students' speaking skills were measured using arranged rubrics from English B of the IB Diploma Programme. Students' speaking tasks were evaluated by two experienced IB English B examiners. To maintain the reliability and validity, the two examiners evaluated the tasks separately (r = .75). If the results indicated large differences, the examiners discussed with each other and moderated students' scores. These results were analysed and divided into low-level and high-level English proficiency groups. The speaking tasks required answering the following questions:

1) Pre: 'You are what you eat' is a well-known American proverb. What are some good foods for maintaining your health? Provide specific reasons and anecdotes to support your answer.

2) Post: Some people love outdoor activities, such as fishing and camping. In contrast, others love to stay at home and relax. Which is better for recharging your batteries? Provide specific reasons and anecdotes to support your answer.

Moreover, for a deeper analysis of the practice, students' reflective essays were analysed by a text mining method using KH Coder Version 3.Alpha (developed by Higuchi, 2014). From the participants' reflective essays, a total of 17,531 words were extracted. As a pre-processing measure, the word 'critical thinking' was selected as a force picking word. Some other word types were extracted before the analysis, such as causative verbs, be-verbs, prepositions, and adverbs. To analyse the data, frequent word lists, co-occurrence networks, and corresponding analyses were used.

In terms of reliably and validity of using text mining analysis, the effects of teaching approaches in EFL courses are mostly analysed by behaviour observation and/or testing students' outcomes in using English skills. Moreover, text mining methods have not been used as the data tended to be analysed and processed by hand either arbitrarily or subjectively (Itagaki et al., 2016).

However, a recent text mining method using the KH Coder is becoming more widely used; in fact, it is being widely used in EFL research (e.g., Okazaki & Kano, 2018; Yoneda, 2017) as the method avoids hand processing and can indicate the data statistically (Higuchi, 2014). In other words, the reliability and validity of text mining analysis have been improved owing to the automation. Therefore, the KH Coder was used to analyse

students' reflective essays in this study.

This study did not measure the relationships between academic achievement levels and CT attitudes. The reasons for this are as follows: recent studies, such as those by Kusumi and Michita (2015) and Shirazi and Heidari (2019), have revealed that CT and the level of academic achievement were not correlated with each other. Furthermore, this study aims to clarify an unrevealed applied linguistics aspect: the relationships between language proficiency level and CT attitudes.

4 Results and Discussions

The results of changing students' CT attitudes and speaking skills are discussed respectively in this section.

4.1 The measurement of transforming critical thinking attitudes

Tables 1 and 2 illustrate the changes in the students' CT attitudes before participating in the programme (pre) and after the programme (post) for lower- and upper-level students, respectively. The reason for the division is to observe the significance of the differences between students' CT attitudes in the two groups. The measurement was conducted using the Critical Thinking Attitudes Scale (Hirayama & Kusumi, 2004, shown in Appendix A). Students answered 33 items on a Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree). Both levels exhibit the significance in every factor from I to IV. Although previous studies—such as those by Floyd (2011) and Manalo, Watanabe, and Sheppard (2013)—revealed that learners' English proficiency level is correlated to achieving CT skills, the results of the present study suggest that the proficiency level is not correlated to achieving CT attitudes (*r*.= 78). From these findings, it is suggested that CT attitudes can be fostered in a mid-term period, as suggested by Stanovich and West (1997), by asking HOTS questions in the EFL course regardless of English proficiency level.

Table 1. Results of Lower English Proficiency Level of CT Attitudes

Factors	Test	*Mean*	*SD*	*P* value
I. Awareness towards	Pre	2.79	0.631	0.003*
logical thinking	Post	3.13	0.428	
II. Inquiry mind	Pre	3.43	0.832	0.001*
	Post	4.06	0.541	
III. Objectivity	Pre	3.02	0.458	0.002*
	Post	3.44	0.421	

IV. Value evidence	Pre	2.91	0.381	0.004*
	Post	3.63	0.391	

*p <.05

Table 2. Results of Upper English Proficiency Level of CT Attitudes

Factors	Test	*Mean*	*SD*	*P* value
I. Awareness toward	Pre	2.75	0.931	0.008*
logical thinking	Post	3.14	0.828	
II. Inquiry mind	Pre	3.45	0.532	0.002*
	Post	4.08	0.443	
III. Objectivity	Pre	2.97	0.328	0.001*
	Post	3.46	0.321	
IV. Value evidence	Pre	2.95	0.291	0.003*
	Post	3.66	0.234	

*p <.05

4.2 The measurement of changing of students' speaking skills

Tables 3 and 4 illustrate the changes in students' speaking skill scores before participating in the programme (pre) and after the programme (post) for lower- and upper-level students, respectively. The measurement was conducted using the rubric (see Appendix B) arranged by referring to the rubric displayed in English B of the IB Diploma Programme. Students answered the question displayed by the teacher within three minutes. The answers were recorded, and then sent to the examiners. Both levels exhibit significant changes in every criterion from A and B, regardless of their English proficiency levels. From these results, it is suggested that CT approaches that include asking HOTS questions can improve students' speaking skills.

Table 3. The Speaking Scores of Lower-Level Students

Criterion	Test	*Mean*	*SD*	*P* value
Criterion A	Pre	2.03	1.019	0.008
	Post	2.99	0.892	
Criterion B	Pre	2.58	0.542	0.003
	Post	2.66	0.893	
Overall	Pre	4.61	0.781	0.006
	Post	5.65	0.893	

*p <.05

Table 4. The Speaking Scores of Upper Level Students

Criterion	Test	*Mean*	*SD*	*P* value
Criterion A	Pre	3.98	0.319	0.002
	Post	4.21	0.412	
Criterion B	Pre	3.28	0.239	0.009
	Post	3.53	0.312	
Overall	Pre	7.26	0.279	0.006
	Post	7.74	0.362	

*p <.05

4.3 The measurement of students' awareness analysed using text mining

To analyse students' awareness toward CT attitudes and their changing of English speaking skills, students' reflective essays were analysed using the KH Coder.

Table 5 shows the top words extracted automatically from the 22 students' essays by the Frequent Word Lists of the KH Coder. For instance, the word 'presentation' was found 226 times. On the contrary, Table 6 shows the top words for each student. The frequency in Table 6 represents the total numbers of students who used the words in their reflective essays. For instance, all students used the word "presentation" in their reflective essays.

Table 5. Highest Frequency Words Extracted from All Students

Frequency	*Words*
226	presentation
146	knowledge
137	think
135	learn
92	use
78	skill
62	know
55	critical thinking
51	Japanese
50	understand
49	write
48	other

Table 5 shows the words 'presentation' (#1), 'knowledge' (#2), 'think' (#4), and 'learn' (#4) as the top ranked. In Table 6, the words 'presentation'

(#1), ‘use’ (#2), ‘know’ (#3) and ‘learn’ (#4) are found to be top ranked. These words seem to indicate that because students were required to give a presentation in the course, they may have gained knowledge.

The words ‘other’ (#12 in Table 5, and #5 in Table 6), ‘skill’ (#6 in Tables 5 and 6), ‘critical thinking’ (#8 in Table 5, #10 in Table 6), ‘opinion’ (#10 in Table 5) and ‘question’ (#11 in Table 6) were extracted. These words indicate that students had the opportunity to communicate with others. Moreover, the students had some amount of awareness regarding CT skills. In addition, students seemed to be involved in expressing their opinions and asking question in the EFL course. However, these results need to be further examined along with individually analysing students’ reflective essays.

Table 6. High Frequency Words Extracted from Each Student

Frequency	*Words*			
22	presentation			
21	use			
20	know	learn		
19	important	think		
18	other			
17	experience	knowledge	skill	understand
16	write			
14	English	student	style	
13	word			
12	academic	believe	change	critical thinking
	such	understanding	work	change
	opinion	realise	opportunity	
11	consider	group	knowledge	life
	speak	question	question prepare	
10	different	difficult		

In Table 6, the word ‘different’ (#12) is shown. This indicates that the style of the course is different from that of other subjects, and from students’ prior learning styles, and that students may have experienced some difficulties while participating in the course.

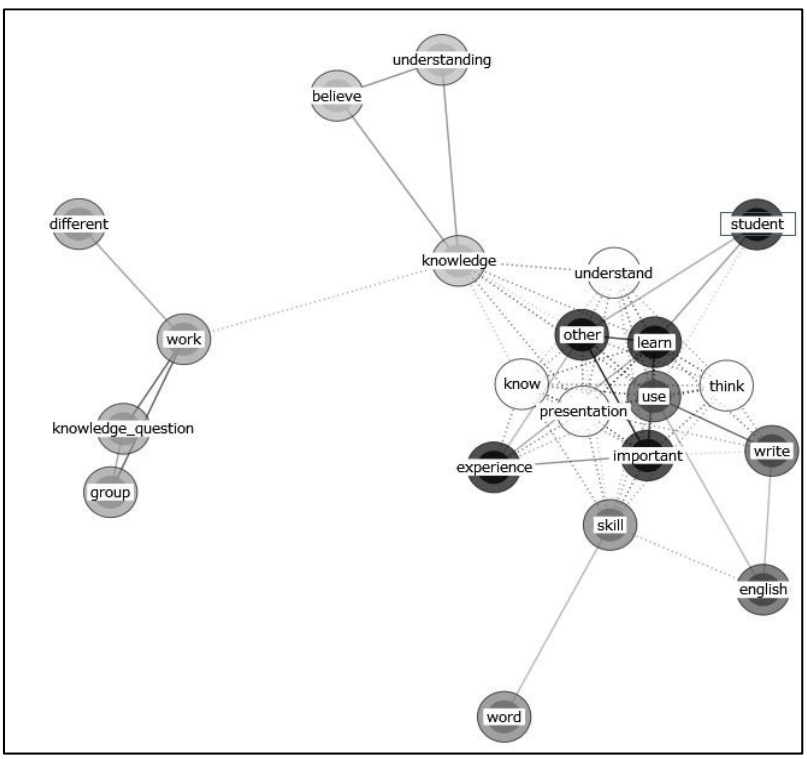

Figure 1. The result of the co-occurrence network of words

For further analysis, the Co-occurrence Network Analysis feature of the KH Coder was used (Figure 1). The analysis demonstrates how students' each extracted word is related to the other words. The solid lines in the figure represent the words that were used as colocations (a set phrase), and the words linked by dots indicate that they lie in colocation but are weakly related to each other. Compared to the lighter shaded circles, the dark shaded circles indicate that larger numbers of words were extracted. The data included words filtered by a minimum frequency of 20 and a minimum document frequency of 10.

First, the word 'use' is connected by a dark line to 'write' and 'English'. It is inferred that students used and wrote English in the course. This seems to illustrate that students are encouraged to use and write English in the EFL course. Additionally, the word 'work' is connected to 'knowledge question', 'different', and 'group'. This seems to indicate that the students' work is based on questions about the knowledge itself as well as different ways of processing the knowledge in a group. Furthermore, the word 'other' is connected by a dark line with 'experience', 'important', 'student', and

'learn'. This indicates that students learned and experienced something important during the course. This demonstrates a student-oriented style of the course. Moreover, the word 'knowledge' is connected by a dark line to 'believe' and 'understanding'. This demonstrates that knowledge, understanding, and belief are interrelated.

4.4 Qualitative analysis of students' reflective essays

This section aims to clarify each group's awareness.

Figure 2 indicates the individual differences among students in their attitudes towards learning. The words (identified by dots) close to the origin (0.0) most commonly appeared in students' reflective essays, and the students (identified by letters) close to the origin exhibited the most general awareness. Meanwhile, words and students at greater distance from the origin are considered to be more characteristic of students. Moreover, the word layout at the same azimuth from the origin exhibits strong mutual relationships and similar tendencies.

The two dimensions shown in Figure 2 illustrate how students' learnings are different. Distance between each student illustrate how much different learnings are happened in the course. In other words, the two dimensions do not indicate specific components such as the numbers of students and words. It is insignificant whether the words and/or the person using them are positioned in the negative or positive areas, or whether they are positioned vertically or horizontally (Higuchi, 2014). For instance, it is suggested that the awareness towards learning of student B (seen in the upper quadrant of Figure 2) is different from that of student S (seen in the lower quadrant of Figure 2). In Figure 2, circles were added to clearly see the similar tendencies.

In the following sections, the most commonly appeared learnings and those that are characteristic are analysed to clarify students' awareness towards CT attitudes and English skills. To analyse the data, the minimum term frequency was 20, and the minimum document frequency was 10.

4.4.1 Awareness towards the importance of thinking in English

Figure 2 shows that the students A, C, G, F, K, H, I, N, P, Q, T, and U have the most common and general attitudes. The key words are 'use', 'think', 'learn', 'something', 'other', 'know', 'understand', 'presentation', 'difficult', and 'important'. For instance, a lower-level student F stated the following:

> *Before I took this class, I was always using English mechanically and I didn't care about what other students were thinking about my thoughts. But now, I changed my mind'.* (Student F) [sic]

The reflective essay by student F indicates that the student had awareness of the importance of thinking in English when they communicate in English.

A high-proficiency student (Q) also had awareness of the importance.

> *In a group, we could share different values with each other by answering questions and include multiple perspectives in our presentation. It's a good opportunity to think deeply and use English'* (Students Q) [Underlined by author]

The results above indicate that regardless of English proficiency level, students had the awareness of the significance of thinking during communication, and learned different values from other classmates while answering HOTS-level questions.

4.4.2 Overcoming frustration

Figure 2 indicates that the learning of students B and E, and O and M, are characteristic. The key words of students B and E are 'question', 'word', 'student', and 'English'. From the low-proficiency student B's reflection below, it is considered that B was aware of the harshness of giving a presentation followed by discussion.

It was found that student B was frustrated because of experiencing harshness for expressing his/her opinion about the HOTS-level question. However, she/he tried to answer using English.

> *I experienced the difficulty of expression and explaining something to people in English. In this class, we thought of "What is emotion? And where does it come from?" I couldn't answer the questions exactly, but I tried to explain my opinion*. (Student B) [Underlined by author]

Below is a reflection of a high-proficiency student, E.

> *Discussing something in English for about two hours was also a first experience for me. It was very difficult because my teacher asked many questions that I had never thought of. When I explained my thoughts, I could try to speak in English using words that I know ….(omission)…. before I took this class, I was always using English without thinking and I didn't mind other people's opinions. However, now I use English objectively. After I write down a sentence, I will imagine what will other people think when they see this.* (Student E) [Underlined by author]

Student E's essay infers that the student struggled to express his/her opinion in English as it was difficult to answer a HOTS-level question. While E was aware of the purpose of communication in English, E's intention was

towards a target audience, rather than grammar and structure. Student E also mentioned that 'I want to put more words in my mind' and 'I also have to acquire fast reading ability and listening skill'. This indicates that through being asked HOTS-level questions, students were motivated to increase their vocabularies.

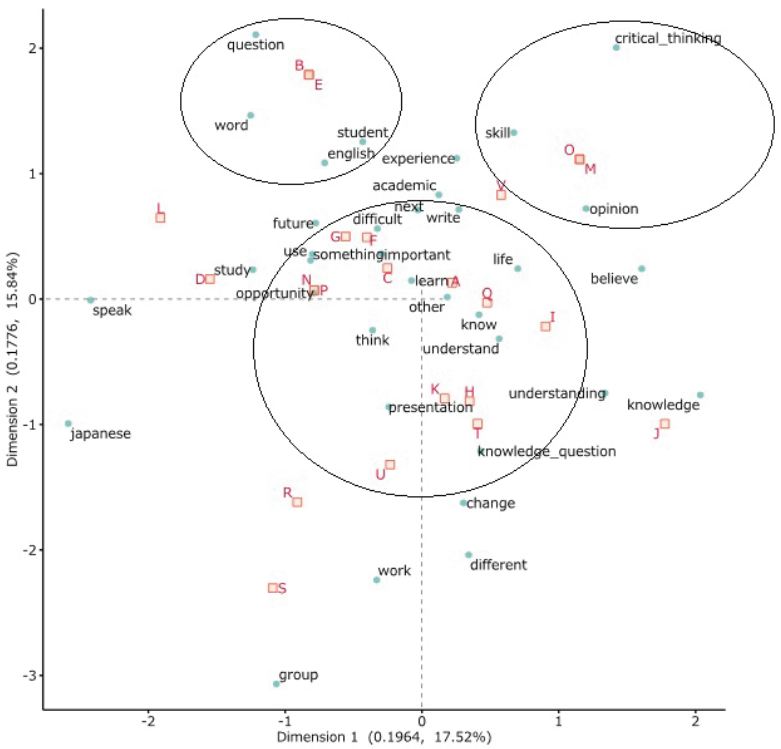

Figure 2. Results of the 22 participants' correspondence of reflective essays

4.4.3 Awareness of vocabulary level, critical thinking, and level of asking questions

The words 'critical thinking', 'skill,' and 'opinion' are found close to student M (a low-proficiency level) and O (a high-proficiency level).

> *I could learn English vocabulary and knowledge. Furthermore, I understood that this theory is useful for critical thinking skills, especially considering 4W and 1H to organise opinions."…. (Omission)….. First, I was stimulated by the English fluency. Second, I noticed the enormous vocabulary of other students, especially my presentation partner. He used various words in the manuscripts. In the*

> *script, there are many words that I don't know. I was certainly very surprised by the disparity of vocabulary.* (Student M) [Underlined by author]

Student M's comment shows they felt the importance of increasing their vocabulary from other students; furthermore, CT skills can be useful for organising English sentences based on the 4 Ws (Who, Where, What, and When) and 1 H (How).

Student O's result indicates that they were aware of the level of CT skills, which were assessed by determining whether they can ask good questions to others.

> *In the class, I have to prepare for sudden questions to express my opinion. I still thought I don't have enough critical thinking skill, because I couldn't ask good questions to other people's.* (Student O) [Underlined by author]

5 Conclusion

From the previous literature, we see that CT attitudes are fostered in short- or mid-term practice at schools. Furthermore, involving higher-order thinking activities in the EFL context fosters CT. Based on the research question 1, the results of the analysis are discussed above. Through the infusion approach in EFL courses, students gained CT attitudes in mid-term practice in a Japanese EFL context by being asked HOTS-level questions. The results also indicate that CT attitudes are fostered irrespective of students' English proficiency levels. To clarify research question 2, students' speaking tasks were analysed using the rubric based on English B of the IB Diploma Programme. The results illustrated that students improved their speaking skills through an infusion approach—being asked HOTS-level questions by a teacher. In addition to the methods above, to examine from the viewpoint of a qualittaive research, students' reflective essays were examined by a text mining method using the KH Coder. The results indicate that students' awareness is categorised into three groups, regardless of their English proficiency levels.

Overall, the results suggest that if a variety of HOTS-level questions are posed to students in the Japanese EFL context, students can acquire both CT attitudes and speaking skills in a short- or mid-term, regardless of their English proficiency levels.

6 Further Research

Throughout this research, students' self-awareness of their attitudes towards

critical thinking and the achievement of English speaking skills were extracted, indicating that the effects of asking HOTS-level questions are suitable for fostering CT attitudes. For more thorough qualitative research, it is important to measure CT skills using parameters such as the Watson-Glaser test, which is designed to assess an individual's critical thinking skills. Furthermore, measuring English proficiency levels using tests such as IELTs and TOEFL is recommended for a more thorough qualitative research.

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Appendix A
The Factors and Items of the Critical Thinking Attitude Scale

I. Awareness towards logical thinking	
	1. I am good at orderly thinking about complex problems.
	2. I am good at summarising my ideas and thoughts.
	3. I am confident to think things correctly.
	4. I can give a persuasive explanation(s).
	5*. I get confused when I think about a complex problem.
	6. I rely on other colleagues as I view things fairly.
	7. I can concentrate on things when I tackle a problem.
	8. I can continue to tackle a problem even if it is complex.
	9. I am the person who thinks things logically.
	10*. My weakness is that I easily get distracted.
	11*. I do not have the headspace for others when I think about something.
	12. I can explore a topic carefully.
	13. I can give suggestions constructively.
II. Inquiry mind	
	1. I want to learn many things while interacting with a variety of people.
	2. I want to be a life-long learner.
	3. I love to try new things.
	4. I want to learn about a variety of cultures.
	5. I believe that it is meaningful to learn what and how foreigners think.
	6. I am interested in people who think differently than me.
	7. I am the person who wants to know more about a subject / a topic.
	8. I want to know as many things as possible, whether they are useful or not.
	9. I enjoy discussions with people who have different opinions.
	10. I am the person who asks questions if I do not understand something.
III. Objectivity	
	1. I always try to judge things in a balanced manner.
	2*. I grasp things only from my personal perspectives.
	3. I try to remain objective when I judge things.
	4. I try to think about things from a variety of perspectives, and not only one or two.

	5. I try to reflect myself whether I am in a narrow perspective or not.
	6*. I cannot be neutral when I discuss my opinions.
	7. I am all ears even if someone is of the opposite view.
IV. Value evidence	
	1. I stick to concrete evidence when I judge something.
	2. I examine a variety of facts or evidence as much as possible when I judge something.
	3. I do not believe things without a doubt.
*reversed items	

Appendix B
Rubric of Speaking Task

	Criterion A Language How successfully does the student command spoken language?	Criterion B Message How relevant are the ideas in the talk?
	- To what extent is the vocabulary appropriate and varied? - To what extent do pronunciation and intonation affect communication?	- How appropriately and thoroughly does the student respond to the question? - To what depth are the questions answered?
4-5	Command of the language is mostly accurate and effective - Vocabulary choice is appropriate to the task, and varied. - Pronunciation and intonation are easy to understand and help to convey meaning.	Student's response is consistently relevant to the question and shows some development. - The answers are consistently appropriate and developed. - The answers are broad in scope and depth.
2-3	Command of the language is partially effective. - Vocabulary choices are appropriate to the task but limited. - Pronunciation and intonation sometimes interfere with communication.	Student's responses are mostly relevant to the questions. - The answers are appropriate, and some are developed. - The answer is mostly broad in scope and depth.
0-1	Command of the language is limited	Student's response consistently struggles to address the question.

	- Vocabulary is sometimes appropriate to the task. - Pronunciation and intonation are recurrent and interfere with communication.	- The answer is inappropriate and rarely developed. - The answer is limited in scope and depth.

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Received: September 1, 2019
Revised: November 29, 2019
Accepted: December 3, 2019