

THE RELATIONSHIP BETWEEN WORKING MEMORY AND ARGUMENTATIVE ESSAY WRITING AMONG PAKISTANI IELTS TEST TAKERSBinish Asghar Aulakh¹, Dr. Aleem Shakir^{*2}**Original Article**

1. MPhil Scholar, Department of Applied Linguistics, Government College University, Faisalabad, Punjab, Pakistan. Email: binisholakh333@gmail.com
2. Assistant Professor, Department of Applied Linguistics, Government College University, Faisalabad, Pakistan. Corresponding Email: almsha@yahoo.com

Abstract

This correlational research study aimed at exploring the relationship between working memory capacity and argumentative writing proficiency of Pakistani IELTS test takers. The goal of this research was to check whether working memory proves helpful in enhancing the writing proficiency of students or remains the same. This study involved 128 (41 female, 87 male) Pakistani IELTS test takers as its population. The study manipulated three instruments (prompt for essay from www.org.ielts scoring rubric of IELTS and OSPAN) for collecting required data. Later to analyse the data SPSS 23rd version was used. Pearson product moment correlation coefficient was calculated to achieve required objectives of current study. The results of Pearson product moment correlation ($r(126) = .071, p = .428$) depicted that there was no significant correlation between working memory and essay writing proficiency of Pakistani IELTS test takers. The results of this research concluded that there was no correlation between working memory and writing proficiency of Pakistani IELTS test takers.

Keywords: Working memory, argumentative writing, operation-word span test, IELTS test takers, visuo spatial sketchpad.

1. Introduction

Argumentative writing and working memory play a vital role in achieving academic success. These are productive and active skills for students to learn the English language. Writing and working memory are considered complementary parts for each other for many years. Theoretical writing models have proposed that WM is a crucial cognitive resource required for composition (Hayes, 2012; Kellogg, 1996).

Writing has traditionally been seen as a skill that must be learned through effort and as something that some people grow to incredibly greater levels than others (Bereiter & Scardamalia, 1987, p. 4). Argumentative writing in a second language (L2) is regarded as being more formal and challenging (Weigle, 2005). Argumentative writing proficiency necessitates a variety of skills and knowledge resources due to the complexity of text composition, including linguistic knowledge, knowledge of the genre and rhetorical requirements, metacognitive writing process knowledge, and fluency in re-possession of linguistic knowledge (De Gloor, Hulstijn, Schoonen, Stoel, & Van Gelderen, 2011). One of the primary cognitive factors influencing writing ability has always been working memory (WM) (Hayes, 2012; Kellogg, 1996). The consequences of working memory in second language writing are less evident, despite the fact that the role of working memory is well-justified theoretically (Hayes, 2012; Kellogg, 1996; Kellogg, Whiteford, Turner, Cahill, & Mertens, 2013) and experimentally (Swanson & Vanderberg, 2007) in L1 writing. Ever since working memory was first studied in the 1960s, researchers have been captivated (Chai, 2018). The ability

to concurrently collect and process information in an actual period of time is referred to as working memory capacity (Sawyer, 1992). Working memory is a mental ability that is helpful in today's professional as well as academic life (Bayliss, 2005). Working memory is the ability to maintain brief moments of active, readily available knowledge, often for fewer than 30 seconds at a time. Working memory is linked to a range of reasoning functions in school years, including reasoning, verbal comprehension, and math skills (Copello, 2013). Working memory shows a significant role in awareness of dynamic tasks like reading and writing. Argumentative writing is generally considered the hardest area of the composition to teach, yet it is worthwhile to include in the curriculum because it teaches reasoning abilities that can be applied to everyday life and business (Mc Cann, 1989). Argumentation can be defined as making assertions and providing evidence to back them up with evidence (Toulmin, 1958). Argumentative writing is used to show that the writer's opinions are truer or more accurate than others' perspectives on a certain topic (Spangler, 1997).

The link between working memory and other factors including reading, listening, speaking, and writing has been the subject of extensive research. The most frequent traits among them are oral L2 performance and reading proficiency. Working memory capacity and writing ability are strongly correlated. But there has been limited research found on the relation between argumentative essay writing and working memory. Therefore this study aims to find correlation between working memory capacity and argumentative essay writing proficiency among IELTS test takers in Pakistan.

1.1 Problem statement

Based on extensive review of literature, there have been found some gaps in previous research studies related to working memory and writing proficiency. These recent developments in research provide adequate evidence to support the hypothesis that second language proficiency may also moderate the involvement of working memory in L2 writing. There is a need for more research because the few studies that have examined this premise (Kormos & Safar, 2008; Lu, 2015) have shown results that are incongruous. Working memory was the subject of scant research in Pakistan, all of which were connected to psychology or social sciences. This study set out to determine the relationship between writing an effective argumentative essay in the English language and the influence of working memory on writing skills among Pakistani IELTS test takers while keeping in mind the significance of argumentative essay writing and working memory in the modern era and its global reach.

1.2 Objectives of current Study

This study was initiated to investigate the correlation between working memory and argumentative essay writing of Pakistani IELTS test takers. This study investigates whether there is a strong correlation between working memory and argumentative essay writing or weak or negative correlation and what the reasons for such results are.

2. Literature Review

Before discussing argumentative writing and working memory it's compulsory to know about writing and memory itself. Writing is a person's unique way of writing on paper with a pen that can be accepted as their own. Axelord and cooper (1985) claim that writing is the process of discovering and shaving meanings. While working memory has been the subject of more than a century of scientific research in the field of psychology. The general agreement concerning working memory backs up the notion that working memory is widely included in objective focused

activities in which information needs to be engaged and handled to confirm effective task performance (Baddeley, 2009). The importance of working memory derives, at least partially, from its attributed role in learning and language processing (Baddeley, 2003).

2.1 Working Memory

Working memory states the capacity of a person to store, analyze, and retrieve information. According to Baddeley's (2003) definition of working memory this is "the temporary storage and operation of information that is considered to be essential for a wide range of complicated cognitive functions." (Baddeley, 2003, p. 189). Working memory differs from short-term memory as it deals with recalling knowledge for a limited period of time, often for a few seconds. There were presented various features, characteristics, models and theories of working memory in the past. There are three main features of working memory. The first is that it has a restricted storage capacity (only 6 to 7 items). Second, it is only for a limited period of time since information might be lost due to attention or the passage of time. Although WM has traditionally been thought of as a fixed trait with a strict limit (Cowan, 2005), there is some evidence to suggest that it can be increased through focused training (Bühner, Fischer, & Schwaighofer, 2015), with potential positive effects on academic performance in general and L2 learning in particular (Tsai et al., 2016). The third step is encoding, which is predominantly acoustic and includes the conversion of visual information into sounds. There were two main models of working memory discussed in past studies; one was well-defined by Baddeley and Hitch in 1974 while the other was explained by Kellogg in 1996. Unlike previous theories of short-term memory that concentrated on its storing function, Baddeley and Hitch's 1974 model was an energetic strategy that linked the memory's processing and storing components.

The central executive of the WM, according to the Baddeley and Hitch (1974) model, is in charge of two modality-specific subsystems: the phonological loop, which manipulates and retains phonological information, and the visuo-spatial sketchpad, which deals with visual and spatial information. Kellogg's (1996) model, which has been employed as a theoretical foundation for writing in both L1 and L2 research, gives a more thorough description of how distinct WM aspects are active in writing. Kellogg stated that planning required the visuospatial sketchpad to mentally visualize and develop ideas, while according to Baddeley's multicomponent model, the central executive is in charge of their processing and coordination. There were multiple memory theories in several branches of psychology, almost all scholars agree with the perception that working memory can be sectioned into two extensive categories: episodic working memory and visuo spatial sketchpad working memory and these two types of working memory are main domains of research. Various types of tests were used in the past for measurement of working memory such as digit span test, reading span test, operation word span test and phonological working memory test. Time was according to nature and length of tests. These all tests were valid and reliable and fulfilling exact needs of measurement.

2.2 Argumentative writing

Argumentative writing is a genre of writing that takes a position on a debatable issue. Argumentative writing is used to demonstrate that the writer's opinions on a particular subject are correct or more truthful than others' opinion on that subject (Spangler, 1997). Argumentative essay writing is defined as a dynamic literary activity in which the author builds a dialogic interaction with an audience in order to convince, get an adhesion, or persuade (Álvarez, 2019). Argumentation is a cognitive skill and an ability of a person to think critically, solve issues, justify solutions, formulate ideas and make decisions (Cho, 2002). Kuhn (2003) a researcher said that writing that includes

evidence, claim, warrant, backing, and rebuttal is known as argumentative writing. Smalley and Ruetten (1986) describes some features which follow an argumentative essay. According to them in argumentative essays, the writer should introduce and describe the argument's topic or case. While Spangler (1986) explains these characteristics of argumentative essays: Argumentative essays must be well-defined and on controversial issues. It should be a counterargument. The writer of an argumentative essay takes a firm stance. There should be a convincing argument for why the writer's point of view is correct. Facts, data, quotes, and rhetorical questions all should be used to back up the thesis. And a reasonable, confident tone (lack of bias) is necessary for an argumentative essay. Argumentative essay writing is the utmost communal type of writing that is required for undergraduate students, particularly in the arts, humanities, and social sciences (Hewings, 2010). There was a huge research conducted on argumentative writing to develop critical thinking and appropriateness in academic writing, help students to understand argumentative essay writing, and develop different strategies to increase students' competence. Some standardized tests used to measure argumentative writing in the academic and professional world. These tests help students to be more efficient in their writing. Standard tests which are being used till today are IELTS, TOEFL, SAT, GAT, GRE, GMAT. These tests are conducted by students for their admission, for scholarships, and for other purposes such as language proficiency.

There were two main models of argumentative writing explained by different researchers. A model of argumentative writing was proposed by Toulmin in 1958 that has been generally mentioned by great scholars (Connor, 1990; Connor & Lauer, 1985; Knudson, 1992; Scardamalia & Paris, 1985). According to the argumentation model of Toulmin (1958), argumentation is a collection of subsequent elements. The first element Claim is a statement that is offered in response to complications, the second element is data, which contains the evidence or justifications for statements. The third element of Toulmin's model is Warrant, which ropes the relationship between claim and data. The fourth element is known as Backing, which is a support of the warrant. The fifth element of the argumentation model is Qualifier, which is a phrase demonstrating the conceivable nature of the claim, and the last sixth element is Reservation, which states to the situations under which a warrant is invalid and unable to verify the allegation (Crammond, 1998). These factors serve as the foundation for arguing speech as well as an organizational structure for producing argumentative essays. Argumentative writing appeals upon numerous mental procedures recognized within the Hayes (1996) model. According to Hayes model, the writer must have awareness about countless features that were precise to the genre of argumentation. There were some theories discussed by various researchers in the context of argumentative writing. In past research studies two main methods were used for measurement of argumentative essay writing. There were some grammar tests, cloze tests and interviews in one method and in another method there were comprehensive paragraphs, short stories and prompts for essay writing. Marking of these tests was also done in different ways. Some researchers used holistic ratings, others marked through rubrics like as analytical rubric or IELST banned descriptors. Some prompts which were used in past for argumentative essay writing were:

Should prisons be turned into tourist attractions?

Does imprisonment deter crime? (Rycker, 2011)

How has technology affected our lives? Or

How can a person make a business successful in a different culture (Seongyong, 2017)?

Facebook is a platform for establishing relationships.

To accumulate information about people's purchasing preferences and sell it to other companies Facebook should be allowed?

Length of all argumentative writing tasks was different in past studies. Interviews, cloze tests and grammar tests were based on 15 minutes while essays and short stories consisted of 200-300 and 30 to 40 minutes time.

2.3 The relationship between Working Memory and Argumentative Writing

There have been presented various theories and past studies by well-known theorists and psychologists on the relationship of writing and working memory. Some of them agree on the point that working memory has a correlation with writing while others show contrary results. McCutchen (1996) presented a theory of working memory and writing named as Capacity Theory of Writing (McCutchen, 1996). McCutchen, Covill, Hoynes, and Mildes (1994) found that writers with higher capacity of working memory produced texts which seemed better than writers with lower capacity of working memory. A reading span task, which does not depend on sentence formation efficiency the way the writing span task does, was used to test working memory capacity, making this distinction less significant. According to Miles et al. (1998), increased translation efficiency frees up working memory space, which improves writing performance. McCutchen (1996) presented the capacity theory of writing, which was motivated by Daneman and Carpenter (1990) and Just and Carpenter (1990), to explain these findings. According to the writing capacity hypothesis, such an interaction is only possible when the writing processes are effective enough to sustain the capacity of the working memory. The evolution of handwriting is a good example of how changes to the effectiveness of one writing process can have an impact on other writing processes (Olive, 2004).

A theory presented by Kellogg that one of the key cognitive factors influencing writing performance has always been working memory (Kellogg, 1996). So Kellogg's theory said that there was an interdependent relation among writing proficiency and working memory. The role of WM was well-justified theoretically and was proved practical in L1 writing (Swanson, 2007). According to theoretical reasoning by Baddeley (2015) and empirical study by Serafini and Sanz (2016), there are additional elements, such as the degree of L2 proficiency that may affect the link between WM and L2 performance (Baddeley, 2015). Training can create a relationship between L2 writing and working memory. Without L2 learning and proper training there will be an almost negative relationship between working memory and writing. Another theory was that the effects of WM in L2 writing were less clear (Ahmaddian, 2021).

There was a deep relation between working memory and writing abilities of students. The role of working memory in second language writing was widely studied in the past. All of those studies were correlational (rather than experimental), and they all identified writing as one from numerous L2 proficiency activities. A study was directed on the relationship between working memory and writing proficiency investigating whether working memory capacity affects L2 writing performance or not. The experiment includes a memory test, the operation-word span test (also known as the OSPAN test), and the reliability and difficulty of a written task (a sequencing narrative story board). The findings indicate that working memory capacity and L2 writing ability had statistically significant correlation. These findings suggest that those with a stronger WM capacity were more likely to conduct more precise and complicated written texts in L2 (Bergsleithner, 2010).

Another research examined whether working memory's implications on second language (L2) writing performance differed depending on the amount of L2 competency. Fifty six L2 English learners at various levels of proficiency performed a complicated working memory task in their original language which was Spanish/Catalan, a standardized L2 proficiency test, and an argumentative L2 writing project. Quantitative measures of reliability, complexity, and fluency, as well as holistic judgments of writing quality, were used to evaluate L2 writing performance. Working memory was linked to improve accuracy at low levels of skills, but there was a positive connection between working memory and lexical sophistication at high levels of proficiency. According to this study working memory has a different role in L2 writing performance (Vasylets, 2020).

Kormos and Sáfár (2008) reported that the phonological short-term memory had a negative, non-significant relationship with beginner ESL learners' writing performance but a considerable, positive relationship with pre-intermediate (upper level) learners' writing performance. However, writing performance of beginners' was unrelated to complex working memory (processing + storage). The authors claim that the learners' writing performance was limited by "content and correctness." According to Service (1992), there was a positive link between L1 Finnish children's phonological short-term memory and their L2 English writing performance, which was defined as translation plus free writing. Abu-Rabia (2003) found a substantial link between complex working memory and high-school ESL students' writing ability, as judged by a ten-subtest writing test (spelling, vocabulary, etc.). Working memory was tested in this study by using a reading comprehension testing system rather than a reading span test.

The influence of working memory on young English language learners' second-language writing performance was investigated in another study. The participants of this study were Ninety Four young learners from Hungary who completed four types of writing tasks as part of the TOEFL Comprehensive standardized test battery and cognitive tests to measure their WM functioning. The email writing and integrated Listen-Write activities achieved excellent results for the participants. On the non-academic version of an editing task, students scored worse than on most other sorts of tasks. Except for the academic editing assignment, WM functions demonstrated no significant association with L2 writing results. The effect of WM on the integrated Listen-Write task was not significant, although it did change the predicted score of results. Learners with a strong/high capacity of working memory performed more consistently across tasks than those with a weak/low capacity of working memory (Michela, 2019).

To conclude, according to Kellogg, and McCutchen writing has a relationship with working memory while according to Baddeley, Ahmaddian, Swanson, Serafini and Sanz L2 writing has no relation with working memory. There are some specific factors which are necessary for creating a relationship between working memory and writing, such as L2 training, L2 levels of proficiency. Past studies also suggest that working memory has a significant impact on L2 learners' writing performance. However, these studies used different methods, and the findings were verified in different ways of research.

2.4 Research Gap

After analysing past studies on relevant topics of national and international level, the researcher of the present study found some gaps related to population, context, use of test type and methodology. In the past, little work was done on writing proficiency and working memory and no work was found in this area in Pakistani context. So this study was designed with a large number of participants as compared to previous studies. No one has worked on IELTS test-takers in Pakistan before this. Further, in Pakistan, no one had used the IELTS band as marking rubric of essays. So this study was conducted with a huge sample size, different population and different methodology with an attempt to fill the gaps of past studies.

2.5 The present study: Research Question

Examining the relationship between working memory and argumentative writing, this research question was developed:

Question: What is the relationship between working memory and argumentative writing proficiency of IELTS test takers in Pakistan?

3. Methodology

Correlational design was selected for this study and a quantitative method was used. Population which was selected for this research study was IELTS test takers from four main cities of Punjab (Lahore, Gujranwala, Faisalabad and Okara) Pakistan. Convenience based sampling was used for collection of data. 131 IELTS test takers from different IELTS preparation centers were selected for this study. This sample size was large from past research studies of this field. All participants were given the same prompt for argumentative essays and the same working memory test. Time for an argumentative essay was 30 minutes while 15 minutes were given for a memory test.

3.1 Instruments

There were three instruments used in this study, one was for measurement of working memory capacity named as operation word span test (OSPAN), second was a prompt for argumentative essay and third was rubric of IELTS band descriptors for evaluation of those essays.

3.1.1 Operation-word Span Test

Operation-word span test was established by Turner and Engle in 1989 for measurement of working memory capacity of L2 writing studies. Turner and Engle demonstrated that they could predict writing ability using a WM span test without requiring sentence composition. Operation word span test relies more on working memory skills than language-related aspects (Mavrou, 2020). Moreover, it has previously been implemented in L2 writing studies (Mavrou, 2020) as a general indicator of working memory capacity, as opposed to a task that evaluates particular decision-making processes (Révész, 2017). The current researcher, however, used Prebianca's (2009) OSPAN test version and developed its own according to instructions and rules given in that version of the test. Reliability of the operation word span test was 0.80 which was a high level of reliability measured by a reliable scale CronBach Alpha (Andrew, 2005). The test consists of 20 operation strings divided into three parts. Participants were asked to read given instructions carefully and then mark on the true or false option and remember the given word to the next column of the equation. After solving the 1st part of the test, participants were asked to write the option they marked for each equation with sequence and the word given in front of that equation on the other sheet within given columns. Then do this same process with the 2nd and 3rd part of the test. The test was done by participants themselves and it was a paper pencil based test.

Paper pencil version was selected for ease of test takers because all test takers did not have a laptop/computer. Test takers were given 15 minutes to complete three parts of the test consisting of 20 strings. Scores of the operation-word span test were measured according to the performance of test takers in the test. Two scores were computed for each string of test while the test contains 40 marks as a whole. 1 number for perfectly recalled answer of equation and 1 number for word recalled in the correct position.

3.1.2 Argumentative Essay

IELTS test takers were asked to write argumentative essays (writing task 2) on a given prompt. Prompt of the argumentative essay which was selected for this research was “some people think that men are naturally more competitive than women. To what extent do you agree or disagree with this statement?” Time and length of essay was according to IELTS writing task 2 (40 minutes & 250 words). Argumentative essay was measured according to rubrics of IELTS writing task 2 on IELTS academic and general modules consisted on four descriptors: task response, coherence and cohesion, lexical resources, and grammatical range and accuracy for a banded scale range 0 to 9 (Ahmad, 2019). Prompt was reliable as it was taken from the official website of IELTS www.ielts.org. The 3rd instrument of this research was scoring rubrics. It was also a reliable scale of measuring writing of IELTS test takers. It was developed by the British council for the purpose of evaluation of IELTS writing task 2. Scoring of argumentative essays was done according to IELTS scoring rubric of task 2 band 0 to 9 which is the highest conceivable score. For scoring of argumentative writing an experienced rater was hired who was an expert in marking IELTS writings.

4. Data Analysis

Data of this research was analysed through SPSS 23rd version. Analysis includes normality test, outlier analysis, Runs test and Pearson product moment formula for correlation coefficient among both continuous variables. Coming sections of data analysis present assumptions that selection of Pearson product moment is appropriate for data of this research.

4.1 Normal Distribution

If skewness value is between +/-1, the data is considered to be normal. Secondly, in accordance with the central limit theorem, if the sample size is sufficiently large (30 or above), the sampled data may be considered to be normally distributed. By virtue of these two principles, the data of both continuous variables (working memory and IELTS writing band score) may be considered to be normally distributed. The descriptive statistics table revealed that skewness value for working memory test was -.649 while for IELTS essay band score it was .109. The sample consisted of 128 cases after removing three outliers which is greater than 30. Both skewness values and volume of sample indicated that data was normally distributed.

4.2 Linearity

The linearity test was conducted to determine the suitability of the continuous variables (working memory scores and IELTS essay band scores) for Pearson product moment correlation.

Table 4.1*Analysis of Variances (ANOVA) Table*

			Sum of Squares	Df	Mean Square	F	Sig.
Essay_Band * WM_Score	Between Groups	(Combined)	47.366	5	.861	.977	.532
		Linearity	.554	1	.554	.629	.430
		Deviation from Linearity	46.811	5	.867	.983	.521
Within Groups			63.476	72	.882		
Total			110.842	127			

As it is obvious from the above table, the p-value was greater than 0.05 (.521>0.05), which indicated that the relationship between the two continuous variables (working memory scores and IELTS band scores) is linear.

In summary, the data meets the requirements of Pearson product moment correlation because the data passed randomness test, both continuous variables involved (working memory score and IELTS essay band score) were continuous, the observations were independent, the data was free of outliers, both dependent variables were normally distributed, the data assumed homogeneity of variances, and the continuous variables had linear relationship.

5. Results and Discussion

Results of this research are being described below.

5.1 Descriptive Statistics

The following table of frequencies of gender (GEN) representation shows that the total number of cases in the data were 128 out of which 87 were male and 41 female.

Table 5.1*Descriptive Statistics of Gender*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	87	68.0	68.0	68.0
	Female	41	32.0	32.0	100.0
Total		128	100.0	100.0	

The percentage of male is more than double than that of females, which might have had an effect on results. Reason of double percentage of male might be that mostly male students give preference for IELTS. However, the results of Levene's test of homogeneity of variances does not support this suspicion because the results reveal equality of variances in the results of both continuous variables (i.e., working memory score and IELTS essay band score).

The following statistics tables offer descriptive statistics for both continuous variables (i.e. working memory score and IELTS essay band scores).

Table 5.2

Descriptive Statistics of Working Memory and IELTS Band Scores

		WM_Score	Essay_Band
N	Valid	128	128
	Missing	0	0
Mean		33.379	3.785
Median		33.833	4.000
Mode		42.0	4.0
Std. Deviation		6.7451	.9342
Skewness		-.649	.109
Std. Error of Skewness		.214	.214
Kurtosis		-.121	-.347
Std. Error of Kurtosis		.425	.425
Minimum		14.0	2.0
Maximum		42.0	6.5

The total marks of the WM test were originally 40 (Part 1: 14, Part 2: 14, and Part 3: 12). In order to give each part equal weightage, the marks obtained in the third part were also calculated out of 14. Thus, the total marks of the test after this weighting were 42, each part with 14 marks. The mean score on the working memory test was 33.379 (Total 42 score), median 33.833, with a mode of 42. The skewness value (i.e., -.649) being within +/-1 range indicates normal distribution. IELTS essay was scored on 9 bands. The mean essay band was 3.785 and the standard deviation of essay band score was .9342 which indicated that essay band scores lacked enough spread. On the other hand, the working memory with a standard deviation of 6.7451 score showed relatively more spread. The skewness value of IELTS band score (i.e., .109) falls within the range of +/-1, which specifies that data was normally distributed. In summary, the descriptive statistics about working memory score and IELTS essay band score revealed that the data on both variables was normally distributed.

5.2 Correlation between Argumentative Essay Writing and Working Memory

The hypothesis of this study was related to the relationship between working memory scores and IELTS essay band scores. It was hypothesized that working memory was not related to

IELTS essay band scores. A Pearson correlation coefficient was computed to assess the relationship, the result of which appears below.

Table 5.3

Correlation between WM and IELTS Band Scores

		WM_Score	Essay_Band
WM_Score	Pearson Correlation	1	.071
	Sig. (2-tailed)		.428
	N	128	128
Essay_Band	Pearson Correlation	.071	1
	Sig. (2-tailed)	.428	
	N	128	128

The above table shows, there was no relationship between working memory scores and IELTS essay band scores ($r(126) = .071$, $p = .428$). Thus the null hypothesis of this research is accepted that there has been found no correlation between working memory capacity and IELTS scores.

The research question of this study about correlation between the mean Scores of Working Memory and IELTS Band Scores of Writing is answered. The Pearson product moment correlation analysis had been conducted to examine the correlation between the working memory and IELTS band scores of writing. The results of Pearson product moment correlation analysis of working memory test and IELTS band scores of writing provided statistical evidence that working memory has no correlation with writing proficiency of the IELTS band. Table (4.4) showed that the correlation between working memory and Band scores of writing was (.071), which is considered the very weak or zero correlation value between these two measurements. The results accepted the null hypothesis and proved zero correlation between the WM and Writing.

Research question of the study is answered now that there is no significant relationship between working memory capacity and writing proficiency. Working memory did not affect the level of writing proficiency. There was a perception that people who have higher capacity of working memory could perform better in writing while some other people who have lower capacity of working memory are less proficient in writing. But this perception proved wrong by results of present study. This study argues that people with lower capacity of working memory could be proficient writers while people who wrote excellently might have had lower capacity of working memory. There have been many research studies conducted in the field of working memory and writing proficiency. Results of some previous studies and theories were in support of current research while some were showing contrary results.

A study was conducted in the past by Kormos & Manchon (2019) in relation with working memory and L1 writing proficiency. Results of this study shows that L1 writing has a relation with working memory capacity. People who were having higher capacity of working memory were better in L1 writing. However in L2 writing, the notion of working memory has not gained much attention. Results of this study were contradictory to present research in two ways. Firstly, the present study shows zero percent correlation of writing and working memory while study of

Kormos show a significant correlation of L1 writing and working memory. Kormos' (2019) study pays no attention to L2 writing proficiency and working memory so this past study accepted in this sense that there can be a relation of L1 writing and working memory but there is no relationship between L2 writing and working memory. Another study was conducted by Bergsleithner (2010) on L2 writing proficiency and working memory. Results of this study show a significant level of correlation between working memory and writing proficiency. Students who were higher in working memory capacity produce better texts in some ways as compared to others. This study also shows contradictory results with present research.

Kormos and Safar (2008) conducted another research on working memory and argumentative writing and results of that study show zero percent correlation of memory and writing. This study of Kormos is in favor of present research that working memory has no effect on writing proficiency. A study was conducted by Michela (2019) on different types of writing and both types of working memory. Results of that study show zero correlation between writing and working memory tasks. This study also correlates with results of present research that there is no correlation between writing proficiency and working memory.

There were some theories presented by well-known theorists of the past on the relationship between writing and working memory. Some theories were in favor of present research that writing has no relation with working memory while some were a little bit contradictory. A theory was presented by McCutchen (1996) named as capacity theory of writing and working memory. According to that theory writers with high capacity of working memory produced text better than that of lower capacity of working memory (McCutchen, 1996). This theory shows moderate results not in support with present research and not in against with present research because it is not saying that there is no relationship between writing and working memory and also not saying that there is deep correlation in working memory and writing. This theory just clarifies that people who have high capacity of memory have high levels of writing proficiency while people with less capacity of memory show lower levels of writing.

Another theory was presented by Kellogg that working memory always be a cognitive feature of writing proficiency so it has a deep relation with writing proficiency (Kellogg, 1996). This theory declares a contradictory point of view as compared to present study. According to Kellogg writing has a correlation with working memory capacity. A theory was presented by Baddeley (2015) by saying that working memory and writing have no relation cognitively. Relationships of these both variables depend on some specific factors like training, practice, context, language and environment etc... so the theory of Baddeley shows related results of present research. It states that by nature there is no correlation between writing and working memory but relationships can be created through a proper environment. Ahmaddian (2021) presents his theory on the relationship between L2 writing and working memory and concludes that working memory has no clear effects on L2 writing. This theory also presents relevant results to present research that there is no correlation between working memory and writing proficiency. There can be some specific reasons for no correlation between working memory and writing proficiency. Firstly, data collection for this research environment was not very appropriate according to the nature of the tests. Weather was too hot, students faced difficulties with noise which disturb their memory performance. So that they cannot perform properly and this thing affects results of present research. Another reason was lack of practice and training for memory and writing tests. Students were unaware that they were going to perform memory and writing tests so performance of students was affected because of

this reason and this also be a factor of no correlation of present research. The last reason can be the use of a paper version of the memory test. Paper version was used because of the non-availability of laptops for every participant and results may be affected by this. To conclude it is said that naturally working memory has no relationship with writing proficiency. Results of present research also show that there was no correlation between writing proficiency and working memory.

6. Conclusion

This study aimed to check the correlation between working memory and argumentative writing proficiency of the Pakistani IELTS test-takers. The researcher selected the correlational design of the study to answer the research question. The researcher went through multiple studies in the outside context rather than in Pakistan in the literature because there was found no study in the Pakistani context related to this field. However, the research proposed to investigate the issue in the Pakistani context to check how far the results of these students are similar or different from the results of the previous findings out-side Pakistan. The researcher used three instruments for collecting and marking the required data. The OSPAN test for measuring working memory capacity and argumentative essay for measuring writing proficiency of Pakistani IELTS test takers and IELTS band descriptor for evaluating those essays. The researcher faced a lot of difficulties during process of data collection like as hot weather condition, attitude of students towards research tests, behaviour of academy holders and above all cost issues. The researcher accumulated data from the Pakistani IELTS test-takers and used a convenient sampling strategy. This study was based on the 128 samples of Pakistani IELTS test-takers. To answer the research question of the study the researcher had performed the Pearson product moment correlation to check the correlation between working memory and writing. The results of the study expressed zero correlation between working memory and writing skills. Previous studies also suggested that people who performed very well in writing were low in memory capacity while some people who were having higher capacity of working memory were poor in writing. But for creation of correlation some necessary factors should be followed like training of memory test, suggested words which will be used in essay, L2 proficiency, and proper environment for memory test where no noise or disturbance be a problem for students to memorize target test.

References

- Abu-Rabia, S. (2003). The influence of working memory on reading and creative writing processes in a second language. *Educational Psychology, 23*(2), 209-222.
- Ahmadian, M. J., & Vasylets, O. (2021). The Role of Cognitive Individual Differences in L2 Writing Performance and Written Corrective Feedback Processing and Use. In *The Routledge Handbook of Second Language Acquisition and Writing* (pp. 139-151). Routledge.
- Alloway, T. P., & Copello, E. (2013). Working memory: The what, the why, and the how. *The Educational and Developmental Psychologist, 30*(2), 105-118.
- Álvarez Valdivia, I. M., & Lafuente Martínez, M. (2019). Improving preservice teachers' scientific argumentative writing through epistemic practices: a learning progression approach. *Journal of Education for Teaching, 45*(2), 169-185.
- Axelrod, R. B., & Cooper, C. R. (1985). *Guide to writing*. St. Martin's Press.
- Baddeley, A. (2003). Working memory: Looking back and looking forward. *Nature Reviews Neuroscience, 4*(10), 829–839. <https://doi.org/10.1038/nrn1201>.

- Baddeley, A. (2015). Working memory in second language learning. In Z. E. Wen, M. B. Mota, & A. McNeill (Eds.), *Working memory in second language acquisition and processing* (pp. 17–28). Multilingual Matters. <https://doi.org/10.21832/9781783093595>.
- Baddeley, A. D. (2015). Working memory in second language learning. *Working Memory in Second Language Acquisition and Processing*, 17-28.
- Baddeley, A. D., & Hitch, G. (1974). Working memory. In *Psychology of learning and motivation* (Vol. 8, pp. 47-89). Academic press.
- Bayliss, D. M., Jarrold, C., Baddeley, A. D., & Leigh, E. (2005). Differential constraints on the working memory and reading abilities of individuals with learning difficulties and typically developing children. *Journal of Experimental Child Psychology*, 92(1), 76-99.
- Bergsleithner, J. M. (2010). Working memory capacity and L2 writing performance. *Ciencias & Cognição*, 15(2). (2), 261–271. <https://doi.org/10.1017/S1366728908003416>.
- Carpenter, P. A., Just, M. A., & Shell, P. (1990). What one intelligence test measures: a theoretical account of the processing in the Raven Progressive Matrices Test. *Psychological Review*, 97(3), 404.
- Chai, W. J., Abd Hamid, A. I., & Abdullah, J. M. (2018). Working memory from the psychological and neurosciences perspectives: a review. *Frontiers in psychology*, 9, 401.
- Cho, K. L., & Jonassen, D. H. (2002). The effects of argumentation scaffolds on argumentation and problem solving. *Educational Technology Research and Development*, 50(3), 5-22.
- Conway, Andrew. R., Kane, M. J., Bunting, M. F., Hambrick, D. Z., Wilhelm, O., & Engle, R. W. (2005). Working memory span tasks: A methodological review and user's guide. *Psychonomic bulletin & review*, 12(5), 769-786.
- Cowan, N. (2005). *Working memory capacity*. Psychology Press.
- Crammond, J. G. (1998). The uses and complexity of argument structures in expert and student persuasive writing. *Written Communication*, 15(2), 230-268.
- De Rycker, A., & Ponnudurai, P. (2011). The Effect of Online Reading on Argumentative Essay Writing Quality. *GEMA Online Journal of Language Studies*, 11(3).
- Gathercole, S. E., Service, E., Hitch, G. J., Adams, A. M., & Martin, A. J. (1999). Phonological short-term memory and vocabulary development: Further evidence on the nature of the relationship. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, 13(1), 65-77.
- Harrington, M., & Sawyer, M. (1992). L2 working memory capacity and L2 reading skill. *Studies in second language acquisition*, 14(1), 25-38.
- Hayes, J. R. (2006). New directions in writing theory. *Handbook of writing research*, 2, 28-40.
- Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication*, 29(3), 369–388. <https://doi.org/10.1177/0741088312451260>.
- Hewings, M. (2010). Materials for university essay writing. *N. Harwood (Ed.), English Language Teaching Materials* (pp. 251–278). Cambridge. <https://doi.org/10.1016/j.jslw.2019.03.002>

- Kellogg, R. T. (1996). A model of working memory in writing. In C. M. Levy, & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 57–71). Lawrence Erlbaum Associates. <https://doi.org/10.4324/9780203811122>.
- Kormos, J. (2011). Task complexity and linguistic and discourse features of narrative writing performance. *Journal of Second Language Writing, 20*, 148–161. <https://doi.org/10.1016/j.jslw.2011.02.001>.
- Kormos, J., & Safar, A. (2008). Phonological short-term memory, working memory and foreign language performance in intensive language learning. *Bilingualism, 11*
- Kuhn, D., & Udell, W. (2003). The development of argument skills. *Child development, 74*(5), 1245-1260.
- Lu, (2010). Automatic analysis of syntactic complexity in second language writing. *International Journal of Corpus Linguistics, 15* (4) (2010), pp. 474-496, [10.1075/ijcl.15.4.02lu](https://doi.org/10.1075/ijcl.15.4.02lu)
- Lu, Y. (2015). Working memory, cognitive resources and L2 writing performance. *Working memory in second language acquisition and processing* (pp. 175–189). Multilingual Matters. <https://doi.org/10.21832/9781783095735>.
- Mavrou, I. (2020). Working memory, executive functions, and emotional intelligence in second language writing. *Journal of Second Language Writing, 50*, 100758.
- McCann, T. M. (1989). Student argumentative writing knowledge and ability at three grade levels. *Research in the Teaching of English, 62*-76.
- McCutchen, D. (1996). A capacity theory of writing: Working memory in composition. *Educational Psychology Review, 8*(3), 299-325.
- Michel, M., Kormos, J., Brunfaut, T., & Ratajczak, M. (2019). The role of working memory in young second language learners' written performances. *Journal of Second Language Writing, 45*, 31-45.
- Miles, C., & Hardman, E. (1998). State-dependent memory produced by aerobic exercise. *Ergonomics, 41*(1), 20-28.
- Olive, T. (2004). Working Memory in Writing: Empirical Evidence from the Dual-Task Technique. *European Psychologist, 9*(1), 32. *Psychologist, 50*(2), 138–166. <https://doi.org/10.1080/00461520.2015.1036274>.
- Révész, A., Michel, M., & Lee, M. (2017). Investigating IELTS Academic Writing Task 2: Relationships between cognitive writing processes, text quality, and working memory.
- Scardamalia, M., & Bereiter, C. (1987). 4 Knowledge telling and knowledge transforming. *Advances in Applied Psycholinguistics: Volume 2, Reading, Writing, and Language Learning, 2*, 142.
- Schoonen, R., Van Gelderen, A., Stoel, R. D., Hulstijn, J., & De Glopper, K. (2011). Modeling the development of L1 and EFL writing proficiency of secondary school students. *Language Learning, 61*(1), 31–79. <https://doi.org/10.1111/j.1467-9922.2010.00590.x>.
- Schwaighofer, M., Fischer, F., & Bühner, M. (2015). Does working memory training transfer? A meta-analysis including training conditions as moderators. *Educational Psychologist, 50*(2), 138-166.
- Seongyong. (2017). Writer identity in narrative and argumentative genres: A case of Korean students in the United States. *International Journal of Applied Linguistics and English Literature, 6*(1), 178-188.

- Serafini, E. J., & Sanz, C. (2016). Evidence for the decreasing impact of cognitive ability on second language development as proficiency increases. *Studies in Second Language Acquisition*, 38(4), 607-646.
- Spangler, W. E. (1997). A computer model of reactive planning and implementation strategy in program-constrained decision-making.
- Swanson, H. L., & Jerman, O. (2007). The influence of working memory on reading growth in subgroups of children with reading disabilities. *Journal of experimental child psychology*, 96(4), 249-283.
- Toulmin, S. (1958). *The Uses of Argument*, Cambridge University Press. Cambridge, UK.
- Tsai, N., Au, J., & Jaeggi, S. M. (2016). Working memory, language processing, and implications of malleability for second language acquisition. *Cognitive individual differences in second language processing and acquisition* (pp. 69–88). John Benjamins Publishing Company.
- Vanderberg, R., & Lee Swanson, H. (2007). Which components of working memory are important in the writing process? *Reading and Writing*, 20(7), 721-752.
- Vasylets, O., & Marín, J. (2020). The effects of working memory and L2 proficiency on L2 writing. *Journal of Second Language Writing*, 52, 100786.
- Weigle, S. C. (2005). Second language writing expertise. In K. Johnson (Ed.), *Expertise in second language learning and teaching* (pp. 128–149). Palgrave Macmillan.