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Cognitive Predictors of Reading Comprehension in English as a Foreign Language

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Abstract

The purpose of this study was to examine the cognitive predictors of reading comprehension in English as a foreign language (EFL). A correlational study showed that verbal reasoning, sustained attention, processing speed, and cognitive flexibility account for 38% of the variance in foreign language reading scores.

Keywords

Reading comprehension, verbal reasoning, sustained attention, processing speed, cognitive flexibility

1 | Introduction

This study is an attempt to investigate the unique contributions of various cognitive factors to reading comprehension in a sample of 228 Iranian high school English as a foreign language (EFL) learners. It is assumed that cognitive factors predict reading comprehension as a complex process in foreign language acquisition. Because there are not many studies which focus on the cognitive factors underlying reading comprehension in second language learning, this investigation focuses on this issue. To this aim, the relationship between verbal reasoning, cognitive flexibility, processing speed, sustained attention, and reading comprehension was assessed using correlation and multiple regression. From multiple regression analysis, it became evident that cognitive factors significantly account for foreign language reading achievement.

2 | Method

2.1 | Participants

The participants were 228 third grade female high school students who studied English as a foreign language (EFL). Their age range was 17 to 18 years old.

2.2 | Instrument

2.2.1 | Reading Comprehension Test

Since the participants were high school 3rd graders, who had a low proficiency of English, a reading comprehension test was adopted from their national English exam (Velayati, 2014). According to Bachman (1990), one of the characteristics of a standard test is that there are a standard procedure and uniformity in administering and scoring of the test in various

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administrations, so the nationwide English exam of high school 3rd grade is assumed to be a standard test. Four reading sections from different years, with different topics, were chosen to test the participants' reading comprehension ability. The topics were about children's naughtiness, fear, having a nurse at school, and being relaxed. The participants had to read four texts and answer 6 questions for each text with a total number of 24 questions; 16 multiple choice questions, that tested their detailed understanding of the text, as well as 8 true/false questions. For the true/false questions, they had to decide if the sentences were right or wrong or if they were mentioned in the text. The maximum allocated time for the reading comprehension test was 30 minutes. The reliability of the reading comprehension test in this study was 0.72.

2.2.2 | Letter Digit Substitution Test

The processing speed was assessed by the Letter Digit Substitution Test (Van der Elst et al., 2012) in a paper and pencil form.

2.2.3 | Ruff 2 and 7 Selective Attention Test

To evaluate sustained attention, Ruff 2 and 7 Selective Attention Test (Ruff et al., 1992) in a paper and pencil form was administered.

2.2.4 | Wisconsin Card Sorting Task

For measuring cognitive flexibility, the computer-based Wisconsin Card Sorting Task (Grant & Berg, 1948) was used. The test was administered individually.

2.2.5 | Verbal Analogy Test

The participant's verbal reasoning was tested by a Persian verbal analogy test containing 30 multiple choice questions from the 49-item verbal analogy test developed by Tabatabaee-Yazdi et al. (2020).

3 | Results

Table 1 shows the descriptive statistics of the reading comprehension test and the independent variables including verbal reasoning, sustained attention, processing speed, and cognitive flexibility. Table 2 also shows the correlation coefficients between reading comprehension and the independent variables.

Table 1

Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation	Test reliability
Reading Comprehension	228	6	23	14.75	3.319	0.72
Verbal Analogy	228	9	28	18.09	3.085	0.70
Sustained Attention	228	244	568	377.13	60.770	0.95
Processing Speed	228	23	123	76.78	12.932	0.96
Flexibility	228	1	6	5.65	0.750	0.95

This study further examined the extent to which the variance in the reading comprehension scores was explained by the cognitive factors (verbal reasoning, sustained attention, processing speed, and cognitive flexibility). After checking the assumptions such as outliers, normality, linearity, homoscedasticity, and independence of residuals, multiple regression analysis was run. The adjusted R square for the model was 0.388, $F(223) = 36.958$ $p < 0.001$. That is, 38% of the variance in the reading comprehension scores can be explained by the four cognitive factors in the study.

Table 2

Correlation Coefficients

Scales	Reading Comprehension	Verbal Reasoning	Sustained Attention	Processing Speed	Cognitive Flexibility
Reading Comprehension	1				
Verbal Reasoning	0.496**	1			
Sustained Attention	0.402**	0.300**	1		
Processing Speed	0.538**	0.470**	0.586**	1	
Cognitive Flexibility	0.411**	0.385**	0.363**	0.545**	1

Table 3 shows the standardized beta coefficients. In multiple regression, the size of the coefficient for each independent variable shows the size of the effect that the variable has on the dependent variable and the significance of the coefficient (positive or negative values gives the direction of the effect). When there is more than one independent variable in multiple regression, the coefficient indicates how much the dependent variable is expected to increase if the independent variable increases by one, holding all the other independent variables constant. The *t* value and the *sig* indicate whether that variable is significantly contributing to the equation for predicting reading comprehension.

As Table 3 shows, verbal reasoning makes the strongest unique contribution (beta = 0.33) to the explaining of reading comprehension, when the variance explained by all other variables in the model is controlled for. Table 4 shows that verbal reasoning and processing speed made a statically significant unique contribution to the prediction of reading comprehension ($p < 0.05$) while sustained attention and cognitive flexibility did not have a significant unique contribution to the prediction of reading comprehension.

Table 3

The Beta Weights and Part Correlations for the Independent Variables

IV	Beta	Part	*t*	*p*
Verbal reasoning	0.330	0.283	5.445	0.000
Sustained attention	0.105	0.085	1.634	0.104
Processing speed	0.257	0.178	3.437	0.001
Cognitive flexibility	0.104	0.086	1.657	0.099

4 | Conclusion

The current study sought to examine the contribution of four cognitive factors, namely, verbal reasoning, sustained attention, cognitive flexibility, and processing speed to reading comprehension among Iranian EFL learners. The correlations indicated that cognitive abilities were significantly related to reading comprehension. Different researchers have also mentioned that general cognitive and metacognitive processes are involved in reading comprehension (Cubukcu, 2008; Muijselaar & De Jong, 2015; Rapp & Van den Broek, 2005).

Findings from multiple regression analysis highlighted that verbal reasoning made the strongest unique contribution to explaining reading comprehension. This suggests that analogical reasoning is a cognitive ability that is strongly associated with EFL reading comprehension. Processing speed also made a significant contribution, suggesting that it is an important factor in reading comprehension achievement. Schweizer and Koch (2002) also identified processing speed as part of the cognitive basis of fluid intelligence and learning. The results indicated that sustained attention and cognitive flexibility did not significantly explain reading comprehension.

The findings of the study suggest that reading comprehension as a complex task requires more than just decoding the text. In fact, it requires the successful coordination of cognitive processes and the integration of information and extraction of meaning (Tiffin-Richards & Schroeder, 2015). The findings of this study enrich the existing theories stating that cognitive processes have a positive role in second language reading comprehension.

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Conflict of Interest

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Data Availability Statements

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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