The relationships between bilingual learning, willingness to study abroad and convergent creativity

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Abstract

Convergent creativity is a form of creative thinking that uses existing knowledge or traditional methods to analyze available information and generate an appropriate solution. The differences in the performance of participants in convergent creativity caused by bilingual learning is a popular research area in creativity. A final sample of 68 participants was asked to complete the remote associates test (RAT). The results indicate that a moderate positive correlation exists between bilingual learning and convergent creativity. Students who want to study abroad perform better on the RAT than those who do not want to study abroad, and this effect is mediated by second language proficiency. These findings suggest that improving students' English proficiency and increasing their opportunities to study abroad are effective ways to promote convergent creativity.

Keywords: Convergent creativity, Insight, Language, Overseas experiences

Introduction

Creativity is defined as the ability of a group or individual to generate original and appropriate problem solutions (Runco, 2007; Moraru, Memmert, & van der Kamp, 2016). Creativity is an advanced expression of human intelligence and plays an important role in scientific creation, social progress and technological innovation. Guilford (1967), a past president of the American

38 Psychological Association, noted that creativity mainly includes divergent creativity and
39 convergent creativity. The former refers to how individuals generate new information and produce
40 a wide variety of outputs from the same source in a novel way. Divergent creativity is mainly
41 evaluated by tasks such as the Torrance Test of Creative Thinking (TTCT) (e.g., Humble, Dixon,
42 & Mpofu, 2018) and the Alternative Uses Test (AUT) (e.g., Hao, Xue, Yuan, Wang, & Runco,
43 2017). In contrast, convergent creativity refers to the cognitive process in which individuals use
44 existing knowledge or traditional methods to analyze given information and obtain the best answer
45 (Lee & Therriault, 2013; Ritter, Abbing, & Van Schie, 2018). The processes of convergent
46 creativity include evaluation of the divergent creativity stage and the selection of ideas, or a full
47 range of phases ranging from evaluation to implementation (Coursey, Williams, Kenworthy,
48 Paulus, & Doboli, 2018). In real life, many different tasks rely on the use of convergent creativity
49 because this type of creativity is part of creation, and the skillful use of convergent creativity can
50 be critical for creative idea production (de Vries & Lubart, 2017). The emphasis on convergent
51 creativity is largely attributed to Simon's study investigating problem solving and the application
52 of Mednick's study on the RAT (Shen, Liu, Shi, & Yuan, 2015). Currently, convergent creativity
53 is primarily measured by tasks such as classical insight problems (e.g., Chein, Weisberg, Streeter,
54 & Kwok, 2010) and the RAT (e.g., Shen, Yuan, Liu, & Luo, 2016). The RAT was used as the
55 experimental material in this study, which originated from the theoretical model proposed by
56 Mednick in 1962 about the relationship between associative behavior and creativity (Benedek &
57 Neubauer, 2013). Guilford highlighted the importance of divergent creativity, which has led
58 convergent creativity to be overlooked. Although convergent creativity has long been on the
59 outskirts of creative research, with the rapid development of research on brain-based insight, an
60 increasing number of scholars have begun to pay attention to this important issue (Shen et al.,
61 2015).

62 Accompanying the development of globalization and international trade, cultural migration and
63 exchange activities such as immigration, transnational study, and multilanguage learning have
64 become increasingly frequent (Cheng & Leung, 2013; Shen & Yuan, 2015). In different countries,
65 people need to understand and absorb different local cultures and accept the influence of different
66 cultures, which might be an important requirement for people to adapt to the rapid development of
67 modern society. Thus, cultural activities have an impact on people's ways of thinking.

68 Rohan, a young entrepreneur mentioned in Tadmor, Galinsky and Maddux's study (2012), lived
69 in five different countries. Rohan stumbled upon some cocoa plantations in Mexico and became
70 fascinated by them. Subsequently, in France, Rohan discovered a chocolate shop that inspired his
71 imagination. Using Aztec-themed designs, Rohan organically combined the pre-Hispanic roots of
72 cacao and the chocolate products that we currently consume. This example highlights how
73 multicultural experiences and exposure to new cultures inspire new ideas. Multicultural
74 experiences refer to all direct and indirect experiences of contact or interaction with elements
75 and/or members of foreign cultures (Hu, Gu, Liu, & Huang, 2017); such experiences can facilitate
76 the performance of individual creativity by improving individual enlightenment learning, distance
77 imagination and concept formation and by generating novel ideas through unfamiliar culture
78 (Wang & Wang, 2018). Under these circumstances, individuals draw new ideas from different

cultures and integrate them in novel ways in problem-solving scenarios. Integrating seemingly unrelated concepts in different cultures helps to extend the conceptual category in the brain (Maddux, Adam, & Galinsky, 2010; Wang & Wang, 2018). Shen and Yuan (2015) summarized Maddux's and other scholars' studies (de Bloom, Ritter, Kühnel, Reinders, & Geurts, 2014; Fee & Gray, 2012; Maddux & Galinsky, 2009; Yi, Hu, Scheithauer, & Niu, 2013) and concluded that both long-term and short-term multicultural experiences can boost individual creativity and that improvement in cognitive fluency is among the most obvious outcomes (Shen & Yuan, 2015). There are two main reasons for this phenomenon: on the one hand, they have a wide understanding of different cultures, so that people with multicultural experiences can better establish connections between different ideas from different cultural sources. On the other hand, extensive exposure to different cultures can sometimes produce conflicting views. This helps multicultural individuals overcome fixed cognition, eliminate the structured and conventional methods of addressing problems, and stimulate creative thinking (Cheng & Leung, 2013). In addition, when individuals are exposed to foreign cultures with a learning mindset, they might elicit a comprehensive emotional response, such as the recognition of some excellent qualities or admiration for some achievements in foreign cultures, which can also enhance creativity (Cheng, Leung, & Wu, 2011). In conclusion, in this era of globalization, multicultural experiences will bring important cognitive benefits (Cheng et al., 2011; Wang & Wang, 2018).

Most existing studies have shown that the length of time people have lived abroad and their overseas experiences can predict their creative ability (Maddux & Galinsky, 2009). However, some studies have found that a certain proportion of those who travel abroad fail to achieve success in the new culture (e.g., Mendenhall & Oddou, 1985; Wederspahn, 1992). While some scholars believe that these failures may be due to the lack of adjustment or psychological discomfort experienced when living abroad (Maddux & Galinsky, 2009), evidence regarding the relationship between adjustment and performance is contradictory (Tadmor et al., 2012). One potential reason is the willingness to study or stay abroad. Some individuals might have no willingness to study or stay abroad (a lack of openness to new countries, cultures, or things) even if they are in foreign countries. Undoubtedly, many people, including students, teachers, and technicians, plan to study abroad but are still in the process of preparation. As Figure 1[1] reported, with the development of society, more and more people have the opportunity to study abroad, it can be inferred that people increasingly study or plan to study abroad for further study (Li & Sun, 2018). The intention to study abroad may have an impact on creativity, and students who have plans to study abroad usually have better creative performance than those who do not have such plans (Lee, Therriault, & Linderholm, 2012). However, few studies to date have explored this interesting issue. Based on existing studies, we are inclined to support the results of Lee and colleagues (2012).

Figure 1.

The main reason for this hypothesis is that students who want to study abroad to study or work in China must improve their English proficiency. Many studies have confirmed that bilingual

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[1]The data were collected from the National Bureau of Statistics of China (http://www.stats.gov.cn/).

117   learning can promote creativity (e.g., Cummins, 1979; Hommel, Colzato, Fischer, & Christoffels,
118   2011; Wang & Cheng, 2016). From the perspective of students' creativity in English learning,
119   English proficiency is the most important factor that determines students' ability to create in
120   English (Wang & Cheng, 2016). In fact, many early studies confirmed the influence of second
121   language proficiency on creativity in children. Kharkhurin (2011) used thirteen examples from
122   1966 to 1999 to illustrate that bilingual children outperformed monolingual children in divergent
123   thinking traits such as fluency, flexibility, elaboration, and originality. Similarly, the effect of
124   second language proficiency on creativity has been supported by some studies involving adults.
125   For example, the performance of bilingual college students on the Abbreviated Torrance Test of
126   Russian-English was better than that of English monolingual college students (Kharkhurin, 2010).
127   This phenomenon is not confined to one country; in the United Arab Emirates (UAE), Farsi-
128   English bilinguals revealed advantages in originality in thinking compared to native speakers from
129   the same educational group (Kharkhurin, 2009). The Chinese scholar Ni (2012) combed through
130   previous studies on the relationship between bilingual learning and creativity and suggested that
131   students with a higher second language proficiency, earlier exposure to a second language and
132   greater length of exposure to a second language have significantly improved creativity, such as in
133   insightful problem solving (IPS).

134   Prior studies have attempted to research creativity as a behavior resulting from an interaction
135   among cognitive abilities, individuality, and social environment, but few studies have examined
136   the role of socioeconomic status (SES), such as family income, in creative thinking (Parsasirat et
137   al., 2013). Recently, some scholars have begun to explore the relationship between family income
138   and creativity. For example, Kim and Lee (2015) reported that children from low-income families
139   have fewer opportunities to engage in scientific experiences than other children; however, through
140   creative science activity programs, their scientific attitude, self-esteem and self-efficacy will be
141   significantly improved. SES is an important factor in the educational environment, and it is one of
142   the crucial elements that influence creativity. SES can promote children's creative thinking as early
143   as the age of 6 (Jankowska & Karwowski, 2018). Castillo-Vergara, Galleguillos, Cuello, Alvarez-
144   Marin and Acuña-Opazo (2018) investigated students from 75 educational institutions through
145   Quality and Educational Context Questionnaires to determine the SES; these questionnaires were
146   mainly used to determine the education level of the students' parents and the monthly income of
147   their family. They also used the Multifactorial Evaluation of Creativity (EMUC) test to measure
148   the performance of creativity including fluency, flexibility, and originality. The results showed
149   that as the socioeconomic level increases, the ability to innovate increases. Similarly, Sánchez and
150   Salinas (2008) suggested that people with the highest SES levels perform better in the language
151   arts, mathematics, and science while low-income groups show the opposite results. Based on the
152   above research, it can be speculated that good economic conditions in a family are a key factor in
153   promoting the development of creativity or that a good environment is at least a contributing factor.
154   Undoubtedly, in mainland China, a stable income is necessary for studying abroad.

155   Since the reform and opening-up, China's economy has developed rapidly, and a booming
156   economy has emerged. Meanwhile, with strong economic support, the government has paid
157   increasing attention to cultivating high-quality innovative students. Thus, the state intends to

158 improve students' creativity and academic performance through international exchange.
159 Therefore, it can be inferred that people increasingly study abroad or plan to study abroad for
160 further study.
161 In recent decades, the relationship between bilingualism and cognitive ability has become a
162 popular topic in pedagogy and psychology. Bilingualism not only plays an important role in cross-
163 language communication but also fulfills social culture and psychological cognitive functions.
164 Alesina, Harnoss and Rapoport (2016) noted that bilingual teaching and multicultural experiences
165 do not burden learners or hinder their growth. In contrast, bilingual teaching and multicultural
166 experiences are necessary cultural, economic, and political resources for both the country and the
167 individual. Although the influence of bilingualism on creativity has been studied in depth, few
168 studies have focused on the exploration of convergent creativity. Therefore, this study aimed to
169 examine the impact of bilingual learning and willingness to study abroad on convergent creativity
170 based on previous research.

171 ## Materials & Methods

172 ### Participants
173 In total, 76 healthy undergraduates (35 male; age_M=20.32 years, age_{SD}=2.10 years) participated
174 in this study. Of the participants in this experiment who spoke Chinese as their first language, 66
175 (86.8%) participants spoke one foreign language (English), 8 (10.5%) participants spoke two
176 foreign languages, 2 (2.6%) participants spoke three foreign languages, and all participants spoke
177 English as a second language. Eight of the 76 participants were excluded from the data analysis
178 (10.53%) for the following reasons: one participant did not provide thoughtful responses to the
179 RAT problems, and the other participants required longer than 20 s to answer one of the RAT
180 problems. A final sample of 68 (32 male; age_M=20.37 years, age_{SD}=2.18 years) participants was
181 used in this study, including 28 students who planned to study abroad and 40 students who did not
182 want to study abroad. All participants had normal or corrected-to-normal vision and had no
183 experience with any similar experiments. Before the experiment, the participants provided written
184 informed consent, and they received RMB 10 Yuan at the end of the study. The study was approved
185 by the Ethics Committee of Human Research Protection of Hohai University.

186 ### Materials
187 ### Convergent creativity task
188 According to Mednick's model, convergent creativity is primarily measured by the RAT; highly
189 creative people show higher associative fluency, and they perform better on the RAT (Benedek &
190 Neubauer, 2013; Shen et al., 2016a). A typical RAT contains three unrelated words (e.g.,
191 rat/blue/cottage), and participants are asked to find a fourth word (e.g., cheese) that serves as an
192 associative link to the stimulus test (Benedek & Neubauer, 2013). In this study, 53 Chinese RAT
193 problems (Shen et al., 2016a; Shen et al., 2019) were used as the experimental materials, including
194 five problems (two difficult and three simple problems) that were used during the practice session.
195 Forty-eight problems, including 24 difficult and 24 simple problems, were used in the formal
196 experiment. These problems can occasionally lead to feelings of insight depending on the
197 participants' judgment. Each item contained three different Chinese words (命/男/学, i.e.,

198 destiny/male/learning in English) that prompted the participants to respond with a single solution
199 character (生, i.e., person in English). The complete solution consisted of three Chinese phrases
200 (生命/男生/学生, i.e., life/men/student in English); participants can get one point for each correct
201 answer (up to 48 points). The higher the score is, the better the performance of divergent creativity.
202 The Cronbach's α of this test was 0.92, indicating strong internal reliability (Shen, Yuan, Liu, Yi,
203 & Dou, 2016). Furthermore, this test has been used in many studies (e.g., Shen et al., 2016a; Shen
204 et al., 2016b), indicating it has good external validity. During this test, the provided problems
205 (horizontally placed) and their corresponding solutions appeared in the center of the screen with
206 boldface 24 and black on gray.

207 **Bilingual Proficiency and Overseas Experience Questionnaire**

208   This questionnaire included 14 items regarding the basic information of the participants, such
209 as their experiences with learning a foreign language, experiences with studying abroad, plans to
210 study abroad, parents' overseas experiences, and monthly household income. The main purpose
211 of this questionnaire was to collect basic information about the participants, especially regarding
212 their intention to study abroad and second language proficiency. Each item required the
213 participants to choose the most suitable option from the choices given. The item regarding second
214 language proficiency, which had a total of five options ranging from very proficient (1) to not
215 proficient (5), was emphasized. According to the Chinese English Scale (CES) (brought forward in
216 *The Results of Linking IELTS and Aptis to China's Standards of English Language Ability Press*
217 *Conference*), the participants provided detailed explanations to the experimenter before the test. If
218 the participants' International English Language Testing System (IELTS) score was greater than
219 7.5 or passed College English Test-8 (CET-8) (mastering approximately 8,000 words), option 1
220 was selected; if the participants had an IELTS score greater than 6.5 or passed College English
221 Test-7 (CET-7) and had mastered approximately 7,000 words, option 2 was selected; if the
222 participants passed College English Test-6(CET-6) or College English Test-4 (CET-4) (mastering
223 approximately 5,000 words), option 3 was selected; if the participants learned English in primary
224 school but had not passed CET-4, option 4 was selected (mastering approximately 2,000 words);
225 and if the participants only knew a few English words (fewer than 500), option 5 was selected
226 (e.g., Schachter, Kimbro, & Gorman, 2012; Müller, 2016). In special cases, if the participants
227 found it difficult to judge their English level, their English level was assessed by a vocabulary test
228 (Hommel et al., 2011). In this study, the participants were able to clearly determine their second
229 language proficiency (all Chinese college students are required to take different English language
230 tests). Thus, the participants did not take the vocabulary test.

231 **Positive and Negative Affect Scale (PANAS)**

232   To exclude potential interference by pre-experimental emotions in the results, the Positive and
233 Negative Affect Schedule (PANAS–State) (Watson, Clark, & Tellegen, 1988) was used. The
234 PANAS contains 20 one-word adjective items reflecting positive affect (PA) and negative affect
235 (NA), and each subscale includes 10 (positive/negative) items (Watson et al., 1988). There was no
236 correlation between the PA and NA subscales (r=0.14), which corroborates the results reported in
237 previous studies (e.g., Heubeck & Wilkinson, 2019; Leue & Beauducel, 2011). The respondents
238 were asked to rate the items on a 5-point Likert-type scale (1=very slightly or not at all to

239 5=extremely). The alpha coefficients of the overall scale, the PA subscale, and the NA subscale
240 were 0.86, 0.81, and 0.91, respectively.

241 **Creative Self-Efficacy Instrument**

242 To rule out the possible impact of creative self-efficacy on the results of the RAT, this study
243 used a four-item Creative Self-efficacy Instrument (Tierney & Farmer, 2002) measured on a scale
244 ranging from 1 (strongly disagree) to 7 (strongly agree). A sample item was "Suggests new ways
245 of performing work tasks". In a study conducted by Tierney and Farmer, this instrument showed
246 a good level of reliability (manufacturing, α=0.83; operations, α=0.87). In this study, the
247 Cronbach's α was 0.85.

248 **Procedures**

249 The participants required approximately 30 minutes to finish the experiment. First, the
250 participants completed a questionnaire about their basic information according to their actual
251 situation. After this section, the participants were asked to complete the PANAS based on their
252 current mood. Finally, the participants responded to the RAT problems, which were designed and
253 presented by E-prime 2.0 (Psychology Software Tools, Inc., Pittsburgh, PA, USA).

254 **Figure 2.**

255 Before the formal experiment, the participants completed a 5-item practice session to become
256 familiar with the experimental process; then, the participants completed 48 RAT problems as
257 shown in Figure 2. Each trial began with a "+" fixation in black on a computer screen to keep the
258 participants focused on the screen. Then, three words appeared in the center of the monitor in Song
259 style, No. 28, black. The problem was displayed on the screen until the participants answered the
260 problem or 20 s had passed. If the participant solved the problem, he/she could press the space bar
261 on the keyboard and enter the answer stage after a 500 ms interval. On this screen, the participants
262 had unlimited time to type in the answer, and they pressed "Enter" to indicate that they had finished
263 this stage. Finally, a 500 ms interval represented the end of the trial with a grayish screen.

264 **Statistical data analysis**

265 The data were input and analyzed using SPSS Version 20.0 for Windows (SPSS Inc., Chicago,
266 IL, SUA). The difference between the group that planned to study abroad and the group with no
267 plans to study abroad on RAT performance and language was analyzed through independent-
268 samples t-tests. Rank-Variable (Second Language proficiency) was used for the between-group
269 differences tested by the Mann-Whitney U test (Isohashi et al., 2013). The Pearson correlation was
270 used to analyze the relationships between the variables (Puth, Neuhauser, & Ruxton, 2014). The
271 mediating effect of second language proficiency was measured by nonparametric bootstrapping,
272 and Hayes's (2013) process was used in the analysis.

273 # Results

274 **Correlations**

275 The RAT is often used to explore the phenomenon of creative thinking, especially when
276 examining insight into problem solving. The averages of the RAT score, monthly household
277 income, and bilingual proficiency were 20.53 (SD=5.90), 8842.65 (SD=10082.13), and

278   3.43(SD=0.70), respectively. Table 1 presents the correlations between the RAT performance and
279   the individual differences measured in the study. One valuable result was that proficiency in a
280   second foreign language was strongly correlated with the RAT score (r=0.47, p<0.001), and the
281   willingness to study abroad was also correlated with the RAT score (r=-0.30, p<0.05).

282   **Table 1.**

283   **Influence of willingness to study abroad on convergent creativity**
284   This study examined the influence of overseas experiences[2] and willingness to study abroad on
285   the participants' performance on the RAT. First, the results of the PA and NA subscales were
286   analyzed to rule out the effect of natural emotions on the performance on the RAT. There was no
287   difference between the group that planned to study abroad and the group that did not plan to study
288   abroad on the PA (t=-0.87, p=0.39>0.05, Cohen's d=-0.21) and NA (t=1.17, p=0.25>0.05, Cohen's
289   d=0.31) subscales. Thus, the additional variable of natural emotions was excluded from this study.
290   The results of the Creative Self-Efficacy Instrument revealed no difference between the group that
291   planned to study abroad and the group that did not plan to study abroad (t=1.61, p=0.11>0.05,
292   Cohen's d=0.40).
293   Table 2 reports the difference in the performance on the RAT between two groups, a group of
294   participants who planned to study or work abroad and a group of participants who did not.
295   According to an independent-samples t-test, the participants who planned to study abroad had
296   significantly higher scores than those who were not planning to study abroad (t=2.48,
297   p=0.016<0.05, Cohen's d=0.62). This result suggests that people who want to study abroad to
298   study or work perform better at solving RAT problems than those who do not. The average
299   monthly household income of the participants who intended to study abroad was 11767.86 yuan,
300   while that of the participants who did not plan to study abroad was 6795.00 yuan, with a significant
301   difference between the two groups (t=2.05, p=0.044<0.05, Cohen's d=0.54). Thus, the family
302   income of those who wanted to study abroad was significantly higher than that of students who
303   did not want to study abroad. Furthermore, as shown in Table 3, students who wanted to study
304   abroad were significantly more proficient in English than students who did not (p<0.01).

305   **Table 2.**

306   **Table 3.**

307   To further explore the influence of bilingual learning and willingness to study abroad on RAT
308   problem solving, a backward regression analysis was employed to analyze the RAT problem
309   scores (Tanksale, 2015). The monthly household income, number of foreign languages spoken by
310   the participants, willingness to study abroad, and number of times the participants and their parents
311   had traveled abroad were inputted to predict the performance on the RAT problems. Only second

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[2] Overseas experiences were measured by the number of short-term (less than two weeks in total) and long-term (more than two weeks in total) studies or trips abroad by the participants (Shen & Yuan, 2015). In this study, only 9 (13.3%) participants had a short experience traveling abroad, and only 2 (2.9%) participants had been abroad for more than two weeks. Most participants did not have experience studying, traveling or working abroad.

312   language proficiency predicted the score on the RAT (B=0.47, SE=0.92, β=0.47, t=4.36, p<0.001).

313   **Mediating effect of second language proficiency**

314   According to Hayes (2013), this study adopted nonparametric Bootstrap to explore the
315   mediating effect of second language proficiency, which was executed based on the PROCESS
316   macro and the observed variables (Jach, Sun, Loton, Chin, & Waters, 2018). By sampling the
317   original data, 5,000 samples were extracted to estimate the 95% confidence of the mediation effect
318   test (Calvo-Mora, Ruiz-Moreno, Picón-Berjoyo, & Cauzo-Bottala, 2014; Yang, Liu, & Chen,
319   2018). The 95% confidence (LLCI=-3.30, ULCI=-0.61) of the indirect effect did not include 0;
320   thus, the mediating effect of second language proficiency was significant. The regression analysis
321   results were shown in Table 4. According to regression model 1, willingness to go abroad has a
322   significant predictive effect on second language proficiency. According to model 2, when both
323   willingness to go abroad and second language proficiency are included in the model, the predictive
324   effect of the RAT solved was significant, but the direct effect of willingness to go abroad on the
325   RAT score was not significant; therefore, second language proficiency had a complete mediating
326   effect between the two variables. The mediation analysis results of each outcome variable are
327   displayed in Figure 3 through a presentation of the unstandardized path coefficients of each model.

328   **Table 4.**

329   **Figure 3.**

330   **Discussion**

331   The purpose of this study was to experimentally investigate the relationships between bilingual
332   learning, willingness to study abroad and convergent creativity. This research showed that
333   bilingual learning was positively correlated with convergent creativity performance. Students with
334   a willingness to study abroad performed better on the RAT than students who were not willing to
335   study abroad, and this effect was mediated by second language proficiency. On the basis of
336   previous studies, the results are discussed according to the aspects of bilingual learning, overseas
337   experience and family income.

338   **The relationship between bilingual learning and convergent creativity**

339   Bilingual learning is a requirement for compulsory education in China. As early as 1979,
340   Cummins (1979) proposed the advantages of bilingual learning, which can help learners form two
341   sets of language systems in their brain to create a special cognitive mechanism. In the process of
342   language selection, the suppression of the nontarget language can improve the suppression control
343   function of bilingual learners. Similarly, practicing a target language can strengthen the function
344   of selective focusing. Moreover, code-switching between two languages helps individuals
345   overcome psychological patterns and achieve strategy adjustment and conversion (Costa,
346   Hernández, & Sebastián-Gallés, 2008). Many studies have explored the impact of multilingual
347   learning on creative thinking and its mechanisms of action. Ricciardelli (1992a) performed a meta-
348   analysis of 25 studies published between 1965 and 1992 and found that approximately 80% of
349   bilingual and multilingual learning experiences can improve individuals' creative thinking.

350 Moreover, this conclusion was confirmed in the author's experiment (Ricciardelli, 1992b), which
351 found that highly proficient bilinguals scored significantly higher on fluency in creative thinking,
352 imagination, and language fluency than monolingual or low-proficiency bilinguals.
353   This study provided an important finding about convergent creativity in the literature: second
354 language proficiency is strongly correlated with the RAT score and can predict performance on
355 RAT problems. On the one hand, this result is consistent with some previous findings, such as
356 those reported by Hommel and colleagues (2011). In total, 42 young healthy participants
357 participated in the authors' study and were asked to complete the RAT and an English vocabulary
358 test. The results showed that high-proficiency bilinguals performed better than low-proficiency
359 bilinguals on the RAT. A study involving Russians (Spanakos, 2001) in which 278 middle school
360 students were recruited as participants and a series of tests was used to measure their divergent
361 and convergent creativity obtained similar results. These results showed that bilingual participants
362 outscored monolingual participants on convergent creativity. On the other hand, some studies,
363 such as the study conducted by de Vries and Lubart (2017) to investigate scientific creativity, have
364 reached the opposite conclusion. Interestingly, these authors found that culture-related variables
365 were significantly negatively correlated with the originality of divergent and convergent scientific
366 creativity and noted that the reason may be the mediating role of personality, personal information,
367 and cultural adaptation. Finally, regarding the prediction of second language proficiency, Wang
368 and Cheng (2016) drew a conclusion similar to that found in this study: English proficiency can
369 significantly predict metaphoric creativity. This finding suggested that English ability is an
370 important factor in predicting creativity. In summary, most studies have reported the influence of
371 multilingual or linguistic learning on creative thinking, especially convergent creativity (Shen &
372 Yuan, 2015).
373 **The relationship between studying abroad and convergent creativity**
374   Numerous studies have confirmed that overseas experiences can influence people's creative
375 thinking. For example, people with one year of immigration experience had a significantly higher
376 score on creative thinking fluency than those without such experience (Fee & Gray, 2012).
377 Surprisingly, in an examination of the impact of short-term overseas experience on individual
378 creative thinking with a traceable pre-post-test design, de Bloom et al. (2014) found that studying
379 abroad for only two weeks can promote fluency. Regarding convergent creativity, Maddux and
380 Galinsky (2009) explored the effect of foreign experiences on the RAT. The results showed that a
381 sample of individuals who had lived abroad performed significantly better on the RAT than a
382 sample of people who had not lived abroad. In addition, this temporary facilitative effect of foreign
383 experiences was strongest among the participants who had lived abroad the longest. In summary,
384 both long-term and short-term multicultural experiences can promote individual creative thinking.
385   The above results could not be analyzed in this study because the proportion of participants with
386 overseas experience was too small, only 13.2% have short-term overseas experience and 2.9%
387 have long-term overseas experience. All participants were students (56 undergraduates and 10
388 postgraduates). Although the participants were adults, they often had insufficient social
389 experience, limited living expenses and heavy academic pressure; thus, the participants may not
390 have had the opportunity to study abroad. Therefore, most participants did not have experience

391 studying, visiting, or working abroad. However, as expected, cultural factors were related to
392 convergent creativity; people who want to go abroad tend to have stronger critical thinking and a
393 stronger desire for expressing themselves, such as being adventurous, culturally savvy or a global
394 cosmopolitan (Adam, Obodaru, Lu, Maddux, & Galinsky, 2018; Martin, Katz-Buonincontro, &
395 Livert, 2015). Frändberg and Handelshögskolan (2015) conducted biographical narrative
396 interviews with 22 adults; in their study, they found that the decision regarding the plan to study
397 or work abroad was typically described as highly personal. People with this intention usually
398 believe that they can improve themselves and develop creative ideas in a foreign country. Notably,
399 the intention to study abroad was related to the performance on the RAT; an individual who wants
400 to study abroad in the future had a higher score on the RAT than an individual who does not want
401 to study abroad. This finding corresponds to the study of Lee and colleagues (2012), who used the
402 Abbreviated Torrance Test for Adults (ATTA) and the Cultural Creativity Task (CCT) to measure
403 the creativity level of three types of participants: those who have studied abroad, those who plan
404 to study abroad, and those with no plan to study abroad. In both scales, the results showed that
405 students who plan to study abroad scored higher than students with no plan to study.

406 The reason for the above finding might be related to the mediating effect of second language
407 proficiency. To face the challenges of an increasingly globalized world, second language
408 proficiency is becoming increasingly important for students who want to obtain better educational
409 opportunities (Schoepp, 2018). In China, to study abroad, students must pass an English test, such
410 as the IELTS or the Test of English as a Foreign Language, to prove that they have the language
411 ability to live and study abroad. Through interviews with 32 students in Guangzhou who want to
412 go abroad, Wu (2018) found that this group wanted to improve their second language proficiency
413 through overseas study experience, and they were willing to invest time into passing the English
414 tests. This may be because excellent performance on the English tests (e.g., IELTS) not only
415 demonstrates students' English ability but also predicts their academic success (Schoepp, 2018).
416 Therefore, students must exert considerable effort to improve their English skills so that they can
417 perform well on English tests. The impact of second language proficiency on the RAT was
418 discussed in the previous section.

419 Going abroad is an opportunity for individuals to come into contact with a strange environment,
420 characterized by novelty and accompanied by completely different values, cultural identity and
421 behavioral habits (Adam et al., 2018). Individuals who want to go abroad are usually more open
422 to new experiences; for example, they are more intellectually curious about foreign cultures and
423 more receptive to cultural instruction, increasing the irregularity and cultural relevance of their
424 approach to insight problems (Cho & Morris, 2015; Martin et al., 2015). Silvia, Nusbaum, Berg,
425 Martin and O'Connor (2009) suggested that openness to new experiences plays an important role
426 in the performance of creativity, with two main aspects which are openness (including imagination,
427 creativity, and aesthetics) and intellect (including thinking and reasoning). A total of 189 students
428 participated in their experiment (Silvia et al., 2009), and their personality, divergent thinking,
429 creative achievement and creative self-efficacy were measured through questionnaires. From the
430 latent variable models, they found broad effects of openness to experience to creativity. Similarly,
431 the results from Schilpzand, Herold and Shalley's (2011) study with 31 graduate student teams

432 indicated that openness is significantly related to team creativity. For intellect, individuals can
433 improve their cultural intelligence by mastering and transmitting their multicultural experience
434 (Hu et al., 2017). Cultural intelligence makes individuals aware of cultural differences, and they
435 can master other cultural knowledge well, which provides them with new ways of thinking and
436 concepts. These new inputs bring about more possibilities for them to view things from different
437 perspectives and contribute to the performance of creativity (Cheng & Leung, 2013; Hu et al.,
438 2017). Through a questionnaire survey of 310 international students, Hu and colleagues (2017)
439 found that cultural intelligence was significantly correlated with creativity, partially mediating the
440 relationship between multicultural experiences and creativity. Based on the above studies, it is
441 possible that people who intend to go abroad perform better on the RAT because of their higher
442 openness to experience.

443   Family income is a key factor that should be considered in study abroad plans and even in the
444 preparation of bi- or multilingual learning. Family income performs an important function in the
445 education and growth process. For example, in China, high-income families receive the greatest
446 educational benefits, while low-income families have the lowest investment in children's specialty
447 training (Zhang, Zhang, Zhang, Xiang, & Wang, 2015). Similarly, family income has a significant
448 independent predictive effect on early childhood language ability after controlling for children's
449 age and gender (Li, Li, & Li, 2012). Income is also related to children's cognitive development in
450 foreign countries, as shown by the Panel Study of Income Dynamics (PSID) in America. The study
451 showed that the level of income was associated with Woodcock-Johnson (W-J) Achievement Test
452 scores and that income stability was associated with W-J applied problem scores and the Behavior
453 Problem Index (BPI) even after including all controls in the models (Yeung, Linver, & Brooks–
454 Gunn, 2002). In addition, among the different indicators of SES, only income showed significant
455 associations with children's emotional health status. Therefore, good and stable economic
456 conditions are crucial for studying abroad (Hercog & van de Laar, 2017) and can provide material
457 security for students to study abroad and achieve professional and personal goals (Doppen, An, &
458 Diki, 2016).

459   Over the last ten years, the number of Chinese students studying abroad has grown rapidly, but
460 more than 90% of these students choose to study abroad at their own expense. This number is
461 mainly determined by the economic strength of their families. Therefore, family income is the
462 most important factor affecting the number of students studying abroad (Li, 2018). In China,
463 among children under the age of 15, the proportion of children who study abroad for further study
464 is 13.02%, and the proportion of children who may be sent abroad in the future is 23.58%. Families
465 with such plans are often high-income families (Sun, Du, Zhao, & Li, 2016). The influence of high
466 family income on creativity might be another reason why there is a significant positive correlation
467 between willingness to study abroad and convergent creativity.

Conclusions

469   In conclusion, this study reveals that bilingual learning is positively correlated with convergent
470 creativity. The higher a student's English level, the better the student's score on convergent
471 creativity as measured by the RAT. Students' plans to study abroad and their convergent creativity

472 ability are significantly related, with students who want to study abroad performing better on the
473 RAT. This facilitation might relate to the mediation of second language proficiency.
474   At present, there are few studies on the relationship between bilingualism and convergent
475 creativity. This study not only explored this issue but also searched for a connection between
476 convergent creativity and life plans.
477   This study had several limitations. First, in this study, we used the PANAS and Creative Self-
478 Efficacy Instrument to control for the influence of emotions and creative self-efficacy on the study.
479 Emotion is an important factor that affects individuals' creativity (e.g., Lin, Tsai, Lin, & Chen,
480 2014), and the PANAS is a common tool used to measure emotions in many studies (e.g., Ceci &
481 Kumar, 2016; Fernandez-Abascal & Diaz, 2013). Creative self-efficacy has a positive and direct
482 influence on achievement goals (Bang & Reio, 2017; Puente-Diaz & Cavazos-Arroyo, 2018) and
483 other personality factors (Karwowski, Lebuda, Wisniewska, & Gralewski, 2013). In many studies
484 investigating creativity, creative self-efficacy is used as a moderator variable (e.g., Gong, Huang,
485 & Farh, 2009; Wan, Tsai, & Tsai, 2014). However, measuring more irrelevant variables, such as
486 novelty seeking and the motivation to study abroad, is necessary to further ensure the accuracy of
487 the results and clarify the underlying mechanisms leading to the results. Second, in China, all
488 college students are required to take different English language tests; thus, it is effective and
489 convenient to assess second language proficiency using the Bilingual Proficiency and Overseas
490 Experience Questionnaire. However, if other groups of participants are included, such as workers
491 or children, it is best to use a vocabulary test (Hommel et al., 2011). Third, this study showed that
492 the intention to study abroad was related to performance in convergent creativity; in future
493 research, the causes of this result could be explored by measuring other relevant variables, such as
494 openness to experience. Further studies are needed to explore the cognitive and neural mechanisms
495 of bilingual learning and willingness to study abroad on convergent creativity and the difference
496 between convergent creativity and divergent thinking. Through a more comprehensive analysis of
497 these issues, effective measures to enhance students' creativity may be proposed from the
498 perspective of educational policy.

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Correlations between RAT performance and individual variables.

Table 1: Correlations between RAT performance and individual variables.

	RAT solved	Income
Income	0.13	
Second language proficiency	0.47***	0.18
Willingness to study abroad	-0.30*	-0.25*

2 *$p<0.05$, **$p<0.01$, ***$p<0.001$

The difference RAT performance and income in two groups.

Table 2: The difference RAT performance and income in two groups.

	Planning to study abroad (n=28)	Not planning to study abroad (n=40)	95% CI	t	Cohen's d
	M±SD	M±SD			
RAT solved	22.57±5.03	19.10±6.10	±2.75	2.48*	0.62
Income	11767.86±14704.17	6795.00±3807.75	±4756.95	2.05*	0.54

The difference language proficiency in two groups (Mann-Whitney *U* test).

Table 3: The difference language proficiency in two groups (Mann-Whitney U test).

	1	2	3	4	5	*Mean Rank*	*P*-value
Planning to study abroad (*n=28*)	1	2	17	8	0	27.41	0.006
Not planning to study abroad (*n=40*)	0	1	15	22	2	39.46	

Results of hierarchical regression.

Table 4: Results of hierarchical regression.

Model	Independent variable	Dependent variable	B	t	SE
1	Willingness to go abroad	Second language proficiency	0.48	2.96**	0.16
2	Second language proficiency	RAT solved	-3.57	-3.67***	0.97
	Willingness to go abroad		-1.75	-1.28	1.37

Figure 1

Number of students stu Number of students studying abroad (1978-2017) .
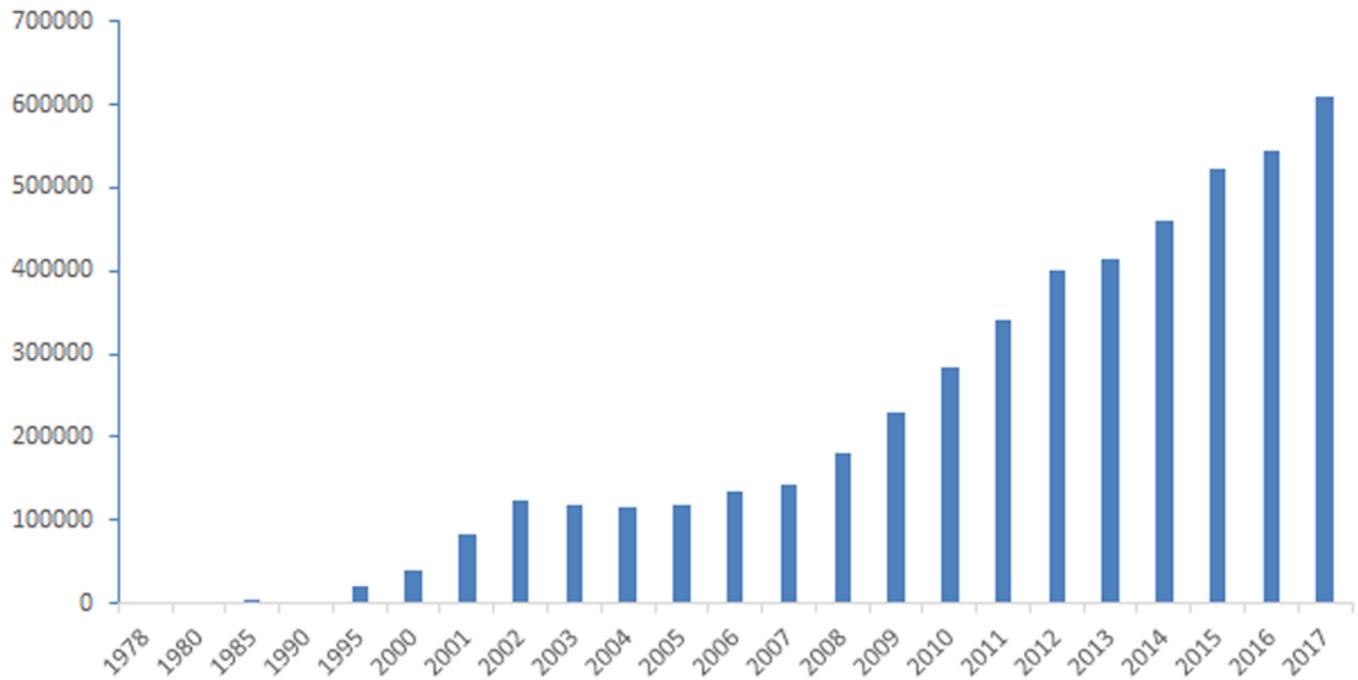
Figure 2

Process of the convergent creativity task.
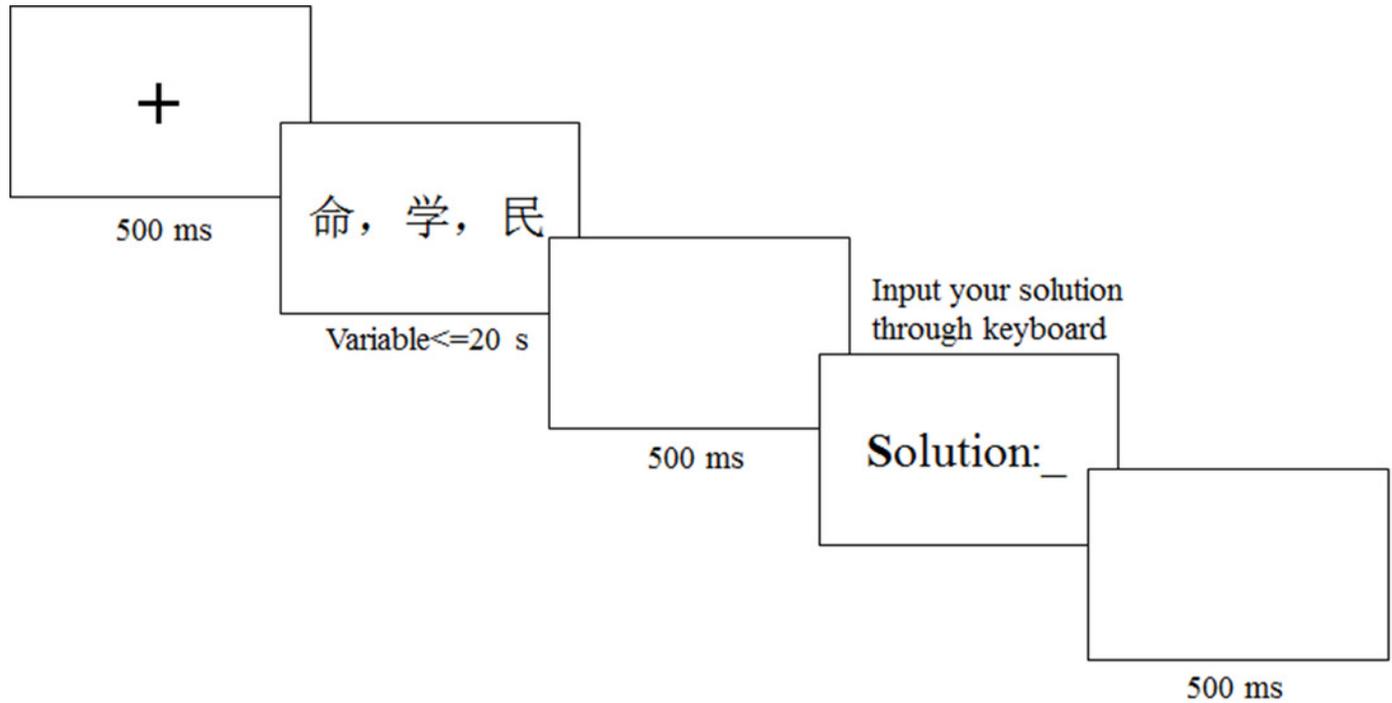
Figure 3

Mediating effect of second language proficiency.