The Effect of L2 Proficiency on Bilinguals' Creative Idea Generation in the Alternative Uses Task: A Statistical Analysis

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Abstract: In psychology research, idea generation is one of the most popular ways to measure divergent thinking. Extensive studies have explored the association between bilingualism and creative thinking and have confirmed the superiority of bilinguals in creative performance. However, only a few studies used the alternative uses task (AUT) to measure bilinguals' creative idea generation. To fulfill this research gap, the current study used AUT to test whether second language proficiency (L2 proficiency) has a positive influence on bilinguals' creativity using standard regression analyses. The study has found that bilinguals with higher L2 proficiency generally outperformed those with lower L2 proficiency in AUT. The results suggested that there was a positive relationship between L2 proficiency and bilinguals' creative idea generation. Specifically, L2 proficiency could explain originality, accounting for 15.8% of the variance, followed by fluency (10.4%). However, there was no significant association between L2 proficiency and flexibility. The current study is conducive to understanding the influencing factors of bilinguals' creative thinking in a more comprehensive way. Moreover, it may also provide some important implications for L2 education.

Keywords: L2 Proficiency; The Alternative Uses Task; Bilinguals; Creative Idea Generation; Divergent Thinking

1. Introduction

Creative idea generation is usually described as the generation of novelty by human intellect in diverse circumstances. It is widely used to measure creative thinking, being deemed as a synonym of divergent thinking (Guilford, 1967; Hass, 2018). As one of the two pivotal subcomponents of creative thinking, divergent thinking is perceived as the ability to generate many different responses to a specific issue or problem (e.g., Guilford, 1967). Divergent thinking task outcomes have often been used to systematically assess relative creative thinking ability.

Among many psychometric and experimental paradigms of creativity, the alternative uses task (AUT) is commonly used to measure individuals' divergent thinking. Studies have demonstrated that divergent tests are correlated with real-life measurement of creative behavior, such as obtaining a patent (e.g., Plucker, 1999; Torrance, 1981). AUT derives from the classic alternate uses task in which people are required to produce numerous novel uses, distinct from the common usage, for a familiar object (Guilford, 1967). For example, brick is one of its most common objects as a prompt. In AUT, participants are often provided with some time interval (e.g., three minutes) in the experimental environment (Hass, 2018). Participants are required to concentrate on both the volume of responses and the quality of creativity.

Researchers have proposed several methods to evaluate responses in divergent thinking tasks. Results of AUT are typically measured in three different dimensions, i.e., fluency, originality, and flexibility (e.g., Amabile, 1982; Park et al., 2016). Fluency refers to the number of generated responses. Originality is the uniqueness of responses or ideas. Flexibility refers to the number of different categories being used. Moreover, in light of semantic distance, recent researchers have developed SemDis, an automated creativity assessment, to score the responses in AUT by calculating and analyzing the similarity between concepts in natural language corpus (Beaty & Johnson, 2021).

Currently, in the field of creative thinking, previous studies have investigated the relationship between bilingualism and creative thinking. Evidence has shown that there is a positive correlation between bilingualism and divergent thinking (e.g., Kharkhurin, 2009; Ricciardelli, 1992). However, only a few studies explored bilinguals' creative idea generation

using AUT. To fulfill the research gap, the current study was designed to explore the effect of L2 proficiency on bilinguals' performance in AUT by conducting standard regression analyses.

2.Research Design

2.1 Participants

Ninety-four healthy volunteers (mean age: 19.98 ± 0.939 years), who were all sophomores in Mandarin Chinese (first language) university students, were recruited in this empirical study. English was reported as their second language. The selection of participants in this study contains two steps. All volunteers firstly participated in the same final examination for all English subjects. Secondly, all volunteers' English scores (all subjects were set at the centesimal system) of reading, speaking, listening, and writing were collected and summed as the total score of their English comprehensive proficiency. The extreme group design (Preacher, 2015) was adopted in this process, and all candidates' English comprehensive scores were ranked accordingly. Among the participants in the current study, fifty students were chosen and distributed into two groups. Twenty-five students (the top 27%) with the highest score were selected as the L2 high proficiency group ($M_{L2\ proficiency}$ = 368.36, $SD_{L2\ proficiency}$ =3.988); twenty-five students (the last 27%) with the lowest score were selected as the L2 low proficiency group ($M_{L2\ proficiency}$ = 315.96, $SD_{L2\ proficiency}$ = 10.914). Table 1 has showed that there is a significant difference between the L2 high proficiency group and the L2 low proficiency group ($p < .001$).

Table1. The Independent Samples t-Test of the L2 High Proficiency Group and the L2 Low Proficiency Group.

		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*
English comprehensive scores	Equal variances assumed	10.498	.002	-22.547	48	< .001	-52.400	2.324
	Equal variances not assumed			-22.547	30.297	< .001	-52.400	2.324

2.2 The Alternative Uses Task (AUT)

In AUT, participants were required to think of as many unusual/original uses of six conventional household objects (i.e., newspaper, shoes, bucket, umbrella, paper clip, and ring-pull can) as possible within ten minutes, e.g., example answers for an "umbrella": ''boat for animals'', ''epee'', and "cane", etc. Participants' total scores in AUT (AUT total score) comprised three components: fluency,
originality, and flexibility. Participants' scores in AUT represented their performance in the creative idea generation. In order to reduce the personal preference and subjectivity of the raters and increase the reliability of the scores, two college English writing teachers performed independent scoring. The score in descending order was set from 10 to 0. The final score of each participant was subject to the average of scores of these two times.

2.3 Data Processing

The data collected were first checked and screened in two rounds. The independent samples t-test was performed to detect the differences between the L2 high proficiency group and the L2 low proficiency group. Microsoft Excel 2016 was used to present the difference of the specific scores in AUT between the two participant groups. After that, the current study used IBM Statistical Package for Social Sciences (SPSS) version 27.0 to quantitatively analyze the English comprehensive scores, which stand for participants' L2 proficiency in the AUT, including descriptive statistics and correlation analyses. Standard regression analyses were also carried out to check the effect of participants' L2 proficiency on bilinguals' performance in AUT.

3. Results

Figure 1 displays the distribution of participants' AUT scores, which indicate their creative idea generation performance. The results have shown that in AUT, participants in the L2 high proficiency group generally have superiority to that of the L2 low proficiency group ($M_{L2\ high\ proficiency\ group}$ = 57.96, $M_{L2\ low\ proficiency\ group}$ = 46.08). In the learning process, bilinguals with L2 high proficiency participate in more L2 activities than those with L2 low proficiency. Higher proficiency is often associated with wider and more varied range of experiences (Cummins, 1976), thus they will experience more bilingual switching training about languages and concepts (e.g., Yang & Li, 2019), which accounts for this result.

More specifically, among three subcomponents of the AUT total score, the L2 high proficiency group obtained 689 points (fluency), 357 points (originality), and 403 points (flexibility), each of which surpassed the L2 low proficiency group (562, 242, and 348). Both two participant groups obtained the most points in "fluency" (47% in the L2 high proficiency group, 49% in the L2 low proficiency group), then followed by "flexibility" (28% in the L2 high proficiency group, 30% in the L2 low proficiency group), and the proportion of the "originality" is the smallest (25% in the L2 high proficiency group, 21% in the L2 low proficiency group) as shown in Figure 2 and Figure 3. The findings of the current study have suggested that in the process of creative idea generation in AUT, bilinguals with different L2 proficiency all tend to perform the best in fluency, while not outstanding in flexibility and originality. There was only a little difference between the two participant groups in the performance of flexibility.

The current study employed descriptive statistics and Pearson correlation analyses to examine the impact of L2 proficiency on overall AUT performance as well as on its three subcomponents. Regression analysis was further conducted to explore the relationship between L2 proficiency and each AUT variable. As shown in Table 2, L2 proficiency was found to correlate with the AUT total score (r = .363, p = .010), and most of the associations were statistically significant and positive, with the exception of the relationship between L2 proficiency and flexibility. Among the relationships between L2 proficiency and AUT variables, L2 proficiency demonstrated the highest correlation coefficient with originality (r = .398, p = .004), followed by fluency (r = .323, p = .022). However, it had an insignificant relationship with flexibility (r = .268, p > .050).

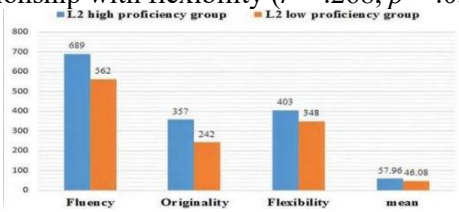

Figure 1. The Distribution of AUT Scores in Two Participant Groups.

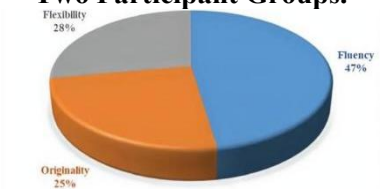

Figure 2. The Distribution of AUT Scores in the L2 High Proficiency Group.

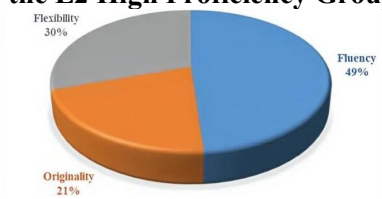

Figure 3. The Distribution of AUT Scores in the L2 Low Proficiency Group.

Table2. Means, Standard Deviations, and Correlations Between Variables.

variables	$M \pm SD$	1	2	3	4	5
1.L2 proficiency	342.16 ± 27.687	1				
2.fluency	25.02 ± 8.731	0.323*	1			
3.originality	11.98 ± 6.143	0.398**	0.849**	1		
4.flexibility	15.02 ± 4.053	0.268	0.714**	0.682**	1	
5.AUT total score	52.02 ± 17.491	0.363**	0.963**	0.933**	0.828**	1

* $p < 0.05$, ** $p < 0.01$.

Figure 4 shows fit curves between different levels of L2 proficiency and AUT total score. It showed that L2 proficiency was linear with AUT total score. Standard regression analyses were also conducted to observe the effect of L2 proficiency on bilinguals' performance of creative idea generation in AUT. L2 proficiency was entered as the independent variable, AUT total score and its three subcomponents were entered as the dependent variables. Statistics in Table 3 has illustrated that L2 proficiency could significantly predict AUT total

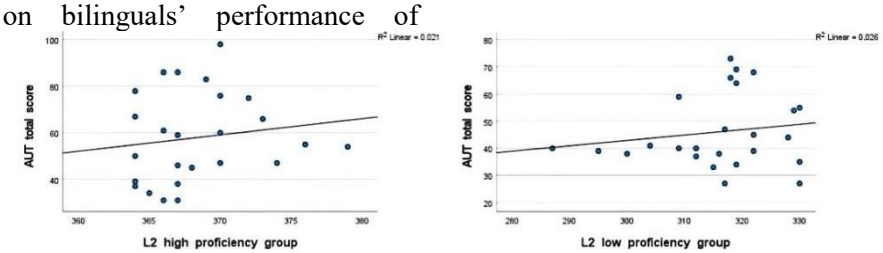

Figure 4. The Fit Curves of AUT Scores in Two Participant Groups.

score, fluency, and originality. As a predictor, L2 proficiency could account for 13.2% of the variance of AUT total score. Among three AUT variables, L2 proficiency could explain originality, accounting for 15.8% of the variance, followed by fluency (10.4%). Although the regression analysis has shown that 7.2% of the variance of flexibility might be explained by L2 proficiency, there was no linear correlation between L2 proficiency and flexibility ($p > 0.05$). Thus, L2 proficiency was the strongest predictor of originality, the second was fluency.

4. Summary

In the current study, a divergent thinking task (i.e., AUT) was employed to explore the impact of L2 proficiency on bilinguals' performance of creative idea generation using standard regression analyses. The results have suggested that L2 proficiency was positively correlated with bilinguals' creative idea generation. Specifically, L2 proficiency could predict originality, accounting for 15.8% of the variance, followed by fluency (10.4%), while the relationship between L2 proficiency and flexibility was statically insignificant. The current study is conducive to L2 education. In order to reduce the problem caused by the difference in creative idea generation, L2 teachers are suggested to focus on learners' language proficiency. Teaching plans should be designed and adjusted accordingly.

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