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Exploring cultural differences in critical thinking: Is it about my thinking style or the language I speak?

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ABSTRACT

Critical thinking is deemed as an ideal in academic settings, but cultural differences in critical thinking performance between Asian and Western students have been reported in the international education literature. We examined explanations for the observed differences in critical thinking between Asian and New Zealand (NZ) European students, and tested hypotheses derived from research in international education and cultural psychology. The results showed that NZ European students performed better on two objective measures of critical thinking skills than Asian students. English proficiency, but not dialectical thinking style, could at least partially if not fully explain these differences. This finding holds with both self-report (Study 1) and objectively measured (Study 2a) English proficiency. The results also indicated that Asian students tended to rely more on dialectical thinking to solve critical thinking problems than their Western counterparts. In a follow-up data analysis, students' critical thinking was found to predict their academic performance after controlling for the effects of English proficiency and general intellectual ability, but the relationship does not vary as a function of students' cultural backgrounds or cultural adoption (Study 2b). Altogether, these findings contribute to our understanding of the influence of culture on critical thinking in international education.

1. Introduction

Cultivation of critical thinking has been considered an important goal of tertiary education, especially in today's learning environment where students are exposed to tremendous amount of information which requires effective cognitive strategies to process. Despite the apparent consensus of the importance of critical thinking (Pithers & Soden, 2000), the influence of culture on critical thinking and its instruction is not clear (ten Dam & Volman, 2004). In particular, there are debates about whether Asian students show lower level of critical thinking in comparison to their Western counterparts, and consequentially whether critical thinking instruction can be applied to students of diverse cultural backgrounds (e.g., Atkinson, 1997; Ennis, 1998; Kumaravadivelu, 2003). The present research seeks to empirically address whether there is a difference in critical thinking between Asian and Western students, and examines the possible explanations and impact if such a difference exists.

1.1. Do Asian students think less critically?

The current trend of tertiary education involves an increasing number of Asian students studying at a Western English-speaking institution (OECD, 2009). With regard to the development of critical thinking in such a context, concern about whether Asian students tend to think less critically in contrast to their Western counterparts has gained much attention (Atkinson, 1997; Kumaravadivelu, 2003).

Research showed that academic staffs experienced in teaching international students are dissatisfied with the international students' poor critical thinking and analytical skills (Robertson, Line, Jones, & Thomas, 2000). Academics often express that Asian students do not naturally take part in critical thinking because they do not overtly participate in classroom discussions (cf. Paton, 2005). Lee and Carrasquillo (2006) found that college professors perceived their Korean students as having "difficulty in openly expressing critical thinking" (p. 451). The perceptions of Asian students being less overt or less expressive in classrooms are often interpreted as lack of critical thinking, especially when Western academic standards of critical thinking involving overt argumentation and debate are applied (Durkin, 2008).

The claim that Asian students think less critically has been based predominantly on the observations by teaching professionals of English-second-language (ESL) learners. Nevertheless, there is currently little empirical research directly examining differences in critical thinking between Asian students and their Western counterparts.

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1.2. Critical thinking — a multi-dimensional construct

At this point, the term *critical thinking* requires clarification. In the international education literature, the term is mostly used to refer to a set of behaviors which is assumed to truly reflect critical thinking skills (e.g., Atkinson, 1997). These behaviors often include overt questioning or debating of ideas in a classroom setting (Durkin, 2008). Teaching professionals observe these behaviors and infer whether the students *show* critical thinking. These observations then lead the educators to conclude whether the students *have* critical thinking or if they *are* critical thinkers.

However, besides behavioral expressions, critical thinking, as a form of thinking, involves important cognitive skills and dispositions. A critical thinker is willing, persistent, flexible, open-minded and confident in using certain cognitive skills when it is necessary and appropriate (Ennis, 1987; Facione, 1990; Halpern, 1998, 2003). Pascarella and Terenzini (2005) summarized various definitions of critical thinking in the literature and suggested that college-level critical thinking skills include identifying assumptions behind an argument, recognizing important relationships, making correct references from data, drawing conclusions from the information or data provided, interpreting the merit of a conclusion based on available information, evaluating the credibility of a statement and its source, and making self-corrections. The ultimate goal of critical thinking is to make decisions or solve problems in different situations with the appropriate use of these critical thinking skills (Ennis, 1987; Halpern, 1998). The term *critical thinking*, as theorized by Ennis (1987) and Halpern (1998), represents a set of cognitive skills and dispositions which are conducive to decision making and problem solving in different situations.

The concepts of critical thinking and intelligence appear similar and are indeed closely related, but critical thinking is more often accepted as teachable and improvable with appropriate instruction (Nickerson, Perkins, & Smith, 1985; Halpern, 2007). Nickerson et al.'s (1985) view of thinking skills as *good strategies* helps to distinguish between critical thinking and intelligence. Their idea was that thinking skills are a consequence of education, while intelligence relates more to the "raw power" of an individual's mental equipment: "raw power is one thing and the skilled use of it (is) something else" (p. 44). Because it is more probable to teach skills rather than the supposedly unchangeable raw mental power, critical thinking has drawn much attention in psychology and education (e.g., Halpern, 1998; Pithers & Soden, 2000; ten Dam & Volman, 2004).

1.3. Focus of the present research

The debate in the international education literature has mainly been focused on the behavioral expression of critical thinking (e.g., Atkinson, 1997; Kumaravadivelu, 2003). Nevertheless, observation of classroom behaviors is susceptible to the influence of different cultural rules and assumptions underlying behaviors such as talking (Kim, 2002) or debating and questioning authorities (Tweed & Lehman, 2002). Here we focus on critical thinking as a skill because (a) the cultivation of critical thinking skills is a principal goal of university education (Pithers & Soden, 2000), and (b) these skills can be objectively measured.

1.4. Cultural differences in critical thinking

To examine if Asian students really think less critically compared with their Western counterparts, one of the best ways is to test and compare the critical thinking skills between these two groups of students. Nevertheless, as ten Dam and Volman (2004) observed, empirical research which addresses the role of culture in relation to critical thinking is currently limited. To the best of our knowledge, there is no published study involving direct comparison of critical thinking skills between Asian and Western students in an international education setting. To fill this gap in the literature, the present study directly tests whether there are objective differences in critical thinking skills between Asian and Western students who are studying at a Western institution.

Based on the assumption that the observations made by university teaching professionals (e.g., Lee & Carrasquillo, 2006; Robertson et al., 2000) reflect a kernel of truth, we hypothesize that Western students would perform better than Asian students in an objective measure of critical thinking (Hypothesis 1).

1.5. Dialectical thinking

The literature on dialectical thinking proposed one causal mechanism to explain why critical thinking performances may be lower among Asian students compared to Western students (Nisbett, Peng, Choi, & Norenzayan, 2001; Peng & Nisbett, 1999). According to this paradigm, the Asian way of information processing can be summarized by three principles: 1) reality is dynamic and changeable; 2) opposing propositions may exist in the same object or event; and 3) everything in life and nature is related (Nisbett et al., 2001). Asians, compared with Westerners, tend to perceive more changes, are more tolerant to contradictions, and perceive things as more interrelated. These three characteristics involved in the Asian way of thinking are suggested to be incongruent with the formal logical tradition of thinking which is dominant in Western cultures (Peng & Nisbett, 1999).

These cultural thinking styles have been shown to have important influence on certain psychological and behavioral differences between Asian and Westerners. In a seminal study, Norenzayan, Smith, Kim, and Nisbett (2002) found that Westerners were more likely to use formal logical rules in reasoning, whereas East Asians used more intuitive and experience-based reasoning when there was a conflict between intuitive and formal reasoning strategies. In one of their experiments, European American and Korean students were presented with a set of arguments and asked to evaluate whether or not a conclusion followed logically from the premises for each argument. When faced with a conclusion that logically follows the arguments but is intuitively unbelievable, Korean students tended to make more mistakes in judging the conclusion as invalid than the American students, indicating that they relied more on their own experience but less on formal logical rules in deductive reasoning than their American counterparts. Norenzayan et al. (2002) speculated that the pedagogical emphasis on critical thinking in Western classrooms compared with the experience-based approach in Asian classrooms may be one of the reasons of the different modes of thinking in the two cultural systems. Therefore, these laboratory experiments suggested that dialectical thinking and critical thinking are linked, but in an opposite direction. A preference for dialectical thinking may prompt Asians students to seek a "middle-way" between apparent contradictions more than their Western counterparts (Peng & Nisbett, 1999, 2000) and to choose intuitive reasoning over formal reasoning (Norenzayan et al., 2002), which then may explain the noted difference on critical thinking performance between Asian and Western students. Therefore, we expect that dialectical thinking style mediates the differences in critical thinking skills between Asian and Western students (*Hypothesis 2*).

This hypothesis is based on the assumption that dialectical thinking is applicable to both Western and Asian students. Based on the different historical developments of philosophical thoughts in the East and the West, dialectical thinking is suggested to be more typical of Asian cultures compared to Western contexts, where analytical thinking styles are more typical (Nisbett et al., 2001). Individuals within each of these cultural contexts differ in terms of their propensity to engage in each of these thinking styles. In other words, dialectical thinking is treated as an individual difference variable that shows variability across cultural

contexts and can be used to explain differences in objective measures of critical thinking (Matsumoto & Yoo, 2006).

Using individual difference variables to account for observed cultural differences has become increasingly popular because of its effectiveness to account for the active ingredients of cultural differences in psychological variables (Leung & van de Vijver, 2008). However, this approach assumes that the mediating variable is similarly related to the target variable in all cultural groups involved. Although this rationale underlies the development of individual difference measures of dialectical thinking, and these scales have been used in past research to explain cultural differences in other psychological variables and behaviors (e.g., Hamamura, Heine, & Paulhus, 2008; Spencer-Rodgers, Peng, Wang, & Hou, 2004), it is uncertain whether dialectical thinking style is similarly associated with critical thinking skills in both European and Asian student populations. Peng and Nisbett (1999, 2000) suggested that dialectical thinking style reflects philosophical tradition prevalent in Eastern cultures, whereas Western culture is characterized by analytical thinking style, which has a root of Greek philosophical tradition. Therefore, these thinking styles may be qualitatively different and may not relate to critical thinking in one cultural group or another. Such qualitative differences in their functioning can weaken the usefulness of thinking styles in accounting for cultural differences in critical thinking. Therefore, a secondary aim of our analysis is to explore whether dialectical thinking shows the same relationship with critical thinking in both Asian and European student populations. The findings will have important implications for the conceptualization of dialectical thinking across cultural groups.

1.6. English proficiency

An alternative hypothesis for explaining cultural difference in critical thinking relates to Asian students' is the use of English as a second language (Paton, 2005). In an international education setting, Asian international or immigrant students usually possess lower level of English proficiency than their native English-speaking counterparts. As a result, these Asian students may be more "cognitively overloaded" when using English in tasks requiring critical thinking. English proficiency then accounts for their lower critical thinking performance. Campbell, Adams, and Davis (2007) suggested similar processes of increased cognitive demand for ESL students in solving mathematical problems. According to the cognitive load theory (Paas, Renkl, & Sweller, 2003), only limited amount of information can be stored and processed in working memory. Using this theoretical framework, Campbell et al. (2007) illustrated that ESL learners required some of that limited working memory to process information related to the unfamiliar language and structure of word problems, which overloaded their working memory and prevented them from effectively processing information pertinent to the question per se. Similar ideas can be applied to ESL learners who are required to think critically about problems presented in English.

In fact, the use of a second language has been shown to have detrimental effect on one's performance in cognitive tasks. Takano and Noda (1993) observed that native-Japanese speakers who had to use English as their second language to work on a linguistic task performed less well in a concurrent calculation task than they would in using Japanese on the linguistic task. The same deteriorating effect was also found among native English speakers who had to use Japanese on the linguistic task. In light of these findings, Takano and Noda (1993) suggested that the use of a foreign language would cause temporary decline of thinking ability as a result of heavier cognitive processing load.

Language proficiency has been found to play an important role in students' critical thinking performance. Previous research on the predictors of university students' critical thinking test performance showed that verbal scores in the Scholastic Aptitude Test (SAT) were significantly and positively related to critical thinking skills as well as grade point average (Taube, 1997). Clifford, Boufal, and Kurtz (2004) also observed college students' scores on the verbal comprehension subtest of the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III; Wechsler, 1997) being significant predictor of their critical thinking test scores. Although these studies did not address the issue of culture, the findings suggested a positive relationship between language proficiency and critical thinking performance, which may be used to explain the difference in critical thinking between Asian and Western students. Accordingly, we hypothesize that English proficiency explains cultural differences in critical thinking (*Hypothesis 3*).

1.7. Possible consequence of cultural differences in critical thinking

An important implication of observing cultural difference in critical thinking concerns the practice of critical thinking in international education. If Asian students were indeed less capable of critical thinking than their Western counterparts, instructions emphasizing critical thinking might become something undesirable to Asian students. The increasing number of Asian students studying in Western institutions (OECD, 2009) might then undermine the values of cultivating critical thinking in university education (see Atkinson, 1997; Davidson, 1998; Ennis, 1998; Gieve, 1998; and Kumaravadivelu, 2003 for details on this line of debate).

If a course has been designed to promote critical thinking, students' critical thinking skills should be reflected in their performance in the course. That is, students should be able to practice their critical thinking in course assessments. Previous research in the United States showed that students' critical thinking skills measured by standardized instruments were positively related to their academic achievement in courses which emphasize the practice of critical thinking (e.g., Bowles, 2000; Collins & Onwuegbuzie, 2000). If such positive relationship between critical thinking skills and academic performance is equally applicable to both Asian and Western student samples, the emphasis of critical thinking can then be considered equally useful to both groups of students.

Assuming Asian students are indeed less capable of critical thinking than Western students, in a course which emphasizes the use of critical thinking, it would be possible to observe that Asian students showing lower level of academic performance (*Hypothesis 4*). Nevertheless, ample research evidence showed that Asian students outperform their Western counterparts in academic achievements in different national and international research, even though certain Asian learning practices have been considered unfavorable to good learning outcomes according to Western standards (i.e., "the paradox of the Asian learners", see Watkins & Biggs, 2001 for details). Therefore, it would also be possible that Asian students can achieve high grades in courses emphasizing critical thinking despite their apparently lower level of critical thinking skills. Instead of observing systematic cultural difference in academic achievement, the relationship between critical thinking and academic performance might be found to be weaker among Asian students than Western students (Hypothesis 5). In such case, the relevance of emphasizing critical thinking and the usefulness of related educational practices in international tertiary education would still require reexamination.

1.8. Overview of the present research

In the present research, we are testing whether there are differences between Asian and Western students on two different objective tests of critical thinking. Second, we explore the roles of English language ability and dialectical thinking styles, based on the propositions of the Cognitive Load Theory (Paas et al., 2003) and the dialectical thinking paradigm (Nisbett et al., 2001; Peng & Nisbett, 1999), in explaining the observed difference. The relationship between dialectical thinking and critical thinking is also explored. Finally, to understand how a teaching programme emphasizing critical thinking may be influenced by culture, we examine the relationship between critical thinking and academic

performance in both Asian and Western student samples. The finding from this investigation is expected to provide important empirical data about the potential impact of culture on the emphasis of critical thinking in university education.

The research was conducted in a large New Zealand University. New Zealand provides a good case study due to its cultural diversity. In the past 20 years, the growth in Asian population has been the highest among all immigrating ethnicities in New Zealand (Friesen, 2008). In the educational context, New Zealand attracts students mostly from Asian countries and communities such as China, Korea, and Japan (New Zealand Ministry of Education, 2008). This characteristic of the students' cultural composition in New Zealand offers an interesting avenue to test out the aforementioned research hypotheses.

Two studies were conducted in this research. Study 1 was designed to provide an initial account of whether there is a difference in critical thinking abilities between the Chinese and New Zealand European students. A newly-developed critical thinking instrument, the Halpern Critical Thinking Assessment using Everyday Situations (HCTAES; Halpern, 2006), was used to assess the critical thinking skills of a sample of Chinese and European students. The roles of dialectical thinking and English proficiency in the observed cross-cultural difference were also explored.

Study 2 included an assessment with a more popular measure of critical thinking (the Watson–Glaser Critical Thinking Appraisal Short Form; Watson & Glaser, 1994, 2006). The study replicated the design and tested the same set of hypotheses as in Study 1, except that a different instrument was used to enhance the generalizability of the results. Following the research strategies employed in previous studies on the predictors of critical thinking performance (e.g., Clifford et al., 2004; Taube, 1997), an objective measure which assesses English proficiency and general intellectual ability was also included. A follow-up data analysis of a subset of study 2 focusing on the academic performance of students in a management class was conducted to test hypotheses 4 and 5, addressing concerns about the possible consequence of cultural difference in critical thinking in international education.

2. Study 1: pilot study with the HCTAES

This pilot study was conducted to provide preliminary evidence on the observed cross-cultural differences in critical thinking between Asian and Western students. To explore the effect of dialectical thinking and English proficiency in explaining the differences, self-report measures of these variables were included in the assessment.

2.1. Method

2.1.1. Participants

Seventy students of a university in New Zealand participated in the study. Twenty-four students identified themselves as ethnically Chinese, 35 as New Zealand European, and 11 participants were of other ethnic identities such as New Zealand Maori and Samoan. Because our research focus was on Asian and New Zealand European students, only the data from the Chinese and New Zealand European students were subjected to further analysis. All international students had to provide evidence of sufficient proficiency in written and spoken English upon enrolling to the university. Among the 59 students included, there were 47 females, 11 males, and one unidentified. The average age of these students was 21.95 years ($SD = 1.99$).

2.1.2. Materials

Participants were instructed to complete a set of instruments as described below:

2.1.2.1. Halpern Critical Thinking Assessment using Everyday Situations (HCTAES). The HCTAES (Halpern, 2006) is an instrument designed for assessing critical thinking abilities on five dimensions, namely, verbal reasoning skills, argument analysis skills, skills in thinking as hypothesis testing, using likelihood and uncertainty, and decision making and problem-solving skills, which are the five important college-level critical thinking skills according to Halpern (1998). The test consists of 25 everyday-life scenarios each with one open-ended item and one forced-choice item.

According to the information in the test manual, the HCTAES was shown to correlate positively with the Arlin Test of Formal Reasoning (Arlin, 1984) within a high-school student sample and a college student sample ($r = .32$ in both samples). The Arlin Test is a test of formal reasoning based on Piaget's model of cognitive development. In addition, the HCTAES was found to have a positive correlation (about .60) with the Analytic subtest of the Graduate Record Exam, showing convergent validity with other tests which measured related cognitive abilities.

The whole test takes about 90 min to finish, so to keep the testing time reasonably brief for the participants, only the forced-choice portion of the test was used. The use of both open-ended and close-ended portions together was intended for educational and training purpose. However, the forced-choice portion alone would be sufficient for a brief assessment of the critical thinking abilities of the samples, which was intended to show if test-takers are able to use the skill when they are provided with more clues in the close-ended items (Halpern, 2006).

Therefore in the final test, there were altogether 25 forced-choice scenario based items, with five items tapping each skill category. In addition to the more common multiple-choice format which involves choosing the best answer among a number of alternatives (nine items), there were also items requiring the testees to give ratings on different options pertinent to a particular scenario (seven items), to choose multiple correct answers among a number of alternatives (five items), and to identify the characteristics of a list of statements (four items). Given the diversified response formats of the items, the final score was calculated using the standardized scores of every item; a similar procedure was employed by Hau, Ho, Lai, Ku, and Hui (2008).

2.1.2.2. Dialectical Self Scale (DSS). The DSS was developed by Spencer-Rodgers et al. (2001) for measuring dialectical thinking in the domain of self-perception. It has been utilized to explain differences in psychological well-being (Spencer-Rodgers et al., 2004) and response styles (Hamamura et al., 2008) between Asian and Western cultures. The scale was constructed using a 7-point format with higher score indicating higher level of dialectical self-concept. Sample items included "When I hear two sides of an argument, I often agree with both", "I often find that my beliefs and attitudes will change under different contexts". Cronbach's alpha was .78 in the Chinese sample and .71 in the New Zealand European sample.

2.1.2.3. Perceived proficiency in reading and writing English (English). The participants were asked to rate their proficiency in English on a 7-point scale on "How proficient are you in reading in English" and "How proficient are you in writing in English", with higher scores indicating higher level of proficiency. The correlation between these items was .82 ($p < .01$) in the Chinese sample and .92 ($p < .01$) in the New Zealand European sample. The scores on these items were averaged to provide an estimate of the participants' perceived proficiency in reading and writing English.

All measures were administered in English because English is the medium of instruction in the New Zealand tertiary education system. Entry requirements of the universities in New Zealand include providing evidence of the students' English language proficiency, either in the form of the NZ Bursary Examination or standardized international English proficiency tests. Therefore we can confidently assume that the participants possess a reasonable level of English proficiency to take part, and no participant from either sample

Table 1
Descriptive statistics and independent sample t-tests of the target variables in Study 1.

	Chinese		New Zealand European		*t*-test
	M	*SD*	*M*	*SD*	
HCTAES (standardized)	−1.26	1.70	0.87	1.13	−5.78***
Perceived English proficiency	4.58	1.10	6.71	0.61	−8.63***
DSS	4.00	0.52	3.87	0.46	1.25

*** $p<.001$.

reported difficulty in understanding the instructions or the items. The average time required for completing the session was about one hour.

2.1.3. Analytical strategy

To examine the effect of perceived English proficiency and the DSS in the relationship between culture and critical thinking skills, mediation analysis was used (MacKinnon, Fairchild, & Fritz, 2007). In testing the mediation hypotheses, the procedures proposed by Preacher and Hayes (2004, 2008) on testing indirect effects were used instead of the more commonly adopted Baron and Kenny's (1986) causal-step procedures with regressions or Structural Equation Modeling (SEM).

According to Preacher and Hayes (2004), the method described by Baron and Kenny (1986) is likely to suffer from low statistical power, especially in small samples (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). For example, the Baron and Kenny procedure requires significance of the X–Y relation. However, the coefficient may be nonsignificant due to low statistical power even though a nonzero effect in the population is actually present. In this situation, mediation model cannot be tested based on the Baron and Kenny's procedures which then results in a Type II error. Instead, Preacher and Hayes (2004) suggested that testing the significance of the indirect effect between X and Y through the mediator requires one fewer hypothesis test, which reduces the likelihood of Type II error in mediation analysis. The Sobel test (Sobel, 1982) has been commonly used for testing significance of indirect effect (MacKinnon et al., 2002). However, the test requires the estimates of indirect effect to be normally distributed which is rarely the case in small samples. To circumvent the problem associated with small sample sizes, Preacher and Hayes (2004) recommended a bootstrapping procedure which makes no assumption about the sampling distribution of the estimates of effects.

Bootstrapping involves repeated sampling from the data set with replacement and estimates the indirect effect in each resampled data set (Preacher & Hayes, 2004). An approximation of the sampling distribution of the indirect effect will be built by repeating the resampling process for thousands of times and then be used to construct confidence intervals for the indirect effect. The procedures of testing indirect effects with bootstrapping have been extended to multiple mediator models, with syntaxes and macros being designed for related analysis with common statistical software such as SPSS, SAS, and LISREL (Preacher & Hayes, 2008). The bootstrapping procedure generates estimates of the total effect of X on Y, the direct effect of X on Y after entering the list of mediators, the indirect effects of X on Y via the list of mediators, and the specific indirect effects of X on Y via each particular mediator. The total indirect effect of X on Y is the sum of all specific indirect effects and is equal to the difference between total and direct effects.

The SPSS macro offered by Preacher and Hayes (2008) was used in the present analysis. Each of the total and specific indirect effects generated through the procedure were assessed by three 95% bootstrap confidence intervals (CIs), namely, the percentile, the bias-corrected (BC), and the bias-corrected and accelerated (BCa) intervals. An indirect effect is shown to be significantly different from zero at 95% confidence if zero is not included in the range of CIs.

2.2. Results and discussion

2.2.1. Cultural differences in critical thinking skills and other self-report measures

Table 1 shows the descriptive statistics and independent sample t-tests results of the three variables under consideration. Significant difference in critical thinking skills was noted between the two samples, with New Zealand European students performing better than the Chinese students in the HCTAES. This result supports Hypothesis 1 which was about the difference in critical thinking between Asian and Westerns students.

The two samples were also significantly different from each other in terms of their perceived English proficiency, again with New Zealand European students scoring significantly higher than the Chinese sample. However, the two samples did not significantly differ from each other on the DSS.

2.2.2. Mediation between culture and critical thinking skills

Multiple mediation analysis was conducted following the procedures suggested by Preacher and Hayes (2008). Perceived English proficiency and the DSS were tested as mediators of the relationship between culture and critical thinking skills. The effect of gender was controlled for in the analysis.

The total effect of culture on critical thinking skills was significant $b=2.45$, $SE=0.34$, $p<.001$. The partial effect of gender on critical thinking skills was not significant ($b=0.38$, $SE=0.41$, $p=.35$), indicating that there is no significant gender effect on the measure of critical thinking skills. With consideration of the two mediators in the model, the direct effect of culture on critical thinking skills became only marginally significant, $b=1.00$, $SE=0.53$, $p=.06$. Using the logic of Baron and Kenny's (1986) causal-step procedures, the reduction of the coefficient between culture and critical thinking skills indicated that at least some of the proposed mediating variables in the model were potent.

Table 2 summarizes the result of the bootstrapping mediation analysis of the total and specific indirect effects as well as contrasts between the specific indirect effects. As zero is not contained in the confidence intervals of the total indirect effect, the total indirect effect was significantly different from zero, indicating that the relationship between culture and critical thinking skills was mediated by at least some of the proposed mediators. The specific indirect effect of perceived English proficiency was the only one significantly different from zero at 95% confidence, showing that perceived English proficiency was the significant mediator in the model. These results provided support to Hypothesis 3 but not Hypothesis 2.

The results of this pilot study showed that there was a difference between Chinese and New Zealand European student samples on critical thinking performance as assessed by an objective measure, with the latter sample performing better than the former in the test. Self-report English proficiency could, at least to a certain extent, explain this difference. Nevertheless, dialectical thinking style could not explain the cultural difference in critical thinking as we proposed.

3. Study 2a: assessment with the WGCTA-SF

To test the research hypotheses more fully, an assessment was conducted with another instrument — the Watson–Glaser Critical Thinking Appraisal Short Form (WGCTA-SF; Watson & Glaser, 1994, 2006). The WGCTA is one of the most popular measures of critical thinking. Similar to the HCTAES (Halpern, 2006), the WGCTA employs everyday situations to test critical thinking in a general sense (Renaud & Murray, 2008). Following the research strategy employed in Taube (1997) and Clifford et al. (2004), English proficiency and general intellectual ability are assessed with an objective measure: The Shipley Institute of Living Scale (SILS; Shipley, 1940; Zachary, 1991). We expected that an objective measure of English proficiency would

Table 2
Mediation analysis in Study 1.

	Bootstrapping results for indirect effects						
	Point Estimate	Percentile 95% CI		BC 95% CI		BCa 95% CI	
		Lower	Upper	Lower	Upper	Lower	Upper
Indirect effects							
English	**1.41**	0.74	2.22	0.74	2.22	0.72	2.19
DSS	0.02	−0.08	0.21	−0.05	0.28	−0.05	0.26
Total	**1.44**	0.75	2.28	0.73	2.24	0.70	2.22
Contrasts							
English vs. DSS	**1.39**	0.69	2.21	0.70	2.23	0.68	2.19

5000 bootstrap samples; significant indirect effects or contrasts in bold.

provide more solid evidence of the role of language in explaining cultural difference in critical thinking. We controlled for general intellectual ability, to rule out the possibility that differences in critical thinking are due to the difference in basal general intellectual competence between the two samples.

Apart from these additional control measures, we acknowledge that self-report English proficiency, apart from representing the intended perceived English proficiency, reflects also a person's adoption to an English-speaking cultural environment (e.g., Gaudet & Clément, 2009). Because of this possible linkage between perceived language proficiency and acculturation, it is logical to argue that the findings in Study 1 was essentially showing that adoption of an English-speaking culture, rather than proficiency in using English, was what explained the cultural difference in critical thinking skills.[1] In such case, critical thinking might alternatively be interpreted as something specifically favorable to Western culture, thereby undermining the usefulness of practicing critical thinking in an international education context. To rule out the possibility of adoption to a Western culture was the actual factor leading to cultural differences in critical thinking, a measure of cultural adoption was also included in the analysis.

Around half of the participants in this study were recruited through a Management course as a part of the accreditation project of the Management school. Data on the final course grade was available for this subsample. As suggested above, cultural differences observed in critical thinking have important implication in evaluating the suitability of promoting critical thinking in an international classroom. If teaching professionals attempt to promote critical thinking in their courses but students of different cultural backgrounds cannot equally apply their critical thinking as intended, the usefulness of promoting critical thinking in education would then be questionable. Therefore, this data set with students' course grades enables the possibility of testing the relationship between students' academic performance and critical thinking abilities, and thereby provides information about the practical implication of promoting critical thinking in higher education.

3.1. Method

3.1.1. Participants

Three hundred and sixty-six university students participated in the study, among these participants 102 identified themselves as ethnically Asian, 210 identified as ethnically New Zealand European, and 54 of other ethnicities, including New Zealand Maori, Samoan, African, and mixed ethnicities. Again, because the major focus of this research was on the comparison between Asian and New Zealand European students, the data from those of the other ethnicities were not included in the subsequent analysis. The majority of the Asian sample consisted of Chinese (68.6%), followed by Indian (9.8%), Vietnamese (6.9%), and Filipinos (3.9%), with the rest being Cambodian, Indonesian, Japanese, Korean, Malay, Sri Lankan, and Thai. This pattern closely resembles the actual situation of international education in New Zealand, where Chinese migrants form the majority of Asian students (New Zealand Ministry of Education, 2008). The average age of the final sample of 312 participants was 20.09 years (SD = 4.83), with 124 males, 187 females and one unidentified gender.

It is noted that the Asian student sample appeared to be more diverse than the NZ European sample. Nevertheless, because we are looking for the active ingredient of cultural difference in critical thinking by using individual differences variables (Matsumoto & Yoo, 2006), the differences in terms of within-group diversity between the two samples would be accounted for in the analysis. Therefore, the conclusion drawn would not be affected by the seemingly more diversified Asian sample.

3.1.2. Materials

The English version of the following instruments was administered to the participants. The average time required for completing the whole session was about one hour.

3.1.2.1. Watson–Glaser Critical Thinking Appraisal Short Form (WGCTA-SF). The WGCTA was designed to measure critical thinking abilities along five dimensions, namely, inferences, recognition of assumptions, deduction, interpretation, and evaluations of argument. The short form version with 40 items was employed in this study (Watson & Glaser, 1994, 2006). The WGCTA-SF was derived by shortening the original 80-item Form A of the WGCTA (Watson & Glaser, 1980) in an attempt to reduce the administration time. Reliability of the test was shown by Cronbach's alpha of .81 based on a sample of 1608 participants in the original development of the short form, and alphas between .66 and .85 in the other studies reported in the Manual. Validity of the test was demonstrated by the significant correlation between test scores and criterion-related measures such as effectiveness in clinical decision making (Shin, 1998) and cognitive problem-solving skills (Spector, Schneider, Vance, & Hazlett, 2000). In each subscale, directions and sample questions were provided in front of the actual test items. All participants were instructed to read carefully before answering the questions.

Although the scores on the WGCTA-SF might be interpreted at the subscale level, a meta-analytic review on the psychometric properties of the WGCTA showed that it would be better to treat the scale as a measure of general critical thinking competency but not to interpret the subscales individually (Bernard et al., 2008). This suggestion was based on the principal component analysis of the subscale means of the original versions of WGCTA (Watson & Glaser, 1980) which yielded a one-factor solution. In view of the empirical evidence and for the sake of parsimony, only the total score of WGCTA-SF is interpreted in the present research.

3.1.2.2. Shipley Institute of Living Scale (SILS). Developed by Shipley in 1940, the SILS was intended for assessing general intelligence in adults and adolescents. The revised version by Zachary (1991) was employed in this study. The SILS consists of two subtests, a 40-item vocabulary test and a 20-item abstraction test. In the vocabulary test, participants were asked to choose among four alternative words that mean the same or nearly the same to a specific target word. In the abstraction test, a logical sequence was presented and the participants were required to complete the sequence by filling in the appropriate numbers or letters. Although the test scores could be used together to estimate IQ scores based on more popular intelligence testing instruments such as the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1981) by means of various sophisticated

[1] We would like to thank an anonymous reviewer of an earlier version of this manuscript for pointing out this possible alternative explanation.

Table 3
Descriptive statistics and independent sample t-tests of the target variables in Study 2a.

	Asian		New Zealand European		*t*-test
	M	*SD*	*M*	*SD*	
WGCTA total	24.07	5.64	27.05	6.19	−4.02***
SILS vocabulary test	24.15	5.90	29.08	4.13	−7.55***
SILS abstraction test	16.15	3.00	16.53	2.24	−1.14
DSS	4.02	0.46	3.92	0.56	1.74
Cultural adoption	4.20	1.02	5.26	0.67	−9.29***
Perceived English Proficiency	5.17	1.45	6.62	0.68	−9.56***

*** $p<.001$.

conversion procedures (e.g., Paulson & Lin, 1970; Zachary, Paulson, & Gorsuch, 1985), the raw scores of each test were used as measures of the participants' English proficiency (vocabulary score) and general intellectual competence (abstraction score), respectively.

3.1.2.3. Dialectical Self Scale (DSS). The same instrument employed in Study 1 was used. Cronbach's alpha was .65 in the Asian sample and .78 in the New Zealand European sample.

3.1.2.4. Perceived English proficiency (English). The two items used in Study 1 were again used to indicate perceived English proficiency. Correlation between the two items was .93 ($p<.01$) in the Asian sample and.76 ($p<.01$) in the New Zealand European sample. The scores on those items were averaged to estimate the participants' perceived proficiency in reading and writing English.

3.1.2.5. Cultural adoption of behavioral norms in New Zealand. The Behavioral Acculturation Scale (BACS-16) was a 16-item scale developed by Groenvynck, Beirens, Arends-Toth, and Fontaine (2006) to measure two independent dimensions of acculturation, namely, cultural maintenance and cultural adoption. The term *acculturation* is used to describe the cultural change that a person undergoes during cross-cultural transitions (Ward, 1996). Based on the two-dimensional model of acculturation (Berry, 1997), the BACS-16 was designed to capture an individual's cultural change in terms of their actual knowledge, actions, and behaviors related to their home and host cultures. In essence, the scale consists of eight pairs of item. Within each pair, one item focuses on the maintenance of home culture, while the other item focuses on the adoption of host culture.

In the present study, eight items from the cultural adoption subscale were chosen to capture the participants' adoption of behavioral norms in New Zealand. All participants were instructed to rate the items concerning their knowledge of and behaviors within New Zealand culture using a 6-point Likert scale, ranging from fully disagree (1) to fully agree (6). Sample items include "I know the New Zealand culture and traditions well" and "I live according to rules that apply in the New Zealand culture". Cronbach's alpha was .87 in the Asian sample and .86 in the New Zealand European sample.

3.2. Results and discussion

3.2.1. Cultural differences in WGCTA, SILS scores, and other self-report measures

Table 3 shows the descriptive statistics of the target variables in the Asian and New Zealand European samples. It was observed that the New Zealand European sample scored higher on all variables except the DSS. Independent sample t-tests on the variables revealed that the differences between the two samples were statistically significant in terms of the WGCTA score, the SILS vocabulary score, cultural adoption, and perceived English proficiency. The differences observed in SILS abstraction score and DSS were not statistically significant, indicating that the two cultural groups are not significantly different from each other in general intellectual competence and self-report dialectical thinking style.

3.2.2. Mediation between culture and critical thinking skills

Similar to the pilot study, multiple mediation analysis was conducted using the procedures proposed by Preacher and Hayes (2008). SILS abstraction score was included as a covariate to control for the effect of general intellectual competence on critical thinking skills. Gender was also controlled for in the analysis.

The total effect of culture on the WGCTA score was significant $b=2.70, SE=0.72, p<.001$. The partial effect of gender on the WGCTA was not significant ($b=-0.19$, $SE=0.67$, $p=.78$), indicating that there was no significant gender effect on critical thinking skills as measured by the WGCTA. However, the partial effect of SILS abstraction score was significant ($b=0.53$, $SE=0.13$, $p<.001$), suggesting that general intellectual competence was positively related to critical thinking skills. After taking into account the mediators, the direct effect of culture on critical thinking skills became statistically nonsignificant, $b=1.51$, $SE=0.86$, $p=.08$. Again, based on Baron and Kenny's (1986) logic, the reduction in the effect of culture on the WGCTA indicated that at least some of the proposed mediators were potent.

Table 4 summarizes the results of the bootstrapped mediation analysis of the total and specific indirect effects as well as contrasts between the specific indirect effects. Consistent with the observation on the difference between the total effect and the direct effect of culture on critical thinking, zero was not contained in the confidence intervals of the total indirect effect, which showed that the total indirect effect was significantly different from zero. In other words, the relationship between culture and critical thinking skills was mediated by at least some of the proposed mediators.

Inspection of the CIs of the proposed mediators revealed that only the specific indirect effect of SILS vocabulary was significantly different from zero. Tests of contrasts between the specific indirect effects showed that the specific indirect effect of SILS vocabulary was significantly different from those of the other variables, suggesting that it was the most important mediator in the relationship between culture and critical thinking skills among the variables considered.

Table 4
Mediation analysis in Study 2a.

	Point Estimate	Bootstrapping results for indirect effects					
		Percentile 95% CI		BC 95% CI		BCa 95% CI	
		Lower	Upper	Lower	Upper	Lower	Upper
Indirect effects							
SILS vocabulary	**2.21**	1.39	3.15	1.42	3.18	1.42	3.18
DSS	0.02	−0.11	0.18	−0.07	0.24	−0.07	0.24
Cultural adoption	−0.57	−1.54	0.19	−1.51	0.21	−1.42	0.27
Perceived English	−0.47	−1.50	0.56	−1.51	0.56	−1.53	0.56
Total	**1.19**	0.16	2.24	0.21	2.33	0.22	2.34
Contrasts							
SILS vocabulary vs. DSS	**2.19**	1.38	3.11	1.42	3.17	1.42	3.17
SILS vocabulary vs. cultural adoption	**2.78**	1.67	4.10	1.65	4.09	1.61	4.06
SILS vocabulary vs. Perceived English	**2.67**	1.15	4.32	1.20	4.39	1.20	4.39
DSS vs. cultural adoption	0.59	−0.16	1.56	−0.18	1.53	−0.26	1.43
DSS vs. Perceived English	0.49	−0.57	1.56	−0.56	1.57	−0.55	1.58
Cultural adoption vs. Perceived English	−0.11	−1.87	1.39	−1.85	1.41	−1.76	1.49

5000 bootstrap samples; significant indirect effects or contrasts in bold.

Table 5
Correlation among the variables in the two samples in Study 2a.

	WGCTA	SILS vocabulary	SILS abstraction	DSS	Cultural adoption
SILS vocabulary	(.43**) .44**				
SILS abstraction	(.43**) .32**	(.33**) .36**			
DSS	(.26*) −.04	(.20) .05	(.29**) .03		
Cultural adoption	(.04) −.12	(.32**) −.05	(.05) −.07	(−.09) .02	
Perceived English proficiency	(.13) .06	(.51**) .20**	(.12) .19*	(−.04) −.04	(.64**) .12

Numbers in parentheses are correlations in the Asian sample, n = 94; Numbers without parentheses are correlations in the New Zealand European sample, n = 169; listwise deletion of missing data.
* $p<.05$.
** $p<.01$.

Therefore, hypothesis 3 was supported with an objective measure of English proficiency.

It is noted that the specific indirect effect of perceived English proficiency, unlike that in Study 1, was not significant in the current analysis. A subsequent analysis using only DSS and perceived English proficiency as mediators revealed that the specific indirect effect of self-report English proficiency was significant without the SILS vocabulary score in the list of mediators.[2] This finding suggested that an objective measure of English proficiency might be more powerful than a self-report measure, so that the effect of perceived English proficiency was taken up by the SILS vocabulary score when they are analyzed simultaneously.

3.2.3. Relationship between DSS and WGCTA across cultures

Table 5 shows the correlations among the target variables in each group. Similar correlation pattern among the three test scores were observed in both cultural groups, where WGCTA was both positively related to SILS vocabulary score and SILS abstraction score, and the two SILS scores were moderately positively related to one another. This pattern is consistent with those observed in previous research (Clifford et al., 2004; Taube, 1997).

It is worth to note that in the Asian sample, perceived English proficiency was significantly related to both SILS vocabulary score and cultural adoption, indicating that perceived English proficiency could be interpreted both in terms of actual English language abilities and behavioral adoption of New Zealand culture.

Dialectical self-concept was found to be significantly positively related to WGCTA score in the Asian sample, whereas its correlation with the WGCTA was close to zero in the New Zealand European sample. The correlation pattern implicated that the relationship between dialectical self-concept and critical thinking vary as a function of culture, although dialectical self-concept could not help explain the cultural difference in critical thinking performance. Moderation analysis using multiple regressions (Baron & Kenny, 1986) was conducted to reveal the possible cultural difference in how dialectical self-concept predicts critical thinking performance. The effects of English proficiency (SILS vocabulary scores) was controlled for in the analysis because it was found to account for the cultural difference in critical thinking performance.

The results of the regression analyses are reported in Table 6. The interaction between culture and dialectical self-concept was marginally significant ($p=.08$), suggesting a trend of cultural difference in the relationship between DSS and critical thinking skills. It was likely that if the sample size was larger, the effect would become statistically significant because of higher statistical power. The interaction effect is depicted in Fig. 1 using the internet version of Modgraph (Jose, 2008). It showed that dialectical self-concept was positively related to critical thinking skills in the Asian sample, but the relationship between the two variables was slightly negative in the New Zealand European sample.

These findings basically replicated the results obtained in Study 1. Asian students were again found to perform less well on a critical thinking skills assessment than their Western counterparts, which provided support to Hypothesis 1. This cultural difference was again explained by English proficiency but not dialectical thinking style, thereby showing support to Hypothesis 3 but not Hypothesis 2. It is also important to note that cultural adoption did not mediate the relationship between culture and critical thinking, which ruled out the possibility that adoption to Western culture is what explains the observed cultural difference. In other words, the result does not support the idea that critical thinking favors Western over Asian cultural group.

Interestingly, the relationship between dialectical thinking and critical thinking was found to be culturally different. Specifically, dialectical thinking was only positively related to critical thinking among Asian students but not New Zealand European students, suggesting that different cognitive processes might be involved in critical thinking between these two samples. Since the current analysis revealed that such cultural difference might exist, and given that dialectical thinking involves a complex array of cultural differences in cognitive tendencies and philosophical traditions (Peng & Nisbett, 1999), further research will be needed to unravel the exact influence of dialectical thinking style on critical thinking.

4. Study 2b: critical thinking skills and academic performance

Study 1 and Study 2a consistently showed that Asian students performed less well on two objective measures of critical thinking skills than their New Zealand European counterparts. This finding might challenge the current enthusiasm on critical thinking in the context of international education, because students of different cultural backgrounds might show different preferences regarding engaging in critical thinking and it may disadvantage some students. In such case, the value of promoting critical thinking in university education would be undermined as its usefulness varied as a function of students' cultural backgrounds.

University education in New Zealand showed relatively stronger emphasis on critical thinking than that in Asia (Lun, Fischer, & Ward, 2009). Academic conventions such as writing literature reviews, critical reviews, essays, and research proposals are commonplace in New Zealand university education, but Asian students often report difficulties in fulfilling the requirement of these assessment methods because of lack of knowledge about these academic conventions

Table 6
Moderating effect of culture on the relationship between critical thinking and DSS.

Steps	β	t	ΔR^2	F Change
1. SILS vocabulary	.49	9.60	.24	92.11**
2. SILS vocabulary	.47	8.39**	.001	.172
DSS	−.01	−.15		
Culture	.03	.55		
3. SILS vocabulary	.47	8.24**	.01	3.17[a]
DSS	.16	1.50		
Culture	.04	.74		
DSS × culture	−.19	−1.78[a]		

Culture was dummy coded as "Asian students = 0" and "New Zealand European students = 1"; DSS was mean centered in the analysis (Aiken & West, 1991).
[a] $p=.08$.
** $p<.01$.

[2] The point estimate of the specific indirect effect of perceived English proficiency was .96, with percentile 95% CI ranged from.11 to 1.94; BC 95% CI ranged from .11 to 1.95; and BCa 95% CI ranged from .11 to 1.94.

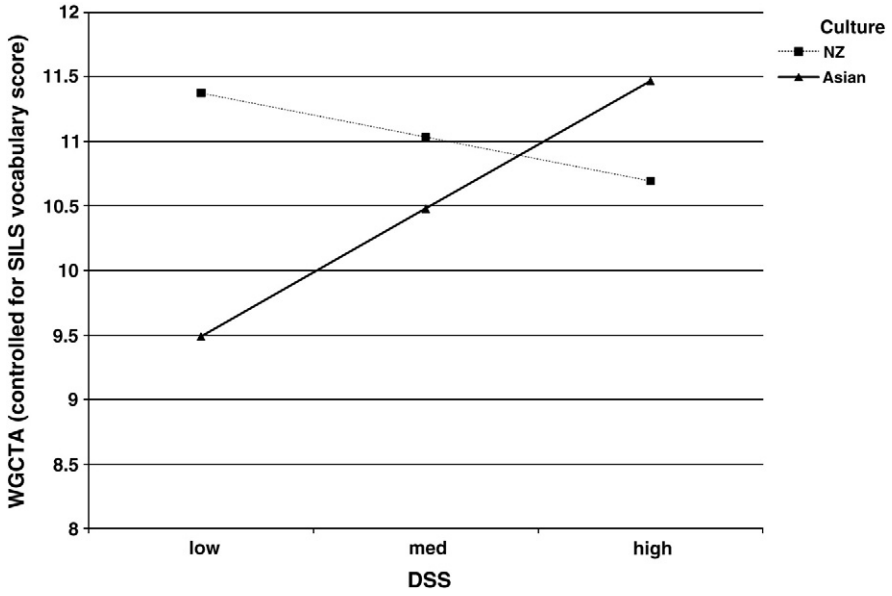

Fig. 1. Visual depiction of the interaction between DSS and culture on critical thinking in Study 2a.

(Campbell & Li, 2008). If students' use of critical thinking is encouraged and assessed by these tasks, Asian students might find it harder to express their critical thinking as required despite their actual ability. Consequently, the relationship between critical thinking skills and academic performance might be weaker among Asian students. The use of these assessment methods to develop students' critical thinking may then be considered inappropriate to Asian students.

In view of these forms of possible cultural influence on the relationship between critical thinking and academic performance, Hypothesis 4 and Hypothesis 5 as outlined in the Introduction were tested in a management course at the university.

4.1. Participants

A subgroup of the sample in Study 2a was included in this analysis. This sample was drawn from an introductory management course, that explicitly focused on critical thinking and the final course grades were available for analysis. The subsample comprised 110 New Zealand European students and 52 Asian students.

4.1.1. Course grades in the introductory management course

The course under investigation was an introductory management course which explicitly emphasizes the development of critical thinking skills. The course outline stated that the major objective of the course was to give an introduction of the trends, issues and challenges of the business environment in New Zealand, and students were expected to develop and apply their critical thinking in the course.

The assessment components were designed with the aim of developing students' critical thinking through various assignments and final examination. These included a journal of the student's personal experience of a business topic (20% of final course grades), essays with critical discussion (40% of final course grades), a final examination which required critical discussion on issues related to business development (30% of final course grades), and satisfactory completion of an essay writing and referencing course (10% of final course grades). With this explicit emphasis of critical thinking, the course offered an interesting avenue for testing the present research hypotheses.

The final course grades of the participants in the introductory management course were obtained with approval from the management school as a part of the school's accreditation project. Ethics approval for the accreditation project was granted to the management school by the university's Human Ethics Committee. The grades were transformed into a continuous numeric variable based on this scale: 1 = E, 2 = D, 3 = C, 4 = C+, 5 = B-, 6 = B, 7 = B+, 8 = A−, 9 = A, 10 = A+. According to the grading system of the university, grade C or above denotes a pass in the course (i.e., achieving 50% of final course grades).

4.2. Results and Discussion

4.2.1. Cultural difference in academic performance

Independent sample *t*-test revealed that there was a marginally significant difference in the academic performance between the two groups [$t(160) = -1.83$, $p = .07$]: New Zealand European students [$M = 6.41$, $SD = 1.53$] performed slightly better than Asian students [$M = 5.92$, $SD = 1.68$] in the course which provides initial support to Hypothesis 4.

4.2.2. Relationship between critical thinking and academic performance across cultures

Table 7 shows the correlation among the target variables in the two samples. WGCTA was significantly correlated with SILS vocabulary and SILS abstraction test scores, indicating that critical thinking are positively related to one's English proficiency and general intellectual competence. The correlation between course grade and the WGCTA score was also positive in both samples. Students' course grades were significantly correlated with SILS abstraction score, showing that general intellectual competence is positively associated with students' academic achievement. The correlation between course grades and SILS vocabulary score was significant only in the Asian sample, but statistical analysis using Fisher z-transformation revealed that the difference in the correlation coefficients between the two samples was only not significant, $z = 1.49$, $p = .14$. This finding suggested that English proficiency may be a factor in predicting students' academic performance in both samples.

With regard to Hypothesis 5, moderation analysis using multiple regressions (Baron & Kenny, 1986) was used to examine the effects of critical thinking skills, cultural adoption, culture, and their interactions on course grades. SILS vocabulary score, SILS abstraction score,

Table 7
Correlation among the variables in the two subsamples in Study 2b.

	Course grade	WGCTA	SILS vocabulary	SILS abstraction	DSS	Cultural adoption
WGCTA	(.29[a]) .34**	–				
SILS vocabulary	(.45**) .19	(.50**) .44**	–			
SILS abstraction	(.32*) .30**	(.38*) .30**	(.38**) .28**	–		
DSS	(−.09) −.21	(.23) .07	(.21) .10	(.37*) .07	–	
Cultural adoption	(.16) .14	(.13) −.14	(.26) −.07	(−.13) −.03	(−.21) −.12	–
Perceived English proficiency	(.20) .19	(.13) .01	(.59**) .28**	(.26) .07	(.02) −.14	(.53**) .15

Numbers in parentheses are correlations in the Asian sample, n = 45; Numbers without parentheses are correlations in the New Zealand European sample, n = 85; listwise deletion of missing data.
[a] $p = .06$.
* $p < .05$.
** $p < .01$.

perceived English proficiency, and gender were entered in the first block of the regression analysis to control for their effects to enable a clearer picture about the cultural influence on the relationship between critical thinking and academic performance. The result of the regression analysis is presented in Table 8.

The first step of the regression analysis showed that course grade was significantly predicted by SILS vocabulary score and SILS abstraction score, but the effect of gender was not significant. In the second step of the regression analysis, it was noted that WGCTA significantly predicted course grades, indicating that critical thinking was positively related to students' academic achievement even after controlling for the effects of English proficiency and general intellectual competence. The significant effect of WGCTA supports that the course assessment was positively related to students' skills in practicing critical thinking.

In the subsequent steps of the regression analysis, the effects of all two-way and three-way interaction terms were statistically nonsignificant, indicating that the relationship between critical thinking and academic performance was neither moderated by the cultural backgrounds nor the level of cultural adoption of the students. Therefore, the results did not support Hypotheses 5. Critical thinking has a positive effect on academic performance independent of the cultural background of students.

These results are important in showing that critical thinking skills, even after considering the effects of language proficiency and general intellectual competence, are predictive of students' academic performance in a course where the practice of critical thinking is emphasized. Though Asian students were found to perform less well on critical thinking as measured by the WGCTA, they were not any different from their New Zealand European counterparts in using critical thinking when it is required in a course. The nonsignificant interaction between critical thinking and cultural adoption also indicated that acquisition of Western cultural norms did not seem to affect the relationship between critical thinking and academic performance.

5. General discussion

Critical thinking is an important skill for many university students (Halpern, 1998; ten Dam & Volman, 2004). We empirically examined cultural differences in critical thinking between Asian and Western university student samples, addressing an important issue debated in the international education literature. We found that New Zealand European students performed significantly better than Asian students in two objective measures of critical thinking. Investigation of the underlying mechanisms revealed that English proficiency, both self-report (Study 1) and objectively measured (Study 2a), at least partially if not fully account for this observed difference. Although dialectical thinking style did not explain the observed cultural difference in critical thinking, results in Study 2a suggested that this thinking style may be beneficial for Asian students but not New Zealand European students in the practice of critical thinking. Moreover, despite the observed cultural difference, the relationship between critical thinking and academic performance did not vary as a function of students' cultural backgrounds or their level of adoption of Western cultural norms (Study 2b).

The present research confirms with objective assessments the cultural differences in critical thinking as observed by ESL teaching professionals. While those observations cannot be simply discounted as cultural stereotypes of Asian students (e.g., Kumaravadivelu, 2003), we should pay attention to the fact that English language proficiency, but not dialectical thinking style, explained the difference. In other words, the difference in critical thinking appears to be more of a linguistic issue rather than a cultural issue. The finding that cultural adoption does not mediate the cultural difference in critical thinking provided further support to this argument.

5.1. Dialectical thinking

Dialectical thinking style did not mediate the observed difference in critical thinking skills in the present investigation. In the examination of the relationship between DSS and WGCTA scores, it was observed that the relationship between the two variables was only positive in the Asian sample, but not the New Zealand sample. The difference in the direction of correlations might explain why dialectical thinking could not mediate the effect of culture on critical thinking skills. It should be highlighted, however, that the interaction effect was only marginally significant. The result should be considered as indicating a possible cultural difference in cognitive processes related to critical thinking.

Dialectical thinking style was a self-report measure in the present research. It is possible that individual's evaluations about various dialectical thinking principles might influence the association between critical thinking and dialectical thinking in different cultures. In a Western culture such as that in New Zealand, the principles involved in dialectical thinking might be interpreted as incongruent to the formal logical rules which have been commonly endorsed as the preferred mode of thinking (Peng & Nisbett, 1999). In this situation, it is reasonable to find the principles of dialectical thinking showing a negative relationship with critical thinking performance, because the endorsement of the principles of dialectical thinking could be seen as illogical to critical thinkers. On the other hand, it is possible that the

Table 8
Moderating effects of culture and cultural adoption on the relationship between critical thinking skills and academic performance.

Steps	β	t	ΔR^2	F Change
1. SILS vocabulary	.22	2.15*	.15	5.67***
SILS abstraction	.23	2.60**		
Perceived English proficiency	.06	0.65		
Gender	−.07	−0.83		
2. SILS vocabulary	.13	1.15	.05	2.59[a]
SILS abstraction	.20	2.31*		
Perceived English proficiency	.02	0.23		
Gender	−.08	−0.94		
WGCTA	.20	2.11*		
Cultural adoption	.17	1.79[b]		
Culture	−.02	−0.25		
3. SILS vocabulary	.17	1.49	.02	1.22
SILS abstraction	.19	2.08*		
Perceived English proficiency	.02	0.19		
Gender	−.09	−1.08		
WGCTA	.16	0.98		
Cultural adoption	.21	1.35		
Culture	−.02	−0.19		
WGCTA X Culture	.06	0.39		
Cultural adoption X Culture	−.01	−0.05		
Cultural adoption X WGCTA	−.15	1.48		
4. SILS vocabulary	.17	1.56	.01	2.22
SILS abstraction	.18	2.00*		
Perceived English proficiency	.02	0.14		
Gender	−.08	−0.90		
WGCTA	.06	0.33		
Cultural adoption	.13	0.78		
Culture	.00	0.03		
WGCTA X Culture	.11	0.71		
Cultural adoption X Culture	.05	0.36		
WGCTA X Cultural adoption	−.02	−0.11		
WGCTA X Cultural adoption X Culture	.19	1.49		

Culture was dummy coded with "Asian students = 0" and "New Zealand European students = 1"; WGCTA score and cultural adoption were mean centered (Aiken & West, 1991).
[a] $p = .06$.
[b] $p = .08$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

endorsement of dialectical thinking was deemed as reflecting an individual's wisdom or intellectual capacities in Asian cultures (see Buchtel & Norenzayan, 2008). So, critical thinkers who are skillful in the use of different cognitive strategies might prefer the principles of dialectical thinking, which resulted in the positive relationship between DSS and WGCTA scores.

The present findings indicated some interesting pattern between dialectical thinking style and cognitive tasks such as critical thinking. Further examination of the concept of dialectical thinking and refinement of its measurement would be beneficial to understand the practical implication of the concept to areas such as designing appropriate cognitive instruction to students of diverse cultural backgrounds.

5.2. English proficiency

The present findings confirm Paton's (2005) suggestion that Asian student's apparent lack of critical thinking is a consequence of the need to use English as a second language in academic discourse. Without sufficient English proficiency and/or enough confidence in using the language, Asian students are discouraged from overtly expressing their critical thinking in classrooms even if they want to do so.

According to the CLT (Paas et al., 2003), cognitive load can be reduced by forming schemas in the long-term memory that can be brought to the working memory for cognitive processing. Increased English proficiency resembles formation of schemas about the language in the long-term memory so that less cognitive load will be created by processing information of the language. It is important to note that this principle applies to every student regardless of their cultural backgrounds. If a critical thinking task requires information processing in a language, students who are proficient in that particular language would be able to spare more cognitive capacity in the working memory to think critically.

Critical thinking skills such as verbal reasoning and argument analysis demand a certain level of language proficiency. Even the mere act of reading a scenario or understanding a problem presented in a language requires certain levels of verbal abilities. While it is almost impossible to avoid the use of language in critical thinking, educators may try to structure assessments in a way that the required cognitive load of language proficiency would be kept at a reasonable level for all students. For example, overuse of jargon or culture-specific slangs or words should be avoided in designing course materials or tests that aim at promoting critical thinking among students. If the use of such language is deemed necessary, it would be important to explain fully and familiarize the students with the associated usage.

The framework proposed by Campbell et al. (2007) for mathematical instruction for second language learners also provided a useful reference of designing critical thinking instruction. One element of the framework includes structuring a problem statement in a way that students may infer the meanings of certain unfamiliar words from the context of the problem. That involves a lot of effort in structuring the problem but close coordination between university teaching professionals and ESL teachers could help to identify the areas of concern and the appropriate solutions.

5.3. Implication of the practice of critical thinking in international education

It was intriguing to note in Study 2b that academic performance was predicted by critical thinking skills after controlling for the effects of language and intellectual competence. This finding suggests that critical thinking could indeed play a unique role, apart from the more commonly emphasized language proficiency and abstract thinking ability, in university education. More importantly, our findings showed that the relationship between critical thinking and academic performance did not seem to be susceptible to the influence of culture. We may argue that cultural difference in critical thinking does not necessarily constitute a cultural unfairness which undermines the value of emphasizing critical thinking in international education (Atkinson, 1997). However, it would be important to pay attention to the discussed linguistic issues while designing and implementing instructional strategies which aim to promote critical thinking among students.

5.4. Limitations and future research

The present research empirically addressed the claim that Asian students lack critical thinking by objectively comparing the critical thinking skills between Asian and Western students. However, some issues remain to be answered in future research.

It is important to be aware of the multi-dimensional nature of critical thinking. Beside behavioral expressions such as debating or questioning ideas (Durkin, 2008), critical thinking also consists of different cognitive skills and dispositions (e.g., Ennis, 1987; Facione, 1990; Halpern, 2003). The present research has been focused on the skill aspect of critical thinking and how culture affects this dimension. A logical follow-up would be to examine the exact relationship between skills, dispositions, and behaviors, and how culture is related to the relationships among these variables. Such investigation enables

a more comprehensive understanding of the relationship between culture and critical thinking so that proper instructional strategies may be designed to cater for the need of promoting critical thinking in multicultural classrooms.

Moreover, the method employed in the present research only involved paper-and-pencil form of assessment of critical thinking skills. This is only one of the many possible ways for measuring one's critical thinking. After all, critical thinking is not only about test performance, it is also the application of different cognitive skills to everyday problems in participants' lives (e.g., Ennis, 1987; Halpern, 1998). To be able to apply critical thinking to real-life situations is the ultimate goal of cultivating critical thinking among students. Research on the application of critical thinking to real-life issues, especially with reference to the influence of culture, would provide useful information about the transfer of critical thinking skills in university education.

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