WORKING MEMORY ROLE ON GENDER TOWARDS LANGUAGE TRANSFER: STUDY OF NEUROLINGUISTICS

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Abstract

Second language acquisition requires many aspects including how the working memory supports the system of the human input system. Working memory has a crucial identity in storing information for a short time. It is a limited complex ability required for holding and manipulating information in a brief period for learning, thinking, giving attention, counting, memorizing, comprehending, and problem-solving. The aims of this research are to predict the role of working memory capacity on males and females and to identify the language transfer in between. The subject of this research consisted of 14 Indonesian students (7 male 7 female) at International Islamic University Malaysia (IIUM). They are signed as postgraduate students of many different majors. Data were taken by using the reading span test of Ronnberg version. Data were analyzed by referring to Baddeley, Hitch, and Ellis. The finding of the research declares that difference gender has different working memory capacity pattern and language transfer. Gender is also a crucial factor in improving second language acquisition.

Keywords:

Working Memory Capacity; Bilingual; Indonesian Student; Language Transfer

A. Introduction

Mastering more than one language is not an option. Many fields of different categories require second language mastery such as job vacancy, bussiness, and education. More than half of world population is bilingual. The term of bilingual in this study refers to Indonesian and English. This study departs from the fact that English proficiency of Indonesian is below average.[1] Indonesia is in rank 51 out of 88 countries in the world. Indonesian ranking has remained in the low proficiency level since 2017 and still remains below the rank of other ASEAN countries, such as Singapore (68.63) at the very high skill level, the Philippines (61.84) and Malaysia (58.32) at the high skill level.

Study between bilingual and the brain function has been more interested

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[1] "Kemampuan Bahasa Inggris Warga Indonesia di Bawah Rata-Rata | Republika Online," accessed December 14, 2018, https://www.republika.co.id/berita/nasional/umum/18/12/14/pjq0na349-kemampuan-bahasa-inggris-warga-indonesia-di-bawah-ratarata.

in the recent time. Chomsky notices that a person's language in all its aspects is a state of some components of the mind. [2] Working memory capacity in bilingual brain is one of the examples. Working memory is a memory store of a very limited capacity that holds information for a few second[3] and other cognitive tasks such as reading, problem solving or learning. [4] Working memory can be ilustrated when someone acquaints new vocabularies. New information will stay in someone's brain lastly 45 minutes. Working memory is important for reasoning and the guidance of decision-making and behavior.[5]

Baddeley and Hitch identifies three components of WM.[6] First, Phonologcal loop stores information in the form of sounds that allow for articulation exercises. It occurs within a limited time span (approximately 2 seconds). Second, visual scatchpad is used in temporary memories and manipulates spatial and visual information. Third, central executive is also the crucial component. Its role includes selective attention to certain stimuli while ignoring others, temporary activation of long-term memory, and resolution of potential conflicts between schemes.[7]

Benefit of having good working memory capacity has been improved by previous researches. Some of them are Bergsleithne[8] and Tavares[9] who similarly found that WM are having sgnificant correlations to L2 performance both in spontanious and planned condition. Another research conducted by Service et al states that aspects of sentence comprehension in foreign language develop with practice.[10] It means that the participants use WM ability and maximize them into long-term memory.

In addition, linguists from various countries have examined the capacity of working memory from various objects such as Speck et al, [11] meta-analysis

[2] Noam Chomsky, *Language and Mind* (Cambridge: Cambridge University Press, 2006).

[3] Eynseck in Rod Ellis, *The Study of Second Language Acquisition*, 2nd ed. (Oxford: Oxford University Press, 2006), 650.

[4] Alan D. Baddeley, "Working Memory," in *Psychology of Learning and Motivation*, vol. 8, Phil. TrNA. R. Soc. Lond. B302 (New York: Academic Press, 1983), 311–24, https://doi.org/10.1016/S0079-7421(08)60452-1.

[5] Adele Diamond, "Executive Functions," *Annual Review of Psychology* 64, no. 1 (January 2, 2013): 135–68, https://doi.org/10.1146/annurev-psych-113011-143750.

[6] Alan D. Baddeley and Graham Hitch, "Working Memory," in *Psychology of Learning and Motivation*, ed. Gordon H. Bower, vol. 8 (New York: Academic Press, 1974), 47–89, https://doi.org/10.1016/S0079-7421(08)60452-1.

[7] Ellis, *The Study of Second Language Acquisition*, 2006, 651.

[8] Joara Martin Bergsleithner, "The Role of Noticing and Working Memory Capacity in L2 Oral," in *Organon, Porto Alegre, N^{2}51*, 2011, 217–43, https://doi.org/10.22456/2238-8915.28841.

[9] Maria da Glória Guará-Tavares, "Working Memory Capacity and L2 Speech Performance in Planned and Spontaneous Conditions: A Correlational Analysis," *Trabalhos Em Linguística Aplicada* 52, no. 1 (June 2013): 09–29, https://doi.org/10.1590/S0103-18132013000100002.

[10] Elisabet Service et al., "Bilingual Working Memory Span Is Affected by Language Skill," *European Journal of Cognitive Psychology* 14, no. 3 (July 2002): 383–408, https://doi.org/10.1080/09541440143000140.

[11] Oliver Speck et al., "Gender Differences in the Functional Organization of the Brain for Working

research by Hill et al,[12] working memory research on aphasia by Majerus.[13] The researches have been carried out with the help of fMRI in order to clearly see the differences in working memory network. Weaknesses in the study are the findings only in the form of working memory network images. It is not supported by the capacity of working memory. The research only focuses in one point of view.

Language transfer based on Ellis refers to any feature of first language influence the use and acquisition of second language.[14] There are some categories of language transfer, they are errors (negative transfer), facilitation (positive transfer), avoidance (or underproduction), and over-use. Errors is occurred as a result of lack of knowledge (lack of competence). Facilitation or positive transfer means that first language can facilitate second language learning. It occurs when there are similarities between first and second language. Avoidance occurs because of

differences between native language and the target language. Over-use occurs as a result of intralingual process such as over-generalization.

Research related to language transfer also has been conducted previously, such as Karim and Nassaji,[15] Alahmadi and Kesseiri[16] and Utami and Malihah.[17] The researches focus on evidence of language transfer. There is no explanation of the brain connection and gender difference.

By saying so, a research to perceive working memory role on gender toward language transfer is urged to conduct, language transfer in this study includes two things, namely positive and negative transfer. It refers to Ellis.[18]

By knowing the relationship between the two, it provides new information about the lack of Indonesian understanding of English. This information can be useful for English institutions, teachers, and parents to gain more success in second language learning. Therefore, Neurolinguistics

Memory:," *NeuroReport* 11, no. 11 (August 2000): 2581–85, https://doi.org/10.1097/00001756-200008030-00046.

[12] Ashley C. Hill, Angela R. Laird, and Jennifer L. Robinson, "Gender Differences in Working Memory Networks: A BrainMap Meta-Analysis," *Biological Psychology* 102 (October 2014): 18–29, https://doi.org/10.1016/j.biopsycho.2014.06.008.

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[14] Ellis, *The Study of Second Language Acquisition*, 2006, 351.

[15] Khaled Karim and Hossein Nassaji, "First Language Transfer in Second Language Writing: An Examination of Current Research," *Iranian Journal of Language Teaching Research* 1, no. 1 (January 2013): 117–34.

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[17] Agustina Ridho Utami and Noor Malihah, "Speech Errors Produced by EFL Learners of Islamic Boarding School in Telling English Story," *OKARA: Jurnal Bahasa dan Sastra* 12, no. 2 (November 30, 2018): 191–200, https://doi.org/10.19105/ojbs.v12i2.1930.

[18] Ellis, *The Study of Second Language Acquisition*, 2006.

based research is deemed necessary in order to provide solution for Indonesian to improve their second language skills.

B. Method

This research is aimed to analyze working memory role on gender towards language transfer. It is a descriptive research which is qualitatively done.

Subjects of the research were 14 Indonesian students at International Islamic University Malaysia (ISUM). They are signed as postgraduate students of many different majors. Category of post graduate has been chose due to the optimal age for brain function.[19]

Data were collected by asking participant to do several things. First, they were asked to fill the questionnaires to be categorized based on their conditional background such as age, major, score of English proficiency, etc. Second, they were asked to do Reading Span Test based on Ronnberg et al version.[20] Participants were shown some slides consisted of several sentences to analyze. One is to identify whether the sentence made sense or not. Two is to recall the first or last word of each sentence. The answer sheets were provided. It was measured using total correct method. Each correct word and yes/no response were written on the given answer sheet. Third, they were asked to transfer 26 Indonesian sentences into English. They are given several stimuli words before transferring in order to support and disrupt their memories.

Data analysis was done qualitatively and considering some of related literatures such as Hakim who found capacity of Indonesian students' memory capacity in Japanese major.[21] Tavares who also succesfully found that there are significant correlations between working memory capacity and accuracy in spontaneous conditions and there are also significant correlations between working memory capacity, fluency and complexity in planned conditions.[22]

Finally, data analysis is explained by using charts and tables. It is supported by verbal elaboration which refers to theories by Baddeley and Hitch,[23] Ellis[24] and Sastra.[25]

[19] "Umur Berapa Otak Manusia Berkembang Optimal?," accessed September 30, 2019, https://health.detik.com/berita-detikhealth/d-1528647/umur-berapa-otak-manusia-berkembang-optimal.

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C. Results

1. Working Memory capacity of Male Participant

Working memory leads people to focus and gives attention. Every individual person has their own working memory capacity. Working memory capacities based on reading span test result are shown in the below tables.

Table 1
Working Memory capacity for male

ML	Participants (n: 14)							
	L	%	M	%	AM	%	H	%
3ss	0	0	0	0	5	71.4	2	28.6
4ss	0	0	2	28.6	4	57.1	1	14.3
5ss	0	0	0	0	7	100	0	0
6ss	0	0	1	14.3	6	85.7	0	0

(ss: sentences), (ML: memory load, L: low, M: moderate, AM: above moderate, H: high, ss: sentences)
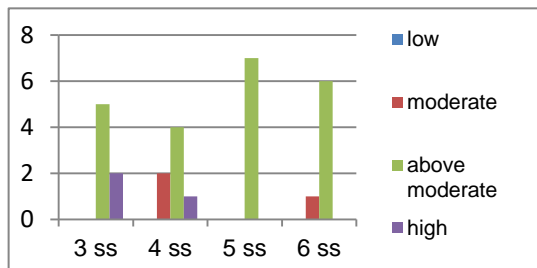

Fig. 1. Working Memory capacity for male

Reading span test has been succesfully identified male participants. Seven students were required to follow the test. Three sentences was the first memory load given to the participants. Two participants are typed of having high working memory capacity (28.6%). It is proved by having 15 and 15.5 numbers of correct asnwers out of 18 Y/N and recall test. Five students are categorized having above moderate.

Working memory capacity is (71.4%) with the number of correct answers 10 to 12.5 out of 18 Y/N and recall test. There is no student categorized having low working memory capacity.

Second, 4 sentences were given as the next level of memory load. The result shows that only one participant successfully circled as having high working memory capacity (14.3%). Total amount of correct answers are 19 out of 24 Y/N and recall test. Four students are grouped having above moderate working memory capacity (57.1%). Total amount of correct answer are between 14.5 to 16 out of 24 Y/N and recall test. Two students are categorized having moderate working memory capacity (28.6%). Total number of correct answers are 10 and 11.5 out of 24 Y/N and recall test. There is no student categorized having low working memory capacity.

Third, the upper level of given memory load is 5 sentences. It appears that all participants are grouped having above moderate working memory capacity (100%). Total amount of correct answers are between 15 to 20.5 out of 30 Y/N and recall test. There is no student categorized having low, moderate and high working memory capacity.

The last one is 6 sentences as the highest level of given memory load. It shows that six participants are circled having above moderate working memory capacity (85.7%). Total amount of correct answers are between 18.5 to 20 out of 36 Y/N and recall test. One participant categorized having moderate working memory capacity (14.3%). Total amount of correct answers are 18 out of

36 Y/N and recall test. There is no participant categorized having low and high working memory capacity.

2. Working Memory capacity of Female Participant

Table 2
Working Memory capacity for female

ML	Participants (n: 14)							
	L	%	M	%	AM	%	H	%
3ss	0	0	0	0	6	85.7	1	14.3
4ss	0	0	0	0	7	100	0	0
5ss	0	0	1	14.3	6	85.7	0	0
6ss	0	0	0	0	7	100	0	0

(ss: sentences) (ML: memory load, L: low, M: moderate, AM: above moderate, H: high, ss: sentences)
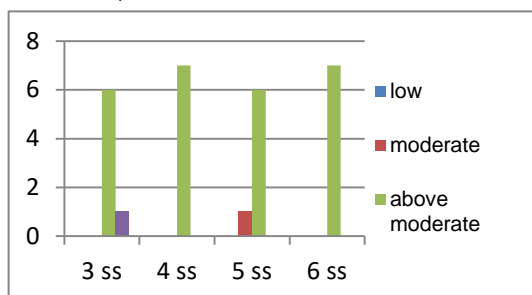

Fig. 2. Working Memory capacity for female

Compared to male participants, female ones have been also succesfully identified using reading span test. Reading span test is a working memory capacity test that mentioned by Ellis[26], this finding is also supported by Hakim where he emphasizes over the result of Indonesian students in Japanese major.[27]

Data show female category of their working memory capacity. First, three

sentences were given as a memory load. One participant is typed of having high working memory capacity (14.3%). It is proven by having 14 numbers of correct asnwers out of 18 Y/N and recall test. Six students are categorized having above moderate working memory capacity (85.7%) with the number of correct answers are between 11.5 to 13.5 out of 18 Y/N and recall test. There is no student categorized having low and moderate working memory capacity.

Second, 4 sentences were given as the next level of memory load. The result shows that all participants are grouped having above moderate working memory capacity (100%). Total amount of correct answers are between 12.5 to 18 out of 24 Y/N and recall test. There is no student categorized having low, moderate, and high working memory capacity.

Third, the upper level of given memory load is 5 sentences. It appears that six participants are grouped having above moderate working memory capacity (85.7%). Total amount of correct answers are between 18 to 19.5 out of 30 Y/N and recall test. One participant is circled having moderate working memory capacity (14.3%). Total amount of correct answers are 14.5 out of 30 Y/N and recall test. There is no student categorized having low and high working memory capacity.

The last one is 6 sentences as the highest level of given memory load. It shows that all participants are grouped having above moderate working memory capacity (100%). Total amount of correct

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26 Ellis, *The Study of Second Language Acquisition*, 2006.
27 Hakim, "Interferensi dalam Bahasa Jepang Ditinjau dari Kapasitas Working Memory Otak: Suatu Kajian Neurolinguistik."

answers are between 20 to 25 out of 36 Y/N and recall test. There is no student categorized having low, moderate, and high working memory capacity.

3. Language Transfer of Male Participant

a. Errors

It has been found several errors of male participant, such as ommission, substitution, and error in sentence structure.

Omission occurs in the following data. (e.g., 'My little sister <u>wear</u> red cap', 'Sometimes he only <u>eat</u> a piece of bread,' 'Yogyakarta has many tourism <u>object</u> to be visited,' 'There is a lot of <u>place</u> to visit in Yogyakarta,' 'Yogyakarta has many tourist <u>destination</u> that can be visited,' 'Yogyakarta has many tourism <u>spot</u> which can be visited,' 'The book that Andy <u>read</u> seem interesting,' 'In Japan, society <u>like</u> to walk,' 'In Japan, society <u>prefer</u> to walk,' 'That computer <u>belong</u> to my friend's parents').

Participants tend to omit suffix –s after single pronoun. It happens based on the rule of first language which has no changes among verbs (there is no subject-verb agreement).

Omission error also occurs in sentence (e.g., this machine <u>created</u> by Indonesian student)*.* Participant ommit "is" as the form of passive voice.

Other errors are: (e.g., 'Some elementary school <u>is</u> not able to read,' 'Every house <u>have</u> its own aroma,'

'The doctor who came at yesterday party <u>was</u> beautiful,' 'The doctor who <u>comes</u> to the party yesterday is pretty,' 'Paul <u>use</u> his shoes, the red car and expensive its <u>broke</u>,' 'Last night the rain <u>fallen</u> heavy,' 'Last night the rain <u>fall</u> heavily,' 'Book that is read by Andy seems <u>interested</u>').

Participants tend to substitute several words into another. It changes the meaning and breaks the grammar. The changes are has > have, is > was, came > comes, wear > use, broken > broke, fell > fallen, fell > fall, interesting > interested.

The reasons for those errors are the lack of participants' knowledge in choosing the suitable words for each meaning. This result is exactly supporting the previous researches such as Marwati,[28] Jam et al,[29] and Leung and Brice[30] which identify the errors and its explanation.

In addition, error also occurs in the level of sentence structure such

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[28] Sofia Marwati, "An Analysis of Error-Pronouncing Phonemes Caused by Interference as Found in Spoken English of the First Year Students at the English Department of Andalas University and Some Universities in Melbourne" (Thesis, Universitas Andalas, 2016).

[29] Bashir Jam, Masood RahimiDomakani, and Zahra Asghari Kasegari, "An Intralingual Analysis of Iranian EFL Learners' Difficulties Caused by the Inconsistency between Spelling and Pronunciation," *International Journal of Educational Investigations* 1, no. 1 (2014): 134–47.

[30] Cynthia Leung Leung and Alejandro Brice, "An Analysis of Phonological Processes Involved in Spoken English of Hong Kong Primary Pre-Service Teachers," *Language Testing in Asia* 2, no. 2 (May 2012): 1–18, https://doi.org/10.1186/2229-0443-2-2-42.

as. (e.g., *Tadi malam hujan turun dengan derasnya* is transferred as <u>Last night was heavy rain</u>. *Masih banyak orang yang salah dalam memakai vitamin rambut* is transferred as <u>still many people are wrong in using hair vitamin</u>. *Saya sangat membenci ketombe* is transferred as <u>I very hate dendrouf</u>).

The patterns of sentences are still following Indonesian. It clearly means that first language gives big influence to the second language use.

b. Facilitation (positive transfer)

There are several positive transfers that successfully found in data ('Paul wears red hat,' 'Bill Gates gives $350.000 for charity').

Most participants succeed to produce those sentences. First language helps them to make it happen since the sentence structure of Indonesian and English is quite similar.

c. Avoidance

The data of over-use are as follow. ('<u>A bread</u> has been produced to replace <u>a piece of bread</u>,' '<u>Let us home</u> has been produced to replace <u>let's go home</u>,' '<u>Really excited</u> has been produced to replace <u>is really excited</u>').

It might occur because of the limitation of participants' knowledge.

d. Over-use (over generalization)

A participant over-generalize the use of suffix –s, (e.g., '<u>Many people likes orchid</u>,' '<u>It rains heavily last night</u>,' '<u>The doctor who comes to party is beautiful</u>').

Suffix –s tends to be used in any type of tenses. It happens as a result of intralingual process. Other over-use data are: ('In Japan, citizen prefer to <u>walk on foot</u>,' 'Many people like <u>anggrek flower</u>,' 'The car that <u>colour red</u> and <u>expensive price</u> is broken,' 'Many people doing mistake in order using <u>vitamin hair</u>.' 'Sometimes he eat <u>pieces</u> of bread).'

In this case, participants use the pattern of Indonesian into English. Last datum is required to write single noun instead of plural. The participants over-use it.

4. Language Trasfer of Female Participant

a. Errors

It also has been found several errors of female pasrticipant, such as ommission, substitution, and error in sentence structure. Omission occurs in the following data ('Sometimes he just <u>eat</u> a bread,' 'Yogyakarta has many tourism <u>place</u> to visited.' 'Yogyakarta offers many tourist <u>attraction</u>,' 'Yogyakarta has many tourism <u>area</u> to visit.' 'Many <u>student</u> of primary school cannot read,' 'In Japan, the society <u>prefer</u> to walk).'

Participants tend to omit suffix –s after single pronoun. It happens based on the rule of first language which has no changes among verbs (there is no subject-verb agreement).

Omission error also occurs in sentences such as: ('Yogyakarta has many tourism places to visited.') Participant omit "be" as the form of passive voice. ('This machine made by Indonesian student'). Participant omit "is" as the form of passive voice.

Another data for error are: ('Expensive red car was broke,' 'The red car which is expensive brokes,' 'Red car is pricey and it is broke,' 'My room have the same wide with my mother's room,' 'The doctor coming to the party last night was beautiful,' 'The doctor who went to the party yesterday was pretty').

Participants tend to substitute several words into another. It changes the meaning and breaks the grammar. The changes are: is > was, is broken > brokes, is broken > is broke, has > have, is > was.

The reasons for those errors are the lack of participants' knowledge in choosing the suitable words for each meaning.

In addition, addition error is found in female, such as (e.g., selfie is my uncle hobbies). Participant add suffix –s of the word *hobby* as a plural marker. In fact, the sentence doesn't need singular form instead of the plural one.

Error also occurs in the level of sentence structure such as *Tadi malam hujan turun dengan derasnya* are tranfered as at night was there heavy rain, tonight was heavy rain. last night was heavy rain, yesterday night, heavy rained, last night was raining heavily.

The patterns of sentences are still following Indonesian. It clearly means that first language gives big influence to the second language use.

b. Facilitation (positive transfer)

There are several positive transfers that successfully found in data which are similar to male ('Paul wears red hat,' 'Bill Gates gives $350.000 for charity').

Most of participants succeed to produce those sentences. First language helps them to make it happen since the sentence structure of Indonesian and English is quite similar.

c. Avoidance

There is only one datum for over-use category. *a bread* has been produced to replace *a piece of bread.* It might occur because of the limitation of participants' knowledge.

d. Over-use (over generalization)

Over-use data are found as follow: ('Many people like orchid flower,' 'Family is a children first school'). Participants use the pattern of Indonesian into English. The last datum of the world children should be single noun.

D. Conclusion

Working memory capacity between male and female has significant differences. Working memory capacity of

male tends to do not have pattern, while female inclines to have the same pattern. Language transfer data has also different results for both genders. Male are having more negative transfer than female. It relies on fact that female are better in language comprehension than male. Then, male has different system of brain which needs more physical activities and big space. It is also supported by the different working memory capacity. It inclines that male has unpredicable pattern which closely related to the teaching strategies. Female stands on a same capacity of working memory. Both of them need different ways to be taught on.

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