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A Comparative Study on Critical Thinking Skills of ISEC and Non-ISEC Teachers in Institutions of Higher Education in the North of China

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Abstract

Viewed as one of the essential skills needed to succeed in the 21st Century, advancing student's critical thinking (CT) is a significant focus in higher education. This study utilized a non-experimental causal-comparative methodology with an explanatory mixed methods research design. The purpose of this study was to explore the status quo (current situation) of Chinese teachers' (including ISEC and non-ISEC teachers) CT, as well as the perception, attitude, and practice of CT among them in institutions of higher education in the north of China. There were 102 participants took the California Critical Thinking Skills Test (CCTST). The results from the quantitative research showed the CT skills of Chinese teachers fell in the upper range of moderate level. There were no significant differences or relationships in CT skills for ISEC and non-ISEC teachers based on the variables: gender, professional rank, educational background, discipline taught, age, and years of teaching. Twelve participants were interviewed. The core phenomenon or theory emerged from the qualitative data: Chinese teachers advocated and supported CT instruction, but they had a varied and fragmented perception about CT. Although they held a positive attitude towards CT and CT instruction, they applied limited CT teaching strategies in their practice. All participants displayed a strong desire to participate in CT training programs. The findings from the qualitative paradigm supported, complemented, and deepened the findings from the quantitative paradigm.

Keywords: critical thinking, China, ISEC

1. Introduction

Critical thinking (CT) is a worldwide concern and the development of critical thinking skills has become the main focus in the context of higher education (Davies & Barnett, 2015). In past decades, or even centuries, China, along with other Asian countries, did not pay much attention to CT (Davies & Barnett, 2015). However, with the development of the critical thinking movement in Western countries, non-Western countries, especially China, began to focus on CT, and Chinese educators, scholars and researchers started to conduct research on CT. "Attempts to apply the ideas to higher education in China did not begin until the mid-1990s" (Dong, 2015, p. 351), but the growth and progress of the critical thinking movement in China has been made since the late 1990s (Dong, 2015).

Problem Statement

Critical thinking (CT) has become a hot issue in higher education and is regarded as one of the key and essential skills for students to succeed in the 21st century (Halpern, 2003; Adelman et al. 2014; Li, 2016; Roohr et al., 2019). However, CT cultivation in Chinese higher education has been missing for decades. The majority of Chinese teachers spend their time giving lectures, and students take notes and learn facts through repetition and rote memorization. The cultivation of students' CT is totally ignored, leading to students' deficiency of CT skills (Li, 2016). Li (2016), further tells us that Chinese students are reproductive learners rather than analytical and speculative learners, and they are passive, unquestioning, and lacking in critical thinking.

Given the fact that Chinese students are lacking in CT skills, innovation, and creativity, the Ministry of Education (MOE) issued documents to advocate, motivate, and advance CT cultivation in the Chinese students. Following these documents, Chinese colleges and universities either set up an independent course for critical thinking, or began to integrate CT into the existing curriculum (Zhai, 2015). However, when they teach CT in schools, teachers are faced with

many obstacles and challenges at the personal, socio-cultural, and institutional levels. These obstacles and challenges include shortage of CT ideology, knowledge, and experiences; the great influence of Confucianism; the Chinese tradition "Doctrine of the mean" (中庸), which represents the "middle way between two extremes" (Chen, 2017, p. 532); inadequate educational resources and support; large class sizes; and the predominantly exam-oriented educational system, etc. Findings from research show that "much of the mandated high-stakes testing have resulted in teachers' over-concentration on lower-order thinking skills" (Zhang & Kim, 2018, p. 160).

According to Statistics Times (2021a), the population of China is 4.35 times greater than that of the US, "with China home to about 1.44 billion people and the United States to 331 million in 2020" (para. 1, United States vs China by Population, January 10, 2021a). Although the population in China is more than four times the US population, "the Per capita income of the United States is 5.78 and 3.61 times higher than that of China in nominal and [Purchasing Power Parity] PPP terms, respectively" (Statistics Times, para 3. Comparing United States and China by Economy, May 15, 2021b). One of the reasons for this disparity is China is short of innovative and creative talents, which makes China lose its competitive edge in global affairs, economy, and events. To change this situation, the Chinese government is pressing colleges and universities to cultivate a new generation of highly skilled workers which produce innovation and creativity in science and technology to serve as a recipe for promoting economic growth and development. Critical thinking is a key component to this recipe.

Research Questions

The research questions, alternative hypotheses, and null hypotheses were as follows:

R_1 What is the level of CT skills of overall Chinese teachers in institutions of higher education in the north of China?

R_2 What is the level of CT skills of the ISEC and non-ISEC teachers in institutions of higher education in the north of China, respectively?

R_3 Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers in the north of China?

R_4 Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers, based on gender identifying as male and female?

R_5 Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers based on professional rank?

R_6 Is there a statistically significant relationship between CT skills and age?

R_7 Is there a statistically significant relationship between CT skills and years of teaching?

R_8 Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers based on the educational background?

R_9 Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers based on the discipline?

Research question 4 – 9 had a hypothesis and a corresponding null hypothesis.

The Central Question

The central question was as follows:

What is the perception, attitude, and practice regarding CT among the ISEC and non-ISEC teachers in institutions of higher education in the north of China?

Definition of Terms

For the purpose of this explanatory mixed methods study, the following terms were used, followed by their definitions.

Critical thinking skills. CT skills are cognitive skills, including "(1) interpretation, (2) analysis, (3) evaluation, (4) inference, (5) explanation and (6) self-regulation. Each of these six is at the core of CT" (Facione, 1990a, p. 4). CT skills can be classified into different subskills. (1) Interpretation covers such subskills as categorization, decoding significance, and clarifying meaning. (2) Analysis involves subskills, like examining ideas, identifying arguments, analyzing arguments. (3) Evaluation includes assessing claims, assessing arguments. (4) Inference consists of querying evidence, conjecturing alternatives, and drawing conclusions. (5) Explanation is composed of stating results, justifying procedures, and presenting arguments. (6) Self-regulation is made up of self-examination and self-correction (Facione, 1990, p. 6).

***ISEC program*.** International Scholarly Exchange Curriculum (Undergraduate) program is acronymized as ISEC program, affiliated to the China Scholarship Council (CSC). It is an international education program, based on the

strategies of "China's Education Modernization 2035 Plan". The targeted members of ISEC program are local or provincial colleges and universities in China. Its mission is to offer guidance, service and support for local schools in faculty and staff training, teaching management, teaching quality assurance, etc. The aim of the ISEC program is to help local colleges and universities to reform their curricula and teaching, and cultivate innovative talents (ISEC office, 2022).

ISEC teachers. Teachers from local or provincial colleges or universities, who have participated in pre-service training of the ISEC program and obtained the qualification of teaching ISEC students, get the title of ISEC teachers. ISEC teachers must attend regular training to keep their knowledge and skills updated. ISEC teachers must be assessed annually, as well. If their assessment is not kept up to the standard, ISEC teachers will lose their qualification of teaching ISEC students (ISEC office, 2022).

Non-ISEC teachers. As opposed to the teachers from Project 211, Project 985, the C9 League and Double First Class universities, teachers who come from ordinary or common colleges and universities (local or provincial colleges and universities) are named non-ISEC teachers. (ISEC office, 2022).

Related Literature

Early roots of the Euro-Western view of rational thought can be traced back to the great Greek philosophers: Socrates, Plato, and Aristotle (Thayer-Bacon, 2000). Their contributions were followed by Dewey, a twentieth-century American pragmatist, who added important contributions to the development of the Euro-Western CT theory (Thayer-Bacon, 2000). Since the 1980s, these early foundations of CT theory have been further bolstered by a large number of empirical studies (Soeherman, 2010). In more recent years, the CT movement has gained momentum at all levels of education in the globalized world and, while the epicenter of the movement "is in North America, its influence is being felt in Europe and beyond" (Paul, 1992, p. 33). Paul (1992) additionally tells us the CT movement is manifested in many educational aspects, such as a variety of academic publications and research projects, educational mandates, curriculum articulations, and school restructuring.

Since the late 1990s, the CT movement in China has begun to grow and develop (Dong, 2015) and CT is valued today in both the Western educational system and the Chinese educational system (Li, 2017). Although controversy concerning CT still exists in the Chinese educational system, such as "whether or not it can be defined and measured, and whether or not it is possible to teach it in the Asian L2 context" (Lin, 2014, p. 16), the importance of CT is well accepted.

However, evidence shows that Chinese students lack CT, which is a concern for both Chinese students who study abroad, and those who study at home (Tian, 2008). Both Western and Chinese scholars have recognized that Chinese students have greater difficulty constructing distinct ideas and they are less likely to challenge authorities compared to Western students (Liu, 1998; Hu, 2002). Partly thanks to these research findings, Chinese policymakers, such as the Ministry of Education (MOE) of China, researchers, scholars, and educators have begun to recognize the importance of critical thinking. Policymakers hope that "introducing CT to Chinese students will enable them to become innovative and creative thinkers and entrepreneurs and introducing CT into Chinese HE [higher education] will help realize the comparative success of Western HE" (Li, 2017, p. 43).

2. Methodology

In order to explore the status quo (current situation), the perception, understanding, and practice of CT among ISEC and non-ISEC teachers in institutions of higher education in the north of China, the researcher used a non-experimental causal-comparative study. In this non-experimental causal-comparative study, the explanatory mixed methods design or the QUAN-Qual Model (Gay et al., 2006), was utilized. For the quantitative research paradigm, the computer-based California Critical Thinking Skills Test (CCTST) on the Insight Assessment website, was utilized to explore the status quo of CT skills of Chinese ISEC and non-ISEC teachers. For the qualitative research paradigm, interviews via Zoom were employed to collect data with respect to teachers' perception, attitudes, and experiences concerning CT and CT teaching in China. By means of data collection and data analyses, the results and findings offered a better understanding of the research purpose and questions.

3. Quantitative

Research Design

Population and Sample. The ISEC teachers and non-ISEC teachers from the local or provincial colleges and universities, rather than from Project 211, Project 985, or C9 League, the key and leading universities in China, comprised the population. According to the ISEC Office (2022), there are 3775 ISEC teachers in total as of August 2022. The number of non-ISEC teachers in the local colleges and universities is unknown. Nonprobability sampling was used. One hundred and two volunteer participants were recruited to take the Chinese version of CCTST, including 52 ISEC teachers and 50 non-ISEC teachers. Email and WeChat (a popular Chinese social media) invitations were sent

to all ISEC and non-ISEC teachers that the researcher knew. The researcher asked the participants to recruit other volunteers. These steps were repeated until the needed sample size (102 participants) was reached. After obtaining quantitative data through CCTST, 12 out of 102 participants were selected for interviews because of their willingness to participate, including 6 ISEC and 6 non-ISEC teachers. According to Guest et al. (2006), 12 interviews were the minimum number to reach theoretical saturation.

Instrument

The Chinese version of the CCTST was used. It measured five core CT skills: analysis, inference, evaluation, deductive reasoning, and inductive reasoning. The CCTST consists of 34 multiple-choice questions that are discipline-neutral. According to the CCTST manual (2021), the reliability and validity of the CCTST were established by Insight Assessment.

Data Analysis

After the participants completed their tests, the researcher downloaded an individual spreadsheet report of the group's assessment scores. All data were input into SPSS Statistics 28 to conduct statistical tests. Descriptive statistics were used to determine overall Chinese teachers' CT level (R_1), as well as the CT levels of ISEC and non-ISEC teachers respectively (R_2). The independent t-test was used to investigate the difference in levels of CT between ISEC and non-ISEC teachers (R_3). A two-way ANOVA was used to explore the difference in CT skills between ISEC teachers and non-ISEC teachers, based on gender (R_4). A two-way ANOVA was used to explore differences in CT skills among ISEC teachers and non-ISEC teachers based on their professional titles or ranks (R_5). A Pearson correlation was run to examine the relationship between CT skills and age (R_6). A Pearson correlation was run to examine the relationship between CT skills and years of teaching (R_7). A two-way ANOVA was used to explore the differences in CT skills between ISEC teachers and non-ISEC teachers based on the educational background (bachelor, master, or doctorate) (R_8). A two-way ANOVA was used to explore the differences in CT skills between ISEC teachers and non-ISEC teachers based on the discipline (R_9). Following a significant two-way ANOVA, the post hoc test, Tukey's HSD, was employed to determine which pair or pairs of group means significantly differ. According to Privitera (2015), post hoc tests are necessary when there are more than two groups ($k > 2$), "because multiple comparisons are needed" (p. 372). If the ANOVA is not significant, post hoc tests are not needed, because "no group means significantly differ" (Privitera, 2015, p. 372).

4. Qualitative

Research Design

For the qualitative research paradigm, the grounded theory design was utilized to gather data concerning ISEC and non-ISEC teachers' perceptions, attitudes, and experiences about CT and CT instruction. The interview protocol, including nine questions, was employed. All the questions in the interview protocol were open-ended. The individual interview was conducted via Zoom, which lasted 40-60 minutes.

Data collection

Procedures.

First, the participants were invited to participate in the interview via email and WeChat. If they agreed to be interviewed, the Informed Consent form was delivered to all participants for their signature. The interview was audio and video recorded with the permission of the participants. The researcher transcribed all the interviews. During the interview, field notes were taken by the researcher.

Data Analysis

The researcher applied Strauss and Corbin's (1998) procedures for data analysis. During the initial coding stage, open coding was aimed at conceptualizing and categorizing data via two analytic procedures: making constant comparisons and asking questions. During the final stage, selective coding was employed to develop and establish central or core categories grounded in data, and thus the theory was generated in a final narrative to explain the detailed process of the phenomenon.

5. Results

Participants' Demographic Profiles

One hundred and two teachers from 22 colleges and universities in the north of China participated in the research. There were 37 males (36.3%) and 65 females (63.7%). With regard to the professional rank, there were 2 assistants (2.0%), 39 instructors (38.2%), 51 associate professors (50.0%), and 10 professors (9.8%). In terms of their educational background (highest degree earned), there were 2 bachelor's (2.0%), 77 master's (75.5%), 21 doctorates (20.6%), and 2 (2.0%) post doctorates.

Reliability

The value of Cronbach's alpha was .86 in this study, suggesting good internal consistency or reliability for this group of participants or sample. According to Pallant (2010), values of Cronbach's alpha above .70 are considered acceptable, and values that are above .80 are preferable.

Quantitative Research Questions Addressed

In this study, the alpha level, or the level of significance was set at .05. For the quantitative research paradigm, nine research questions were addressed. The researcher first conducted descriptive statistics to address the first two research questions. The independent *t*-test, two-way ANOVA, and Pearson correlation were used to address the remaining seven research questions.

Research Question 1: What is the level of CT skills of overall Chinese teachers in institutions of higher education in the north of China?

The descriptive statistics indicated the mean score of the overall CT skills was 17.34 (SD = 3.66). According to the CCTST user manual (2021), if the overall scores range from 0-7, then they fall into the "Not Manifested" level; if the overall scores are from 8-12, they belong to the "Weak" level; if scores are 13-18, they fall into the "Moderate" level; scores ranging from 19 to 23 belong to the "Strong" level; and 24 or higher falls into the "Superior" level. This criterion showed the overall CT mean scores of Chinese teachers in the north of China fell into the upper range of the "Moderate" level.

The mean scores of the 5 core CT skills---*analysis, inference, evaluation, induction reasoning, and deduction reasoning* were 4.21 (SD = 1.36), 8.62 (SD = 2.44), 4.52 (SD = 1.65), 9.25 (SD = 2.12), 8.10 (SD = 2.35) respectively. Based on the CCTST 34-Point Scale Score Interpretation in the user manual (2021), the mean value of *analysis* skill of Chinese teachers fell into the range between Moderate (3-4) and Strong (5 or more), belonging to the lower range of the "Strong" level. The *inference* skill of Chinese teachers fell into the middle range of the "Moderate" level (6-11). The *evaluation* skill was in the lower range of the "Moderate" level (4-7). The *induction reasoning* fell into the medium range of "Moderate" level (6-11), and the *deductive reasoning* was in the medium range of "Moderate" level (6-11) as well (see Table 1).

Table 1. Five Core CT Skills of Chinese Teachers

Five Core CT Skills	Analysis	Inference	Evaluation	Induction	Deduction
Mean	4.21	8.62	4.52	9.25	8.10
SD	1.36	2.44	1.65	2.12	2.35
Level of CT skills	Lower range of the "Strong" level	Middle range of the "Moderate" level	Lower range of the "Moderate" level	Medium range of the "Moderate" level	Medium range of the "Moderate" level

Research Question 2: What is the level of CT skills of the ISEC and non-ISEC teachers in institutions of higher education in the north of China, respectively?

The descriptive statistics (Table 2) showed the mean score of the overall CT skills of the ISEC teachers was 17.39 (SD = 3.63), and for the non-ISEC, the mean score was 17.30 (SD = 3.74). The overall score of ISEC teachers was slightly higher than that of non-ISEC teachers (see Table 2).

Table 2. Overall CT Scores of ISEC and Non-ISEC Teachers

Overall Scores	n	Range	Minimum	Maximum	Mean	SD
ISEC	52	18	9	27	17.39	3.63
Non-ISEC	50	18	8	26	17.30	3.74

Research Question 3: Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers in the north of China?

An independent t-test was conducted to compare the overall CT scores and five scores of the core CT skills for the

ISEC and non-ISEC teachers. Although the mean overall CT score of the ISEC teachers was higher than that of non-ISEC teachers, there was no statistically significant difference in the overall CT scores for the ISEC teachers (M = 17.39, SD = 3.63) and non-ISED teachers (M = 17.30, SD = 3.74; $t_{(100)} = .12$, $p = .91$, two-tailed). The researcher of this study failed to reject the null hypothesis. The magnitude of the differences in the means (mean difference = .08, 95% CI: -1.36 to 1.53) was very small (Cohen $d = .02$).

Research Question 4: Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers, based on gender (male and female)?

A two-way between-groups analysis of variance (ANOVA) was conducted to explore the difference in CT skills between the ISEC teachers and non-ISEC teachers, based on gender. According to the descriptive statistics, the overall mean score of male teachers (M = 17.11, SD = 3.99, n = 37) was lower than that of female teachers (M = 17.48, SD = 3.49, n = 65). The mean value of male ISEC teachers (M = 17.65, SD = 3.35, n = 17) was higher than that of female ISEC teachers (M = 17.26, SD = 3.79, n = 35). The mean score of male non-ISEC teachers (M = 16.65, SD = 4.50, n = 20) was lower than that of female non-ISEC teachers (M = 17.73, SD = 3.14, n = 30). The mean score of female non-ISEC teachers ranked the highest, followed by male ISEC and female ISEC. The male non-ISEC teachers ranked the lowest. The interaction effect between gender and two teacher groups was not statistically significant, $F_{(1, 98)} = .93$, p = .34, and the effect size was very small (partial eta squared = .01). There was no statistically significant main effect for two groups of teachers: ISEC and non-ISEC, $F_{(1, 98)} = .12$, p = .73. The main effect for gender, $F_{(1, 98)} = .21$, p = .65, did not reach statistical significance, either. The researcher of this study failed to reject the null hypothesis.

Research Question 5: Are there any statistically significant differences in CT skills between the ISEC teachers and non-ISEC teachers based on professional rank?

A two-way ANOVA was performed to examine the differences in CT skills between the ISEC teachers and non-ISEC teachers based on professional rank. Because there were only two assistant ISEC teachers, the rank of assistant was not considered in the two-way ANOVA. With respect to descriptive statistics, the overall mean score of instructors (M = 17.54, SD = 3.93, n = 39) was the highest, followed by that of associate professors (M = 17.26, SD = 3.27, n = 51) and professors (M = 16.30, SD = 3.97, n = 10). The mean value of ISEC professors (M =18.00, SD = 2.16) was higher than that of non-ISEC professors (M =15.17, SD = 4.67). Professors were not further considered because there were only 4 ISEC professors and 6 non-ISEC professors. The mean value of ISEC instructors (M = 18.09, SD = 3.91, n = 22) was higher than that of ISEC associate professors (M = 16.33, SD = 3.09, n = 24). The magnitude of the differences in the means (mean difference = 1.76) was medium (Cohen $d = .5$). Therefore, the difference between these groups had some practical significance (Pallant, 2010). The mean value of non-ISEC instructors (M = 16.82, SD = 3.96, n = 17) was lower than that of non-ISEC associate professors (M = 18.07, SD = 3.27, n = 27). The magnitude of the differences in the means (mean difference = 1.25) was small (Cohen $d = .3$). The mean score of ISEC instructors was higher than that of non-ISEC instructors. The magnitude of the differences in the means (mean difference = 1.27) was small (Cohen $d = .3$). While the mean score of ISEC associate professors was lower than that of non-ISEC associate professors. The magnitude of the differences in the means (mean difference = 1.74) was medium (Cohen $d = .6$). The difference between these groups had some practical significance (Pallant, 2010).

The interaction effect between three professional ranks and two teacher groups was not statistically significant, $F_{(2, 94)} = 2.87$, p = .06, and the effect size was very small (partial eta squared = .01). There was no statistically significant main effect for two groups of teachers: ISEC and non-ISEC, $F_{(1, 94)} = .73$, p = .39. The main effect for the professional rank, $F_{(1, 94)} = .24$, p = .79, did not reach statistical significance, either. The researcher of this study failed to reject the null hypothesis. Although there were no statistically significant differences in CT skills for the ISEC teachers and non-ISEC teachers based on the professional rank, the practical significance did exist between ISEC associate professors and non-ISEC associate professors, as well as ISEC instructors and ISEC associate professors.

Research Question 6: Is there a statistically significant relationship between CT skills and age?

The Pearson correlation coefficient was $r = -.17$, n = 102, $p = .09$. Cohen (1988) suggested such guidelines: small relationship, if $r = .10$ to .29; medium relationship, if $r = .30$ to .49; and large if $r = .50$ to 1.0. Therefore, there was a weak, negative correlation between the two variables: overall CT skill scores and age. According to Privitera (2015), a negative correlation means that the values of two factors change in the opposite direction (as the values of one factor increase/decrease, the values of the second factor decrease/increase). The older participants generally had lower CT scores and vice versa. There was no statistically significant relationship between overall CT scores and age, because the p value was larger than .05. The coefficient of determination $r^2 = .03$, which meant only 3% of the variance in overall CT scores could be explained by age. The researcher of this study failed to reject the null hypothesis.

The relationships between the five core CT skill scores and age were investigated. Table 3 indicated there was a weak, negative correlation between analysis and age ($r = -.12$, $p = .23$), inference and age ($r = -.10$, $p = .31$), evaluation and age

(r = -.13, p = .21), induction and age (r = -.24, p = .02), as well as deduction and age (r = -.05, p = .66). The correlation or relationship between induction and age (p < .05) was statistically significant. The coefficient of determination r^2 = .06, which meant only 6% of the variance in induction scores could be explained by age. The remaining correlations were not statistically significant.

Table 3. Pearson Correlations between Five Core CT Skill Scores and Age

		Analysis	Inference	Evaluation	Induction	Deduction
Age	Pearson correlation	-.12	-.10	-.13	-.24	-.05
	Sig. (2-tailed)	.23	.31	.21	.02*	.66
	n	102	102	102	102	102

* Correlation is significant at the .05 level (two-tailed)

Research Question 7: Is there a statistically significant relationship between CT skills and years of teaching?

The Pearson product-moment correlation indicated the correlation coefficient r = -.18, n =102, p = .07. There was a weak, negative correlation between overall CT scores and years of teaching, demonstrating that participants with more years of teaching generally had lower CT skill scores and vice versa. A statistically significant relationship did not exist between these two variables: overall CT scores and years of teaching (p > .05). The coefficient of determination r^2 = .03, showed that only 3% of the variance in overall CT scores could be explained by years of teaching. The researcher of this study failed to reject the null hypothesis.

Table 4 indicated there was a weak, negative correlation between *analysis* and years of teaching (r = -.10, p = .32), *inference* and years of teaching (r = -.14, p = .17), *evaluation* and years of teaching (r = -.12, p = .23), *induction* and years of teaching (r = -.20, p = .04), as well as *deduction* and years of teaching (r = -.10, p = .32). Although the relationship between *induction* and years of teaching (p < .05) was statistically significant, the coefficient of determination r^2 = .04 indicated that only 4% of the variance in *induction* scores could be explained by years of teaching. There were no statistically significant relationships with regard to the remaining four correlations.

Table 4. Pearson Correlations between Five Core CT Skill Scores and Years of Teaching

		Analysis	Inference	Evaluation	Induction	Deduction
Years of Teaching	Pearson correlation	-.10	-.14	-.12	-.20	-.10
	Sig. (2-tailed)	.33	.17	.23	.04*	.32
	n	102	102	102	102	102

* Correlation is significant at the .05 level (two-tailed)

Research Question 8: Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers based on the educational background?

A two-way ANOVA was conducted to explore the differences in CT skills between the ISEC teachers and non-ISEC teachers based on the educational background. Because there were only two teachers with bachelor's degrees and two teachers with post doctorate experiences, bachelors and post doctorates were not considered in the two-way ANOVA. Descriptive statistics indicated the overall mean score of ISEC teachers (M = 17.33, SD = 3.47, n = 49) was slightly higher than that of non-ISEC teachers (M = 17.29, SD = 3.77, n = 49), with regards to the educational background. The mean score of ISEC teachers with master degrees (M = 17.81, SD = 3.46, n = 37) was higher than that of non-ISEC teachers with master degrees (M = 17.38, SD = 3.75, n = 40). The magnitude of the differences in the means (mean difference = 0.43) was very small (Cohen d = .1). The difference between these groups had little practical significance. The mean score of non-ISEC teachers with doctoral degrees (M = 16.89, SD = 4.11, n = 9) was higher than that of ISEC teachers with doctorates (M = 15.83, SD = 3.17, n = 12). The magnitude of the differences in the means (mean difference = 1.06) was small (Cohen d = .3).

The interaction effect between two educational background groups and two teacher groups was not statistically significant, $F_{(1, 94)}$ = .69, p = .41, and the effect size was very small (partial eta squared = .007). There was no statistically significant main effect for two groups of teachers: ISEC and non-ISEC, $F_{(1, 94)}$ = .12, p = .73. The effect size was very small (partial eta squared = .001). The main effect for the educational background, $F_{(1, 94)}$ = 1.89, p = .17, did not reach statistical significance, either. The effect size was quite small (partial eta squared = .02), as well. The researcher of this study failed to reject the null hypothesis.

Research Question 9: Is there a statistically significant difference in CT skills between the ISEC teachers and non-ISEC teachers based on the discipline?

A two-way ANOVA was conducted to investigate the differences in CT skills between the ISEC teachers and non-ISEC teachers based on the discipline. Descriptive statistics showed that there were 24 ISEC and 2 non-ISEC teachers who taught Economics, Management, Accounting, and Tourism. There were 16 ISEC and 31 non-ISEC teachers who taught Foreign Languages. Five ISEC and 3 non-ISEC teachers teaching Math, Physics and Chemistry. Four ISEC and one non-ISEC teachers teaching Education. Four ISEC and two non-ISEC teachers teaching Liberal arts (Chinese, Marxism, Literature). There were 6 non-ISEC teachers who taught Physical Education, but no ISEC teachers taught Physical Education. Given the uneven distribution of the disciplines among participants, disciplines were divided into two general groups: Science and Arts. Science consisted of Computer Science and Technology, Math, Physics and Chemistry, Economics, Management, Accounting and Tourism, and Physical education. Arts included Foreign Language, Education, and Liberal Arts.

The descriptive statistics of the overall CT scores for ISEC and non-ISEC teachers were based on two discipline groups. It indicated the overall CT scores of ISEC teachers (M = 17.39, SD = 3.63, n = 52) was slightly higher than that of non-ISEC teachers (M = 17.30, SD = 3.74, n = 50). The mean score of Arts ISEC teachers (M = 16.75, SD = 3.30, n = 24) was lower than that of Arts non-ISEC teachers (M = 17.12, SD = 3.30, n = 34). The mean value of Science ISEC teachers (M = 17.93, SD = 3.86, n = 28) was higher than that of Science non-ISEC teachers (M = 17.69, SD = 4.63, n = 16). The difference between these groups had little practical significance (Pallant, 2010).

The interaction effect between two discipline groups and two teacher groups was not statistically significant, $F_{(1, 98)} = .16$, $p = .69$, and the effect size was very small (partial eta squared = .002). There was no statistically significant main effect for two groups of teachers: ISEC and non-ISEC, $F_{(1, 98)} = .01$, $p = .93$. The effect size was very small (partial eta squared = .000). The main effect for the educational background, $F_{(1, 98)} = 1.33$, $p = .25$, did not reach statistical significance, either, and the effect size was quite small (partial eta squared = .01). The researcher of this study failed to reject the null hypothesis.

6. The Qualitative Data Analysis Procedures

Participant Interviewees' Demographic Profiles

Table 5 described the demographic information of 12 participants.

Table 5. Demographic Information of Non-ISEC and ISEC Teacher Participants

Interview-ee	Age	Gender	Educational Background	Profession-al Rank	Years of Teaching	ISEC or Non-ISEC	CT Scores
P1	43	M	PhD	Associate prof	1	Non-ISEC	26
P2	43	F	PhD	Associate prof	17	Non-ISEC	20
P3	46	F	MA	Associate prof	22	Non-ISEC	20
P4	45	F	MA	Associate prof	24	Non-ISEC	20
P5	46	F	MA	Associate prof	24	Non-ISEC	15
P6	49	M	PhD	Prof	25	Non-ISEC	15
P7	33	F	MA	Instructor	8	ISEC	24
P8	45	M	PhD	Prof	23	ISEC	21
P9	34	F	MA	Associate prof	9	ISEC	20
P10	44	F	MA	Associate prof	21	ISEC	18
P11	44	M	PhD	Instructor	14	ISEC	16
P12	40	F	MA	Instructor	16	ISEC	15

Interpretation of Conditional/Consequential Matrix

The answer to the central question, "What is the perception, attitude, and practice regarding CT among the ISEC and non-ISEC teachers in institutions of higher education in the north of China?" was discovered in this study. Through the perspective of the participants, their experiences in CT instruction offered clues for Chinese higher education. The meaning of the results is best understood from the explanation of three major categories: barriers to CT instruction; inadequacy of CT instruction; and necessity of promoting CT. Meanwhile, the core category of "advocacy and support for CT instruction" provided a descriptive narrative about the central phenomenon of the study. The following sections mainly deal with context and environment, action/interaction strategies, influencing factors, outcomes/consequences, relationship among categories, and the substantive theory.

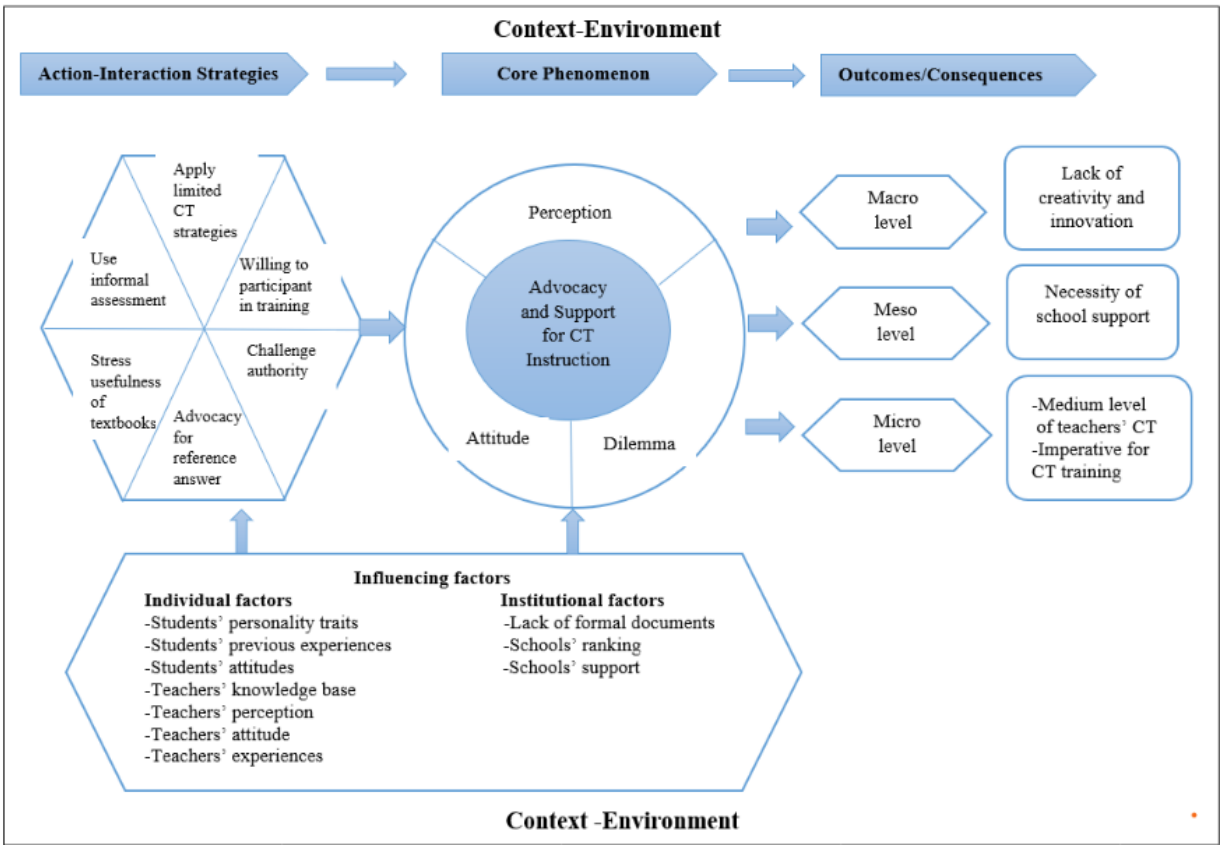

Figure 1. Conditional /Consequential Matrix or Mental Model

Action-Interaction Strategies

Apply limited CT teaching strategies. Effective CT teaching or instructional strategies play a vital role in cultivating and improving students' CT skills in the educational process. In

this study, all ISEC and non-ISEC teachers in institutions of higher education in the north of China reported they applied some teaching strategies to cultivate students' CT in their teaching practice. The most frequent strategies they employed were group discussion, followed by open questions, presentations and writing assignments. Among the 12 teacher interviewees, only two ISEC teachers used the strategy of case study and one ISEC teacher employed a debate strategy in the teaching process. According to Behar-Horenstein and Niu (2011), there were specific CT instructional methods that had been investigated, and they were: concept mapping, scenario-based course exercises, active learning techniques, problem-based learning, inquiry-based learning, question approach, guided practice, computer-based instruction, structured web-based bulletin boards, and online instruction. Compared to CT instructional strategies discussed by Behar-Horenstein and Niu, Chinese teachers utilized limited CT teaching or instructional methods or strategies**,** although they realized the importance and benefit of CT for students' learning, exams (especially with open questions), and future development.

Use informal assessment. "The most important tool available for effective teaching is assessment" (Rotenberg, 2010, p. 139). Assessment plays a vital role in both teaching and learning process. Participants reported their students' CT level

was not high, belonging to medium or low level: three participants rated their students' CT as low level, four participants rated students' CT as medium level, four rated students' CT at the lower end of medium, and one rated students' CT at the upper end of medium (see Figure 7). The majority of these participants used informal methods of assessment to evaluate students' CT skills, such as students' engagement in class, questions that students posed and answered, assignments that student completed, as well as results from quizzes or exams. There was only one ISEC teacher (Participant #10) that used a global CT assessment tool to assess students' CT. She explained this CT assessment tool was offered by her discipline leader, who got it when he participated in the ISEC program training. The assessment tool was a Chinese version and the format was Likert-scale.

Stress the usefulness of textbooks. According to Jackson and Du (2022), textbooks are "central to teaching in Chinese schools and compulsory university courses. Not only must students memorize their contents, but most teachers depend heavily on textbooks in their teaching" (p. 198). In this study, most participants emphasized the usefulness of textbooks. However, they talked about the uses and contents of textbooks from different dimensions. Some mentioned the authoritative status of textbooks in the Chinese educational system. Some stressed the importance of textbooks in the teaching and learning process. Some claimed that textbooks should be regarded only as a reference.

Advocate for reference answers. With regards to standardized answers, some participants stated all standardized answers should be changed into reference answers. Some believed that objective questions need standardized answers, while subjective questions need suggested answers or answers for reference. Some claimed that whether standardized answers were needed or not depended on the different disciplines: disciplines of sciences, such as mathematics, need standardized answers. No matter what words they used, all participants advocated for reference answers.

Challenge authority. With respect to the assignment of identifying flaws in textbooks, there were varied opinions. Some believed that picking flaws in textbooks was not suitable for college students, and college students need to do something more complicated to improve their CT skills. Some claimed that identifying flaws in punctuation marks, spelling, and grammar was useless to train students' CT skills, while identifying flaws in the logic of the textbook contents seemed more effective to train students' CT. However, most participants stated that identifying flaws in textbooks was like asking students to challenge authority, so it was good to do such an assignment. There was an exception: one non-ISEC teacher, Participant #2 (associate professor, having a Ph.D and one-year experience as a visiting scholar in the U.S), held a unique opinion and claimed editors should avoid making mistakes in any textbooks before they were published, and it was not Chinese students' responsibility to pick out mistakes in the textbook. This type of challenging authority was more suitable for American students, which advocated independence, freedom, and democracy. She described her ideas by pointing out:

In China, we should set up a type of authority, ask students to defer to authority, and lead students to learn and imitate… If there is no authority constructed, students are required to challenge, to do critical thinking [about everything], what about other issues, such as Chinese system, Chinse constitution and law? Do you still allow students to challenge and question those things? Therefore, there should be a standard for what issues should be regarded as authority, and what issues may be discussed and revised by the civilians and students.

When asked whether their schools emphasized and required the cultivation of students' CT, some participants responded by saying "yes." Some said "no" and some were not one hundred percent sure. For example, Participant #4, a non-ISEC teacher, described, "Based on the requirements of syllabus and the scheme of cultivation, our university should have required the cultivation of students' CT." One ISEC teacher, Participant #9, pointed out it was hard for the school to formulate a general requirement to stress CT cultivation. She added, "However, it was likely that CT cultivation was mentioned in the scheme of cultivation in other programs or disciplines." For those participants who claimed there were no official or formal documents to advocate the cultivation of students' CT, when asked what recommendations or suggestions they would like to offer to their schools, they stated they were not willing to render any recommendations or suggestions to schools (it was an indirect way to challenge authority), because they were just ordinary faculty at schools who had no ability, expertise, and/or influence to provide suggestions to the school administration. Participants stressed their recommendations or suggestions would not be adopted even if they were given the opportunity. For them, their colleges or universities focused more on ideological and political education rather than CT education in the last few years.

Willing to participate in CT training. All participants regarded attending CT training as a useful way to improve their CT skills. Some participants stressed that teachers first need to learn about their own CT skills and then to improve students' CT. It was vital for teachers to understand what CT was and what connotations CT represented. Reading more books on CT was an effective way to understand it's connotations. Developing the awareness of CT was equally important. Some participants suggested building a scientific assessment system of teachers' CT to urge teachers to improve their CT actively, because most of the teachers got access to CT via either study-abroad experiences or the ISEC program. Unfortunately, most of them came into contact with CT relatively late, when they were almost or already adults and their thinking styles had been fossilized. Therefore, it was necessary for teachers to participate in the CT training program frequently.

With regard to how to improve teachers' CT, all participants rendered feasible strategies. These suggestions were: attending experts' presentations, participating in workshops, hosting seminars, building interschool partnerships, sponsoring teacher abroad exchange programs, participating in teaching experience sharing (teaching peer collaboration), attending teacher demonstration classes, and engaging in class observation. Some participants especially pointed out the most difficult and important issue in their teaching practice was how to effectively integrate CT into their disciplines. For some participants, teachers need to put different and effective strategies together and use them with flexibility, in order to solve this problem. Some participants summarized formulas for improving teachers' CT: "theory-practice-reflection" and "awareness-recognition-practice". It was worth noting that three participants, two ISEC teachers and one non-ISEC teacher, mentioned CT was not foreign to the Chinese people. Some ancient Chinese classics, such as *The Analects of Confucius*, *Zhuangzi*, and *The Tao Te Ching* (or *The Book of Tao and Teh*), did elaborate CT in their own ways. Therefore, CT was not solely the product of the West. Chinese culture did have CT as well. Their ideas were congruent with Paton's (2005) argument: CT is not a special Western construct, and CT has existed "in Chinese culture for at least the last thousand years" (p. 4).

Influencing Factors

For this model, influencing factors referred to the factors that impacted the participants' behaviors and their teaching practice. These influencing factors were summarized as *institutional factors* and *individual factors*. *Institutional factors* involved: schools' ranking, lack of formal or official documents on CT, and school support. For most participants, the school's ranking exerted a strong influence on their teaching results. Most participants claimed there was no formal or official document on the cultivation of students' CT, although their colleges and universities only offered some formats of support.

With regard to the problem of limited support from schools, some participants provided their ideas. For instance, Participant #5 believed the ways to solve this problem were closely related to what extent the school leaders attached importance to CT education.

Individual factors consisted of *student-related* and *teacher-related factors* respectively. *Student-related factors* included: students' personality traits, students' previous experiences, and students' attitudes. Most participants reported the difficulties and challenges in their teaching practice were student-oriented: introverted personality traits, medium or low English proficiency, inactive attitude, non-cooperation, etc. For example, Participant #2 held a strong belief that students' CT skills were closely related to their previous experiences, such as, learning habits, individual ability, prior to attending college. She further explained that her students held inactive attitudes toward their learning. They were short of motivation or drive to learn, and were not cooperative with their teachers. They demonstrated a state of "Lying flat" (a current buzz word in China, indicating more and more Chinese young people around 20 reject the rat race and choose to "lie flat" after they watch their friends work themselves to death).

Teacher-related factors were made up of teachers' knowledge base, teachers' perception, teachers' attitude, and teachers' experiences. Participants in this study pointed out when students posed deep academic, professional or specialized questions in class, teachers had to face the dilemma that they could not answer these questions. Under such circumstances, students' questioning and challenging demanded higher requirements for teachers with respect to their knowledge base and ability. For instance, Participant #6 stated CT was related to a person's knowledge and experiences. He took his mother as an example and described her as an illiterate old woman who lived in the countryside. She was easily influenced or even deluded by others' words and behaviors, especially during the COVID-19 pandemic. Participant #6 mentioned many Chinese rushed to queue up to buy a so-called effective medicine for curing COVID, without considering or questioning the truthfulness of the news. The consequence of this behavior was that the medication was sold out and people who lined up for a long time caught COVID. He stressed this was a typical example that people lacked CT.

Participant #11, an ISEC teacher, elaborated most ISEC teachers learned about CT through the ISEC program. Before participating in this program, they did not have any awareness of or, perception about, CT. He claimed it was likely that a few teachers had access to CT, but they had a weak understanding about CT. He then claimed it was vitally important for teachers to have an awareness of CT, understand its definition, recognize the importance of CT, and finally practice in their teaching process.

Most participants stated teachers' attitude also impact their CT instruction. For instance, Participant #7 believed holding an active attitude was vital. She suggested everything need to be considered and dealt with from different perspectives: listen to others' opinions, avoid stubbornness, and finally do more reflections. Participant #7 stressed teachers need to hold a positive attitude to cultivate and train students' CT skills actively.

Most participants claimed their experiences exerted influence on their CT and CT instruction. Participant #8, an ISEC teacher, reported his experiences and stated since 2015, when his university began to introduce the ISEC program, it was the first time for him to access the ideology of CT. Then he became interested in CT and learned about it further. He

benefited greatly from this process. In addition to his ISEC experience, he also mentioned his other professional and academic experiences. He stressed his doctoral program, especially his dissertation writing and academic research were beneficial to improving his CT. He pointed out that during his academic research, he had to pose scientific questions, read various literature around the problem, and do a literature review. By means of scientific research methodology, he addressed his questions and finally drew a conclusion. He regarded the process of doing scientific research as the process of using CT.

Outcomes/Consequences

For this model, the outcomes/consequences were grouped into three levels: Macro, meso and micro. Macro level outcomes included *lack of creativity and innovation*. With the influence of a predominantly exam-oriented educational system, a lot of students obtain knowledge through rote learning and memorization, resulting in Chinese students' lack of creativity and innovation. Meso level outcomes consisted of *necessity of further school support*. Participants in this study claimed there was no formal or official document on the cultivation of students' CT, indicating it was necessary for colleges and universities to offer further support for teachers with more obvious goals or missions. Micro level outcomes covered *medium level of teachers' CT* and the *imperative of CT training*. All participants in this study reported the level of their CT skills was medium, which was similar to the results from the CCTST. All participants believed participating in CT training was useful and necessary.

The Substantive Theory

Through development of the concepts, categories, and their relations to each other based on the data from 12 participants' interviews, a substantive theoretical model emerged and "continued to evolve throughout the GT [grounded theory] research process" (Branden, 2012, p. 138). The final product was the conditional/consequential matrix or model about Chinese teachers' CT, shown in Figure 6. This conditional/consequential matrix or model demonstrated Chinese teachers' advocacy and support for CT instruction as a process that other teachers could take as a reference in the context of institutions of higher education. This substantive theory grounded in data was, Chinese teachers advocated and supported CT instruction in the north of China, which suggested that a combination of internal and environmental features of, and around the teachers, set forth the context in which an advocacy and support event took place. After discovering the context/environment and the teachers' decision to advocate and support CT instruction, teachers engaged in the advocacy and support process positively. Finally, in order to alter the status quo of Chinese higher education and students' lack of creativity and innovation, teachers were willing to promote their CT instruction via various strategies. These strategies included participating in CT training programs and obtaining more support from their colleges and universities.

7. Conclusions

Findings from the Quantitative Research

The Status Quo (Current Situation) of Chinese Teachers' CT Skills (Questions 1 & 2)

With respect to ***Question #1***, what is the level of CT skills of overall Chinese teachers in institutions of higher education in the north of China?, the descriptive statistics obtained from CCTST described the overall CT skills of Chinese teachers as medium or moderate, specifically falling into the upper range of the moderate level. Among the five core subskills, the *analysis* skill was the highest, standing in the lower range of the strong level. Three subskills of CT: *inference*, *inductive reasoning* and *deductive reasoning* fell into the moderate or medium level, and *evaluation* skill was in the lower range of the moderate level. For ***Question #2***, what is the level of CT skills of the ISEC and non-ISEC teachers in institutions of higher education in the north of China, respectively? The overall CT skills of the ISEC teachers were slightly higher than that of non-ISEC teachers. With regards to the five core subskills, the mean scores of *analysis*, *inference*, and *deduction* among non-ISEC teachers were slightly higher than those of the ISEC teachers, and the mean scores of *evaluation* and *induction* among the ISEC teachers were slightly higher than those of non-ISEC teachers.

It is worth noting that when the researcher collected data from the end of 2022 to the beginning of 2023, the Chinese government had just canceled its COVID-19 pandemic zero-tolerance policy. While collecting data, most participants were suffering from COVID-19; some were quarantined at home, and some were recovering from the illness. According to Cuffari (n.d.), COVID-19 can badly impact human health and mental health. Therefore, because most participants were either suffering or recovering from COVID-19 while participating in the study, their mental health may have been impacted. This was an intervening factor that could not be disregarded when interpreting the status quo of the Chines teachers' CT skills.

Although some studies stress the crucial role of higher education teachers in fostering student's CT (Birjandi & Bagherkazemi, 2010; Boonjeam et al., 2017; Cave, 1993; Janssen, et al., 2019; Stedman & Adams, 2012), there is a paucity of studies concentrating on teachers' CT skills (Janssen, et al., 2019). After searching and screening the extant literature, both in China and in the West, the researcher of this study could not find any literature focusing on CT skills of

Chinese teachers, especially the ISEC and non-ISEC teachers. Only limited literature concentrated on teachers' perceptions of and/or attitudes toward CT in higher education (Choy & Cheah, 2009; Li, 2016; Stedman & Adams, 2012; Zhang, et al., 2020). Because there were no empirical studies available on the CT skills of Chinese teachers, the researcher of this study had to make a comparison with an aggregate sample of CCTST Four Year College Students, "the average percentile score of this group of participants is 62" (Insight Assessment Report, January 2023, p. 1). This means that roughly 61 people out of 100 score lower than this group of Chinese teacher participants and 38 persons out of 100 score higher than this group of Chinese teachers in the national comparison group (CCTST User Manual, 2021).

Significant Differences among Variables (Questions 3, 4, 5, 8, & 9)

Variables here included the dependent variable of CT skill scores (ratio level of measurement), and independent variables: gender, professional rank, educational background, and discipline (nominal level of measurement). ***Question #3*** addressed whether there was a statistically significant difference in CT skills between the ISEC and non-ISEC teachers. Although the mean overall CT score of the ISEC teachers was higher than that of non-ISEC teachers, there was no statistically significant difference in the overall CT scores for the ISEC and non-ISEC teachers, after performing an independent t-test. Meanwhile, the scores of five core subskills for the ISEC and non-ISEC teachers were not statistically significantly different, either.

For ***Question #4***, a two-way ANOVA was conducted to examine the difference in CT skills between the ISEC and non-ISEC teachers, based on gender. The results of the ANOVA indicated the overall mean score of the female teachers was higher than that of the male teachers. The mean score of the female non-ISEC teachers was higher than that of the male non-ISEC teachers, too. However, the mean score of female ISEC teachers was lower than that of male ISEC teachers. The mean score of the female non-ISEC teachers ranked the highest, followed by the male ISEC, female ISEC, and male non-ISEC. The interaction effect between gender and scores of CT skills of two groups was not statistically significant, and there was no significant main effect for two groups of teachers: ISEC and non-ISEC.

With respect to ***Question #5***, a two-way ANOVA was conducted to investigate the differences in CT skills for the ISEC and non-ISEC teachers based on professional rank. The mean score of the ISEC instructors was the highest, followed by non-ISEC associate professors, ISEC professors, non-ISEC instructors, ISEC associate professors, and non-ISEC professors. There was no significant interaction effect between the two professional ranks: instructors and associate professors (ten professors were not further considered because of the small number) and two teacher groups (ISEC and non-ISEC). There was no significant main effect for the two teacher groups and the professional rank. Although there were no significant differences in CT skills for the ISEC and non-ISEC teachers based on professional rank, there was practical significance between the ISEC instructors and ISEC associate professors (Cohen d = .5), as well as between the ISEC associate professors and non-ISEC associate professors (Cohen d = .6).

Question #8 was aimed to investigate the significant difference in CT skills between the ISEC teachers and non-ISEC teachers based on their educational background. A two-way ANOVA showed the overall mean score of the ISEC teachers was slightly higher than that of non-ISEC teachers based on their educational background. The mean scores of teachers with master's degrees were higher than those with doctoral degrees. The mean scores of ISEC teachers with a master ranked the highest, followed by the non-ISEC teachers with a master, non-ISEC teachers with a doctorate, and ISEC teachers with a doctorate. The interaction effect between two educational background groups (with a master's degree and with a doctorate) and two teacher groups was not statistically significant. There was no statistically significant main effect for two teacher groups and the main effect for the educational background did not reach statistical significance.

Q***uestion #9*** was designed to examine the difference in CT skills between the ISEC teachers and non-ISEC teachers based on discipline. After performing a two-way ANOVA, the overall mean score of science teachers was higher than that of arts teachers. The overall mean score of the ISEC teachers was slightly higher than that of non-ISEC teachers based on the discipline. The mean score of the ISEC teachers of science ranked highest, followed by non-ISEC teachers of science, non-ISEC teachers of arts, and ISEC teachers of arts. There was no statistically significant interaction effect between the two discipline groups and two teacher groups. No significant main effect for two groups of teachers was found and no significant main effect was found for the educational background, either.

Significant Relationships among Variables (Questions 6 &7)

Variables here involved the criterion variable of CT skill scores (ratio level of measurement), and predictor variables of age and years of teaching, which were the ratio level of measurement. Q***uestion #6*** was designed to examine the relationship between CT skills and age. The Pearson product-moment correlation (r = -.17) indicated there was a weak, negative correlation between overall CT scores and age, which meant that older people generally had lower CT skill scores and younger people had higher CT skill scores. This weak negative relationship between overall CT scores and age was not statistically significant. With regards to the five core CT skill scores and age, there were weak, negative correlations between the five core skills and age respectively: *analysis* (r = -.12), *inference* (r = -.10), *evaluation* (r = -.13),

induction (r = -.24), and *deduction* (r = -.05). Only the correlation between i*nduction* and age was statistically significant, and the remaining correlations were not statistically significant.

Question #7 was designed to explore the relationship between CT skills and years of teaching. The Pearson product-moment correlation indicated there was a weak, negative correlation (r = -.18) between overall CT scores and years of teaching, but it was not statistically significant. There were weak, negative correlations between the five core skills and years of teaching: *analysis* (r = -.10), *inference* (r = -.14), *evaluation* (r = -.12), *induction* (r = -.20), and *deduction* (r = -.10). The results indicated participants with more years of teaching generally had lower CT skill scores and vice versa. A significant correlation was only found between *induction* and years of teaching, and the remaining correlations were not statistically significant. The researcher of this study failed to reject all null hypotheses.

8. Findings from the Qualitative Research

Participants' Perception of CT

Many conditional factors exerted great influence on the Chinese teachers' perception of CT. At the macro level, the exam-oriented educational system is still dominant in China, although a series of educational reforms have been implemented since the founding of the People's Republic of China (Tan, 2016). At the meso level, Chinese colleges and universities began to focus more on cultivation of creative and innovative talents, because the Chinese government advocated for internationalization, modernization, and creative and innovative talents (Wei, 2003; Ryan, 2011; Zhu, 2019). Although colleges and universities have introduced CT into their campuses, they are confronted with numerous difficulties. At the micro level, Chinese teachers showed a strong tendency for advocating and supporting CT instruction, under the aforementioned contexts and environments. However, the definitions of CT offered by Chinese teachers were varied and fragmented. Some of them regarded CT as being skeptical, critical, and rational. Some perceived CT as being independent and active thinking. Some viewed CT as challenging and questioning. Some believed CT was an ability of logical reasoning, and some stressed CT helped to make a judgement or decision and finally solve problems. This insight indicated Chinese teachers perceived CT in their own ways and they lacked professional understanding and perception of CT.

Participants' Attitude Toward CT

In this study, Chinese teachers believed CT played a vital role in the process of students' learning and personal development. They all held a positive and supportive attitude towards CT. All of them liked students to question and challenge them in class. They tried to create a welcoming environment in class and encourage students to question and challenge via some teaching strategies, such as questioning, group discussion, and presentation. Training students' CT was a difficult task, leaving Chinese teachers in a dilemma. For instance, students' individual qualities, such as learning habits, knowledge base, and attitude, exerted a great influence on CT instruction. Students displayed a passive attitude and refused to cooperate or engage in class activities. Teachers sometimes worried about their own knowledge base when students posed deep questions in class. Both teachers and students had been trained to obey authority since their childhood, which was closely linked to the social norm and Chinese culture.

Participants' Practice of CT

All participants claimed they applied CT teaching strategies in their practice. The most frequently used strategies were group discussion, followed by open questions, presentations, and writing assignments. Only two out of twelve participants used case study and debate in their teaching practice. This indicated Chinese teachers in this study employed limited CT teaching strategies in their teaching process. The majority of participants employed informal assessment to evaluate students' CT skills and their own CT skills. Only one ISEC teacher used a global CT assessment tool to measure herself and students' CT. All participants reported their students' CT skills were not high, falling into the medium or low level. The majority of participants rated their CT skills as medium or at the upper end of medium. Only one participant rated herself at the lower end of medium (in reality, her CT scores from the CCTST belonged to medium). Compared to CT skill scores obtained from the CCTST, most of the participants underrated their CT skills. With respect to standardized answers, participants held varied views. However, all participants advocated for referent answers. It is a good trend that Chinese teachers tend to not depend too much on so called standardized answers and are willing to design more open questions to develop students' thinking skills.

Chinese education has "a long tradition of valuing knowledge" (Mast, 2016, p. 43). Chinese people believe knowledge is a basis for understanding. Thus, Chinese students are encouraged to obtain as much knowledge as possible. The effective way for them to absorb knowledge in volume is through rote learning and memorization. Furthermore, Chinese language is based on characters, rather than pronunciations. In order to become literate, Chinese students have to memorize "4500 characters" (Mast, 2016, p. 43). In addition to this emphasis on knowledge, there is a strong belief among Chinese in the wisdom of elders. Students learn how to read Chinese through memorization of "classical literature throughout all compulsory years of education" (Mast, 2016, p. 44). Teachers play a key role in transmitting the message of the wise men

and various knowledge. After teachers pose rhetorical questions, "like Confucius, they then give the answer in order to share the wisdom" (Mast, 2016, p. 44). Promoting referent answers instead of strongly valuing standardized answers shows progress towards improved emphasis on teaching CT by these Chinese teachers.

This study also showed Chinese teachers held various attitudes and views about textbooks. School textbooks, as an important resource in support of teaching and learning in China, play an important role in classrooms (Liu & Laohawiriyanon, 2013). Most participants in this study stressed the usefulness of textbooks. Some stated textbooks in China were regarded as authority. Some claimed textbooks should be taken as reference. Some also emphasized textbooks played an important role in the educational process. There was a conflicting view among Chinese teachers concerning challenging authority. All Chinese teachers claimed they liked and encouraged their students to question and challenge them in class. Most of them also compared identifying flaws in the textbook to challenging authority. They thought it was good for students to challenge authority. However, when teachers were asked to offer suggestions to their schools concerning CT education, they refused to do so. For them, it was an indirect way to challenge authority, and it was unlikely that this bottom-up suggestion would be accepted by the top leaders.

The aforementioned implied that the Chinese education system is deeply rooted in Chinese culture (Mast, 2016). The traditional aspects of Chinese culture are entrenched in the pervasive influence of Confucius (Bush & Haiyan, 2000). Confucius was the first scholar to start private education and recruited disciples in the Spring and Autumn period in ancient China (Gu, 2006). Confucius emphasized education and hoped "through education, the ruler could become wise and the subjects could 'be civilized,' thus become good subjects" (Gu, 2006, p. 170). Put another way, education and a set of rites made people become obedient (Gu, 2006). Traditional Chinese culture is "reflected in continued respect for authority, collectivism and harmony in schools" (Bush & Haiyan, 2000, p. 58), indicating Confucianism still exerts strong influence on Chinese education. This explained why both Chinese teachers and students are reluctant to challenge authority in the educational practice.

Findings in this study also showed all Chinese teachers had a strong desire for CT training. They were willing and eager to participate in any CT training program. For them, if teachers know nothing about CT, how could they teach their students to think critically? One of the barriers for them to train students' CT skills was from the macro level: the exam-oriented education system created difficulty in stimulating and cultivating students' creativity and innovation. Teachers faced challenges in deciding whether to prioritize the development of CT skills over exams. This finding corroborated the research results of Li (2016). Other studies, such as Craft (2005), Zohar (2008), and Zawojewski and McCarthy (2007), also claimed high-stakes exams hampered the development of students' thinking.

At the meso level, participants in this study reported there were no formal or official documents to guide them to integrate CT into their discipline. It indicated that, for some colleges and universities, CT education was ~~not~~ carried out in depth and it was only superficial. When colleges and universities did not focus on CT education, teachers could not put their heart and soul into it without guidance and support. Therefore, colleges and universities need to elevate the slogan of "integrating CT into disciplines" to the policy level, and reflect this slogan in the goals and missions of school development. It was also vitally important for colleges and universities to render enough support, encouragement, and help for teachers to teach CT in class.

At the micro level, teacher-related barriers or factors were: most Chinese teachers knew and accessed CT through either the ISEC program or going abroad experiences. This meant they knew little about the definition and connotation of CT, as well as the ways to improve CT, before they reached adulthood. In their childhood, all of them were encouraged to obtain more knowledge, and cultivation of their thinking skills was neglected. When they became adults, their thinking mode had been focalized and they lacked innovation and creativity. Because of this, Chinese teachers lacked knowledge and awareness of CT. An additional barrier comes when teachers reached the middle age, such as 40s or late 40s, laziness and being self-content get in the way from further developing and improving themselves for career advancement. The most challenging problem for most teachers was they did not have an understanding of how to effectively integrate CT into their discipline. It implied Chinese teachers were lacking in CT skills. Student-related factors or barriers included: students' previous learning habits in secondary schools hindered them from thinking critically. Students were taught to show respect for, and not question, their teachers from their childhood. They became obedient and passive and were not willing to challenge authority (the teachers) in their learning process. This finding supported the research results of Zhang, et al. (2020). Students in Zhang, et al.'s study had no strong motivation to learn after they went to college. They exhibited a passive attitude towards learning and did not cooperate with others in class. Many students were in a state of "lying flat".

Implications of the Findings

The findings from this study had implications at three different levels or dimensions. At the macro level, although China has achieved remarkable progress in educational development, Chinese education is still faced with many problems and challenges (Zhu, 2019). For instance, the current focus on exams still dominates mainstream education, making the

transformation from "exam-oriented" to "quality-oriented" reforms unsatisfying (Zhou, 2013). Thus, when the Ministry of Education (MOE), an important educational policy maker, releases plans, policies, and guidelines, they must provide necessary guidance, interpretation, and supervision to ensure that school leaders, faculty, and staff fully comprehend and implement the policies. It needs "further exploration to bridge the gap between policy, curriculum, and practice" (Li, 2016, p. 286).

At the meso level, some participants reported their schools did not render enough support for them to teach CT in class, and there were no formal documents to guide them to integrate CT into their disciplines. The first task for colleges and universities is to place increased emphasis on CT education, in order to cultivate more students equipped with creativity and innovation in this globalized world. Colleges and universities need to provide guidelines or policies for teachers to effectively integrate CT into their disciplines. The guidelines or policies need to cover the definition of CT, connotation of CT, and the paradigm or parameters for CT. The positive influence of CT on both teachers and students "should drive the school to invest effort and financial resources to students [and teachers] develop their critical thinking abilities" (Soeherman, 2010, p. 234). Finally, colleges and universities need to build a campus culture that advocates, encourages, and supports CT education. With the goal of constructing CT-based campus culture, colleges and universities need to offer more CT training programs to develop and improve teachers' CT skills. Only when teachers' CT skills are improved, will more likely students' CT skills be improved. Colleges and universities need to set up a systemic and scientific teachers' CT assessment system to push and encourage teachers to integrate CT into their teaching practice. The first step is to put students' CT cultivation into teachers' syllabus.

At the micro level, Chinese teachers' CT skills were not high, and they had a fragmented perception of CT. Thus, they applied limited CT teaching strategies into their practices. Therefore, it is important that Chinese teachers obtain increased CT knowledge in order to further develop CT awareness and improve their CT skills.

Although all participants reported they applied CT teaching strategies in class, the number of these strategies were limited. Teachers should realize some of their teaching methodologies or strategies may have no or little impact on the improvement of students' CT skills. Teachers first need to construct a CT-based atmosphere in class, give students more open topics, such as current affairs and issues, to discuss. Then teachers need to offer students appropriate examples of how to use CT to solve problems. Finally, teachers need to learn and utilize various CT strategies in the teaching process, such as, case study, debate, concept mapping, scenario-based course exercises, active learning techniques, problem-based learning, inquiry-based learning, guided practice, computer-based instruction, structured web-based bulletin boards, and online instruction (Behar-Horenstein & Niu, 2011), in addition to the four main strategies that participants self-reported: group discussion, open questions, presentation, and writing.

In order to improve knowledge, awareness, and skills of CT, teachers need to participate in CT workshops and seminars, build interschool partnerships at home and abroad, take part in teaching experience sharing (teaching peer collaboration), attend CT experts' presentation and teachers' demonstration class, participate in teacher exchange programs, and engage in class observation. These strategies were presented by all participants in this study. Finally, some participants rendered two formulas for teachers to improve their CT and CT instruction: "theory-practice-reflection" and "awareness-recognition-practice", which can be used as a reference or paradigm for others to utilize in their own teaching practice.

9. Recommendations

The recommendations for practitioners and others are presented from three perspectives: policy makers, school leaders, and educators. Policy makers must formulate plans, policies, and guidelines based on the social and economic development of the culture. As China "has become the second largest economy in the world and achieved remarkable progress in educational development" (Zhu, 2019, p. 355), "China's Education Modernization 2035 Plan" was implemented in 2019 to cater to the educational development in the new era (Zhu, 2019). The major policy maker of Chinese education, the Ministry of Education (MOE), should guide, advance, and supervise all schools to carry out education modernization thoroughly, and avoid-allowing the implementation of education modernization to remain at the policy level. Additionally, the ISEC program needs to continue advocating CT education in Chinese higher education. The ISEC office needs to continue hosting more CT training programs with additional focus on improving Chinese teachers' CT skills.

From the leaders' perspective, school leaders should first construct a CT-based campus culture, formulate policies or guidelines to advocate CT education, and encourage teachers to carry out critical thinking-based pedagogy in their teaching practice. School leaders need to render "more CT-based resources to teachers and design relevant teacher training programs, focusing on concrete CT pedagogy and assessment" (Zhang, et al., 2020, p. 491). Finally, school leaders need to formulate a scientific CT assessment system to motivate teachers to integrate CT into the teaching practice.

From the perspective of educators or faculty members, teachers need to learn more about CT concepts and theories by reading, attending workshops, presentations, and seminars. Teachers need to understand they are not disseminators of knowledge, but mediators of students' learning (Choy & Cheah, 2009). In this regard, teachers should have a holistic perception of CT, act as a mediator of students' learning, and integrate CT into their teaching process. Despite utilizing limited CT strategies in class, teachers held a positive attitude toward CT and CT instruction. It is imperative for teachers to take part in CT training programs to improve their own CT skills. To summarize, policy makers, school leaders, and educators can use the findings of this study to create appropriate strategies, policies, and procedures to increase the quality of their support to improve CT instruction, service, and learning.

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