

**Research Article**

## **EFFECT OF FLUID INTELLIGENCE ON READING AND LISTENING ABILITIES**

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*Received: 20 February 2023, Accepted: 29 June 2023*

### **ABSTRACT**

The present study explored the effect of fluid intelligence on reading and listening abilities. A total of 50 undergraduate students (age ranging from 20 to 24 years) participated in this study. Data were collected using the shortened version of Raven's Standard Progressive Matrices, and the tests assessed reading and listening ability. The obtained data were analyzed using an independent sample *t*-test. Results indicated that individuals with high intelligence outperformed on reading and listening comprehension compared to individuals with low intelligence. However, no significant gender difference was observed in intelligence, reading ability, and listening ability ( $p > .05$ ). The findings offer crucial allusions for educational institutions in designing the curriculum for students.

**Keywords:** *Fluid intelligence, Reading ability, Listening ability*

### **Introduction**

Ingenious people are assumed to have a good memory, and to think rationally. The concept of 'Intelligence' not only delineates humans as a distinct species from other creatures but also enables individuals to maintain their uniqueness while coexisting among fellow human beings (Sternberg, 2018). Intelligence encompasses a broad range of cognitive abilities crucial for various learning tasks (Ellis, 2008), influencing every aspect of our lives (Gordon, 1997).

Cattell-Horn-Carroll's theory of intelligence (Cattell, 1963; Horn and Cattell, 1968) focuses on the idea that intelligence represents two distinct forms—fluid intelligence and crystallized intelligence. The capacity to apply previously acquired, culturally approved problem-solving skills that gain from education and experience is known as crystallized intelligence (Baghai and Tabetabae, 2015). Crystallized intelligence references our pre-existing knowledge—facts, reading and writing skills, and information we previously learned. On the other hand, fluid intelligence refers to the ability to solve new problems, identify relationships between elements, and remains unaffected by cultural influences or formal learning experiences. Therefore, fluid intelligence is crucial for acquiring new skills like reading, listening, writing, and speaking. In this study, we specifically focused on fluid intelligence.

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For decades the question of whether language ability is represented as a single skill or as a set of skills. Finally, Carroll (1961, 1968) proposed a model to map native and secondary language proficiency by four basic skills (reading, listening, writing, and speaking). Empirically, there is no doubt that intelligence is good predictors of language skills. A study conducted with a group of 32 secondary Indonesian school students revealed a significant contribution of intelligence to reading comprehension (Ningrum and Wibowo, 2017). However, Corso *et al.* (2016) found no direct link between intelligence (measured using Raven's Progressive Matrices), and reading comprehension among fourth and sixth graders in Brazil. This discrepancy motivates us to include reading comprehension in our current investigation as a potential predictor of fluid intelligence.

Out of the four language skills, listening stands out as the most beneficial and crucial for students. Listening involves the learned process of receiving, interpreting, recalling, evaluating, and responding to both verbal and nonverbal messages (Ridge, 1993). There is a strong correlation between intelligence and listening ability (Brown, 1965). However, most studies on this relationship were conducted years ago. Therefore, our current study aims to offer further insights into the connection between intelligence and listening ability. Consequently, exploring the relationships between fluid intelligence, reading, and listening abilities could yield valuable findings.

#### Gender difference in cognitive abilities

The concept of gender differences in cognitive abilities is fascinated for both psychologists and general people over the past 100 years (Hyde and McKinley, 1997). Most psychologists believe that general intelligence does not differ by gender (Hunt and Madhyastha, 2008). The idea of gender difference on cognitive abilities is changing over time, and often show considerable cross-cultural variation in effect size. Therefore, this controversial topic may need to be revised.

#### Research questions

Against this background, the present study addressed two research questions:

1. Is there any impact of fluid intelligence on reading and listening ability?
2. Is there any gender difference in fluid intelligence, reading ability and listening ability?

### **Materials and Methods**

#### *Participants*

Participants in this experiment were 50 undergraduate students (64% boys) who were studying at Jagannath University. The age of the participants ranged from 20 to 24 years ( $M_{\text{age}} = 23.10$  years,  $SD_{\text{age}} = 0.86$  years). All participants had normal or corrected to normal vision and hearing.

#### *Measures*

The following measures were used for data collection in the study:

#### *The Shortened Raven's Standard Progressive Matrices*

The Short Version of Raven's Standard Progressive Matrices (RSPM; van der Elst *et al.*, 2013) was individually administered at the university laboratory. The shortened RSPM consisted of three sets of items of the original RSPM (sets B, C, and D). Each item presented a matrix of black and white elements. Participants had to discover the rules that govern the distribution of patterns and to apply them to response options in order to choose the one and only right pattern. Each item

set contains 12 multiple choice items (items B1-B12, C1-C12, and D1-D12) with 6 (Set B) or 8 (Sets C and D) response options. All examinees were allowed to complete the entire test with no time limit. Items were scored as 1 for correct response or 0 for wrong response. Proportions of correct responses were deemed as dependent variable.

#### *Reading Ability Test*

Reading ability was taken from the district competition organized by the Society for Foreign Languages Literature of Serbia. This passage was about "The Robot Wine Waiter". Based on the passage, eight questions with four alternatives were presented. Example item was "The restaurant employed the robot". Proportion of correct responses was considered as dependent variable.

#### *Listening Ability Test*

The listening test was taken from IELTS Cambridge guide, in which participants had to listen audio recording and respond accordingly. There were ten fill-in-the-blank questions. Example item was "Poor train service at \_\_\_". Proportion of correct responses was considered as dependent measure.

#### *Procedure*

Initial permission was taken from the participants. They were briefed on the purpose and importance of the research. In the beginning, they were simply instructed how to fill out the questionnaire, including personal information sheet, the RSPM, and reading comprehension test. After that, audio conversation was played over headphones to assess listening ability. Participants were given a five-minute break after each task. They took 45 minutes to complete all the tasks. Participants were assured that their information only used for research purposes and were kept confidential. Finally, they were thanked for their participation.

#### *Data analysis*

In the present study, descriptive statistics were calculated. First, we converted the raw scores of intelligence into standard scores. Participants who scored above the mean were grouped into high intelligence groups, and participants who scored below the mean were grouped into low intelligence group. The obtained data were analyzed by using the independent samples *t*-test. All statistical analysis was carried out using the statistical program SPSS version 25 for windows.

## **Results and Discussion**

### ***Results***

Table 1 represents the mean, standard deviation, skewness, kurtosis and reliability of the fluid intelligence, reading ability, and listening ability. Reliability of the listening ability test was found to be higher ( $r = 0.82$ ) than other two measures.

Table 1. Mean, Standard Deviation, Skewness, Kurtosis, and Reliability of Fluid Intelligence, Reading Ability, and Listening Ability

Variables	Mean	Standard Deviation	Skewness	Kurtosis	Cronbach's Alpha
Proportion of Fluid Intelligence	.85	.08	.14	-.68	.689
Proportion of Reading Ability	.43	.20	.90	.32	.631
Proportion of Listening Ability	.45	.23	1.05	.67	.822

Table 2 displays the means and *t*-statistics comparing the reading and listening comprehension of individuals with high and low intelligence. There was a significant difference between fluid intelligence, and reading and listening ability. It indicates that high intelligent participants had better reading ( $M = .57, SD = .21$ ) and listening ( $M = .62, SD = .24$ ) abilities, compared to low intelligent counterparts (reading ability:  $M = .31, SD = .09$ ; listening ability:  $M = .31, SD = .10$ ). In addition, the Cohen's *d* values showed large effect size ( $d > 0.8$ ).

Table 2. The t-statistics Comparing Participants with High and Low Intelligence on Reading and Listening Ability

Variables	High Intelligence		Low Intelligence		<i>t</i> (48)	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
	Proportion of Reading Ability	.57	.21	.31			
Proportion of Listening Ability	.62	.24	.31	.10	5.55	<.001	1.69

Note.  $p < .05$ .

Table 3 represents *t*-statistics and effect size (Cohen's *d*) of gender differences. There was no significant gender difference in fluid intelligence, reading, and listening abilities.

Table 3. The t-statistics of Gender Difference on Listening and Reading Ability

Variables	Male		Female		<i>t</i> (48)	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Proportion of Fluid Intelligence	.86	.08	.83	.08	1.05	.30	0.38
Proportion of Listening Ability	.44	.25	.45	.21	-.09	.93	-0.04
Proportion of Reading Ability	.43	.22	.42	.18	.10	.92	0.05

## Discussion

The primary aim of the present study was to explore whether differences in fluid intelligence impact on reading ability and listening ability. In addition, this study further investigated gender differences in intelligence, reading ability, and listening ability. Results revealed that intelligence had an effect on reading and listening abilities. However, there was no gender difference in these three cognitive skills.

The significant impact of intelligence on reading comprehension ( $t = 5.43, p < .05$ ) and listening ability ( $t = 5.55, p < .05$ ) supports prior works (Esmaeel and Zahra, 2015; Ningrum and Wibowo, 2017). This finding suggests that the brain network of people with higher intelligence has shorter path lengths and thus better cognitive ability (Langer et al., 2012). In general, fluid intelligence which means the reasoning and the problem-solving capacity of an individual is related to language skills. Therefore, a student with high intelligence can easily understand the information from the text and listening comprehension rather than others. A study on identical twins showed

that children with strong reading skills are more likely to have higher intelligence levels than young adults (Ritchie *et al.*, 2014). Intelligence is highly correlated with working memory, and working memory is important to grammar and vocabulary knowledge to gain skills in reading and listening components (Morra and Camba, 2009).

From Table 2, the lack of gender differences in fluid intelligence is consistent with the findings of Waschl and Burns (2020). However, some studies showed that men excelled women in fluid intelligence (Lynn and Irwing, 2002), and others claimed that women outperformed (Keith *et al.*, 2008) men. Furthermore, Table 2 also indicates that there was no significant gender difference in listening ability ( $t = -.90, p > .05$ ), and reading ability ( $t = .10, p > .05$ ) which supports prior works (e.g., Gruber *et al.*, 1979; Halpern *et al.*, 2007; Oda and Khadim, 2018). However, Hajovsky *et al.* (2017) found a small gender difference, in which women performed better in verbal tasks such as reading and writing abilities than men (Petersen *et al.*, 2020). Metacognitive awareness may assist learners in their listening and reading comprehension improvement. In general, gender differences in intelligence are a controversial issue, and this controversy might occur due to the societal perception that women in our society often underestimate their intellectual abilities.

Finally, the current results advance our understanding regarding the interplay of fluid intelligence and language skills like listening and reading.

#### **Acknowledgment**

We are thankful to the students who participated in the study.

#### **Declaration of conflicting interest**

We declare that we have no conflict of interest.

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