

Insight from the association between critical thinking and English argumentative writing: Catering to English learners' writing ability

Yanfang Hu^{1,2}, Atif Saleem^{3*}

¹College of Teacher Education, Zhejiang Normal University, Jinhua, China

²Pinghu Normal College, Jiaying University, Pinghu, China

³School of Education, Huaibei Normal University, Huaibei, China

Corresponding Author:

Atif Saleem

Email address: ad668@nenu.edu.cn

Abstract

Introduction: English ~~a~~Argumentative ~~w~~Writing (EAW) is a 'problem-solving' cognitive process, and its relationship with critical thinking has drawn attention in China. This is because fostering EAW proficiency is a crucial ~~element~~, but ~~a~~ challenging task for Chinese high school English teaching and learning. The present study ~~examines-examined~~ how critical thinking is related to Chinese high school students' EAW performance. The study ~~identifies-identified~~ eight critical thinking disposition (CTD) subscales and aims to determine whether EAW and CTD are correlated.

Methods: A questionnaire was modified from the Chinese Version Critical Thinking Disposition Inventory and the writing section of an English test. The latter required students to develop a piece of EAW. Both were administered to ~~156~~ students from Grade 12. Student EAW performance was scored by two experts based on the Evaluation Criteria for English Argumentative Writing (ECEAW).

Results: A significant relationship was found between students' CTD and EAW abilities. Furthermore, among the eight CTD subdispositions, cognitive maturity, truth-seeking, analyticity, and justice were found to be positively correlated with EAW, and they all were found to be the main predictors of EAW proficiency among high school students.

Conclusion: High school students' CTD, ~~especially the four subdispositions, cognitive maturity, truth-seeking, analyticity and justice~~ should be engaged in the context of EAW teaching or learning. ~~especially the four subdispositions, cognitive maturity, truth-seeking, analyticity and justice.~~

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34 Introduction

35 From a cognitive perspective, English writing is an intricate problem-solving process, that requires
36 not only basic writing skills but also the capacity to imagine, make claims, be visionary, and provide
37 proper supporting subarguments (Kirkland and Saunders, 1991; Bruning and Horn, 2010; Howell et
38 al., 2018) for the claims, especially when the claims are argumentative. Additionally, as a critical and
39 versatile skill (Graham, 2006), English writing is essential for academic success (Al Asmari, 2013)
40 and required globally, in political and business contexts, serving as a benchmark for college
41 admissions, job applications, and career promotions (National Commission on Writing, 2004). As an
42 index of comprehensive English proficiency, English writing is also pivotal in countries that study
43 English as a second language (Archibald, 2016). In China, English writing task is a common
44 assessment tool used on almost every standardized English test. However, English writing is a
45 challenging and complex undertaking (Anastasiou and Michail, 2013), even for native speakers. Only
46 one-quarter (24%) of students at both grades 8 and 12 in the United States perform at a proficient
47 English writing level, and only 3% from both grades achieved an advanced level of writing
48 proficiency, according to the American National Center for Education Statistics (National Center for
49 Education Statistics, 2012). Chinese high school students also performed relatively poorly on English
50 writing (Liu, 2016; Pan and Wu, 2019; Chang, 2021).

51 What factors could determine English writing proficiency? The systematic cognitive research on the
52 writing process started in the late 1970s, when Hayes and Flower applied cognitive psychological
53 methods to investigate writing. They further emphasized that “think-and teach-writing” should be
54 seen as “a problem-solving, cognitive process” (Flower and Hayes, 1980). Since the early 1990s,
55 researchers have tried to discover the relations between English writing proficiency, language
56 thinking, and writing style (Kobayashi and Rinnert, 1992; Sasaki and Hirose, 1996). It has become
57 widely accepted that English passages are “linear”, which is quite different from “roundabout”
58 Eastern languages such as Chinese (Kamimura, 1996; Yin, 1999; Wu, 2003). Inspired by Kamimura,
59 textual linguistics and discourse analysis methods have been widely adopted to study the effects of
60 second language writing, including the structure (Soter, 1988; Kirkpatrick, 1997; Kubota, 1998),
61 paragraph arrangement (Ostler, 1987; Bicker & Peyasantiwong, 1988), and characteristics of
62 articulation and coherence (Simpson, 2000). The increasing use of computers directed people’s
63 attention to the factors of keyboard proficiency (Barkaoui, 2016), automatic scoring system (Deane,
64 2013; Liao, 2016) and different feedback types (Hanjani, 2016; Latifi, 2021). Currently, self-efficacy
65 (Sun et al., 2021) and lexical bundles (Kim and Kessler, 2022) are the main focuses.

66 Previous studies including ... have proven that proficient performance in English writing involves
67 various cognitive skills that in most cases are complicated for English learners in particular (Peng et
68 al., 2021). The specificity of writing has been posited as the cause of this difficulty, since writing
69 requires not only linguistic capability but also ideation and analytical capabilities, logic, and
70 synthetic reasoning (Anastasiou & Michail, 2013; Bruning et al., 2013). Furthermore, some cognitive
71 ability factors have been attributed to students’ low writing performance.

72 As a part of cognitive competence, critical thinking skills have attracted researchers’ attention.
73 Studies have attempted to discover the effects of critical thinking skills on English writing (Yang et
74 al., 2016; Li, 2021). However, the relationship has not been determined between the critical thinking
75 disposition (CTD) and high school students’ English argumentative writing (EAW) performance, and
76 empirical studies in China are insufficient. Thus, this study explores-explored the link between
77 critical thinking and Chinese high school students’ EAW performance. To this end, this study sheds
78 light on (1) high school students’ current CTD in China, (2) the relationship between high school

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79 students' CTDs and their EAW performance, and (3) the prediction of the CTD on the EAW
80 performance.

81 English argumentative writing (EAW)

82 Although writing in school includes a range of genres, argumentative type is particularly significant
83 (Lin et al., 2020). Improving and fostering argumentative writing performance is a vital component
84 of English teaching reforms in schools and universities globally as well as a main challenge for
85 teachers of English writing at the K–12 and college levels (Newell et al., 2011).

86 In the United States, EAW is emphasized as a passport to further educational and job opportunities
87 (Common Core State Standards Initiative, 2010). Similarly, in China, argumentation is one of the key
88 assessment elements on English language proficiency, especially in the high-stakes college entrance
89 examination, which plays an essential role in college admission decisions. Additionally, EAW tasks
90 have been widely adopted in internationally renowned English general proficiency examinations,
91 such as the International English Language Testing System (IELTS), the Test of English as a Foreign
92 Language (TOEFL), and the Canadian Academic English Language Test (CAEL).

93 Regarding the IELTS, for instance, empirical findings have established that there is no correlation
94 between argumentation writing and students' test scores (Coffin, 2004). However, the National
95 Assessment of Educational Progress (NAEP) report revealed that approximately one-quarter of the
96 students provide logical reasons in support of the examples they use in their argumentative essays,
97 and students often fail to consider alternative perspectives (National Center for Educational Statistics,
98 2012). These problems also occur in China (Cai, 2017; Zhang 2017; Cai, 2019). As stipulated in the
99 General High School Curriculum Standards (2018), Grade 12 students in China should be able to
100 actively utilize resources to clearly express opinions in writing in a structured manner (Ministry of
101 Education of the People's Republic of China, 2018). Thus, improving English argumentation
102 proficiency is an important but difficult part of teaching and learning English writing in China.

103 From a cognitive perspective (Hayes, 1996; Graham, 2018; MacArthur & Graham, 2016), English
104 argumentation is a process of problem-solving requiring self-regulation to reach the author's
105 rhetorical targets (Graham & Harris, 1989). Writing proficiency is affected adversely by the inability
106 to strategically allocate limited cognitive resources (Ferretti & Fan, 2016). Skilled writers write
107 arguments based on their knowledge reserve of the topic, critical assessment standards, and
108 argumentative discourse (Ferretti & Lewis, 2019).

109 What are the critical evaluation standards on argumentative writing achievements? Previous studies
110 such as ... have inspired research about English argumentation and have promoted EAW
111 performance assessments. An initial objective was to identify the linguistic features in high-quality
112 writing samples (Witte and Faigley, 1981; McNamara et al., 2015), which Wen Qiufang and Liu
113 Runzhou did. Based on close scrutiny of the 20 best compositions from 1–4 grades of English major
114 undergraduates in China, the authors hypothesized 4-four parameters (i.e., relevance, explicitness,
115 coherence, and sufficiency) accompanying the supposedly 4-four thinking stages in writing (i.e.,
116 topic comprehension, thesis statement development with supporting arguments, organizing a
117 coherent discourse, and putting ideas into writing). Afterward, the authors tried to verify/falsify their
118 hypotheses by marking another 100 compositions of the same kind twice over a 3-month period, and
119 doing so yielded a framework for analyzing the general features of Chinese students' EAW and
120 salient problems in the students' abstract thinking (Wen & Liu, 2006). The Evaluation Criteria for
121 English Argumentative Writing (ECEAW) they constructed has been widely used in China (Liu,
122 2013; Yang, 2014; Xu, 2016; Li, 2018). However, until now, the analysis of English argumentation

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123 has mostly been at the undergraduate level, and little attention has been given to high school students
124 in China.

125 **Critical thinking**

126 An essential skill in education is critical thinking because Its importance in education was
127 emphasized by Aristotle two thousand years ago (Weng, 2002,). Since 1980, countries have
128 continually sought to cultivate student’s critical thinking skills (Huang et al., 2015). Various
129 definitions of critical thinking have been given. For instance, Edward Glaser defined critical thinking
130 as “an attitude of being disposed to consider in a thoughtful way the problems and subjects that come
131 within the range of one’s experience; knowledge of the methods of logical inquiry and reasoning; and
132 some skills in applying these methods” (Glaser, 1942). This definition considers critical thinking as a
133 synthesis of attitude, knowledge, and skills. However, Robert Ennis insisted critical thinking was “a
134 reasonable, reflective thinking that is focused on deciding what to believe or do”. He believed critical
135 thinking contained both critical thinking silks and personality traits (Ennis, 1987).

136 Critical thinking has also been described as “a mode of thinking, about any subjects, contents or
137 problems, in which the thinker improves the quality of his or her thinking by skillfully taking charge
138 of the structures inherent in thinking and imposing intellectual standards upon them” (Paul and
139 Binker, 1990). These definitions reveal that critical thinking is a mode of thinking on the subjects
140 within our realm of experience and helping us make decisions. Critical thinking should be reflective,
141 reasonable, and logical, containing both critical thinking skills and personal dispositions. Peter
142 Facione offered a more precise definition in the Delphi Report. It states that critical thinking is “a
143 purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and
144 inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or
145 contextual considerations upon which that judgment is based” (Facione, 1990).

146 To this end, critical thinking consists of a learned collection of analytic thinking skills and a tendency
147 to engage in the reasoning process (Halpern, 2003). Earlier studies have shown that the critical
148 thinking disposition (CTD) is an inner motivation that guides decision-making and problem-solving,
149 and that is essential for the application of critical thinking and the tendency to think critically
150 (Colucciello,1997; Facione et al., 2000). Based on these studies, Fesler-Birch further found that CTD
151 could be evaluated as a baseline for critical thinking performance (Fesler-Birch, 2005).

152 The California Critical Thinking Disposition Inventory (CCTDI) (Facione, 1992) is one of the most
153 well established instruments for assessing students’ CTDs, designed on the definition of critical
154 thinking formulated by Peter Facione in 1990. The CCTDI contains seven subdispositions with 75
155 items: inquisitiveness, self-confidence, truth-seeking, open-mindedness, analyticity, systematicity,
156 and cognitive maturity (Facione et al., 1994). Since its development in 1990s, the CCTDI has been
157 widely used in CTD studies (Miri et al., 2017; Zuriguel-Pérez et al., 2017; Sun et al., 2020). The
158 CCTDI has different versions. Luo and Yang were the first to translate the CCTDI into Chinese and
159 to use it in in China (Lou and Yang, 2001).

160 After being revised twice, this version has good internal consistency and reliability. Peng et al.
161 argued that, although the previous Chinese version of the CCTDI included semantic equivalence, it
162 ignored cultural factors (Peng et al., 2004). Therefore, Peng et al. adapted and modified the CCTDI to
163 obtain a conceptually equivalent Chinese variant that has the cultural sensitivity to be applied with
164 Chinese-speaking students. However, Peng et al. chose nursing students to test the instrument’s
165 validity and reliability and doing so limits the questionnaire’s generalizability. Therefore, Wen et al.
166 retranslated the CCTDI and constructed the CTDI–CV, mainly focused on checking the consistency

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167 of the Chinese translation with the original English, leaving no translation traces, and making the
168 language consistent and smooth but not overly colloquial (Wen et al., 2009). The revised CTDI-CV
169 contains 54 items with eight subdispositions: analyticity (the ability to independently and objectively
170 analyze life problems and to foresee the outcome or consequences of an event based on facts), truth-
171 seeking (the desire to seek the truth and to explore the essence of things), open-mindedness
172 (tolerance and openness to external things and different perspectives), systematicity (the ability to
173 overcome difficulties and solve problems with perseverance and an indomitable will), cognitive
174 maturity (a measure of whether the understanding of things is comprehensive and life events are
175 considered carefully), inquisitiveness (an instinct people have to be curious about the unknown), self-
176 confidence (having the ability to do a certain thing well or solve a certain problem), and justice
177 (conscious criteria for judging whether something is morally and legally fair) (Wen et al., 2009).

178 The CTDI-CV has generally been proven to be a reliable and valid instrument for assessing Chinese
179 students' CTDs (Wen et al., 2010a; Wen et al., 2010b; Wen et al., 2011). However, the CTDI-CV
180 has mostly been used for undergraduates or postgraduates and a preliminary analysis revealed that its
181 internal reliability in this study was not acceptable. Therefore, the instrument was slightly modified
182 for high school students to ensure its reliability and validity. Additionally, the reliability and validity
183 analyses for the modified CTDI-CV were checked by educators and experts at the School of
184 Educational Science in Minnan Normal University, China.

185 EAW and CTD

186 English argumentation is a "problem-solving" cognitive procedure, demanding self-regulation to
187 reach the author's targets (Graham & Harris, 1997), and critical thinking is "a purposeful, self-
188 regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as
189 explanation of the evidential, conceptual, methodological, criteriological, or contextual
190 considerations upon which that judgment is based" (Facione, 1990). Researchers includind ... have
191 posited that English writing as a cognitive process is indivisible from the cultivation of critical
192 thinking ability (Dong and Yue, 2015), and the research employing questionnaires and writing test
193 has shown that students' critical thinking abilities are related to on their English writing performance.
194 Therefore, improving the ability to think critically is essential for fostering English writing abilities
195 (Li et al., 2019).

196 Tian Dong and Lu Yue showed that students' English writing proficiency is strongly influenced by
197 their critical thinking skills, and the authors suggested that cultivating students' critical thinking skill
198 is necessary for improving their English writing competence (Dong and Yue, 2015). Since EAW
199 depends on the critical thinking ability to organize paragraphs and to reason, the cultivation and the
200 improvement of critical thinking abilities are crucial for argumentative writing (Li, 2015). However,
201 what is the relationship between them?

202 Based on an analysis of 181 prospective teachers from six different departments in Turkey, Bayat
203 found that the prospective teachers' critical thinking levels were related statistically significantly with
204 their academic writing success (Bayat, 2014). Similarly, a significant and positive relationship of ...
205 was found in China. Based on a study of 104 English major students, Afshar et al. established a
206 strong correlation between students' critical thinking skills and their English writing abilities (Afshar
207 et al., 2017). In addition, a significant relationship between the CTD and English writing has
208 regularly been reported.

209 McLean claimed that a negative CTD accounts for a low writing proficiency (McLean, 2005). A
210 study involving 73 senior English major students at a Shanghai university showed that the students

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Hence, try to avoid choppy sentences.

were weak in CTDs and had comprehension difficulties as well as in demonstrating in-depth rhetorical clarity in academic English writing. This result implied a correlation between students' CTDs and their English academic writing performance (Mu, 2016). Liu explored 120 postgraduate students majoring in English and found a significant positive correlation between students' CTDs and their academic English writing (Liu, 2018). A positive linear correlation has also been found between critical thinking and English writing among secondary school students. Jin also examined 211 grade 8 students' CTDs at the junior high school level and found that students demonstrated negative CTDs, which were positively correlated with their English writing achievements (Jin, 2021). Besides, Liu found a significant correlation between the CTDs of grade 12 students and their writing proficiency on English practical writing and continual writing tasks (Liu, 2021).

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Research questions

Although numerous studies have examined the link between critical thinking and English writing, the subjects-participants have mostly been undergraduate students, and little is known about the link in high school students. Additionally, few of the studies have focused on argumentative writing. Thus, to narrow this gap, the current researchers aimed to explore whether CTD is correlated with high school students' EAW performance. Hence, this study investigates-investigated eight CTD subscales as well as the relationship between EAW and CTD. The study aims-to discover ed CTD predictors of CTD for participants'-high school students' EAW abilities. Thus, Fthree specific questions are addressed in this study:

1. What are high school students' current CTDs in China?
2. Is there any significant relationship between high school students' CTDs and their EAW performance?
3. What are the predictors of the CTD on EAW performance?

The answers to the three questions will contribute to the knowledge of Chinese high school students' cognition and English learning status. In addition, it has implications for the enhancement of EAW teaching and learning in China.

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Besides, it should be also rephrased as:
"The findings of the current study will contribute to the knowledge of Chinese high school students' cognition and English learning status. In addition, it has implications for the enhancement of EAW teaching and learning in China".

Materials & Methods

Procedure and Participants

A sample of 189 students was-were taken from 189 students from a high school in Zhangzhou, China. All of them are-were from grade 12 students who and aged 17–18, because students at this grade level can write relatively complete EAW pieces and are more aware of critical thinking. Of the 189 questionnaires distributed to the students, 156 (84%) valid copies were returned.

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Hence, you better rephrase your sampling reasons.

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Commented [A22]: Are 89 and 67 percents or number of students?

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Of this sample, 81 (52%) were science students (whose subjects including who were learning physical, chemistry, and biology), and the other 75 (48%) were social science students (whose subjects-including who were learning politics, geography, and history). In terms of gender, there were 89 males (57.1%) and 67 females (42.9%). The participants' demographic distribution is presented in Table 1. The proportion of men (89) and women (67) among the respondents was uneven. One of the possible reasons may be that most of the science discipline classes have more male students in China.

249 Additionally, students were given 40 minutes to write a 120-word English argumentative essay on
250 the same topic, "No smoking in public places?". The average of the two scores was taken as the final
251 score for the EAW performance. Two experienced English teachers from Minnan Normal University
252 scored the tests in two separate rooms to ensure the process was transparent. The teachers have taught
253 and studied English writing for over 3 years and were well familiar with Wen's ECEAW. More to the
254 point, to ensure the authenticity and reliability of the scoring results, the researchers, with the help of
255 a head teacher from Minnan Normal University, trained the two teachers. After scoring, the two
256 teachers cross-checked all the scores, which the head teacher then rechecked. This triangulation
257 process ensured the reliability of the final scores. Table 2 presents the descriptive statistics of the
258 final EAW scores.

259 **Measures**

260 A correlational research design was adopted ~~for the study to explore the relationship between the~~
261 ~~CTD (independent variable) and EAW (dependent variable). The CTDI-CV and the ECEAW were~~
262 ~~used as measures of ... for the study because ...~~ All 189 high school students were selected for the
263 research. We purposefully chose this research design ~~to explore the relationship between the CTD~~
264 ~~(independent variable) and EAW (dependent variable). The CTDI-CV and the ECEAW were used as~~
265 ~~measures of ... for the study.~~

266 **CTDI-CV**

267 The CTDI-CV was adapted by Wen (Wen et al., 2009) from the CCTDI (Facione,1992) and has
268 been widely applied in the Chinese context (Jin, 2021; Li, 2011; Ruan, 2012; Li, 2018; Lu, 2020),
269 mainly in studies involving English learners. Sample items include, analyticity ("I like to analyze
270 complex problems methodically."), truth-seeking ("I don't want to choose between multiple
271 controversial views."), open-mindedness ("I stand by my opinion and no one has the right to ask me
272 for reasons."), systematicity ("My decisions are less susceptible to outside interference."), cognitive-
273 maturity ("The best basis for arguing for an opinion is how you feel at the time."), inquisitiveness
274 ("Working hard to solve complex problems is a joy."), self-confidence (" I can come up with
275 creative solutions..").

276 **ECEAW**

277 The ECEAW was determined by Wen and used to measure students' EAW proficiency and was
278 divided into five levels (i.e., best, good, moderate, poor, and bad) according to four parameters (i.e.,
279 relevance, explicitness, coherence, and sufficiency) accompanying the supposed four thinking stages
280 in English writing: topic comprehension, thesis statement development with supporting arguments,
281 organizing coherent discourses, and putting ideas into writing (Wen and Liu, 2006). Table 3 provides
282 the ECEAW details.

283 **Data analyses**

284 The data analyses were performed using SPSS ~~version 23, from~~ IBM. Chinese high school students' |
285 CTDs were approached using a descriptive statistical analysis, which illustrated the students' CTDs
286 and eight subdispositions. Next, the relationship between the students' CTDs and their EAW was
287 explored through a Pearson correlation analysis, which was followed to determine whether there was
288 any significant correlation between the students' EAW proficiency and their CTDs as well as its
289 eight dimensions. Last, since the CTD has eight subscales, to reduce interference between the
290 variables, multiple regression analyses were conducted to examine the prediction of the students'

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3 years = Experienced; the two teachers do not seem that much experienced in teaching.

How is there educational qualification – BA, MA, PhD, Associate Professor? Or, what?

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Commented [A27]: Choppy or too short sentences are not often engaging to readers, and decreases the quality of articles.

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291 CTDs subdispositions and their writing proficiency on English argumentation. The prediction of the
292 different CTD dimensions for argumentative writing was explored in the regression analysis in detail.

293 During data screening, 33 questionnaires ~~were found to be~~ incomplete and were thus removed. The
294 instrument's face and content validity were ensured by educational experts from the School of
295 Educational Science in Minnan Normal University, China. The data's internal reliability was
296 determined by calculating Cronbach's α coefficients, and the construct validity was verified by
297 conducting an EFA using SPSS package.

298 **Ethical Concerns and Consent Detail**

299 Ethics committee approval was obtained from Zhejiang Normal University's institutional review
300 board. The ethical principle of informed consent was upheld: each participant in the questionnaire
301 was informed in advance of what was to be studied, and its possible benefits and impacts. All were
302 informed of their right to withdraw their agreement to participate at any stage before the study was
303 published. Finally, ~~we the researchers~~ upheld the right to privacy by preserving the participants'
304 anonymity at all points in the research process, ensuring that the publication of the research would
305 not result in any conflicts of interest.

306 The two instruments involved in this study named ~~The~~ Chinese version of California Critical
307 Thinking Disposition Inventory (CCTDI-CV) and Evaluation Criteria for English Argumentative
308 Writing (ECEAW) ~~were used to~~ The authors have permission to use this instrument from the
309 copyright holders/authors.

Commented [A30]: What were the purposes of these two instruments?

Commented [A31]: Are you sure? Let you be!

310 **Results**

311 **Construct Reliability and Validity**

312 Harman's single-factor test had an explanatory variance for the first common factor of 25.76% >
313 40%, confirming no evidence of common method variance. Regarding the CCTDI-CV questionnaire,
314 eight subdispositions had 54 items, measuring the following subscales: analyticity (7 items), truth-
315 seeking (7 items), open-mindedness (7 items), systematicity (6 items), cognitive maturity (8 items),
316 inquisitiveness (6 items), self-confidence (7 items), and justice (6 items). Each item was rated on a
317 six-point scale of "strongly agree" (6), "agree" (5), "somewhat agree" (4), "somewhat disagree" (3),
318 "disagree" (2) and "strongly disagree" (1), and the total scores of the CCTDI-CV were between 54 and
319 324. ~~Unloaded items~~ were removed in the exploratory factor analysis (EFA) and the remaining items
320 were retained for all eight factors. The items in systematicity, inquisitiveness, and justice remained
321 the same. However, analyticity, open-mindedness, and self-confidence decreased to six items, and
322 truth-seeking and cognitive maturity decreased to five items.

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323 ~~We analyzed~~ The instrument reliability ~~was analyzed~~ using Cronbach's alpha, and the eight
324 subscales in CTD showed reliability scores of 0.73, 0.71, 0.74, 0.70, 0.80, 0.72, 0.81, and 0.79. As all
325 reliability scores were beyond the 0.7 threshold, the constructs were determined to be reliable
326 (Hancock, 2013; Saleem et al.; Byrne, 2016).

327 Next, construct validity ensured the questionnaire's validity. The six factors were generated using an
328 EFA. The results showed that the validity was acceptable (Kaiser-Meyer-Olkin test = 0.629 > 0.6;
329 Bartlett's test of sphericity: $\chi^2 = 2665.49$, $df = 1431$, $p < 0.01$; factor loadings for all factor's items:
330 0.68~0.81; total variance: 66.39 %, eigenvalue >1). Thus, the tool was reliable and valid.

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331 **Descriptive Statistics and Correlations**

332 Table 4 presents the descriptive statistics of the students' CTDs and the eight elements. Overall, the
333 students' CTD was positive ($M=4.08>4$). Among the eight dimensions, inquisitiveness ($M=4.41$,
334 $SD=5.13$) scored the highest, while self-confidence ($M=3.62$, $SD=4.88$) scored the lowest.
335 ~~Additionally Besides~~, the students scored higher on justice ($M=4.38$, $SD=4.05$), cognitive maturity
336 ($M = 4.36$, $SD = 5.12$), open-mindedness ($M=4.32$, $S=4.66$) and truth-seeking ($M = 4.02$, $SD =4.35$)
337 but lower on analyticity ($M = 3.91$, $SD = 4.07$) and systematicity ($M = 3.63$, $SD = 4.80$). The results
338 also showed that 5 dimensions (inquisitiveness, justice, cognitive maturity, open-mindedness, and
339 truth-seeking) had positive traits, while 3 dimensions (analyticity, systematicity, and self-confidence)
340 had negative traits.

341 The Pearson Correlation analysis revealed that the CTD and EAW were significantly moderately
342 correlated ($r=0.543$, $p<0.01$). ~~Additionally In addition~~, EAW proficiency was significantly
343 positively correlated with four CTD subscales: cognitive maturity($r=0.529$, $p<0.01$), truth-
344 seeking($r=0.416$, $p<0.01$), analyticity($r=0.348$, $p<0.01$), and justice($r=0.185$, $p<0.05$). EAW
345 proficiency was not significantly correlated at the $p=0.05$ level with inquisitiveness ($r=0.333$),
346 systematicity ($r=0.856$), self-confidence ($r=0.067$), and open-mindedness ($r=0.888$). ~~The Pearson~~
347 ~~correlation also shows that there were~~ Some insignificant associations among ... ~~were also found as~~
348 ~~it is depicted in~~ ~~Table 5 shows the detailed results on Pearson correlation.~~

Commented [A34]: associations among what?

349 ~~In the part of~~In line with the prediction of the CTD on EAW performance, a multiple regression
350 analysis is carried out to examine the extent to which the CTD can significantly predict EAW
351 proficiency. ~~In this analysis As it is presented in Table 6~~, eight CTD subscales were the independent
352 variables and EAW proficiency was the dependent one. ~~Table 6 shows the results~~VIF results stated
353 in table 6 show no evidence of collinearity. The R-square (R^2) of .436 and adjusted R-square (R^2) of
354 .405 revealed four CTD subscales: cognitive maturity, truth-seeking, analyticity and justice
355 accounted for 43.6% of the variance in EAW proficiency. The standardized regression coefficients
356 (Beta) of 0.419, 0.257, 0.231 and 0.143 for cognitive maturity, analyticity, truth-seeking and justice,
357 respectively, indicate that the four subscales significantly and positively predicted students' EAW
358 performance ($p<.05$). This finding implies that high school students' EAW performance can be
359 explained by the subdispositions of cognitive maturity, analyticity, truth-seeking and justice, among
360 which cognitive maturity($Beta=.419$) strongly predicts EAW proficiency. The analysis indicates the
361 following regression equation for the dependent and independent variables: "EAW proficiency =
362 $10.266 + 0.419 * \text{cognitive maturity} + 0.257 * \text{analyticity} + 0.231 * \text{truth-seeking} + 0.143 * \text{justice}$ ".

Commented [A35]: Such too short sentence is not advisable in academic writing.

Commented [A36]: This sentence also should be linked with other sentences using linking words and phrases.

363 **Discussion**

364 EAW performance is a major topic of interest in English teaching and learning, particularly in
365 China's high schools. The present study ~~explores-explored~~ the current CTD of Chinese high school
366 students and the relationship between that and their EAW performance. The study also ~~tried to~~
367 ~~identify-identified~~ the CTD subdispositions that are positively related to and the main predictors of
368 the high school students' EAW performance in China. Additionally, the study adds fresh evidence
369 about the Chinese version of the CCTDI when applied in a non-Western context.

370 The results showed that the high school students' CTDs were overall positive ($M=4.08$), ~~that is~~ in
371 line with Zhou et al., who examined the CTD of 121 grade 12 students in YuJin High School
372 ($M=4.23$) (Qing et al., 2010), and Li, who found a positive disposition in grade 11 high school
373 students ($M=4.095$) (Li, 2021). These results might reveal that high school students' CTDs have not
374 improved dramatically during the past decade. However, after 3 years' further study in university, the

375 students' CTD scores tended (M=4.289) (Liu, 2018). This finding, therefore, contradicts Jin's finding
376 that junior school students' CTD at grade 8 is overall negative (M=3.52) (Jin, 2021). One possible
377 reason is that the CTD is enhanced with age and learning, since the CTD is a psychological attribute
378 that shapes one's beliefs or actions (Profetto-McGrath et al., 2003) enabling individuals to
379 sufficiently solve problems and to make judgments as a product of thinking (Facione, 2007).

380 Compared with the CTD scores from other Asian and Middle Eastern countries—such as Israel
381 (M=4.02) (Ben-Chaim et al., 2000), Turkey 3.25±0.27 (Kaya et al., 2017), and Japan (M=3.91)
382 (Kawashima and Petrini, 2004)—the result of this study is relatively high (M=4.08), and close to
383 some developed countries such as Australia (M=4.11) (Tiwarei et al., 2003) and Italy (M=4.10)
384 (Zoller et al., 2010). This finding may partly challenge the statement that students from Asian
385 societies (vs. those from non-Asian ones) are less inclined to demonstrate CTDs (Wang et al., 2019).
386 However, room remains for improvement in comparison with other developed countries such as
387 Norway (M=4.72) (Wangensteen et al., 2010) and America (M=4.33) (Yeh et al.).

388 The current study reported a moderate relationship ($r=0.543$, $p<0.01$) between students' CTD and
389 their EAW performance. These findings confirm those of earlier studies, such as Li (2021), Liu
390 (2021) and Jin (2021). One possible reason is that the CTD correlates significantly with the total
391 content knowledge resources and presentation strategies of English writing (Yeh et al.). This finding
392 indicates that participants-students with stronger CTDs have wider content knowledge resources and
393 presentation strategies, which are essential for good EAW performance. And among the eight
394 subscales of CTD, cognitive maturity, truth-seeking, analyticity, and justice have positive correlation
395 with EAW. Interviews from previous studies help to explain the results. According to the interviews,
396 students who score highly on the CTDs perform better on the four thinking stages involved in EAW
397 i.e., topic comprehension, thesis statement development with supporting arguments, organization of a
398 coherent discourse, and putting ideas into writing (Liu, 2021). For instance, understanding the task
399 topic refers to the process of understanding concepts and judging the relationships among them. This
400 process may involve the abilities of cognitive maturity and analyticity, since the former can help
401 writers better understand the meaning of the title while the latter enables students to judge the
402 relationships among concepts faster. Regarding developing a thesis statement with supporting
403 arguments, which is central to writing, this process it is greatly influenced by the dispositions of
404 truth-seeking and justice. The desire to seek the truth and explore the essence of things could drive
405 students to carefully observe their surroundings, from which EAW's supporting arguments are
406 usually derived. Moreover, the sense of justice could hone students' abilities draw distinctions, a skill
407 that might allow them to perceive or draw conclusions after thinking deeply about some social
408 phenomena in daily life, and this process could be converted into a central EAW thesis statement.
409 Meanwhile, the dispositions of systematicity, self-confidence, and open-mindedness might have
410 some effects on EAW that are not directly relevant, as they were not significantly correlated at the
411 0.05 level. The disposition of inquisitiveness, which refers to 'an instinct that people are curious
412 about the unknown' (Wen et al., 2009), might help to expand students' knowledge reservoirs, but it
413 does not help them to focus on exercising logical and critical thinking abilities. As a result, it had an
414 insignificant relation with EAW performance.

415 The four related subscales (cognitive maturity, analyticity, truth-seeking and justice, respectively),
416 were proved also have prediction on EAW proficiency. The other four subscales—inquisitiveness,
417 systematicity, self-confidence, and open-mindedness—were not predictors, perhaps because they are
418 not significantly related to EAW. The reason cognitive maturity, truth-seeking, analyticity and justice
419 are significantly correlated and positively predictive of EAW might be discussed in the context of the
420 definitions of these four subdispositions and the EAW writing process. Cognitive maturity refers to

Commented [A37]: This paragraph is interesting for it compares the current findings with other findings all over the world. However, it would be more comprehensive if relevant studies from Africa are incorporated.

Commented [A38]: Needless to say. It is obvious that interview results substantiate other results of other instruments.

Commented [A39]: I thought that researchers should be quite sure on their findings.

421 'a measure of whether the understanding of things is comprehensive and life events are considered
422 carefully', and truth-seeking is defined as 'the desire to seek the truth and to explore the essence of
423 things' (Wen et al., 2009). Persuasive English argumentation requires an individual to 'find the
424 essence of the topic' and to relate convincing subarguments and examples gleaned from the
425 'comprehensive and thoughtful understanding of things in life'. On the other hand, analyticity is
426 defined as 'the ability to independently and objectively analyze life problems and to foresee the
427 outcome or consequences of an event based on facts' (Wen et al., 2009), which is required
428 throughout the argumentative writing process, specifically during the layout process. Justice is
429 defined as 'conscious criteria for judging whether something is morally and legally fair' (Wen et al.,
430 2009), and do help provide arguments in EAW writing, since the sense of justice can promote
431 students to observe things around them objectively.

432 Additionally Besides, a prominent feature of writing from the cognitive perspective is problem-
433 solving (Graham and Harris, 1997), which is regarded as crucially important and thought to
434 positively affect EAW performance. Thus, a student with high CTD scores is expected to better gain
435 the essence of the argumentative topic and comprehensively analyze the topic in a piece of EAW.
436 According to this, we argue that cognitive maturity, truth-seeking, and analyticity, as the CTD
437 components, could be strong EAW predictors. Therefore, it might be helpful to enhance these CTDs
438 to develop better EAW performance, since these were found to be linked to success in English
439 argumentation.

440 Conclusion and implications

441 EAW teaching and learning has been of prime importance for English education in China, since
442 EAW performance is currently significant on both international and domestic English language
443 proficiency tests. To discover the predictive influencing factors on EAW proficiency improve EAW
444 performance, this study explored the relationship between the CTD (independent variable) and the
445 EAW (dependent variable) proficiency of high school students with an emphasis on the CTD
446 subscales. High school students' CTDs were overall positive, and students' EAW performance
447 correlated significantly with the overall CTD and its four subdispositions of cognitive maturity, truth-
448 seeking, analyticity, and justice. Furthermore, among the eight CTD subscales, only four dispositions
449 (cognitive maturity, truth-seeking, analyticity and justice) showed a significantly predictive validity
450 on EAW performance.

451 The findings showed that Chinese high school students generally have positive CTDs, i.e., they
452 perform well on the abilities of analyticity, truth-seeking, systematicity, open-mindedness, cognitive-
453 maturity, inquisitiveness, self-confidence, and justice. In addition, their CTDs have been proven to be
454 related to their performance on EAW. Specifically, their dispositions on cognitive maturity, truth-
455 seeking, analyticity, and justice are related to their EAW proficiency score. A further analysis
456 revealed that Chinese high school students' EAW performance can be predicted by their abilities in
457 terms of cognitive maturity, truth-seeking, analyticity and justice. These results convey clear
458 messages for how to improve EAW teaching and learning in Chinese high schools.

459 Primarily, in line with previous study findings in China (Sun, 2020; Ren, 2020), instructors in China
460 should be concerned about students' CTDs, since students from China and other, more developed
461 countries continue to have a gap. Secondly, a significant and positive correlation was found
462 between EAW and CTD as well as its subdispositions—such as cognitive maturity, truth-seeking,
463 analyticity, and justice—which has been confirmed in previous studies (Han, 2020; Feng, 2021).
464 Therefore, instructors should provide clear CTD definitions for students and strengthen their critical

Commented [A40]: However, it is not clear that why the study relied on cognitivism. The reason should be explained in the introduction section of this manuscript.

Commented [A41]: "might be"
Unless the researchers are not sure on their findings, how readers could believe and accept the results of the study.

Commented [A42]: This expression seems overgeneralization. Hence, it seems that ALL Chinese high school students. Do you think that the samples are representative to all Chinese high school students? I do not think so?

465 thinking awareness. Lastly, teachers are urged to conduct suitable CTD training, especially on the
466 four predictive subdispositions (i.e., cognitive maturity, truth-seeking, analyticity and justice), which
467 could foster and facilitate four thinking stages involved in EAW and directly improve high school
468 students' EAW performance.

469 EAW is included as a prompt in the writing sections of some international standardized English
470 exams (e.g., TOEFL and IELTS) and English for Specific Purposes exams, which necessitate
471 argumentative writing. Additionally Besides, EAW is a crucial skill in China because Teachers
472 of English writing in high school should focus on students' critical thinking and help them do a better
473 job of analyzing the topic, establishing a layout, and organizing and writing argumentation logically,
474 especially because EAW skills increasingly play crucial roles in students' general academics at all of
475 their study levels (Németh and Kormos, 2001).

Commented [A43]: Why is it a crucial skill? Explain the reason to convince your readers.

476 Limitations

477 Although the present study yields, three limitations, which also point the way to future work, need to
478 be addressed. This study is limited in ... First, the present study is limited to a developing, non-
479 Western, Asian high schools. Second, the current study is limited to the CTD, and other critical
480 thinking aspects such as thinking skills have yet to be explored. Including additional Incorporating
481 other critical thinking variables in future studies could generate insightful results in future studies.
482 Third, because of unknown factors regarding the participants' background information, the possible
483 differences caused by years of study or other demographic factors were not been examined, a
484 problem that could be resolved in future research.

Commented [A44]: This sentence is not complete, and it is not relevant to the paper. You better remove it.

Commented [A45]: It is also my question. The participants' background information is collected for this study but not linked with the major research variable, critical thinking. Why is it?

Hence, years of study and other demographic factors should be examined and reported in this study. If not, the demographic data should be removed from the paper because it is incorporated in the study for nothing.

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Commented [A46]: It could be more comprehensive if relevant studies from Africa are also referred.

GOOD LUCK!