



## **Lexical Fluency and C-Test Performance: A Correlational Study**

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### **ABSTRACT**

*This study aims at investigating the relationship between student's second language lexical fluency and their C-test performance. Using cluster sampling procedure, 75 undergraduate students of Engineering and Basic Sciences studying general English at Shahrood University of Technology were randomly selected to participate in this study. Controlled Oral Word Association Test (COWAT) and C-test were then administered to gather data related to students' lexical fluency and C-test performance respectively. Data were analyzed through correlational analysis and independent-sample T-test. The results revealed a strong positive correlation of  $r = 0.79$  between students' performance on C-test and their lexical fluency. In addition, it was revealed that lexical fluency predicts 54% of the variance in C-test performance. These findings have clear implications for instructed second language learning.*

### **INTRODUCTION**

Verbal fluency is the cognitive ability to retrieve as many related words as possible from memory under special constraints in a limited time (Lezak et al. 2004; Lezak et al. 2012). Verbal fluency tests are psychological tests, divided into two major categories including semantic and lexical fluency. In semantic fluency tests, also called category fluency or free listing, subjects have to produce as many meaningfully-related words as possible in a given category such as animals, fruits or vegetables in a given time. On the other hand, in lexical fluency tests, also called letter fluency or phonetic fluency tests, they retrieve as many phonologically related words as possible starting with a specific letter (Benton 1968; Newcombe 1969). This word retrieval process requires special processes of neural networks in different areas of the brain, in order to access and decode long-term memory stores (Oria et al. 2009)

Since verbal fluency tests are considered as appropriate tools which require utilization of special parts of brain including both frontal and temporal lobes in the brain,

such tests are widely used in neuropsychological assessment for clinical issues in order to diagnose brain disorders and gain some rich data about cognitive impairments such as Alzheimer's (Tierney, Black and Szalai 2001; Zhao et al. 2013), Parkinson's (Rohrer et al. 1999) and Schizophrenia (Green et al. 2000) disease. They have also been used in order to diagnose dyslexia which is a language impairment in which, despite normal intelligence, the patient has some difficulties in spelling, pronouncing, reading and writing words (Cohen et al. 1999).

Furthermore, verbal fluency tests have been used to measure first language verbal abilities such as lexical knowledge, lexical access, lexical retrieval and also executive control abilities. In verbal fluency tasks, which are used to measure verbal abilities (VA) in general and lexical access in particular, participants should access their mental lexicon, select, retrieve and produce related words in their first language as quickly as possible following special rules, in a limited time and avoiding repetition. These processes require executive control ability which is a group of functions and processes that adjusts someone's thoughts and behaviors in order to achieve a special goal (Shao et al. 2014).

### **Lexical Fluency**

The difference between lexical and semantic fluency tasks is that in the former, words are retrieved according to their sound forms and without a complex track of meaning (Oria et al. 2009) while in the latter, words are retrieved according to conceptual attributes and participants have to detect links between related concepts in their mind because they need to fit the retrieved words in a special semantic group. In addition, semantic fluency tasks are very common in everyday use of language such as making a shopping list while lexical fluency tasks are rarely employed in everyday speech; hence, the novel performance on lexical fluency task requires special delicate retrieval techniques and strategies because those tasks are more difficult and less common than semantic fluency tasks (Shao et al. 2014).

Controlled oral word association test (COWAT) is the most commonly used lexical verbal fluency test in measuring the phonetic aspect of verbal fluency. This test was first introduced by Benton and his colleagues (Spreen and Strauss 1998). In the first version of COWAT, which is the most common version, three letters F, A and S have been used (Borkowski, Benton and Spreen, 1967). Since the test had a great performance in neuropsychological assessments, it became part of the neurosensory center examination of aphasia (Benton 1967). Then Benton and Hamsher suggested two other sets of letters: CFL and PRW. Contrary to F.A.S set, which was selected randomly, these letters were selected on the basis of the frequencies and difficulties of English words beginning with these letters (Benton, Hamsher and Sivan, 1994). While this test has been vastly used in neuropsychological assessment, it has been rarely used in second language studies.

Empirical studies on verbal fluency have revealed that some demographic factors including gender, age and education level can have some effects on fluency performance. However, among these three variables, age and education seem to have a higher effect on fluency than gender (Ivnik et al. 1996; Tombaugh et al. 1999). Considering gender, studies have reported that women performed slightly better than men in lexical fluency tasks (Capitani, Laiacona and Basso 1998; Crossley et al. 1997; Loonstra et al. 2001). Taking

semantic fluency into account, gender can differentiate fluency performance in some semantic categories but not in others (Capitani, Laiacona and Barbarotto 1999).

In addition, previous studies show that education level has an effect on verbal fluency, especially lexical fluency in which, highly educated people perform better in these tasks than the others (Crossley, D'Arcy and Rawson 1997; Gladsjo et al.1999; Ratcliff et al. 1998; Ruff, Light, Parker and Levin, 1996; Tombaugh et al., 1999). It has also been found that as the age increases, verbal fluency performance decreases. This findings is more evident in semantic fluency than in lexical fluency tasks (Gladsjo et al. 1999; Kozora and Cullum, 1995; Loonstra, Tarlow and Sellers 2001; Lucas et al. 1998; Mathuranath et al. , 2003; Tombaugh, Kozak and Rees, 1999; Troyer et al. 1997)

### **C-Test**

The C-Test is a kind of text completion test which is based on the reduced redundancy principle (Spolsky 1969). The assumption behind the reduced redundancy principle is that natural languages are redundant which means "In natural communication messages contain elements which are not necessary" (Baghaei 2011, p.7). In fact, redundant messages include more information than is required for understanding them. Redundancy can be decreased by deleting words from a text and asking the test taker to fill in the gaps (Raatz and Kelein-Braley 2002).

The most important issue about C-Tests is how test takers' behaviors and mental processes can be measured while the gaps are being filled by the examinees(Fledmann and Stemmer 1987; Grotjahn and Stemmer 1985; Klein-Braley 2002). There are three suggested methods to identify these processes including analysis of individual performance, text linguistic item analysis and item analysis (Klein-Braley 2002).

In order to validate the test, those mental processes involved in answering C-test should be studied. The mental processes must be compatible with the construct of the test. C-Test validation has been a great issue for several years. It has been validated for different groups of learners including first language, second language and foreign language learners (Baghaei 2014). Previous studies verify the validity of C-Tests as general language proficiency measurement. For instance, it has been found that C-Test has had a high correlation with other language tests. Other evidence of C-Test validity are Factorial structure and the Rasch model (Baghaei 2010, 2011; Eckes 2006, 2011; Eckes and Baghaei 2015; Eckes and Grotjahn 2006; Raatz 1984, 1985).

### **Purpose of the Study**

Lexical fluency seems to be a very good predictor of second language performance; nonetheless, as the review of previous empirical findings suggests, no studies have been undertaken to test their interrelationships. To fill in this gap, this correlational study was undertaken to explore the magnitude of correlation between lexical fluency and C-test performance among EFL learners. Since we believe males and females may perform differentially on lexical fluency tests and C-test, as a secondary objective, this study aims to explore the effect of gender on learners' performance on the aforementioned tests. More specifically, the study gathered some empirical data to address the following research questions:

- What is the magnitude of correlation between EFL learners' lexical fluency and their c-test performance?

- Is there any significant difference between males and females in lexical fluency?
- Is there any significant difference between males and females in C-test score?
- To what extent does lexical fluency predict C-test performance?

Based on our previous experience and logical reasoning we hypothesize that:

- There is a significant positive correlation between EFL learners' lexical fluency and C-test performance.
- There is a significant difference in performance between males and females in lexical fluency.
- There is a significant difference between males and females in C-test performance.
- EFL learners' lexical fluency is a strong predictor of their C-test performance.

## METHODOLOGY

### Participants

The research was conducted at Shahrood University of Technology, Iran. Participants were undergraduate students of Engineering and Basic Sciences studying general English as part of the overall curriculum. Following cluster sampling procedure, three classes of EFL learners learning general English at Shahrood university of Technology were randomly selected from an accessible population of 22 classes. The three classes consisted of 24, 21 and 30 students in each class. The total number of participants was 75 including 41 males and 34 females, aging between 18 to 24 with a mean age of 20.16 years old.

### Data collection instruments

To collect the required data, two instruments were employed in this study. COWAT (controlled oral word association test) was used to measure student's lexical fluency. It consists of three word-naming trials. Learners were given seven minutes to write as many words beginning with letters F, C, and L as they could think of. Following the test guidelines, learners were instructed to write any word except nonwords, proper nouns, numbers, repeated words and the same word with different suffixes. In order to assess lexical fluency performance, the total number of words produced in all three trials minus any unacceptable responses was calculated as the index of lexical fluency. Since the COWAT test's reliability and validity are well established, they are not reviewed here.

Moreover, in order to evaluate student's C-test performance, a standard C-test passage suggested by Raatz and Klein-Braley (1982) and designed by Chihara, Cline and Sakurai (1996) was used. The test consists of four independent paragraphs with about 80 words and 25 deletions in each paragraph giving a total of 100 deletions. In the C-tests, starting from the second sentence, the second half of every second word in the text is deleted. The four passages were arranged from the easiest to the most difficult. The C-test passage is shown in the Appendix.

### Data collection Procedures

At first the COWAT test was distributed among the students of each class and they were given seven minutes to take the test. We made sure that the learners understand the

instructions perfectly. Having administered the COWAT test, we then administered the C-test, which lasted 15 minutes.

The gathered data were analyzed using SPSS software. The non-parametric Spearman Correlation Coefficient was used to measure the correlation between lexical fluency and c-test performance. In addition, the independent sample T-test was applied to see whether there is a difference between men and women in their lexical fluency or not. Furthermore, in order to compare men with women in their c-test performance, the non-parametric Mann-Whitney U test was applied. Finally, the regression model was conducted to find out the degree students' c-test performance contributes to their lexical fluency.

## RESULTS

This study aimed at answering three research questions and testing three null hypotheses. To report the findings in a well-organized mode, first we present each hypothesis followed by the pertinent statistical analysis to see whether it is verified or rejected.

- **Null Hypothesis 1:** *There is not any significant correlation between EFL learners' lexical fluency and their performance on C-test.*

Kolmogorov-Smirnov test of normality was conducted to see whether the COWAT test scores and C-test scores are normally distributed or not. The results showed that C-test data are not normally distributed (p-value= 0.02) while the COWAT test scores are normally distributed (p-value=0.2). Thus, the non parametric Spearman Correlation Coefficient was used to measure the correlation between these two variables.

**Table1.** Correlation between Lexical Fluency and C-Test Performance Correlations

		cowat	ctest
Spearman's rho	Cowat	1.00	.72**
	Correlation Coefficient		
	Sig. (2-tailed)	.	.00
	N	75	75
Ctest	Cowat	.729**	1.00
	Correlation Coefficient		
	Sig. (2-tailed)	.00	.
	N	75	75

\*\* . Correlation is significant at the 0.01 level (2-tailed).

As shown in Table 1, there is a significantly high correlation (0.72) between the variables under study. Therefore, the null hypothesis is rejected in favor of the alternative hypothesis which states that there is a significant correlation between students' lexical fluency and their performance on c-test.

- **Null hypothesis:** *There isn't any significant difference in performance between males and females in lexical fluency.*

Kolmogorov-Smirnov test of normality was conducted to see whether the COWAT test scores are normally distributed between men and women or not. The results show that it is normally distributed between both men (p-value= 0.11) and women (p-value= 0.2). To compare males' and females' performance in lexical fluency, the independent sample T-

test was applied. As shown in table 2, that there isn't any significance difference between men and women in their lexical fluency. So the null hypothesis is verified in favor of the research hypothesis.

**Table 2.** Independent Sample T-Test of Lexical Fluency

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI	
									Lower	Upper
cowat	Equal variances Assumed	4.35	.040	1.43	73	.155	3.48	2.42	-1.34	8.30
	Equal variances not assumed			1.48	71.89	.143	3.48	2.35	-1.20	8.16

- **Null hypothesis:** *There isn't any significant difference in performance between males and females on c-test.*

Kolmogorov-Smirnov test of normality was conducted to see whether the C-test scores are normally distributed between men and women or not. The results show that they are normally distributed between women (p-value= 0.2) but is not normally distributed between men (p-value= 0.03); hence, in order to compare men with women, the non-parametric Mann-Whitney U test was applied.

**Table 3.** Non-Parametric Man-Witney U Test of C-Test Test Statistics<sup>a</sup>

	Ctest
Mann-Whitney U	629.00
Wilcoxon W	1224.00
Z	-.72
Asymp. Sig. (2-tailed)	.46

a. Grouping Variable: sex

As shown in table 3, there isn't any significant difference between males and females in their C-test performance; therefore, the null hypothesis is verified.

- **Null hypothesis 4:** EFL learners' lexical fluency isn't a strong predictor of their C-test performance.

As shown in table 1, there is a strong correlation between students' lexical fluency and their performance on C-test; hence, we can consider lexical fluency as an important independent variable affecting students' C-test performance. In order to find the predictive power of the independent variable lexical fluency in relation to C-test performance as the dependant variable of the study, the regression model was run. The results of this analysis are shown in tables 4-6.

Table 4 shows the overall contribution of the independent variable lexical fluency to the dependant variable C-test performance. According to the value of R-square, it is revealed that lexical fluency predicts 54% of the variance in C-test performance and that the other 46% is predicted by other variables not included in this study.

**Table 4.** Model Summary in Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.73 <sup>a</sup>	.54	.53	8.52

a. Predictors: (Constant), cowat

In addition, as shown in table 5, regression is significant at 0.01 level. That is, the independent variable lexical fluency significantly predicts C-test performance.

**Table 5.** ANOVA in Regression Analysis

ANOVA<sup>a</sup>

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6221.93	1	6221.93	85.69	.000 <sup>b</sup>
	Residual	5300.06	73	72.60		
	Total	11522.00	74			

a. Dependent Variable: ctest

b. Predictors: (Constant), cowat

Furthermore, table 6 shows the power of lexical fluency in predicting the variance in C-test performance as the dependant variable. As it is shown, lexical fluency (COWAT) has a significance level below 0.01. It means that this variable is able to predict the variance in C-test scores.

**Table 6.** Coefficients in Regression Analysis

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.15	2.33		1.77	.08
	Cowat	.872	.094	.73	9.25	.00

a. Dependent Variable: ctest

## CONCLUSION

The study aimed at investigating the degree of correlation between lexical fluency and c-test performance. As the findings clearly show, there is a significant positive correlation between students' performance on C-test and their lexical fluency; therefore, we can consider lexical fluency as a significant predictor of C-test performance. According to the value of R-square, it is revealed that lexical fluency predicts 54% of the variance in C-test performance and that the other 46% is predicted by other variables not included in this study. This finding is indirectly supported by other previous empirical findings. For instance, it has been found that that there is a correlation between lexis and C-test as a

lexical elicitation instrument (Chapelle, 1994; Little & Singleton, 1992; Singleton, 1999; Singleton & Singleton, 2002). This study sheds some lights on the findings of the present study since lexical chunks or prefabricated patterns significantly contribute to both lexical fluency and C-test performance. Daller *et al.* (2003, p. 206) concluded that 'lexical competence plays a crucial part in successfully completing a C-test'.

Moreover, Read (2000, p. 113) mentioned the lexical competence plays a great role in cloze tasks processes (including C-tests). He mentioned that "a cloze tends to make a very *embedded* assessment of vocabulary, to the extent that it is difficult to unearth the distinctive contribution that vocabulary makes to test performance". Moreover, he emphasized that word morphology knowledge is vital if a language has complex word endings in a C-test. Singleton (1999, p. 205) also concluded that "our own claim that C-test data are essentially lexical data is strongly supported by recent theoretical reflections and empirical findings relative to the nature of the lexicon. What the test very obviously taps into is knowledge of lexico-grammatical specificities of a given language.

As the results show, there is not any relationship between gender and performance on lexical fluency test and C-test. Therefore, we can make sure that the gender variable does not play an intervening role in the results of the study. While previous studies in the field of lexical fluency are only devoted to the neurological and psychological issues, this study showed that lexical fluency interventions can have a significant effect on improving EFL learners' performance in C-test. More to the point, since cloze test and C-test are very well-known predictors are overall language proficiency, it can be implied that improving EFL learners' lexical fluency can improve EFL learners' overall proficiency. Taking this implication into account, it is suggested that:

- Commercial materials developers add lexical fluency tasks which aim at developing EFL learners' lexical fluency
- Practitioners develop EFL learners' lexical fluency through effective interventions.

However, despite their rigorous designs, quantitative studies are shaky in terms of internal and external validity; hence, the field is in need of more studies not only to test the effect of lexical fluency interventions on individual language skills and overall language proficiency but also to study the correlation between lexical fluency and listening, speaking, reading, and writing performance. Only then can these empirical findings be developed into clear policies that shed some light on the practice of language teaching.

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