Educational Methods & Practice

https://emp-open.de
Volume 2 (2024)

Rapid Communication

The Role of Fluid Intelligence in EFL Learners' Mental Lexicon

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Abstract

The present study investigates the relationship between fluid intelligence and the development of the mental lexicon in Iranian learners of English as a Foreign Language (EFL). Findings from 200 participants showed a positive correlation between fluid intelligence and mental lexicon development, with no significant association with gender. The study suggests potential insights for EFL educators to enhance vocabulary teaching and overall language proficiency.

Keywords

EFL learners, fluid intelligence, mental lexicon

1 | Introduction

Intelligence is a multifaceted and complex cognitive ability encompassing various mental skills such as problem-solving, learning, reasoning, and adapting to new situations (Gardner, 2004). It involves the capacity to acquire, process, and apply information effectively to navigate challenges and make informed decisions. Intelligence is not limited to a singular dimension but includes a combination of logical, creative, and practical elements. It enables individuals to understand, learn from experience, and engage with the world in adaptive ways, contributing to their overall ability to succeed in various aspects of life.

According to Gardner (2004), intelligence is a multilayered cognitive ability including problem-solving. It is a composite of various functions, allowing individuals to find effective solutions to challenges. Besides, Cattell-Horn-Carroll (CHC) theory was introduced as a framework classifying cognitive abilities into ten groups, including fluid intelligence and crystallized intelligence. CHC theory made a distinction between fluid intelligence (gf) and crystallized intelligence (gc); with gf representing skills essential for advanced mental processes, critical thinking, and reasoning, while gc encompasses knowledge gained through formal education and life experiences (Baghaei & Tabatabaee-Yazdi, 2015; Cattell, 1943; Vieira et al., 2022). The importance of fluid intelligence in problem-solving and its role in predicting various life outcomes,

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Received 29 November 2023; Received in revised form 20 January 2024; Accepted 29 January 2024
Available online 7 February 2024

including academic performance and achievements, has been highlighted by numerous scholars (e.g., Carpenter et al., 1990; Chuderski, 2022; Egeland et al., 2022).

Mental lexicon often likened to a mental dictionary (Elman, 2004; Kenett & Hills, 2022; Vitevitch, 2020) is also a dynamic system influencing language processing (Aitchison, 2012; Castro & Siew, 2020). It shows the interconnectedness of words, semantic relationships, and associations within the mental lexicon, along with the impact of orthographic and phonological features. Various studies on word associations, lexical access, and the organizational structure of the mental lexicon have indicated the context-dependent nature of word meanings and the role of mental lexicon in language processing (Aitchison, 2003; de Sousa & Gabriel, 2015; Elman, 2004; Farahian, 2011; Kenett & Hills, 2022; Issa et al., 2022; Jayantha et al., 2022; Vitevitch, 2020).

This study aims to delve into the concept of intelligence, emphasizing the CHC theory, focusing on fluid intelligence (gf) as a predictor of mental lexicon. It highlights intelligence as a composite of multiple functions rather than a singular entity (Anastasi, 1992; Lenat & Feigenbaum, 1991). Accordingly, the study aims to investigate the relationship between fluid intelligence and the mental lexicon of Iranian English as a Foreign Language (EFL) learners. It also explores potential gender differences in both mental lexicon and fluid intelligence among the participants.

2 | Method

2.1 | Participants and Setting

The sample of the current study included 200 Iranian intermediate EFL students (116 females and 84 males) who were selected based on convenience sampling. Their age ranged from 17 to 25 years old (Mean age = 22.6 years, *SD* = 1.8). All the participants' mother tongue was Persian.

2.2 | Instruments

2.2.1 | Baddeley's 3-min Grammatical Reasoning Test

To assess participants' fluid intelligence, the Persian Adaption of Baddeley's 3-minute grammatical reasoning test developed and validated by Baghaei et al. (2017) was used. The test includes sixty-four true/false sentences that should be completed in 3 minutes. The reliability of the test was reported to be 0.91 (Baghaei et al., 2017).

2.2.2 | Lex30 Test

To measure the participants' mental lexicon, Lex30 test developed and validated by Meara and Fitzpatrick (2000) was used. It is a word association task (WAT) in which test takers are given a list of stimulus words and asked to respond to these words with at least three related words or phrases that come to their mind. All of the words on the test were carefully selected from the most widely used Nation's first 1000 wordlist (1984) because the test was designed to be administered at a variety of proficiency levels. There were 30 stimulus words in the test, and participants had 30 seconds to respond to each one.

3 | Results

To examine the correlation between Iranian EFL learners' fluid intelligence and their mental lexicon, Spearman's *rho* correlation was used due to the violation of parametric tests' assumptions in the data. There was a moderate positive correlation between Iranian EFL learners' fluid intelligence and their mental lexicon with (*rho* = 0.33, *p* = 0. 00). Besides, the Mann-Whitney U test was used (Tables 1 and 2) to examine any significant differences in females' and males' Mental Lexicon and Fluid Intelligence.

As Table 1 shows, male learners have a higher Mean Rank score in their both Mental Lexicon (Males = 102.20, Females = 99.27) and Fluid Intelligence (Males = 108.97, Females = 94.37). To find whether the differences are significant, the Mann-Whitney U test (Table 2), the nonparametric alternative to the independent samples *t*-test, was conducted. The

results indicated no significant difference between the two groups neither in their Mental Lexicon (Mann-Whitney U = 4729.00, Z = -0.354, $p = 0.72$) nor in their Fluid Intelligence (Mann-Whitney U = 4160.00, Z = -1.763, $p = 0.07$).

Table 1

Descriptive Statistics Concerning Gender

	Participant	N	Mean	Mean Rank	Standard Deviation
Mental Lexicon	Female	116	45.49	99.27	0.87
	Male	84	45.92	102.20	1.04
Fluid Intelligence	Female	116	94.37	94.37	10948.50
	Male	84	108.97	108.97	9153.50

Table 2

Mann-Whitney Test

Mann-Whitney U	4729.000	4160.500
Wilcoxon W	11515.000	10946.500
Z	-0.354	-1.763
Asymp. Sig. (2-tailed)	0.723	0.078

Note. a. Grouping Variable: Gender

4 | Conclusion

The study aimed to explore the relationship between Iranian EFL learners' fluid intelligence and their mental lexicon. The results showed that higher fluid intelligence correlates with a more extensive mental lexicon, with no significant gender impact. The findings highlight that vocabulary knowledge is crucial for English learning, influencing communicative competence. Therefore, educators should adapt teaching techniques considering learner diversity. While fluid intelligence contributes to the prediction of mental lexicon growth, other factors like motivation and exposure also play major roles. Higher fluid intelligence enhances efficient vocabulary processing and retrieval. Future research can focus on longitudinal studies, larger sample sizes, and different intelligence types, teaching approaches, and techniques which affect mental lexicon and fluid intelligence.

Funding

The author(s) received no specific funding for this work from any funding agencies.

Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statements

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

How to Cite:

Livdani Torghabeh, F., & Tabatabaee-Yazdi, M. (2024). The role of fluid intelligence in EFL learners' mental lexicon. *Educational Methods & Practice, 2*:8.

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