Faculty of Cognitive Sciences and Human Development

GENDER DIFFERENCES IN VERBAL WORKING MEMORY

KONG XIAN CHENG

Bachelor of Psychology (Honours)

2022

UNIVERSITI MALAYSIA SAWARAK

A

Grade: _____

Please tick (√)
Final Year Project Report ☑
Masters ☐
PhD ☐

DECLARATION OF ORIGINAL WORK

This declaration is made on the 4th day of July 2021.

Student's Declaration:

I, **KONG XIAN CHENG (70109)**, Faculty of Cognitive Sciences and Human Development hereby declare that the work entitled, **"GENDER DIFFERENCES IN VERBAL WORKING MEMORY"** is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

4/7/2022
_____
Date submitted

_____
KONG XIAN CHENG (70109)

Supervisor's Declaration:

I **KARTINI ABD GHANI** hereby certifies that the work entitled, **GENDER DIFFERENCES IN VERBAL WORKING MEMORY** was prepared by the above named student, and was submitted to the "FACULTY" as a * partial/full fulfillment for the conferment of **BACHELOR OF PSYCHOLOGY(HONOURS),** and the aforementioned work, to the best of my knowledge, is the said student's work

_____
Received for examination by:
KARTINI ABD GHANI

Date: 4 Sept 2022

I declare this Project/Thesis is classified as (Please tick (√)):

☐ **CONFIDENTIAL** (Contains confidential information under the Official Secret Act 1972)*****
☐ **RESTRICTED** (Contains restricted information as specified by the organisation where research was done)*****
☑ **OPEN ACCESS**

Validation of Project/Thesis

I therefore duly affirmed with free consent and willingness declared that this said Project/Thesis shall be placed officially in the PeTARY with the abide interest and rights as follows:

- This Project/Thesis is the sole legal property of Universiti Malaysia Sarawak (UNIMAS).
- The PeTARY has the lawful right to make copies for the purpose of academic and research only and not for other purpose.
- The PeTARY has the lawful right to digitise the content to for the Local Content Database.
- The PeTARY has the lawful right to make copies of the Project/Thesis for academic exchange between Higher Learning Institute.
- No dispute or any claim shall arise from the student itself neither third party on this Project/Thesis once it becomes sole property of UNIMAS.
- This Project/Thesis or any material, data and information related to it shall not be distributed, published or disclosed to any party by the student except with UNIMAS permission.

Student's signature _____   Supervisor's signature: _____
(4/7/2022)   (4/7/2022)

Current Address:
No 6, Lorong Datuk Temenggong Tan Meng Chong 8F2, 93150, Kuching, Sarawak

Notes: ***** If the Project/Thesis is **CONFIDENTIAL** or **RESTRICTED**, please attach together as annexure a letter from the organisation with the period and reasons of confidentiality and restriction.

[The instrument was duly prepared by the PeTARY]

GENDER DIFFERENCES IN VERBAL WORKING MEMORY

KONG XIAN CHENG

This project is submitted
in partial fulfilment of the requirements for a
Bachelor of Psychology with Honours

Faculty of Cognitive Sciences and Human Development
UNIVERSITI MALAYSIA SARAWAK
(2022)

The project entitled **'GENDER DIFFERENCES IN VERBAL WORKING MEMORY'** was prepared by **KONG XIAN CHENG (70109)** and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Psychology with Honours

Received for examination by:

Kartini

_____

(KARTINI ABD GHANI)

Date:

4 Sept 2022

Gred
A

ACKNOWLEDGEMENT

The completion of this paper could be impossible without the support and the assistance of people surrounding me. However, there is two group of people which I would like to express my deep appreciation to.

The first group is my supervisor and lecturers especially Dr Kartini Abd Ghani and Encik Azhari Abu Bakar. I would like to express my sincere gratitude to them for their supervision, guidance, and advice throughout this research.

I would also like to thank my friends especially Michelle Voon Hui Thien, Bryan Voon Li Qi and Chiew Shie Jin for their support, either morally or physically, in completing this research.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This study aimed to discover the gender differences in working memory among university students whose age and education level is similar. It is because there are inconsistent findings from the past studies such as some research found that female outperform male in verbal working memory task while some found there is no gender differences in performance related to verbal working memory. Besides, it is also found that there is not much research control other confounding variable such as age and education level which can also affect performance in working memory. Therefore, a quantitative research focus on the gender differences in verbal working memory is done with the control of age and education level. The instrument used is modified reading span task which sentences are extract from a course module familiar by the participants to ensure the language used is capable by all participants. Results shows that the differences in performance between male and female is not statistically significant. The results of this research showed that more similar studies are needed in order to discover gender differences in verbal working memory as the gender differences in verbal working memory does not shown in this research may be due to the low effect size of gender in verbal working memory performance.

Keywords: Verbal Working Memory, Age, Education Level, Reading Span Task.

ABSTRAK

Kajian ini bertujuan untuk mengenal pasti kewujudan perbezaan jantina dalam memori kerja lisan antara pelajar universiti yang serupa daari segi umur dan peringkat pendidikan. Hal ini kerana keputusan dari kajian lain tidak konsisten, terdapat kajian yang membuktikan wanita mempunyai prestasi yang lebih tinggi berbanding dengan lelaki dalam tugasan ingatan kerja lisan, tetapi juga ada kajian yang menunjukkan perbezaan jantina dalam ingatan kerja lisan tidak wujud. Selain itu, kajian yang mempertimbangkan pembolehubah yang dapat menpengaruhi pretasi ingatan kerja lisan seperti umur dan peringkat pendidikan amat kurang. Oleh itu, kajian kuantitatif yang fokus pada perbezaan jantina dalam ingatan kerja lisan dijalankan dengan kawalan umur dan peringkat pendidikan. Alat yang digunakan dalam kajian ini adalah tugasan membaca yang diubahsuai supaya bahasa yang diguna boleh difahami oleh semua perserta kajian. Keputusan kajian ini membuktikan tiada perbezaan jantina dalam ingatan kerja lisan. Walaubagaimanapun, kajian yang serupa amat diperlukan untuk membuktikan ketidakwujudan perbezaan jantina dalam ingatan kerja lisan dalam kajian ini tidak disebabkan oleh saiz kesan jantina yang kecil dalam pretasi ingatan kerja lisan.

Kata kunci: Ingatan Kerja Lisan, Umur, Peringkan Pendidikan, Tugasan Membaca

1.0 Introduction

Working memory refers to the ability to retain and manipulate information that is available in limited time. Its importance can be shown through its connection with learning, intelligence, information processing, comprehension, problem solving and executive function (Cowan, 2014). The cognitive abilities that correlate with working memory are important in performing daily tasks. The most influential model of working memory is the multicomponent working memory model that was proposed by Baddeley and Hitch (1974). In this model, they explain that working memory can be divided into two types which are verbal working memory and visuospatial working memory. Verbal working memory and visuospatial working memory are stored in separated storage termed phonological loop and visuospatial sketchpad. Verbal working memory enables people to communicate with each other which is significant to humans as humans are intensely social beings. This is because verbal working memory enables people to retain and process verbal stimuli such as words, number so they can understand what the others want to present. Visuospatial working memory is significant in other ways as it enables people to remember and process object's features and spatial information.

1.1 Background of Study

Working memory was proposed by Baddeley and Hitch (1974) to replace the concept of short-term memory which they view as oversimplified. They proposed that domain-general executive attention manage the information that is stored in domain-specific storage. Baddeley (2000a) later added an episodic buffer to improve the model

in explaining the mechanism of working memory. However, there are also researchers who proposed different ideas in the mechanism of working memory. For example, Cowan (1995, 2001) proposed that working memory is part of long-term memory which has been activated due to ongoing cognitive ability or perceptual experience and is aware because one's attention is on the memory. Besides, there is also a model that views working memory as a limited cognitive resource that is required to maintain information and process information (Daneman & Carpenter, 1980; 1983). A lot of explanations have been provided, however working memory still seems to be a mystery because it is an abstract idea that was proposed in order to explain human cognitive ability.

Although working memory is difficult to study, researchers have conducted lots of studies to understand its nature. For example, Kyolloen and Christal (1990) found that efficiency of working memory in maintaining and manipulating information is associated with intelligence which is described as general mental ability that underlines cognitive functions (Spearman, 1904). Besides, speed of information processing and capacity of information storage is also found accountable for the association of working memory and intelligence (Colom et al., 2008; Fry & Hale, 1996; Jensen & Munro, 1979). Reading ability also being found is associated with working memory (Baddeley,1979; Cain et al.t, 2004; McDougall et al., 1994). Next, the ability to maintain information while processing information is also found associated with mathematical problem-solving skills (Bisanz et al., 2005; Kintsch & Greeno, 1985; Siegler & Booth, 2005; Swanson, 2004; Tronsky, 2005). In short, working memory is important as it is associated with cognitive abilities that we need to perform daily tasks.

Besides relation with cognitive abilities, working memory research also focuses on the individual differences. It is important because individual differences in working

memory can influence their performance in daily task as well as professional achievement. Just like other cognitive abilities as well as perception, and sensation, working memory will decline due to aging (Fabiani, 2012; Park et al., 2002). Besides aging, differences in working memory also being proved is associated with socioeconomic status (Evans & Schamberg, 2009; Farah et al., 2006; Hackman et al., 2015; Herrmann & Guadagno, 1997; Noble et al., 2007; Sarsour et al., 2011). It is because socioeconomic status can affect the highest education and nutrition one can receive. Education level is shown to be associated with working memory performance (Zahodne et al., 2011) and sufficient nutrition can help in preserving cognitive decline such as working memory (Debette et al., 2011). Besides these acquired factors that can result in individual differences in working memory, researchers are also curious with the inborn differences such as gender differences in working memory. There are a lot of studies that found gender differences appear in various cognitive ability such as female perform better in verbal task (Andreou et al., 2005; Stumpf, 1995; Bae et al., 2000; Hedges & Nowell, 1995; Torres et al., 2006) while male outperform female in visuospatial tasks (Parsons et al., 2005; Torress et al., 2006; Upadhayay & Guragain, 2014). Besides, studies from neuroscience also showed differences in brain activation area between male and female when doing the same working memory task (Clements et al., 2006; Gur et al., 2000; Speck et al., 2000). However, studies that directly focus on gender differences using working memory measurement have failed to reach a consistent conclusion. For example, research by Lejbak et al. (2011) found no significant gender differences in verbal N-back tasks but Speck et al. (2000) has found significant differences in the score of the same measurement between two genders. Therefore, more research is needed in order to provide more empirical data in explaining the consistent findings.

3

1.2 Problem Statement

The problem of studies related to working memory and gender differences is the inconsistent findings from past research. Working memory as a cognitive ability is important as it is associated with other cognitive abilities such as reading and problem solving which is essential for one's life. Therefore, exploring the gender differences in working memory is important as it can be the source of inequalities especially in the teaching methods in school, college and university. The inequalities in teaching methods may discriminate against one particular gender in academic achievement and the opportunity of careers as well. If the inequality remains unsolved, the harmony of society may be affected as conflict may happen in serious cases.

Studies from neuroscience have shown that male and female has different brain activation when using working memory (Clements et al., 2006; Speck et al., 2000; Gur et al., 2000). However, studies from psychology have failed to achieve consistent findings. For example, a study done by Lejbak et al. (2011) showed no significant gender differences in performance in verbal N-back tasks, but Speck et al. (2000) found opposite results from their studies. Both of these studies have issues related to validity. In Lebjak et al. Study, the age range of the sample is not consistent where the age range of female participants are 17-28 years while for male participants is 17-21 years. The studies on age-related differences in working memory have shown age is a confounding variable that can affect working memory performance where younger adults can perform better than senior (Chen et al., 2005; Jenkins et al., 2000; Myersin et al., 1999; Salthouse, 1995; Shelton et al., 1982). Issue related the validity in Speck et al. (2000) is the imbalance and small sample size. The sample size in their studies is only 17 which consist of 9 male and 8 female. The small sample size has issues in generalizing

4

conclusions to the population while imbalance sample size in male and female is crucial in studies that focus on gender differences because it can affect the results of statistical analysis especially with smaller sample size. There is also research with large samples such as the one done by Piccardi et al. (2019). They managed to have 104 male and female with similar average age: 28.66 years for male and 28.03 years for female. However, the other confounding variables such as educational level are not stated in their paper. This leads to the worry of validity of their results. Besides, only a few studies have been done in the Malaysian context. This leads to the needs of additional empirical evidence for generalizing conclusions from studies that have been done to be applied in Malaysia context.

Therefore, this quantitative research focus on undergraduate university students in Malaysia that are similar in age and education level in order to explore the gender differences in working memory.

1.3 Research Objectives

This research is aimed to explore the gender differences in verbal working memory among undergraduate university students in University Malaysia Sarawak (UNIMAS) by limiting other confounding variables such as age and educational level that may affect one's working memory performances.

1.4 Research Questions

Based on the objective, research question is addressed:

1. Does gender differences in verbal working memory appears in undergraduate university students in University Malaysia Sarawak (UNIMAS)?

1.5 Research Hypotheses

The null hypothesis for the research question is

H0: There are no significant gender differences in verbal working
memory among undergraduate university students in University
Malaysia Sarawak (UNIMAS).

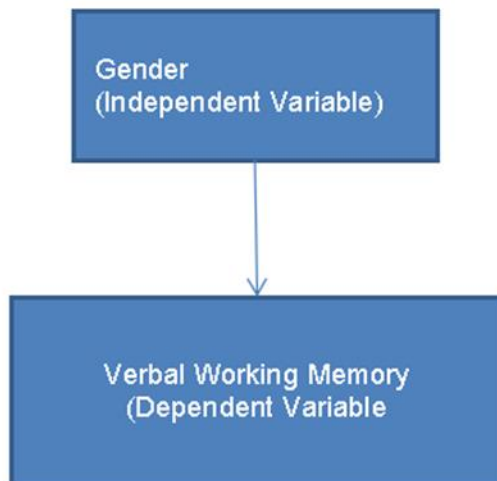## 1.6 Conceptual Framework

Figure 1.6. Conceptual framework of the study

1.7 Significance of Study

At present, there are only a few studies that focus on gender differences in verbal

working memory within the context of Malaysia, but a lot of studies have been done in

other countries. This study is hoped to provide inspiration to other researchers to conduct studies related to working memory in Malaysia. It is important as the conclusion from other countries' studies is only able to apply in the Malaysian context if we have enough evidence to support it.

Besides, these studies also aim to provide additional empirical evidence as contribution to existing knowledge on working memory, learning and individual differences.

1.8 Scope of Study

This study focus on the verbal working memory performance of undergraduate university students in University Malaysia Sarawak (UNIMAS). The verbal working memory is measured using a reading span task. It is aimed to have a large enough sample (sample size at least 60) to provide more accurate mean values, identify outliers that could skew the data in a smaller sample and provide a smaller margin of error which can produce significant effects on the analysis of data later. However, the conclusion of this study may face an obstacle in generalizing to the Malaysian population as the sample only came from University Malaysia Sarawak (UNIMAS) and the age and educational level is specified.

1.9 Definition of Terms

1.9.1 Gender

Conceptual Definition: According to World Health Organization (n.d.), gender is a collection of norms, behaviour and roles that are socially construct and may change as

the time travel. It is related with sex but not equal to sex as one's gender identity may or may not correspond to one's sex which is innate.

Operational Definition: In this study, gender refers to male and female undergraduates' students of University Malaysia Sarawak (UNIMAS).

1.9.2 Verbal Working Memory

Conceptual Definition: Verbal working memory is commonly considered as temporal maintenance of verbal information, such as symbol that created by human which represent certain meaning. It is different from short-term memory memory, a passive information storage as researcher viewed verbal working memory as memory for processing information such as convert words to speech (Schwering & MacDonald, 2020)

Operational Definition: In this study, verbal working memory is accessed through reading span task. Reading span task is task that required participants to read and remember last word of each sentence. The verbal working memory performance is determined by the score which reflect the numbers of words that successfully recalled.

1.10 Summary

This chapter introduced the concept of working memory and its application in daily tasks. Past findings of working memory related to learning and individual differences is also briefly discussed. The limited numbers of research on working

memory and gender differences in Malaysia context is pointed out together with the limitation of previous studies. The necessities to carry out this study is elaborated. Research objectives, questions and hypotheses were listed to carry out this study. The significance of this study in empirical and practical fields was explained.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

There are a few models that explain the mechanism of working memory. The model that is chosen for this research is the multicomponent working memory model that proposed by Baddeley and Hitch in 1974. Besides, working memory also been proved important in learning-related abilities. However, studies in working memory and individual differences especially gender differences does not have consistent finding.

2.1 Memory and Working Memory

Memory is the term that use to describe the structures and process of storing and retrieving information (Mcleod, 2013). Memory is important in our daily life because all our thought and behaviors are based on the information, we received in the past which stored in our memory. For example, a person can understand the term "pencil" represents because he learned the object is named pencil in the past. A lot of research had been done to study and understand the abstract concept of memory (Oberauer & Cowan, 2005; Cowan, 2008). Memory can be traced back to the scientific study done by Hermann Ebbinghaus (1913), researcher has subdivided memory into two or more categories such as primary and secondary memory by James (1890). Nowadays, the widely accepted and used categorizations of memory by researcher are long-term memory, short-term memory and working memory (Chai et al., 2018). Long-term memory and short-term memory are differences in term of the period of time information is retained. Long-term memory is described as a huge storage for the information and knowledge that received in the past while short-term memory is known

as a temporary storage of information (Cowan, 2008). Working memory is a different concept that emerged due to the argument created by Baddeley and Hitch (1974) who view the concept of short-term memory from Multi-Sotre Model (Atkinson & Shiffrin, 1968) is oversimplified. Therefore, working memory has similarity with short-term memory but different from it with the introduction of information manipulation role (Baddeley,2012). In general, short-term memory can only retain information for limited time but working memory is able to hold and process the information (Mcleod, 2012). The differences between short-term memory and working memory can be shown through a reading task. When a person looks at the sentence on a book. The words will enter and store in the short-term memory, but he will be unable to understand the meaning and pronounce the words as there is no mechanism for information processing in short-term memory concept. In the working memory concept, the words will enter and retain in the working memory and also the words will be linked to the semantic knowledge related to the meaning and pronunciation of the words that are stored in long-term memory. Therefore, the person is able to read the sentence, understand the meaning of the sentence and even identify syntax errors in the sentence. This example explains the reason Baddeley and Hitch (1974) think that the concept of short-term memory is oversimplified.

2.2 Working Memory Model

2.2.1 Multicomponent Working Memory Model

There are several working memory models that try to explain the structure and functions of working memory. One of them is the multicomponent working memory model that was proposed by Baddeley and Hitch in 1974. The multicomponent working memory model is modified from the multi-store model of memory that was proposed