

1 **The relationships between bilingual learning,**  
2 **willingness to study abroad and convergent**  
3 **creativity**

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21

22 **Abstract**

23

24Convergent creativity is a form of creative thinking that uses existing knowledge or  
25traditional methods to analyze available information and generate an appropriate  
26solution. The differences in the performance of participants in convergent creativity

27caused by bilingual learning is a popular research area in creativity. A final sample of  
2868 participants was asked to complete the remote associates test (RAT). The results  
29indicate that a moderate positive correlation exists between bilingual learning and  
30convergent creativity. Students who want to study abroad perform better on the RAT  
31than those who do not want to study abroad, and this effect is mediated by second  
32language proficiency. These findings suggest that improving students' English  
33proficiency and increasing their opportunities to study abroad are effective ways to  
34promote convergent creativity.

35

36**Keywords:** Convergent creativity, Insight, Language, Overseas experiences

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### 38Introduction


39 Creativity is defined as the ability of a group or individual to generate original and  
40appropriate problem solutions (Runco, 2007; Moraru, Memmert, & van der Kamp,  
412016). Creativity is an advanced expression of human intelligence and plays an  
42important role in scientific creation, social progress and technological innovation.  
43Guilford (1967), a past president of the American Psychological Association, noted  
44that creativity mainly includes divergent creativity and convergent creativity. The  
45former refers to how individuals generate new information and produce a wide variety  
46of outputs from the same source in a novel way. Divergent creativity is mainly  
47evaluated by tasks such as the Torrance Test of Creative Thinking (TTCT) (e.g.,  
48Humble, Dixon, & Mpofo, 2018) and the Alternative Uses Test (AUT) (e.g., Hao,  
49Xue, Yuan, Wang, & Runco, 2017). In contrast, convergent creativity refers to the  
50cognitive process in which individuals use existing knowledge or traditional methods  
51to analyze given information and obtain the best answer (Lee & Therriault, 2013;  
52Ritter, Abbing, & Van Schie, 2018). The processes of convergent creativity include  
53evaluation of the divergent creativity stage and the selection of ideas, or a full range  
54of phases ranging from evaluation to implementation (Coursey, Williams, Kenworthy,  
55Paulus, & Doholi, 2018). In real life, many different tasks rely on the use of  
56convergent creativity because this type of creativity is part of creation, and the skillful  
57use of convergent creativity can be critical for creative idea production (de Vries &  
58Lubart, 2017). The emphasis on convergent creativity is largely attributed to Simon's  
59study investigating problem solving and the application of Mednick's study on the  
60RAT (Shen, Liu, Shi, & Yuan, 2015). Currently, convergent creativity is primarily  
61measured by tasks such as classical insight problems (e.g., Chein, Weisberg, Streeter,  
62& Kwok, 2010) and the RAT (e.g., Shen, Yuan, Liu, & Luo, 2016). The RAT was used  
63as the experimental material in this study, which originated from the theoretical model  
64proposed by Mednick in 1962 about the relationship between associative behavior and  
65creativity (Benedek & Neubauer, 2013). Guilford highlighted the importance of  
66divergent creativity, which has led convergent creativity to be overlooked. Although  
67convergent creativity has long been on the outskirts of creative research, with the  
68rapid development of research on brain-based insight, an increasing number of

69scholars have begun to pay attention to this important issue (Shen et al., 2015).




70 Accompanying the development of globalization and international trade, cultural  
71migration and exchange activities such as immigration, transnational study, and  
72multilanguage learning have become increasingly frequent (Cheng & Leung, 2013;  
73Shen & Yuan, 2015). In different countries, people need to understand and absorb  
74different local cultures and accept the influence of different cultures, which might be  
75an important requirement for people to adapt to the rapid development of modern  
76society. Thus, cultural activities have an impact on people's ways of thinking.

77 Rohan, a young entrepreneur mentioned in Tadmor, Galinsky and Maddux's study  
78(2012), lived in five different countries. Rohan stumbled upon some cocoa plantations  
79in Mexico and became fascinated by them. Subsequently, in France, Rohan  
80discovered a chocolate shop that inspired his imagination. Using Aztec-themed  
81designs, Rohan organically combined the pre-Hispanic roots of cacao and the  
82chocolate products that we currently consume. This example highlights how  
83multicultural experiences and exposure to new cultures inspire new ideas.  
84Multicultural experiences refer to all direct and indirect experiences of contact or  
85interaction with elements and/or members of foreign cultures (Hu, Gu, Liu, & Huang,  
862017); such experiences can facilitate the performance of individual creativity by  
87improving individual enlightenment learning, distance imagination and concept  
88formation and by generating novel ideas through unfamiliar culture (Wang & Wang,  
892018). Under these circumstances, individuals draw new ideas from different cultures  
90and integrate them in novel ways in problem-solving scenarios. Integrating seemingly  
91unrelated concepts in different cultures helps to extend the conceptual category in the  
92brain (Maddux, Adam, & Galinsky, 2010; Wang & Wang, 2018). Shen and Yuan  
93(2015) summarized Maddux's and other scholars' studies (de Bloom, Ritter, Kühnel,  
94Reinders, & Geurts, 2014; Fee & Gray, 2012; Maddux & Galinsky, 2009; Yi, Hu,  
95Scheithauer, & Niu, 2013) and concluded that both long-term and short-term  
96multicultural experiences can boost individual creativity and that improvement in  
97cognitive fluency is among the most obvious outcomes (Shen & Yuan, 2015). There  
98are two main reasons for this phenomenon: on the one hand, they have a wide  
99understanding of different cultures, so that people with multicultural experiences can  
100better establish connections between different ideas from different cultural sources.  
101On the other hand, extensive exposure to different cultures can sometimes produce  
102conflicting views. This helps multicultural individuals overcome fixed cognition,  
103eliminate the structured and conventional methods of addressing problems, and  
104stimulate creative thinking (Cheng & Leung, 2013). In addition, when individuals are  
105exposed to foreign cultures with a learning mindset, they might elicit a comprehensive  
106emotional response, such as the recognition of some excellent qualities or admiration  
107for some achievements in foreign cultures, which can also enhance creativity (Cheng,  
108Leung, & Wu, 2011). In conclusion, in this era of globalization, multicultural  
109experiences will bring important cognitive benefits (Cheng et al., 2011; Wang &  
110Wang, 2018)

111 Most e sting studies have shown that the length of time people have lived  
112abroad and their overseas experiences can predict their creative ability (Maddux &


113 Galinsky, 2009). However, some studies have found that a certain proportion of those  
114 who travel abroad fail to achieve success in the new culture (e.g., Mendenhall &  
115 Oddou, 1985; Wederspahn, 1992). While some scholars believe that these failures  
116 may be due to the lack of adjustment or psychological discomfort experienced when  
117 living abroad (Maddux & Galinsky, 2009), evidence regarding the relationship  
118 between adjustment and performance is contradictory (Tadmor et al., 2012). One  
119 potential reason is the willingness to study or stay abroad. Some individuals might  
120 have no willingness to study or stay abroad (a lack of openness to new countries,  
121 cultures, or things) even if they are in foreign countries. Undoubtedly, many people,  
122 including students, teachers, and technicians, plan to study abroad but are still in the  
123 process of preparation. As Figure 1<sup>1</sup> reports with respect to Chinese students studying  
124 abroaded, with the development of Chinese society, more and more people have taken  
125 advantage of the opportunity to study abroad, it can be inferred that people  
126 increasingly study or plan to study abroad ~~for further study~~ (Li & Sun, 2018). The  
127 intention to study abroad may ~~have an impact on~~ be related to  ativity, and students  
128 who have plans to study abroad usually have better creative performance than those  
129 who do not have such plans (Lee, Therriault, & Linderholm, 2012). However, few  
130 studies to date have explored this interesting issue. Based on existing studies, we are  
131 inclined to support the results of Lee and colleagues (2012).


### 132 **Figure 1.**

133 The main reason for this hypothesis  that students who want to study abroad to  
134 study or work in China must improve their English proficiency. Many studies have  
135 confirmed that bilingual learning can promote creativity (e.g., Cummins, 1979;  
136 Hommel, Colzato, Fischer, & Christoffels, 2011; Wang & Cheng, 2016). From the  
137 perspective of students' creativity in English learning, English proficiency is the most  
138 important factor that determines students' ability to create in English (Wang & Cheng,  
139 2016). In fact, many early studies  confirmed the influence of second language  
140 proficiency on creativity in children. Kharkhurin (2011) used thirteen examples from  
141 1966 to 1999 to illustrate that bilingual children outperformed monolingual children  
142 in divergent thinking traits such as fluency, flexibility, elaboration, and originality.  
143 Similarly, the effect of second language proficiency on creativity has been supported  
144 by some studies involving adults. For example, the performance of bilingual college  
145 students on the Abbreviated Torrance Test of Russian-English was better than that of  
146 English monolingual college students (Kharkhurin, 2010). This phenomenon is not  
147 confined to one country; in the United Arab Emirates (UAE), Farsi-English bilinguals  
148 revealed advantages in originality in thinking compared to native speakers from the  
149 same educational group (Kharkhurin, 2009). The Chinese scholar Ni (2012) combed  
150 through previous studies on the relationship between bilingual learning and creativity  
151 and suggested that students with a higher second language proficiency, earlier  
152 exposure to a second language and greater length of exposure to a second language  
153 have significantly improved creativity, such as in insightful problem solving (IPS).   
154 Prior studies have attempted to research creativity as a behavior resulting from an

9<sup>1</sup> The data were collected from the National Bureau of Statistics of China (<http://www.stats.gov.cn/>).

155interaction among cognitive abilities, individuality, and social environment, but few  
156studies have examined the role of socioeconomic status (SES), such as family income,  
157in creative thinking (Parsasirat et al., 2013). Recently, some scholars have begun to  
158explore the relationship between family income and creativity. For example, Kim and  
159Lee (2015) reported that children from low-income families have fewer opportunities  
160to engage in scientific experiences than other children; however, through creative  
161science activity programs, their scientific attitude, self-esteem and self-efficacy will  
162be significantly improved. SES is an important factor in the educational environment,  
163and it is one of the crucial elements that influence creativity. SES can promote  
164children's creative thinking as early as the age of 6 (Jankowska & Karwowski, 2018).  
165Castillo-Vergara, Galleguillos, Cuello, Alvarez-Marin and Acuña-Opazo (2018)  
166investigated students from 75 educational institutions through Quality and  
167Educational Context Questionnaires to determine the SES; these questionnaires were  
168mainly used to determine the education level of the students' parents and the monthly  
169income of their family. They also used the Multifactorial Evaluation of Creativity  
170(EMUC) test to measure the performance of creativity including fluency, flexibility,  
171and originality. The results showed that as the socioeconomic level increases, the  
172ability to innovate increases. Similarly, Sánchez and Salinas (2008) suggested that  
173people with the highest SES levels perform better in the language arts, mathematics,  
174and science while low-income groups show the opposite results. Based on the above  
175research, it can be speculated that good economic conditions in a family are a key  
176factor in promoting the development of creativity or that a good environment is at  
177least a contributing factor. Undoubtedly, in mainland China, a stable income is  
178necessary for studying abroad.

179 Since the reform and opening-up, China's economy has developed rapidly, and a  
180booming economy has emerged. Meanwhile, with strong economic support, the  
181government has paid increasing attention to cultivating high-quality innovative  
182students. Thus, the state intends to improve students' creativity and academic  
183performance through international exchange. ~~Therefore, it can be inferred that people~~  
184~~increasingly study abroad or plan to study abroad for further study.~~ 

185 In recent decades, the relationship between bilingualism and cognitive ability has  
186become a popular topic in pedagogy and psychology. Bilingualism not only plays an  
187important role in cross-language communication but also fulfills social culture and  
188psychological cognitive functions. sina, Harnoss and Rapoport (2016) noted that  
189bilingual teaching and multicultural experiences do not burden learners or hinder their  
190growth. In contrast, bilingual teaching and multicultural experiences are necessary  
191cultural, economic, and political resources for both the country and the individual.  
192Although the influence of bilingualism on creativity has been studied in depth, few  
193studies have focused on the exploration of convergent creativity. Therefore, this study  
194aimed to examine the impact of bilingual learning and willingness to study abroad on  
195convergent creativity based on previous research.

## 196 **Materials & Methods**



### 197 **Participants**

198 In total, 76 healthy undergraduates (35 male;  $age_M=20.32$  years,  $age_{SD}=2.10$  years)  
199 participated in this study. Of the participants in this experiment who spoke Chinese as  
200 their first language, 66 (86.8%) participants spoke one foreign language (English), 8  
201 (10.5%) participants spoke two foreign languages, 2 (2.6%) participants spoke three  
202 foreign languages, and all participants spoke English as a second language. Eight of  
203 the 76 participants were excluded from the data analysis (10.53%) for the following  
204 reasons: one participant did not provide thoughtful responses to the RAT problems,  
205 and the other participants required longer than 20 s to answer one of the RAT  
206 problems. The final sample of 68 (32 male;  $age_M=20.37$  years,  $age_{SD}=2.18$  years)  
207 participants was used in this study, including 28 students who planned to study abroad  
208 and 40 students who did not want to study abroad. All participants had normal or  
209 corrected-to-normal vision and had no experience with any similar experiments.  
210 Before the experiment, the participants provided written informed consent, and they  
211 received RMB 10 Yuan at the end of the study. The study was approved by the Ethics  
212 Committee of Human Research Protection of Hohai University.

### 213 **Materials**

#### 214 **Convergent creativity task**

215 According to Mednick's model, convergent creativity is primarily measured by the  
216 RAT; highly creative people show higher associative fluency, and they perform better  
217 on the RAT (Benedek & Neubauer, 2013; Shen et al., 2016a). A typical RAT contains  
218 three unrelated words (e.g., rat/blue/cottage), and participants are asked to find a  
219 fourth word (e.g., cheese) that serves as an associative link to the stimulus test  
220 (Benedek & Neubauer, 2013). In this study, 53 Chinese RAT problems (Shen et al.,  
221 2016a; Shen et al., 2019) were used as the experimental materials, including five  
222 problems (two difficult and three simple problems) that were used during the practice  
223 session. Forty-eight problems, including 24 difficult and 24 simple problems, were  
224 used in the formal experiment. These problems can occasionally lead to feelings of  
225 insight depending on the participants' judgment. Each item contained three different  
226 Chinese words (命/男/学, i.e., in English, destiny/male/learning-in-English) that  
227 prompted the participants to respond with a single solution character (生, i.e., in  
228 English, person-in-English). The complete solution consisted of three Chinese phrases  
229 (生命/男生/学生, i.e., in English, life/men/student-in-English); participants can get  
230 one point for each correct answer (up to 48 points). The higher the score is, the better  
231 the performance of divergent creativity. The Cronbach's  $\alpha$  of this test was 0.92,  
232 indicating strong internal reliability (Shen, Yuan, Liu, Yi, & Dou, 2016).  
233 Furthermore, this test has been used in many studies (e.g., Shen et al., 2016a; Shen et  
234 al., 2016b), indicating it has good external validity. During this test, the provided  
235 problems (horizontally placed) and their corresponding solutions appeared in the  
236 center of the screen with boldface 24 and black on gray.

#### 237 **Bilingual Proficiency and Overseas Experience Questionnaire**

238 This questionnaire included 14 items regarding the basic information of the  
239 participants, such as their experiences with learning a foreign language, experiences  
240 with studying abroad, plans to study abroad, parents' overseas experiences, and  
241 monthly household income. The main purpose of this questionnaire was to collect  
242 basic information about the participants, especially regarding their intention to study  
243 abroad and second language proficiency. Each item required the participants to  
244 choose the most suitable option from the choices given. The item regarding second  
245 language proficiency, which had a total of five options ranging from very proficient  
246 (1) to not proficient (5), was emphasized. According to the Chinese English Scale  
247 (CES) (~~published in~~*brought forward in The Results of Linking IELTS and Aptis to*  
248 *China's Standards of English Language Ability Press Conference*), the participants  
249 provided detailed explanations to the experimenter before the test. If the participant's<sup>2</sup>  
250 International English Language Testing System (IELTS) score was greater than 7.5 or  
251 ~~he or she had~~ passed College English Test-8 (CET-8) (mastering approximately 8,000  
252 words), ~~Option~~ 1 was selected; if the participants had an IELTS score greater than  
253 6.5 or passed College English Test-7 (CET-7) and had mastered approximately 7,000  
254 words, ~~Option~~ 2 was selected; if the participants passed College English Test-  
255 6 (CET-6) or College English Test-4 (CET-4) (mastering approximately 5,000 words),  
256 ~~Option~~ 3 was selected; if the participants learned English in primary school but had  
257 not passed CET-4, ~~Option~~ 4 was selected (mastering approximately 2,000 words);  
258 and if the participants only knew a few English words (fewer than 500), ~~Option~~ 5  
259 was selected (e.g., Schachter, Kimbro, & Gorman, 2012; Müller, 2016). In special  
260 cases, if the participants found it difficult to judge their English level, their English  
261 level was assessed by a vocabulary test (Hommel et al., 2011). In this study, the  
262 participants were able to clearly determine their second language proficiency (all  
263 Chinese college students are required to take different English language tests). Thus,  
264 the participants did not take the vocabulary test.

### 265 Positive and Negative Affect Scale (PANAS)

266 To exclude potential interference by pre-experimental emotions in the results, the  
267 Positive and Negative Affect Schedule (PANAS-State) (Watson, Clark, & Tellegen,  
268 1988) was used. The PANAS contains 20 one-word adjective items reflecting positive  
269 affect (PA) and negative affect (NA), and each subscale includes 10  
270 (positive/negative) items (Watson et al., 1988). There was no correlation between the  
271 PA and NA subscales ( $r=0.14$ ), which corroborates the results reported in previous  
272 studies (e.g., Heubeck & Wilkinson, 2019; Leue & Beauducel, 2011). The  
273 respondents were asked to rate the items on a 5-point Likert-type scale (1=very  
274 slightly or not at all to 5=extremely). The alpha coefficients of the overall scale, the  
275 PA subscale, and the NA subscale were 0.86, 0.81, and 0.91, respectively, ~~indicating~~  
276 ~~strong internal consistency~~.

### 277 Creative Self-Efficacy Instrument

278 To rule out the possible impact of creative self-efficacy on the results of the RAT,  
279 this study used a four-item Creative Self-efficacy Instrument (Tierney & Farmer,  
280 2002) measured on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). A  
281 sample item was "Suggests new ways of performing work tasks". In a study

282conducted by Tierney and Farmer, this instrument showed a good level of reliability  
283(manufacturing,  $\alpha=0.83$ ; operations,  $\alpha=0.87$ ). In this study, the Cronbach's  $\alpha$  was 0.85.

#### 284Procedures

285 The participants required approximately 30 minutes to finish the experiment. First,  
286the participants completed a questionnaire about their basic information according to  
287their actual situation. After this section, the participants were asked to complete the  
288PANAS based on their current mood. Finally, the participants responded to the RAT  
289problems, which were designed and presented by E-prime 2.0 (Psychology Software  
290Tools, Inc., Pittsburgh, PA, USA).

#### 291 Figure 2.

292 Before the formal experiment, the participants completed a 5-item practice session  
293to become familiar with the experimental process; then, the participants completed 48  
294RAT problems as shown in Figure 2. Each trial began with a “+” fixation in black on  
295a computer screen to keep the participants focused on the screen. Then, three words  
296appeared in the center of the monitor in Song style, No. 28, black. The problem was  
297displayed on the screen until the participants answered the problem or 20 s had  
298passed. If the participant solved the problem, he/she could press the space bar on the  
299keyboard and enter the answer stage after a 500 ms interval. On this screen, the  
300participants had unlimited time to type in the answer, and they pressed “Enter” to  
301indicate that they had finished this stage. Finally, a 500 ms interval represented the  
302end of the trial with a grayish screen.

#### 303Statistical data analysis

304 The data were input and analyzed using SPSS Version 20.0 for Windows (SPSS  
305Inc., Chicago, IL, SUA). The difference between the group that planned to study  
306abroad and the group with no plans to study abroad on RAT performance and  
307language was analyzed through independent-samples *t*-tests. ~~Rank-Variable (Second  
308Language proficiency is a rank-ordered variable, and so between-group differences)  
309was used for the between-group differences were~~ tested by the Mann-Whitney U test  
310(Isohashi et al., 2013). The Pearson correlation was used to analyze the relationships  
311between the variables (Puth, Neuhauser, & Ruxton, 2014). The mediating effect of  
312second language proficiency was measured by nonparametric bootstrapping, and  
313Hayes's (2013) process was used in the analysis.

#### 314Results

##### 315Correlations

316 The RAT is often used to explore the phenomenon of creative thinking, especially  
317when examining insight into problem solving. The averages of the RAT score,  
318monthly household income, and bilingual proficiency were 20.53 (SD=5.90), 8842.65  
319RMB (SD=10082.13), and 3.43 (SD=0.70), respectively. Table 1 presents the  
320correlations between the RAT performance and the individual differences measured in  
321the study. One valuable result was that proficiency in a second foreign language was  
322strongly correlated with the RAT score ( $r=0.47$ ,  $p<0.001$ ), and the willingness to



323 study abroad was also correlated with the RAT score ( $r=-0.30, p<0.05$ ).

### 324 **Table 1.**

#### 325 **Influence of willingness to study abroad on convergent creativity**

326 This study examined the influence of overseas experiences<sup>2</sup> and willingness to  
327 study abroad on the participants' performance on the RAT. First, the results of the PA  
328 and NA subscales were analyzed to rule out the effect of natural emotions on the  
329 performance on the RAT. There was no difference between the group that planned to  
330 study abroad and the group that did not plan to study abroad on the PA ( $t=-0.87,$   
331  $p=0.39>0.05$ , Cohen's  $d=-0.21$ ) and NA ( $t=1.17, p=0.25>0.05$ , Cohen's  $d=0.31$ )  
332 subscales. Thus, the additional variable of natural emotions was excluded from this  
333 study. The results of the Creative Self-Efficacy Instrument revealed no difference  
334 between the group that planned to study abroad and the group that did not plan to  
335 study abroad ( $t=1.61, p=0.11>0.05$ , Cohen's  $d=0.40$ ).

336 Table 2 reports the difference in the performance on the RAT between two groups,  
337 a group of participants who planned to study or work abroad and a group of  
338 participants who did not. According to an independent-samples  $t$ -test, the participants  
339 who planned to study abroad had significantly higher scores than those who were not  
340 planning to study abroad ( $t=2.48, p=0.016<0.05$ , Cohen's  $d=0.62$ ). This result  
341 suggests that people who want to study abroad in order to study or work perform  
342 better at solving RAT problems than those who do not. The average monthly  
343 household income of the participants who intended to study abroad was 11767.86  
344 yuan, while that of the participants who did not plan to study abroad was 6795.00  
345 yuan, with a significant difference between the two groups ( $t=2.05, p=0.044<0.05,$   
346 Cohen's  $d=0.54$ ). Thus, the family income of those who wanted to study abroad was  
347 significantly higher than that of students who did not want to study abroad.  
348 Furthermore, as shown in Table 3, students who wanted to study abroad were  
349 significantly more proficient in English than students who did not ( $p<0.01$ ).

### 350 **Table 2.**

### 351 **Table 3.**

352 To further explore the influence of bilingual learning and willingness to study  
353 abroad on RAT problem solving, a backward regression analysis was employed to  
354 analyze the RAT problem scores (Tanksale, 2015). The monthly household income,  
355 number of foreign languages spoken by the participants, willingness to study abroad,  
356 and number of times the participants and their parents had traveled abroad were  
357 inputted to predict the performance on the RAT problems. Only second language  
358 proficiency predicted the score on the RAT ( $B=0.47, SE=0.92, \beta=0.47, t=4.36,$   
359  $p<0.001$ ).

#### 360 **Mediating effect of second language proficiency**

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

361 According to Hayes (2013), this study adopted nonparametric Bootstrap to explore  
362 the mediating effect of second language proficiency on ???? which was executed  
363 based on the PROCESS macro and the observed variables (Jach, Sun, Loton, Chin, &  
364 Waters, 2018). By sampling the original data, 5,000 samples were extracted to  
365 estimate the 95% confidence of the mediation effect test (Calvo-Mora, Ruiz-Moreno,  
366 Picón-Berjoyo, & Cauzo-Bottala, 2014; Yang, Liu, & Chen, 2018). The 95%  
367 confidence (LLCI=-3.30, ULCI=-0.61) of the indirect effect did not include 0; thus,  
368 the mediating effect of second language proficiency was significant. The regression  
369 analysis results were shown in Table 4. According to regression model 1,  
370 willingness to go abroad has a significant predictive effect on second language  
371 proficiency. According to model 2, when both willingness to go abroad and second  
372 language proficiency are included in the model, the predictive effect of the RAT  
373 solved was significant, but the direct effect of willingness to go abroad on the RAT  
374 score was not significant; therefore, second language proficiency had a complete  
375 mediating effect between the two variables. The mediation analysis results of each  
376 outcome variable are displayed in Figure 3 through a presentation of the  
377 unstandardized path coefficients of each model.

378 **Table 4.**

379 **Figure 3.**


### 380 Discussion

381 The purpose of this study was to experimentally investigate the relationships  
382 between bilingual learning, willingness to study abroad and performance on a  
383 Chinese variant of the RAT problems as an index of-convergent creativity. This  
384 research showed that bilingual learning was positively correlated with convergent  
385 creativity RAT performance. Students with a willingness to study abroad performed  
386 better on the RAT than students who were not willing to study abroad, but and this  
387 effect was mediated by second language proficiency. On the basis of previous studies,  
388 the results are discussed according to the aspects of bilingual learning, overseas  
389 experience and family income.


#### 390 The relationship between bilingual learning and convergent creativity

391 Bilingual learning is a requirement for compulsory education in China. As early as  
392 1979, Cummins (1979) proposed the advantages of bilingual learning, which can help  
393 learners form two sets of language systems in their brain to create a special cognitive  
394 mechanism. In the process of language selection, the suppression of the non-target  
395 language can improve the suppression control function of bilingual learners.  
396 Similarly, practicing a target language can strengthen the function of selective  
397 focusing. Moreover, code-switching between two languages helps individuals  
398 overcome psychological patterns and achieve strategy adjustment and conversion  
399 (Costa, Hernández, & Sebastián-Gallés, 2008). Many studies have explored the  
400 impact of multilingual learning on creative thinking and its mechanisms of action.  
401 Ricciardelli (1992a) performed a meta-analysis of 25 studies published between 1965

402 and 1992 and found that approximately 80% of bilingual and multilingual learning  
403 experiences can improve individuals' creative thinking. Moreover, this conclusion  
404 was confirmed in the author's experiment (Ricciardelli, 1992b), which found that  
405 highly proficient bilinguals scored significantly higher on fluency in creative thinking,  
406 imagination, and language fluency than monolingual or low-proficiency bilinguals.

407 This study provided an important finding about convergent creativity in the  
408 literature: second language proficiency is strongly correlated with the RAT score and  
409 can predict performance on RAT problems. On the one hand, this result is consistent  
410 with some previous findings, such as those reported by Hommel and colleagues  
411 (2011). In total, 42 young healthy participants participated in the authors' study and  
412 were asked to complete the RAT and an English vocabulary test. The results showed  
413 that high-proficiency bilinguals performed better than low-proficiency bilinguals on  
414 the RAT.  study involving Russians (Spanakos, 2001) in which 278 middle school  
415 students were recruited as participants and a series of tests was used to measure their  
416 divergent and convergent creativity obtained similar results. These results showed that  
417 bilingual participants outscored monolingual participants on convergent creativity. On  
418 the other hand, some studies, such as the study conducted by de Vries and Lubart  
419 (2017) to investigate scientific creativity, have reached the opposite conclusion.  
420 Interestingly, these authors found that culture-related variables were significantly  
421 negatively correlated with the originality of divergent and convergent scientific  
422 creativity and noted that the reason may be the mediating role of personality, personal  
423 information, and cultural adaptation. Finally, regarding the prediction of second  
424 language proficiency, Wang and Cheng (2016) drew a conclusion similar to that  
425 found in this study: English proficiency can significantly predict metaphoric  
426 creativity. This finding suggested that English ability is an important factor in  
427 predicting creativity. In summary, most studies have reported the influence of  
428 multilingual or linguistic learning on creative thinking, especially convergent  
429 creativity (Shen & Yuan, 2015).

#### 430 **The relationship between studying abroad and convergent creativity**

431 Numerous studies have confirmed that overseas experiences can influence people's  
432 creative thinking. For example, people with one year of immigration experience had a  
433 significantly higher score on creative thinking fluency than those without such  
434 experience (Fee & Gray, 2012). Surprisingly, in an examination of the impact of  
435 short-term overseas experience on individual creative thinking with a traceable pre-  
436 post-test design, de Bloom et al. (2014) found that studying abroad for only two  
437 weeks can promote fluency. Regarding convergent creativity, Maddux and Galinsky  
438 (2009) explored the effect of foreign experiences on the RAT. The results showed that  
439 a sample of individuals who had lived abroad performed significantly better on the  
440 RAT than a sample of people who had not lived abroad. In addition, this temporary  
441 facilitative effect of foreign experiences was strongest among the participants who  
442 had lived abroad the longest. In summary, both long-term and short-term multicultural  
443 experiences can promote individual creative thinking. 

444 The above results could not be analyzed in this study because the proportion of  
445 participants with overseas experience was too small, only 13.2% have short-term

446overseas experience and 2.9% have long-term overseas experience. All participants  
447were students (56 undergraduates and 10 postgraduates). Although the participants  
448were adults, they often had insufficient social experience, limited living expenses and  
449heavy academic pressure; thus, the participants may not have had the opportunity to  
450study abroad. Therefore, most participants did not have experience studying, visiting,  
451or working abroad. However, as expected, cultural factors were related to convergent  
452creativity; people who want to go abroad tend to have stronger critical thinking and a  
453stronger desire for expressing themselves, such as being adventurous, culturally savvy  
454or a global cosmopolitan (Adam, Obodaru, Lu, Maddux, & Galinsky, 2018; Martin,  
455Katz-Buonincontro, & Livert, 2015). Frändberg and Handelshögskolan (2015)  
456conducted biographical narrative interviews with 22 adults; in their study, they found  
457that the decision regarding the plan to study or work abroad was typically described as  
458highly personal. People with this intention usually believe that they can improve  
459themselves and develop creative ideas in a foreign country. Notably, the intention to  
460study abroad was related to the performance on the RAT; an individual who wants to  
461study abroad in the future had a higher score on the RAT than an individual who does  
462not want to study abroad. This finding corresponds to the study of Lee and colleagues  
463(2012), who used the Abbreviated Torrance Test for Adults (ATTA) and the Cultural  
464Creativity Task (CCT) to measure the creativity level of three types of participants:  
465those who have studied abroad, those who plan to study abroad, and those with no  
466plan to study abroad. In both scales, the results showed that students who plan to  
467study abroad scored higher than students with no plan to study.

468 The reason for the above finding might be related to the mediating effect of second  
469language proficiency. To face the challenges of an increasingly globalized world,  
470second language proficiency is becoming increasingly important for students who  
471want to obtain better educational opportunities (Schoepp, 2018). In China, to study  
472abroad, students must pass an English test, such as the IELTS or the Test of English  
473as a Foreign Language, to prove that they have the language ability to live and study  
474abroad. Through interviews with 32 students in Guangzhou who want to go abroad,  
475Wu (2018) found that this group wanted to improve their second language proficiency  
476through overseas study experience, and they were willing to invest time into passing  
477the English tests. This may be because excellent performance on the English tests  
478(e.g., IELTS) not only demonstrates students' English ability but also predicts their  
479academic success (Schoepp, 2018). Therefore, students must exert considerable effort  
480to improve their English skills so that they can perform well on English tests. The  
481impact of second language proficiency on the RAT was discussed in the previous  
482section.

483 Going abroad is an opportunity for individuals to come into contact with a strange  
484environment, characterized by novelty and accompanied by completely different  
485values, cultural identity and behavioral habits (Adam et al., 2018). Individuals who  
486want to go abroad are usually more open to new experiences; for example, they are  
487more intellectually curious about foreign cultures and more receptive to cultural  
488instruction, increasing the irregularity and cultural relevance of their approach to  
489insight problems (Cho & Morris, 2015; Martin et al., 2015). Silvia, Nusbaum, Berg,

490 Martin and O'Connor (2009) suggested that openness to new experiences plays an  
491 important role in the performance of creativity, with two main aspects which are  
492 openness (including imagination, creativity, and aesthetics) and intellect (including  
493 thinking and reasoning). A total of 189 students participated in their experiment  
494 (Silvia et al., 2009), and their personality, divergent thinking, creative achievement  
495 and creative self-efficacy were measured through questionnaires. From the latent  
496 variable models, they found broad effects of openness to experience to  
497 creativity. Similarly, the results from Schilpzand, Herold and Shalley's (2011) study  
498 with 31 graduate student teams indicated that openness is significantly related to team  
499 creativity. For intellect, individuals can improve their cultural intelligence by  
500 mastering and transmitting their multicultural experience (Hu et al., 2017). Cultural  
501 intelligence makes individuals aware of cultural differences, and they can master  
502 other cultural knowledge well, which provides them with new ways of thinking and  
503 concepts. These new inputs bring about more possibilities for them to view things  
504 from different perspectives and contribute to the performance of creativity (Cheng &  
505 Leung, 2013; Hu et al., 2017). Through a questionnaire survey of 310 international  
506 students, Hu and colleagues (2017) found that cultural intelligence was significantly  
507 correlated with creativity, partially mediating the relationship between multicultural  
508 experiences and creativity. Based on the above studies, it is possible that people who  
509 intend to go abroad perform better on the RAT because of their higher openness to  
510 experience.

511 Family income is a key factor that should be considered in study abroad plans and  
512 even in the preparation of bi- or multilingual learning. Family income performs an  
513 important function in the education and growth process. For example, in China, high-  
514 income families receive the greatest educational benefits, while low-income families  
515 have the lowest investment in children's specialty training (Zhang, Zhang, Zhang,  
516 Xiang, & Wang, 2015). Similarly, family income has a significant independent  
517 predictive effect on early childhood language ability after controlling for children's  
518 age and gender (Li, Li, & Li, 2012). Income is also related to children's cognitive  
519 development in foreign countries, as shown by the Panel Study of Income Dynamics  
520 (PSID) in America. The study showed that the level of income was associated with  
521 Woodcock-Johnson (W-J) Achievement Test scores and that income stability was  
522 associated with W-J applied problem scores and the Behavior Problem Index (BPI)  
523 even after including all controls in the models (Yeung, Linver, & Brooks-Gunn,  
524 2002). In addition, among the different indicators of SES, only income showed  
525 significant associations with children's emotional health status. Therefore, good and  
526 stable economic conditions are crucial for studying abroad (Hercog & van de Laar,  
527 2017) and can provide material security for students to study abroad and achieve  
528 professional and personal goals (Doppen, An, & Diki, 2016).

529 Over the last ten years, the number of Chinese students studying abroad has grown  
530 rapidly, but more than 90% of these students choose to study abroad at their own  
531 expense. This number is mainly determined by the economic strength of their  
532 families. Therefore, family income is the most important factor affecting the number  
533 of students studying abroad (Li, 2018). In China, among children under the age of 15,




534 the proportion of children who study travel abroad for further study is 13.02%, and the  
535 proportion of children who may be sent abroad in the future is 23.58%. Families with  
536 such plans are often high-income families (Sun, Du, Zhao, & Li, 2016). The influence  
537 of high family income on creativity might be another reason why there is a significant  
538 positive correlation between willingness to study abroad and convergent creativity.

## 539 **Conclusions**

540 In conclusion, this study reveals that bilingual learning is positively correlated with  
541 convergent creativity. The higher a student's English level, the better the student's  
542 score on convergent creativity as measured by the RAT. Students' plans to study  
543 abroad and their convergent creativity ability are significantly related, with students  
544 who want to study abroad performing better on the RAT. This facilitation might relate  
545 to the mediation of second language proficiency.

546 At present, there are few studies on the relationship between bilingualism and  
547 convergent creativity. This study not only explored this issue but also searched for a  
548 connection between convergent creativity and life plans.

549 This study had several limitations. First, in this study, we used the PANAS and  
550 Creative Self-Efficacy Instrument to control for the influence of emotions and  
551 creative self-efficacy on the study. Emotion is an important factor that affects  
552 individuals' creativity (e.g., Lin, Tsai, Lin, & Chen, 2014), and the PANAS is a  
553 common tool used to measure emotions in many studies (e.g., Ceci & Kumar, 2016;  
554 Fernandez-Abascal & Diaz, 2013). Creative self-efficacy has a positive and direct  
555 influence on achievement goals (Bang & Reio, 2017; Puente-Diaz & Cavazos-Arroyo,  
556 2018) and other personality factors (Karwowski, Lebuda, Wisniewska, & Gralewski,  
557 2013). In many studies investigating creativity, creative self-efficacy is used as a  
558 moderator variable (e.g., Gong, Huang, & Farh, 2009; Wan, Tsai, & Tsai, 2014).  
559 However, measuring more irrelevant variables, such as novelty seeking and the  
560 motivation to study abroad, is necessary to further ensure the accuracy of the results  
561 and clarify the underlying mechanisms leading to the results. Second, in China, all  
562 college students are required to take different English language tests; thus, it is  
563 effective and convenient to assess second language proficiency using the Bilingual  
564 Proficiency and Overseas Experience Questionnaire. However, if other groups of  
565 participants are included, such as workers or children, it is best to use a vocabulary  
566 test (Hommel et al., 2011). Third, this study showed that the intention to study abroad  
567 was related to performance in convergent creativity; in future research, the causes of  
568 this result could be explored by measuring other relevant variables, such as openness  
569 to experience. Further studies are needed to explore the cognitive and neural  
570 mechanisms of bilingual learning and willingness to study abroad on convergent  
571 creativity and the difference between convergent creativity and divergent thinking.  
572 Through a more comprehensive analysis of these issues, effective measures to  
573 enhance students' creativity may be proposed from the perspective of educational  
574 policy. 

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44 RUNNING TITLE: BILINGUALISM, LEARNING, CREATIVITY, AND STUDY  
45 ABROAD ABROAD WILLING AND CREATIVITY  
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