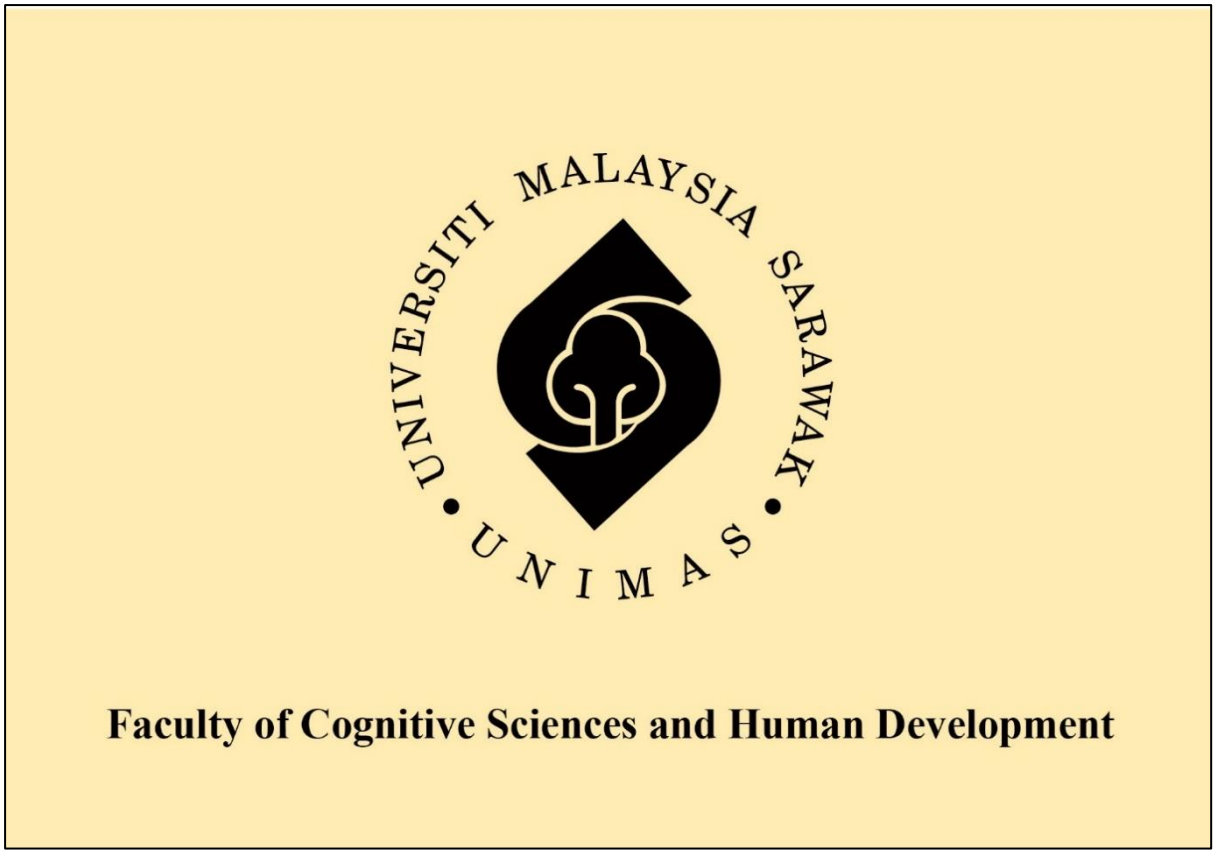

GENDER DIFFERENCES IN VERBAL WORKING MEMORY

KONG XIAN CHENG

Bachelor of Psychology (Honours)

2022

UNIVERSITI MALAYSIA SAWARAK

Grade: A

Please tick (√)

Final Year Project Report ☑

Masters ☐

PhD ☐

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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

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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

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Date:

4 Sept 2022

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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.

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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

CHAPTER ONE

INTRODUCTION

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.

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 tovalidity. 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

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

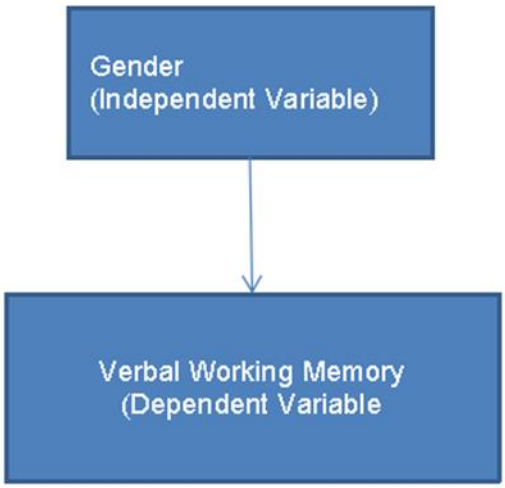

Figure 1.6. Conceptual framework of the study

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

by Atkinson and Shiffrin in 1968. In the multicomponent working memory model, the unitary short-term memory system in the multi-store memory model is replaced by the working memory which has a multicomponent. The components of working memory are central executive, visuospatial sketchpad, phonological loop (Baddeley and Hitch, 1974; Baddeley, 2000b) and episodic buffer which only added to the model in 2000 by Baddely (Baddeley, 2000a). Working memory is described as domain-general executive attention which manages the active representations of domain-specific information by multicomponent working memory model. The central executive act as domain-general executive attention managing the domain-specific information such as verbal and visuospatial working memory that are stored in phonological loop and visuospatial sketchpad respectively.

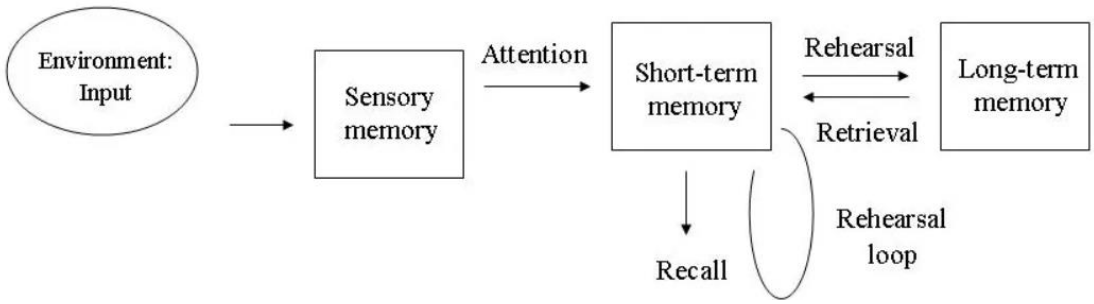

Figure 2.2.1(a): Multi-Sore Model of Memory (Mcleod,2021)

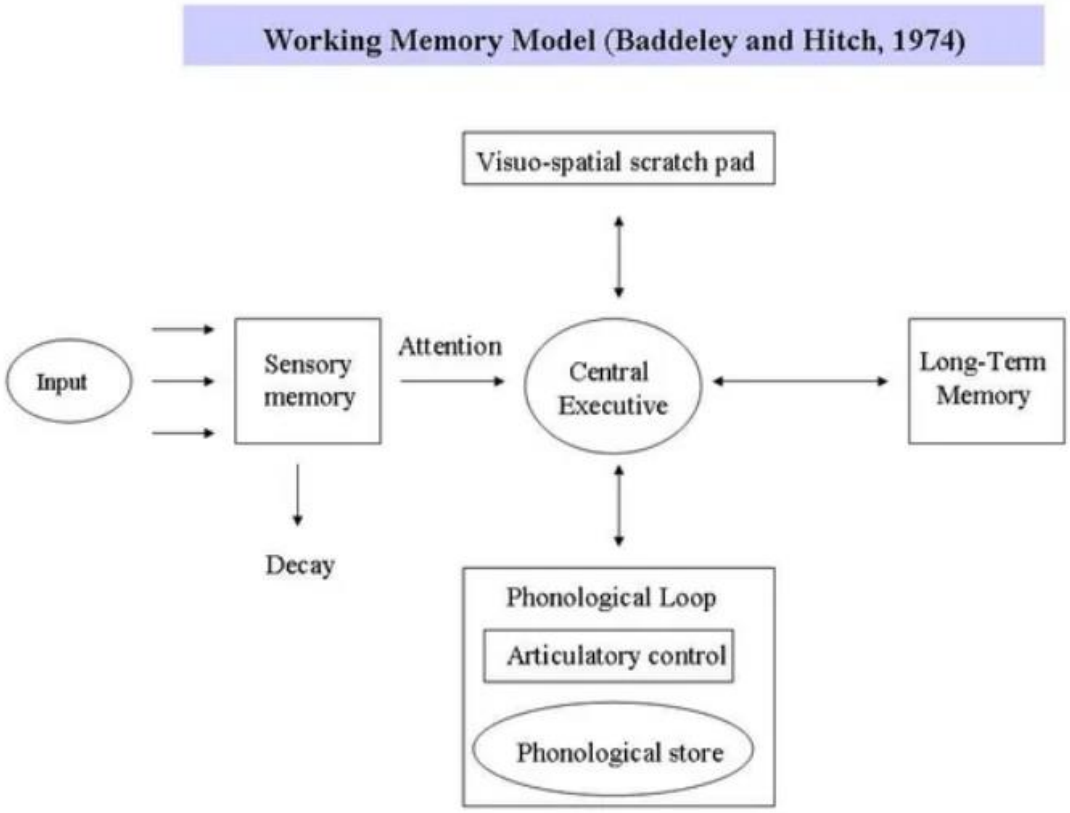

Figure 2.2.1(b): Working Memory Model (McLeod, 2012)

Central Executive is the most important component in the multicomponent working memory model. The role of central executive is to coordinate, allocate and manipulate information that is stored in visuospatial sketchpad and phonological loop (McLeod, 2012). It can coordinate and monitor the manipulation of information in visuospatial sketchpad and phonological loop because it involves attention control system (Baddeley and Hitch, 1974; Baddeley, 2000b). The attention control system enables people to use attention to decide what is needed to be done on the information in the visuospatial sketchpad and phonological loop.

The phonological loop has two components which are phonological store and articulatory control. Phonological store is the component which stores verbal information in the working memory while articulatory control is the component that

helps to refresh the verbal information in the phonological store (Salame & Baddeley, 1982; Buchsbaum, 2013). The information in the phonological loop is in two forms which are phonological code (quasi-sensory) and articulatory code (quasi-motor) (Wilson, 2001). The founding of the dual coding views in verbal working memory came from the results of several studies. One of it is patients with severely reduced auditory-verbal short-term memory as results of temporo-parietal lesion have auditory comprehension abilities and preservation of speech (Shallice & Vallar, 1990; Shallice & Warrington, 1997). Second, articulatory suppression unable to affect the rhyme judgement ability on a pair of words presented in visual form (Baddeley & Lewis, 1981). Next, presenting irrelevant speech during immediate verbal working memory has a negative effect on series recall (Beaman & Jones, 1998; Jones & Morris,1992). These studies suggest the existence of representational code in multiple forms. The information is in phonological code when it is in phonological store while is in articulatory code when it is in articulatory control. The information in phonological stores is subject to rapid-time based decay and only able to retain through articulatory control processes. This can be shown when people want to remember telephone numbers from one call. The common way to remember it and not let it decay is through rehearsal with the subvocal repetition (Mariën et al., 2014). This is the role of articulatory control. Besides, articulatory control also converts verbal information that presents in visual form to articulatory code and transfers it to phonological stores (Kim & Mariën, 2016).

Visuospatial sketchpad is the component that handles visual and spatial information (Buchsbaum & D'Esposito, 2008). Unlike the phonological loop that has several components, the visuospatial sketchpad is a unitary component. However, both components have similarity which is able to be affected by interference which results

in the information in the storage failing to retain. The example of activity that can make inference to visuospatial sketchpad is random eye movements (Bushsbaum & D'Esposito, 2008). Just like the verbal information is rehearsed through subvocal repetition, the spatial information is maintained through saccadic rehearsal (Postle et al., 2005) as Baddeley (1986) proposed that covert eye movement is a way to revisit locations in memory. According to Baddeley (1997, as cited in McLeod, 2012), visuospatial sketchpad is important to help people to keep track of the relative distances of people and objects when he is moving through his environment. It is important to update the spatial information when moving so people can avoid knocking the object. Besides, studies that concluded spatial information input will only interference retention of spatial information (Cocchini et al., 2002) and nonspatial visual information retention will only affect by nonspatial visual perceptual input (Klauer & Zhao, 2004) suggested that nonspatial visual information and spatial information may store in different storage (Logie, 1995).

Episodic buffer is the component that is newly added to the multicomponent working memory model (Baddeley, 2000a). In the paper, Baddeley argued that there is a need for a separate buffer capable of representing and integrating inputs from all subcomponents of working memory and from long-term memory. The introduction of episodic buffers by Baddeley is due to the limitation of multicomponent working memory model in explaining visual and information are coded in separate channel, which is phonological loop and visuospatial sketchpad, but our perception will view the event as a unitary whole. For example, a car moving from left to right. The visual information which is the information of the car appearance and its relative distance is received and stored in the visuospatial sketchpad while the auditory information, the sound created by the car engine is received and stored in the phonological loop. If the

phonological loop and visuospatial sketchpad is isolated and does not have a channel to share information, people's perception should perceive the sound and the car are from different events but in reality, it will be perceived as the sound coming from the car. This is because information related to the sound of a car engine which originally stored in long-term memory is retrieved to a component in working memory and that component can integrate all the information from visuospatial sketchpad, phonological loop and long-term memory. Therefore, the component, episodic buffer is introduced.

2.2.2 Attention Based Model

Besides the multicomponent working memory model, there are also other models that try to explain working memory. One of them is the attention-based model. The embedded process model proposed by Cowan (1995, 2001) is one of the influential theoretical accounts of working memory of attention-based models (Gathercole, 2008). According to the embedded process model, long-term memory can be divided into three parts. The first part is the long-term storage that stores information that was received in the past. The second part is called a short-term store. It is a portion of long-term storage in which the information is activated as the results of ongoing cognitive abilities or perceptual experiences. The third part is the subset of short-term stores which is the focus of attention. The information of the third part which is in the focus of attention is consciously aware. The focus of attention is controlled by voluntary processes that are limited in capacity in chunks (Gathercole, 2008) Research shows that the capacity of focus of attention is usually three to five chunks (Chen & Cowan, 2005; Cowan 2001; Cowan et al., 2005). Cowan et al. (2005) interpreted the complex memory span task and measurement used as divergent from the multicomponent working memory model explanation as use of control strategies such as rehearsal is prevented. According to

Cowan, the measurement and complex memory span task is more likely to measure the chunks of attention. Besides, the attention-based model is improved by Engle and colleagues (Engle et al., 1999). Engle's model shares similarity with multicomponent working memory model which has specific storage for verbal and visuospatial information with controlled attention but differ with Baddeley and Hitch (1974) model, it is not information from environment but activated short-term memory due to perceptual experience and cognitive function.

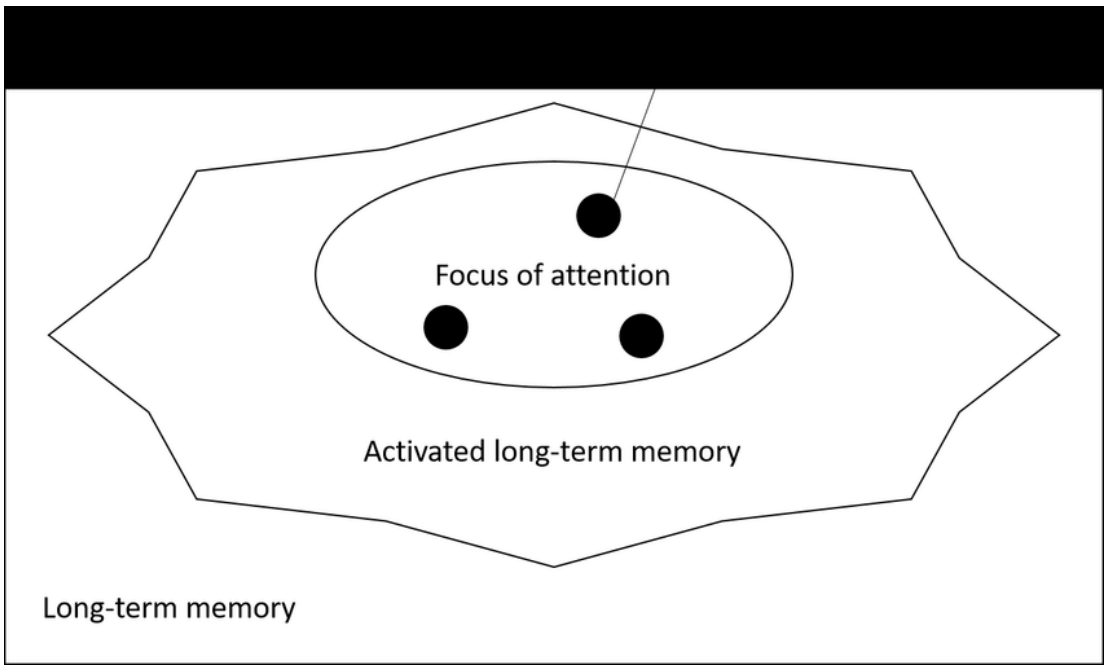

Figure 2.2.2: Cowan's embedded processes model of WM (Kowialiewski, 2019)

2.2.3 Resource-Sharing Model

Resource-sharing model proposed by Daneman and Carpenter (1980, 1983; Just & Carpenter, 1992) describe working memory as cognitive resources that are limited which can be used to retain information or process activity (Gathercole, 2008). According to this model, those who score relatively high in complex memory span tasks are because they are more familiar with the process activity in complex tasks such as

mathematical calculation in operational span tasks. This enables them to use less working memory to do calculations compared to those who are not familiar with mathematical calculation which in turn enables them to have more working memory to memorize the item needed to be recalled in the task. Case et al. (1982) explains the increase of working memory performance across childhood years is due to the efficiency of process in children increasing as they become more mature.

2.2.4 Time-based Model

Towse and Hitch (1995) proposed that process and store information does not happen simultaneously but switch strategically to oppose the resource-sharing model. According to their proposal, time-based theories of working memory are introduced (Gathercole, 2008). Based on this model, working memory is limited in terms of time it can hold information. As the memory span task complexity increases, more time is needed for processing, the information stored in working memory will decay as it cannot be refreshed (Barrouillet & Camos, 2001; Barrouillet et al., 2004). Research performed by Towse & Hitch (1995) and Towse et al. (1998) show period of information stored is better prediction of performance of complex memory span task compared to the complexity of the task. This led to the claim that complex memory span is constrained by time-based loss of activation of memory (Hitch et al., 2001).

2.3 Working Memory and Learning

Working memory is the concept of domain-general executive attention which manages the active representations of domain-specific information which can also be defined as the ability to maintain and manipulate information. Working memory is

important in one life as it is related to learning. Learning is the ability of humans to change by acquiring information from the environment. For example, a newly born baby does not know how to fill his hunger. The only thing he can do is produce sounds such as crying because he is unable to control his muscles yet. His crying will lead to the feeding from the mother. Thus, the baby learned that crying could lead to feeding. This example shows that learning is an essential process for humans to survive. However, working memory is required for a person to learn. The ability to maintain and manipulate the information from the surroundings is essential for learning because all the knowledge we have in our long-term memory is the processed information that was stored in working memory before. By using the example of the baby above, the baby experiences that food is available after cry and this information is stored in working memory and processed to be stored in long-term memory. If the information is unable to be retained in working memory, it will not be able to be processed and coded into long-term memory. The baby may not cry for food the next time as he does not remember that cry can attract his mother to feed him. In conclusion, working memory is essential in the learning process.

Working memory is related to learning and can be proved by research that studies the correlation between working memory and cognitive skill that is used in learning. Intelligence or g is defined as general mental ability that underlines multiple cognitive abilities (Spearman, 1904). Based on the multicomponent working memory model proposed by Baddeley and Hitch (1974), the key function of working memory is storing information and information manipulation. Researchers suggested that efficiency of working memory in terms of maintaining and manipulating information is the basis of reasoning ability that is associated with intelligence (Kylloen & Christal, 1990). Besides, Jensen and Munro (1979) found that speed of information processing

and reaction time tasks were correlated with intelligence. A confirmatory factor analysis showed that short-term memory storage which is a part of working memory is accounted for by the relationship between intelligence and working memory (Colom et al., 2008). Besides, Fry and Hale (1996) found that processing speed influenced working memory capacity which in turn was capable of predicting fluid intelligence. They also found that working memory remains significant in predicting fluid intelligence after removing the data of processing speed. These studies suggested that the relationship between intelligence and working memory is most likely caused by the capacity of storage and the speed in processing the information stored in the storage.

Besides intelligence, working memory also plays an important role in reading. The multicomponent working memory model suggests that phonological loop and central executive are essential in reading. The phonological loop is important to store information while the central executive is establishing grapheme-phoneme connection for reading purpose and processing information for the aim of comprehension (Baddeley, 1979; Cain et al.t, 2004; McDougall et al., 1994). The episodic buffer also aids in reading as it is the buffer that is connected to phonological loop and long-term memory. The long-term memory can assist reading by allowing retrieval of knowledge from long-term memory and integrating it with information from the text read to achieve comprehension. This hypothesis is supported by research that found that long-term memory representation mediated the relation between working memory and reading comprehension (Hambrick & Engle, 2002; Nation et al., 1999) Besides, the resource-sharing model of working memory also suggest that there is a trade-off between maintaining and processing information which process efficiency can affect amount of additional information that can be maintained for the aim of understanding of the sentence (Daneman & Carpenter, 1980; Perfetti, 2007).

Next, working memory is related to mathematical performance in adults, developing children and children with difficulty in math (Raghubar et al., 2010). Mathematical competence involves complex skills that are different in term of concept and procedure from one to another such as algebra, arithmetic, and geometry (Raghubar et al., 2010) Problem solving in these domains require holding of partial information while processing new information in order to arrive the solution. By using the example of choosing the bigger digit between 7 and 5. The children need to maintain the number 7 and 5 in their working memory and retrieve the quantities that digits 7 and 5 represent from the knowledge that is stored in long-term memory. Then, the children will need to compare the quantity of 7 and 5 in order to get the correct answer. The description of working memory aids in mathematical competence is applied to informal mathematical problem solving in preschool education (Bisanz et al., 2005) and complex mathematical tasks in higher education level (Kintsch & Greeno, 1985; Siegler & Booth, 2005; Swanson, 2004; Tronsky, 2005). There are empirical data that show working memory correlated to mathematical competence as children with mathematical difficulty (dyscalculia) show low working memory performance especially visuospatial working memory (Szucs et al, 2013).

2.4 Working Memory and Individual Differences

Besides the research that focuses on correlation of working memory with other cognitive ability, research that aims to explore individual differences in working memory also has been done. For example, age has been found to be a factor that can affect working memory performance among people. (Chen et al., 2005; Jerkins et al., 2000; Salthouse, 1995; Shelton et al., 1982). Besides, the other identified factor that can cause differences in working memory performance are socioeconomic status (Evan

& Chamberg, 2009; Farah et al., 2006; Hackman et al., 2015; Hermann & Guadagno, 1997; Noble et al., 2007; Sarsour et al., 2011), familiarity of the item (Case et al., 1982; Chi, 1978), education (Kyolloen & Christal, 1990; Zahodne et al., 2011) and nutrition (Debette et al., 2011; Goldberg et al., 2019).

Other than that, gender differences in cognitive abilities also have been the focus of researchers. Many research has shown that female perform better than male in verbal task such as syntax, semantic task and writing skill (Andreou et al., 2005; Stumpf, 1995; Bae et al., 2000; Hedges & Nowell, 1995; Torres et al., 2006) while male outperform female in visuospatial tasks such as mathematics, problem solving and visual memory (Parsons et al., 2005; Torress et al., 2006; Upadhayay & Guragain, 2014). However, the finding of gender differences in working memory are inconsistent based on the research done. For example, a study done by using 36 undergraduate students (18 male and female) whose age is almost similar (17-21 years for male and 17-28 years for female) showed male performed better than female in spatial version of N-back task while no significant differences between gender is observed in verbal N-back task (Lejbak et al., 2011). This result is contradicted with the results of Speck et al. (2000). Result from Speck et al., (2000) which data collected from 17 participants (9 male and 8 female) whose age and education level is similar (male average age 35.6 years, average years receive education 18.3 years; female average age 31.6 years, average years receive education 18.7 years) showed female performed better in verbal N-back task. Besides, the result of reading span task from 32 undergraduates (16 male and female, age range 21-24 years) shows that female perform better in verbal working memory in terms of item recall (Chan & Mohamad Azhari Abu Bakar, 2021). In another research that has 208 samples (104 male and female, male average age 28.66, average age of female 28.03) showed gender differences does not exist in verbal working

memory as measured in forward and backward digit span task but exist in visuospatial working memory measured by forward and backward Corsi Block-Tapping test (Piccardi et al., 2019). Research done on 346 right-brain damaged patients using forward, backward Corsi Block-Tapping Test and digit span test showed that right brain damaged male has better verbal and visuospatial working memory (Piccardi et al., 2016). However, the results of these studies also have questionable validity. This may be due to the sample size used in the research and the control of other variables that may cause error in the research and the results obtained may be contaminated by those variables such as age, education, familiarity of item and nutrition.

The finding of gender differences in working memory does not show consistency, but neuroscience studies have shown there are differences in male and female in basic cognitive ability and associated neuroanatomical functioning (Clements et al., 2006; Gur et al., 2000; Shaywitz et al, 1995). For example, right-hemispheric laterality was exhibited by male but left-hemispheric laterality by female on verbal working memory task (Speck et al., 2000). On visuospatial task, femele showed right-hemispheric laterality but male showed diffuse bilateral activation. (Clements et al., 2006; Gur et al., 2000). Hypotheses to the differences in brain activation is that male and female use different strategies in problem solving. Gender differences in underlying neural substrate and gender specific mechanism that regulate the blood oxygenation level dependent effect which lead to signal change in functional magnetic resonance imaging (fMRI) (Speck et al., 2000). These findings showed that there is a need to have more research to study the gender differences in working memory. In short, these neuroscience studies showed that there are differences between gender when they are doing working memory task. Therefore, more research is required to study the gender

differences in working memory to have a full understanding of the effect of gender in working memory.

2.5 Summary

This chapter reviews the models that aim to explain the abstract concept of working memory. Besides, the relation of working memory with learning skill is also being discovered, especially intelligence, reading and mathematical skill. The discovery is important to show the importance of working memory in human life where learning is the process to change and live better. Next, the individual differences in working memory are revised. Empirical data shows that working memory will decline in aging and show correlation with educational level. However, gender difference in working memory is still undefined due to inconsistent findings from previous findings. Neuroscience study suggested that there is gender difference in brain activation when performing working memory task. Therefore, more research is needed to explore the gender differences in working memory.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This research is a quasi-experimental design to explore the gender differences in verbal working memory performance. The details of the research including research design, sampling procedure, instrument used, validity and reliability of instrument and the data analysis procedure will be stated below.

3.1 Research Design

This research is a quasi-experiment. It is because randomization subject to group is impractical as independent variable, gender is determined by subject's sex. Therefore, quasi-experimental design is chosen. Due to random assignment being impossible, there is caution that the groups (male and female) will not be considered equivalent. Therefore, it is important to account for any confounding variables that may affect the results. In this research, confounding variables such as age and education level are requirements for participating in this research. It is because researchers have found that age and education level are variables that can affect verbal working memory performance (Chen et al., 2005; Jenkins et al., 2000; Kylloen & Christal, 1990; Myersin et al., 1999; Salthouse, 1995; Shelton et al., 1982; Zahodne et al., 2011). Other confounding variables such as nutrition will not be included in this research because it is hard to control the meal participants have every day. The participants of this research must be in the age range 22-23 years while the educational level should be undergraduate students and has passed the generic subject, Academic English 2. The reason specifies participants has to be undergraduate students who have passed the

Academic English 2 subject is to ensure the participants has the same familiarity of the instrument as the instruments is developed from the Academic English 2 Course Module that provided by Faculty of Language and Communication of University Malaysia Sarawak (UNIMAS).

3.2 Population and Sample

The target population of this research is the undergraduate students at University Malaysia Sarawak (UNIMAS) whose age is around 22-23 years old and has passed the subject Academic English 2. The sampling method of this research is purposive sampling method. Purposive sampling method is the most suitable method for this research because there is specific requirement for the students to be chosen as subjects. The sample size of this research is 30 males and 30 females.

3.3 Instruments

3.3.1 Instrument Structure

The instrument that used is divided into two sections. The first section consists of demographic information. The data that collected in this section is the gender of participants.

The second section is the verbal working memory task. The task chosen to access the participant's verbal working memory is reading span task. The task has several items while each item consists of two to ten sentences which the participants need to remember the last word of the sentence. After an item is done, participants is asked to recall the words according to the order it presented in the item. This task requires participant to read the task while actively maintain the memory of the word

(Daneman & Carpenter, 1980. The 46 sentences that used in this task are extract from the Academic English 2 Course Module that published by Faculty of Language and Communication of University Malaysia Sarawak (UNIMAS). Each sentence is 12-16 words length and ended up with a different word for each sentence.

3.3.2 Instrument Validity and Reliability

According to Conway (2005), working memory task such as reading span task has reasonable reliability which typical range value of coefficient alphas and split half correlation is 0.7 to 0.9, where 0 represent no reliability and 1 represent perfect reliability. Based on a specific case, data from 236 respondents, Kane and colleague (2004) found coefficient alphas of 0.78 for reading span task. Besides reliability, validity is also an important factor when considering measurement. According to Conway (2005), reading span has considerable construct validity as it can predict performance on task that emphasize attention and thought control.

3.3.3 Procedure

The data collection process is done through one-to-one interview to prevent distraction.

Procedure:

1. The first page of the instrument will be given to the participant.
2. Participant will be asked to fill the details such as age and gender.
3. The first page of the instrument will be collected, and page 2 will be given to participant. Page 2 consists of trial item of the reading span task which consist of 2 sentences.

4. The instruction will be given to the participant. The participant will need to read the sentences aloud and remember the last word of each sentence.

5. The paper will be collected back and participant will be asked to recall the last word of each sentences and pronounce the words in the sequence they appear in the item after participant has read all the sentences in the item.

6. Page 3 which consist of test item 1 will be given to the participants after the participant has recalled all the words,

7. Step 4, step 5 and step 6 are repeated by replacing page 3 with page 4, 5, 6, 7, 8, 9, 10, 11 which consist of test item 2, 3, 4, 5, 6, 7, 8, 9 respectively.

8. The interview will be terminated after the participant fail to recall all the words in certain item or finish all 10 items.

9. The highest item participant can recall successfully is recorded

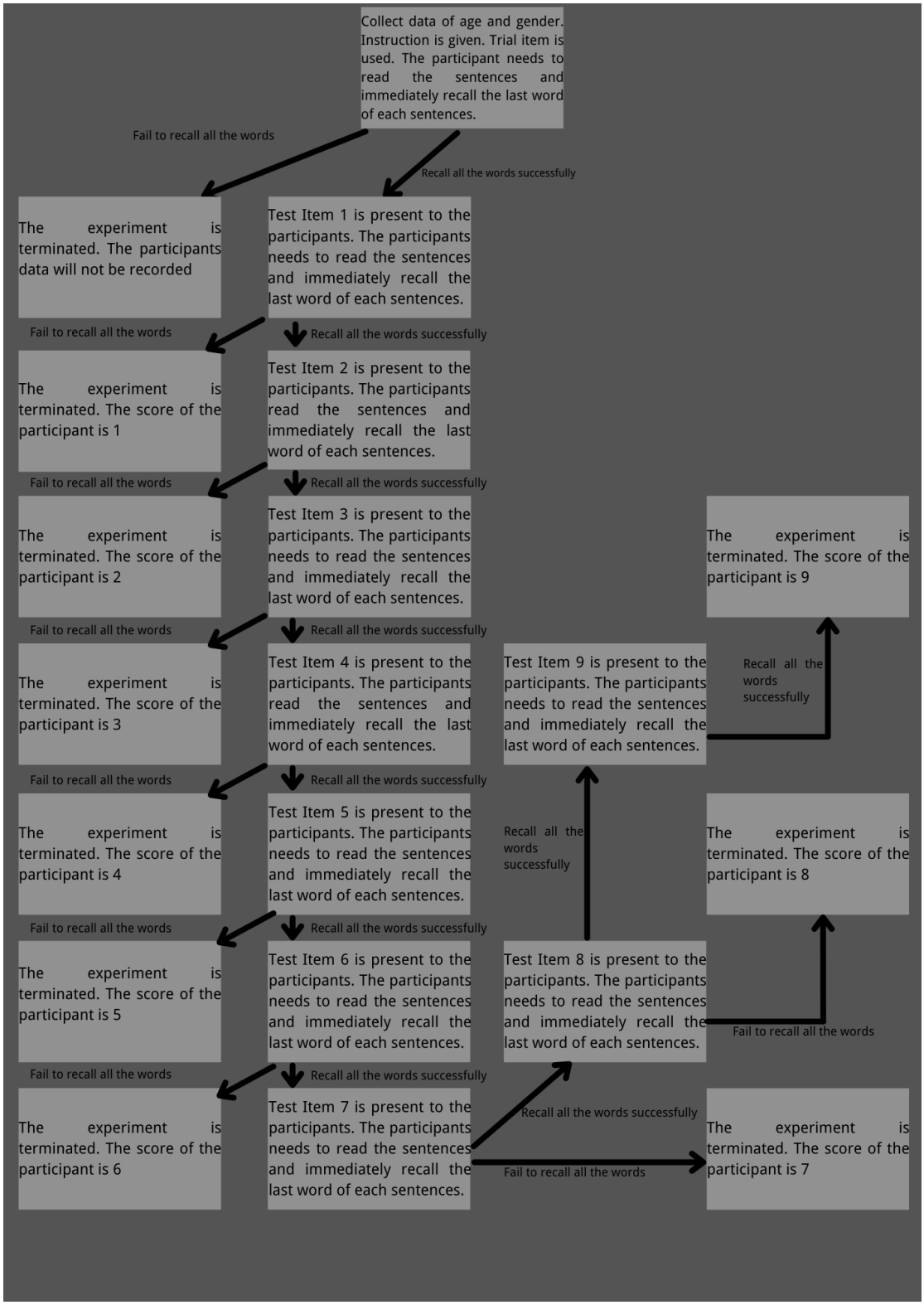

Figure 3.3.3: Flowchart of the experiment

3.4 Data Analysis Procedures

Data analysis of this research is in form of statistical analysis, the data from two groups (male and female) is compared. The programme that uses to perform statistical test is the Statistical Package for Social Science (SPSS) version 26 that developed by International Business Machines Corporation (IBM). The statistical tests that conducted is Mann-Whitney U Test. It is one of the are statistical tests to test the existence of significant differences in dependent variable (score in the reading span task) between nominal independent variable (gender). Normality test, Shapiro-Wilk test is conducted prior other statistical test to identify the distribution of the data. Since the data does not normally distribute, non-parametric test Mann-Whitney U Test is used.

3.5 Summary

This research focus on examine gender differences in verbal working memory among undergraduate students who are qualified with age around 22-23 years and has passed Academic English 2 subject. The instrument used is reading span task which material is extract from Academic English 2 course module. Data collected is analyze with the support of Statistical Package for Social Science (SPSS) software.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.0 Introduction

This chapter will focus on the analysis of data collected from the participants of the research. The statistical test that used to identify the differences in score between male and female respondents is Mann-Whitney U Test. The test is chosen due to the abnormal distribution of the scores from the participants.

4.1 Demographic Data

4.1.1 Gender of Participants

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	30	50.0	50.0	50.0
	Female	30	50.0	50.0	100.0
	Total	60	100.0	100.0	

Table 4.1.1: Frequency and Percentage of Participants' Gender

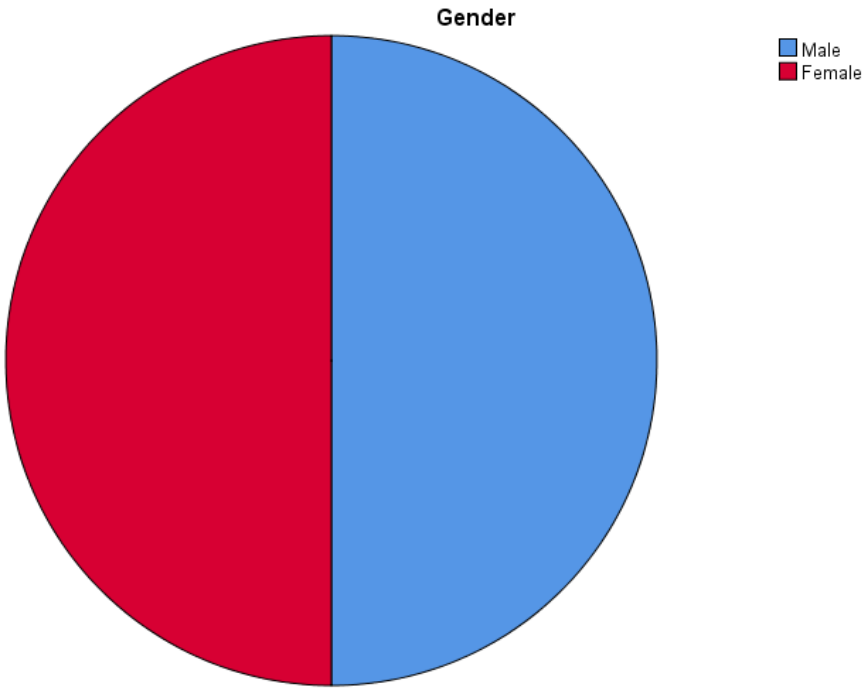

Figure 4.1.1: Pie Chart of Participants' Gender

Table 4.1.1 and *Figure 4.1.1* indicated the frequency and percentage of participants' gender.

4.1.2 Age of Participants

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	22	43	71.7	71.7	71.7
	23	17	28.3	28.3	100.0

	Total	60	100.0	100.0

Table 4.1.2: Frequency of Participants' Age

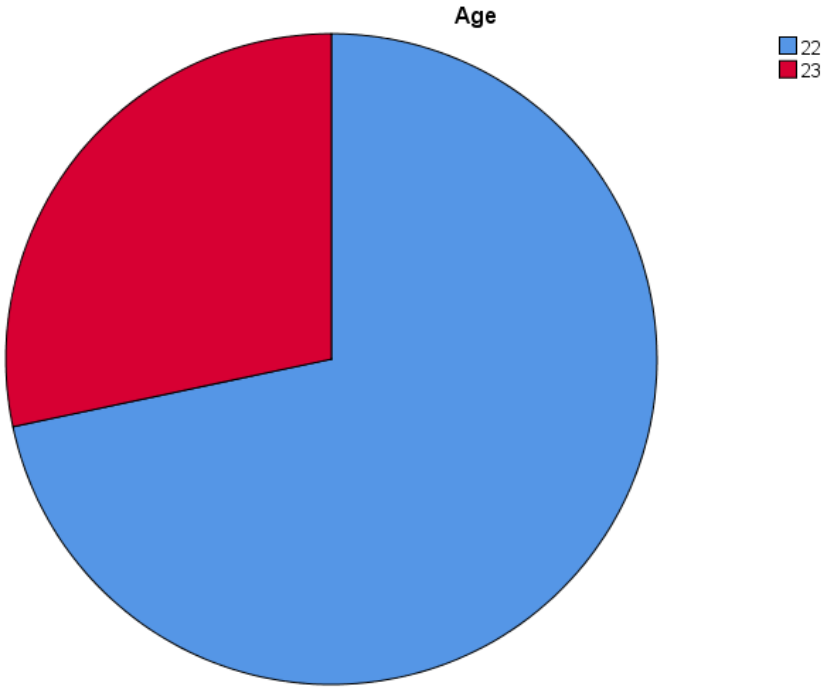

Figure 4.1.2: Pie Chart of Participants' Age

Table 4.1.2 and *Figure 4.1.2* indicated the frequency and percentage of participants' Age

4.2 Inferential Data (Main Findings)

4.2.1 Results of Mann-Whitney U Test

Ranks

	Gender	N	Mean Rank	Sum of Ranks
Score	Male	30	31.45	943.50

	Female	30	29.55	886.50
	Total	60		

Table 4.2.1(a): Calculated Data of Statistical Test

Test Statistics[a]

	Score
Mann-Whitney U	421.500
Wilcoxon W	886.500
Z	-.462
Asymp. Sig. (2-tailed)	.644

a. Grouping Variable: Gender

Table 4.2.1(b): Illustrated Result of Mann-Whitney U Test

4.2.1.1 Discussion of Mann-Whitney U Test result

As observed in Table 4.2.1.a, the score of males (Mdn= 3.5) is slightly higher than female (Mdn= 3.0). The Mann-Whitney U Test result is, U=421.50, z=-.462, p=.644. The significant value, p=.644>.05 showed that the null hypothesis of Mann Whitney U test is failed to reject. This means that the differences in scores between males and females is not statistically significant as the result of the statistical test supported thatmales and female belong to the same population which members of the population has the same verbal working memory performance.

The finding of this research is that males and female university students does not differ in term of verbal working memory performance. This result does not in line

with the research done by Chan and Mohamad Azhari Abu Bakar (2021) which found gender differences in verbal working memory. The research done by Chan and Mohamad Azhari Abu Bakar (2021) is mentioned because it is similar with this research in term of task chosen, sampling method and the participants' age and education level, but the result is different with this research. The possible explanation of the different results is that other confounding variables of verbal working memory affect the performance of participants' verbal working memory. It is because the sampling method is purposive sampling method, a type of non-probability sampling method. The participants are not randomly pick from the large general population but selected from small sample population. Although restriction play an important role in purposive sampling in control the confounding variable such as education level and age in these research, it failed to control other confounding variables. One of it is hormone especially estrogen level. Research found that estrogen users performances better in verbal working memory task (Duff & Hampson, 2000). It is possible that estrogen level in partcipants especially female participants is relatively low in this research compared to the research by Chan and Mohamad Azhari Abu Bakar (2021) caused the gender differences found in their research but not this research.

Another explanation of the differences in result is based on the finding of Lynn and Irwing (2008). They reported that the effect size of gender differences in verbal working memory task (digit span task) is not large, and education level can highly affect the performance. According to their statement, gender differences are almost absent in higher educated people but more apparent in people with lower education. Therefore, it can be reasonable that gender differences do not show in this research but show in other research where participants of both research are highly educated.

CHAPTER FIVE

LIMITATION, IMPLICATION, RECOMMENDATION AND CONCLUSION

5.0 Introduction

This chapter will explain the limitation and the implication of this study. Besides, some recommendation is made based on the result of this study. A conclusion is made to briefly describe the research done.

5.1 Limitations of Study

The limitation of this study is the conclusion of this research is unable to generalize to a larger population because of its purposive sampling method. Due to the sampling method chosen, the conclusion of this study is advised only apply to students at University Malaysia Sarawak (UNIMAS) whose age is in range of 22 to 23 years old and passed their Academic English 2 subject.

Next, another limitation of this research is the research does not happen in laboratory setting. This might cause the distraction from environment affect the performance of the participants. Although the participants are comfort with the environment where the data collection is done, it is still unknown that whether some of the participants' performance is affected by the environment or not because the environment conditions is not consistent among all participants.

5.2 Implications of Study

Besides, this studies also provided empirical data related to gender differences in verbal working memory in Malaysia context. Although the finding is not in line with the previous study done by Chan and Mohamad Azhari Abu Bakar (2021), it contributes to the identification of inconsistent findings of gender differences in verbal working memory in Malaysia university student. Therefore, more research is needed to perform in Malaysia context in order to explore more on the topic of gender differences in working memory in Malaysia setting.

This research together with the previous research (Chan & Mohamad Azhari Abu Bakar, 2021) provide data to support the findings of by Lynn and Irwing (2008) where gender differences in working memory might be invisible in higher educated people. This might provide a new view that education can help to reduce the gender differences in verbal working memory by enhancing the efficiency of strategic used by male and female when they are using working memory although the brain activation area is different.

5.3 Recommendations

Gender differences in working memory is still considered an unsolved question in the field of psychology as there is still no consistent finding from the psychology field to prove the existence of gender differences in working memory. Therefore, similar research which aim to identify gender differences in working memory in university students are needed to prove the theory suggested by Lynn and Irwing (2008) where gender differences are almost absent in higher educated people due to the low effect size of gender in higher educated people is true.

Besides, future research should also focus on longitudinal design to identify the existence of gender differences in working memory across the human life span. The reason to do this kind of research is because previous studies does not involve longitudinal design and inconsistent findings of previous studies may raise due to the participants of previous research are differ in term of norms, age, education level and culture. Therefore, longitudinal design of gender differences in working memory research can be provide a new insight and direction for further research on this topic.

Next, similar research are also needed to be conducted in Malaysia context because only a few studies are done in Malaysia. It is needed because the finding might be different compared to findings in other countries context which can in turn help to discover the mystery of gender differences in working memory.

5.4 Conclusion

This study is aimed to discover the existence of gender differences in verbal working memory in University Malaysia Sarawak (UNIMAS) students. The reason to conduct this research is to provide empirical data to current understanding of gender differences in verbal working memory especially in Malaysia context as there is no consistent findings related to gender differences in verbal working memory in psychology field but evidence from neuroscience field has shown the gender differences exist in brain activation when doing working memory task. This study reduces the effect of age and education level on verbal working memory performance by limit the participants must be 22 or 23 years old and passed their Academic English 2. The result of this research showed that gender differences in verbal working memory among the participants are not statistically significant, but it can be explained that the

absence of gender differences is due to the low effect size of gender in working memory performance. Therefore, more research is needed before it can be proved that gender differences in verbal working memory does not exist in the targeted population.

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APPENDIX A

RAW SPSS OUTPUTS

```
NEW FILE.
DATASET NAME DataSet1 WINDOW=FRONT.

GET DATA
  /TYPE=XLSX
  /FILE='C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\Data.xlsx'
  /SHEET=name 'Sheet1'
  /CELLRANGE=FULL
  /READNAMES=ON
  /DATATYPEMIN PERCENTAGE=95.0
  /HIDDEN IGNORE=YES.
EXECUTE.
DATASET NAME DataSet2 WINDOW=FRONT.
DATASET CLOSE DataSet1.
EXAMINE VARIABLES=Score
  /PLOT BOXPLOT HISTOGRAM NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		10-MAY-2022 17:09:51
Comments		
Input	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=Score /PLOT BOXPLOT HISTOGRAM NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:02.59
	Elapsed Time	00:00:01.55

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Score	60	100.0%	0	0.0%	60	100.0%

Descriptives

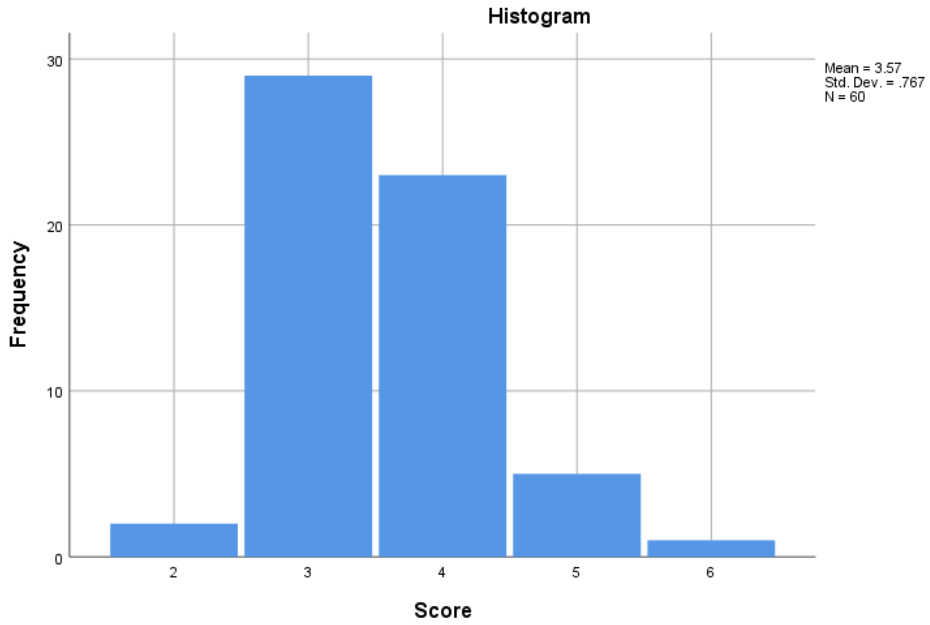
			Statistic	Std. Error
Score	Mean		3.57	.099
	95% Confidence Interval for Mean	Lower Bound	3.37	
		Upper Bound	3.76	
	5% Trimmed Mean		3.54	
	Median		3.00	
	Variance		.589	
	Std. Deviation		.767	
	Minimum		2	
	Maximum		6	
	Range		4	
	Interquartile Range		1	
	Skewness		.700	.309
	Kurtosis		.740	.608

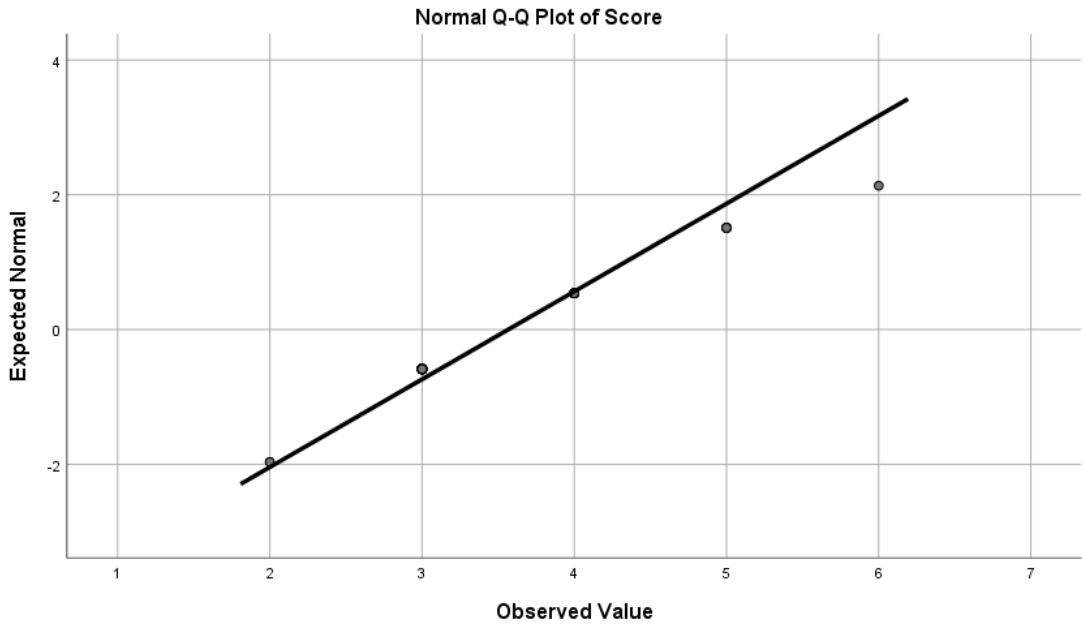
Tests of Normality

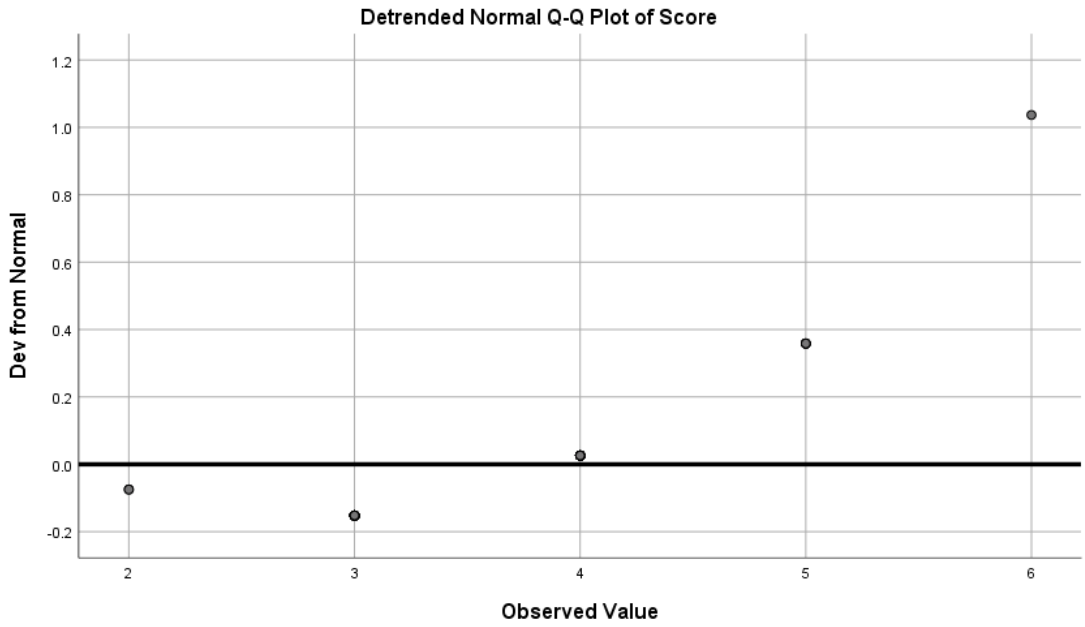
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Score	.287	60	.000	.827	60	.000

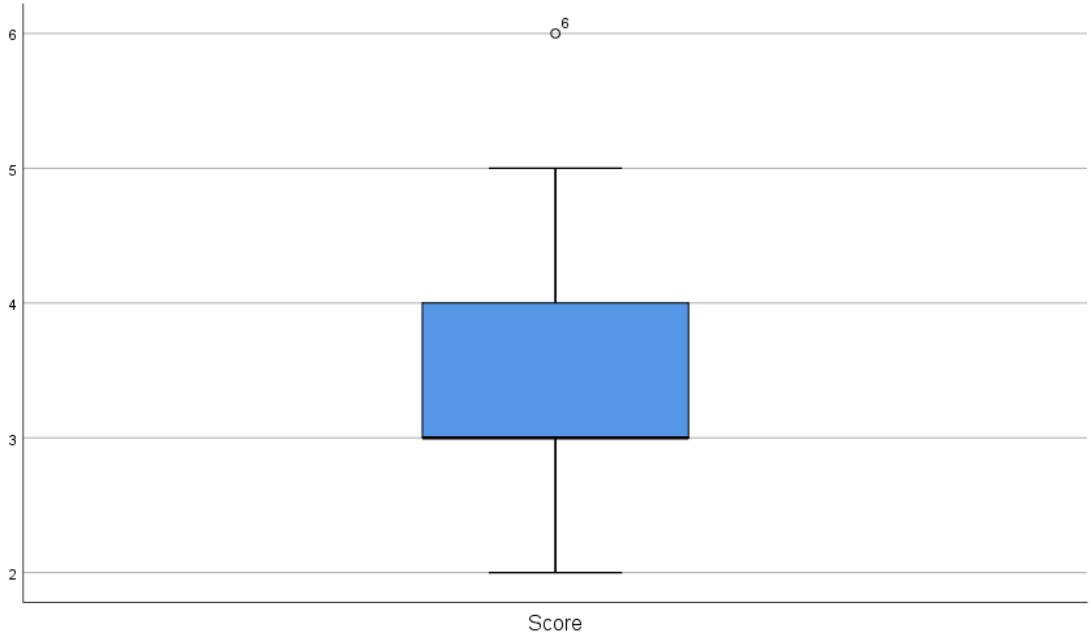
a. Lilliefors Significance Correction

Score




Normal Q-Q Plot of Score
Expected Normal
4
2
0
-2
1
2
3
4
5
6
7
Observed Value


Detrended Normal Q-Q Plot of Score
Dev from Normal
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
2
3
4
5
6
Observed Value




```
NPAR TESTS
  /M-W= Score BY Gender(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

Notes

Output Created		10-MAY-2022 17:20:03
Comments		
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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TESTS /M-W= Score BY Gender(1 2) /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01
	Number of Cases Allowed[a]	449389

a. Based on availability of workspace memory.

Mann-Whitney Test

Ranks

Gender	N	Mean Rank	Sum of Ranks

Score	Male	30	31.45	943.50
	Female	30	29.55	886.50
	Total	60		

Test Statistics[a]

	Score
Mann-Whitney U	421.500
Wilcoxon W	886.500
Z	-.462
Asymp. Sig. (2-tailed)	.644

a. Grouping Variable: Gender

```
SAVE OUTFILE='C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project
2\Data\data.sav'
 /COMPRESSED.
```

Notes

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Comments		
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	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Gender /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.02

[DataSet1] C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav

FREQUENCIES VARIABLES=Age
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Frequencies

Notes

Output Created		17-MAY-2022 19:57:22
Comments		
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	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Age /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.03

Statistics

Age

N	Valid	60
	Missing	0

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	22	43	71.7	71.7	71.7
	23	17	28.3	28.3	100.0
	Total	60	100.0	100.0	

```
FREQUENCIES VARIABLES=Gender
  /PIECHART PERCENT
  /ORDER=ANALYSIS.
```

Frequencies

Notes

Output Created		17-MAY-2022 20:01:32
Comments		
Input	Data	C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav
	Active Dataset	DataSet1
	Filter	<none>

	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Gender /PIECHART PERCENT /ORDER=ANALYSIS.
Resources	Processor Time	00:00:04.67
	Elapsed Time	00:00:02.43

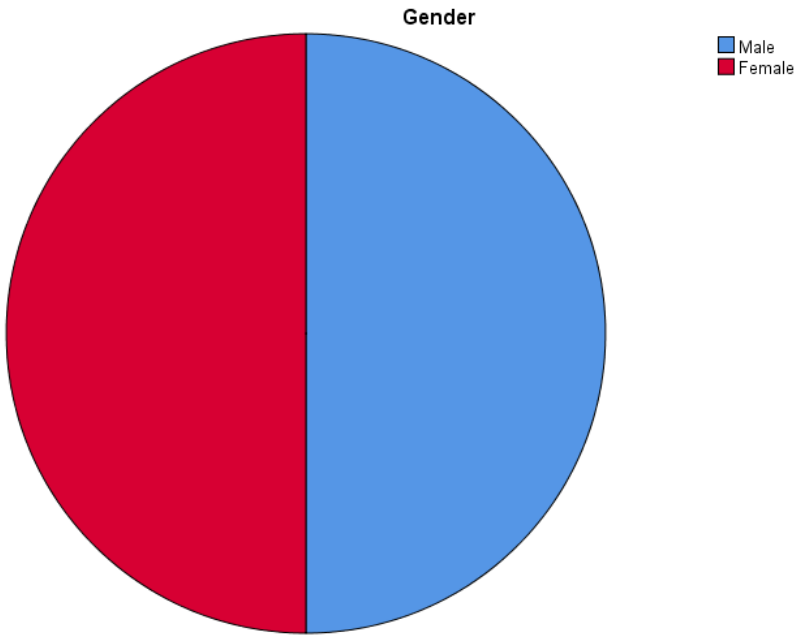
Statistics

Gender

N	Valid	60
	Missing	0

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	30	50.0	50.0	50.0
	Female	30	50.0	50.0	100.0
	Total	60	100.0	100.0	




```
FREQUENCIES VARIABLES=Age
  /PIECHART PERCENT
  /ORDER=ANALYSIS.
```

Frequencies

Notes

Output Created	17-MAY-2022 20:02:49
Comments	

Input	Data	C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Age /PIECHART PERCENT /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.78
	Elapsed Time	00:00:00.38

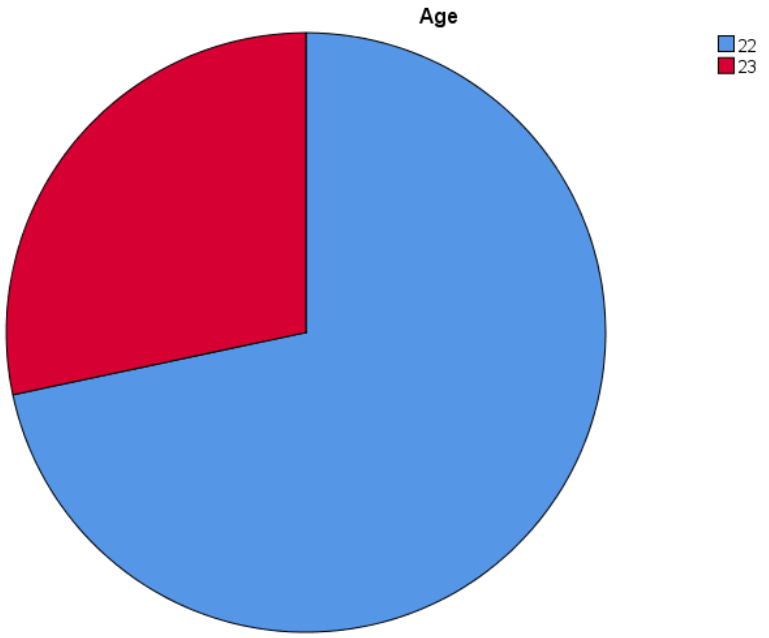
Statistics

Age

N	Valid	60
	Missing	0

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	22	43	71.7	71.7	71.7
	23	17	28.3	28.3	100.0
	Total	60	100.0	100.0	




```
GET
  FILE='C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav'.
DATASET NAME DataSet1 WINDOW=FRONT.
NPAR TESTS
  /M-W= Score BY Gender(1 2)
  /STATISTICS=DESCRIPTIVES QUARTILES
  /MISSING ANALYSIS.
```

NPar Tests

Notes

Output Created		18-MAY-2022 16:40:00
Comments		
Input	Data	C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.

Syntax		NPAR TESTS /M-W= Score BY Gender(1 2) /STATISTICS=DESCRIPTIVES QUARTILES /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.03
	Number of Cases Allowed[a]	449389

a. Based on availability of workspace memory.

[DataSet1] C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles	
						25th	50th (Median)
Score	60	3.57	.767	2	6	3.00	3.00
Gender	60	1.50	.504	1	2	1.00	1.50

Mann-Whitney Test

Ranks

	Gender	N	Mean Rank	Sum of Ranks
Score	Male	30	31.45	943.50
	Female	30	29.55	886.50
	Total	60		

Test Statistics[a]

	Score
Mann-Whitney U	421.500
Wilcoxon W	886.500
Z	-.462
Asymp. Sig. (2-tailed)	.644

a. Grouping Variable: Gender

```
SORT CASES  BY Gender.
SPLIT FILE LAYERED BY Gender.
FREQUENCIES VARIABLES=Score
  /FORMAT=NOTABLE
  /STATISTICS=MEAN MEDIAN SKEWNESS SESKEW  KURTOSIS SEKURT
  /HISTOGRAM
  /ORDER=ANALYSIS.
```

Frequencies

Notes

Output Created		18-MAY-2022 16:51:17
Comments		
Input	Data	C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	Gender
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Score /FORMAT=NOTABLE /STATISTICS=MEAN MEDIAN SKEWNESS SESKEW KURTOSIS SEKURT /HISTOGRAM /ORDER=ANALYSIS.

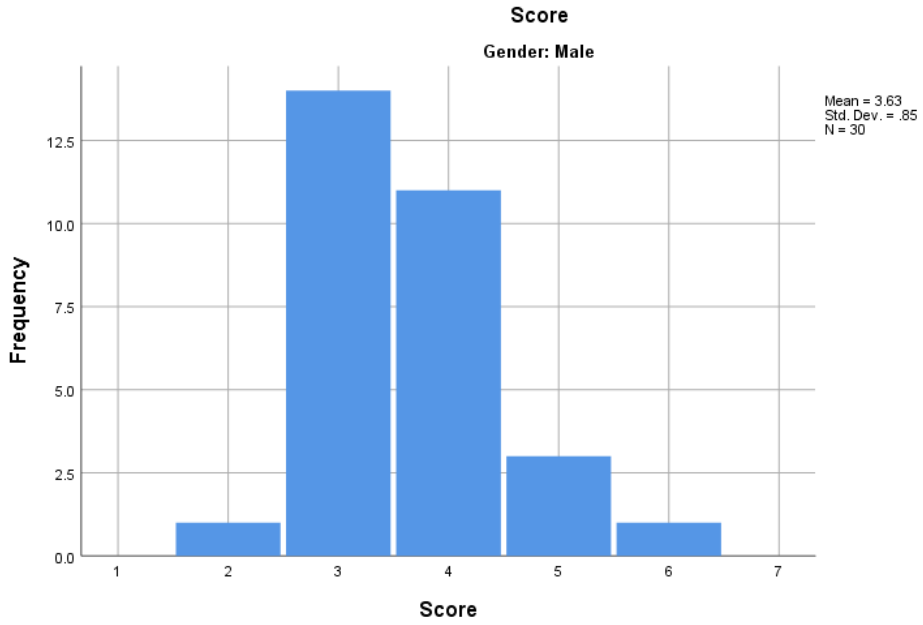
Resources	Processor Time	00:00:05.13
	Elapsed Time	00:00:02.59

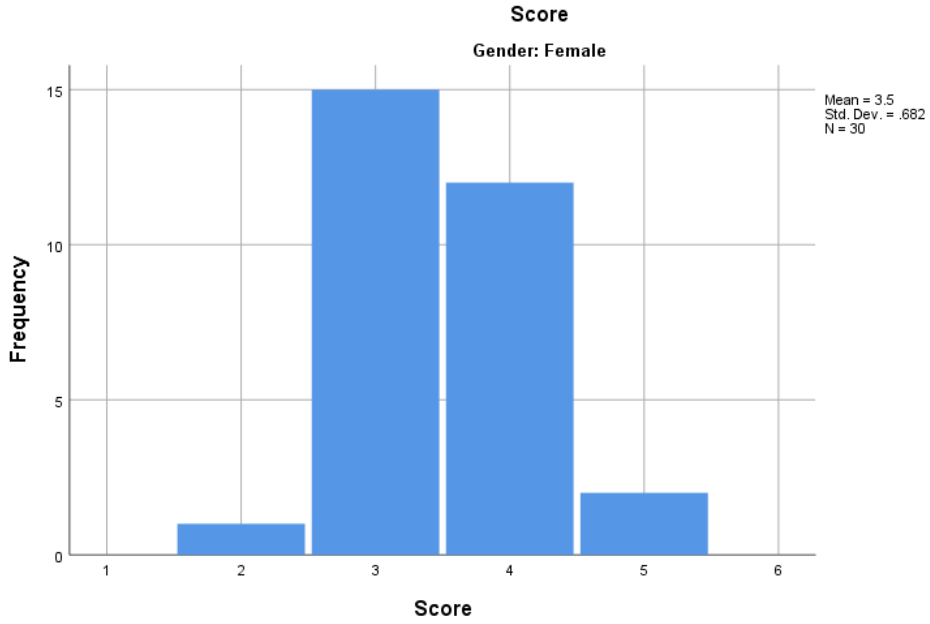
Statistics

Score

Male	N	Valid	30
		Missing	0
	Mean		3.63
	Median		3.50
	Skewness		.814
	Std. Error of Skewness		.427
	Kurtosis		.834
	Std. Error of Kurtosis		.833
Female	N	Valid	30
		Missing	0
	Mean		3.50
	Median		3.00
	Skewness		.349
	Std. Error of Skewness		.427
	Kurtosis		-.034
	Std. Error of Kurtosis		.833

Histogram


Score
Gender: Male
Mean = 3.63
Std. Dev. = .85
N = 30
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
1
2
3
4
5
6
7
Score


Score
Gender: Female
Mean = 3.5
Std. Dev. = .682
N = 30
Frequency
15
10
5
0
1
2
3
4
5
6
Score

Notes

Output Created		18-MAY-2022 17:12:30
Comments		
Input	Data	C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=Score BY Gender /PLOT BOXPLOT STEMLEAF /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:00.94

Elapsed Time	00:00:00.50

```
EXAMINE VARIABLES=Score BY Gender
  /PLOT BOXPLOT STEMLEAF SPREADLEVEL
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		18-MAY-2022 17:13:29
Comments		
Input	Data	C:\Users\USER\OneDrive - UNIMAS\20212022-2\KMY3104 Final Year Project 2\Data\data.sav
	Active Dataset	DataSet1

	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	60
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=Score BY Gender /PLOT BOXPLOT STEMLEAF SPREADLEVEL /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:01.25
	Elapsed Time	00:00:00.74

Gender

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Gender	N	Percent	N	Percent	N	Percent
Score	Male	30	100.0%	0	0.0%	30	100.0%
	Female	30	100.0%	0	0.0%	30	100.0%

Descriptives

	Gender			Statistic	Std. Error
Score	Male	Mean		3.63	.155
		95% Confidence Interval for Mean	Lower Bound	3.32	
			Upper Bound	3.95	
		5% Trimmed Mean		3.59	
		Median		3.50	
		Variance		.723	
		Std. Deviation		.850	
		Minimum		2	
		Maximum		6	
		Range		4	
		Interquartile Range		1	
		Skewness		.814	.427
		Kurtosis		.834	.833
	Female	Mean		3.50	.125
		95% Confidence Interval for Mean	Lower Bound	3.25	
			Upper Bound	3.75	

	5% Trimmed Mean	3.48	
	Median	3.00	
	Variance	.466	
	Std. Deviation	.682	
	Minimum	2	
	Maximum	5	
	Range	3	
	Interquartile Range	1	
	Skewness	.349	.427
	Kurtosis	-.034	.833

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Score	Based on Mean	.970	1	58	.329
	Based on Median	.851	1	58	.360
	Based on Median and with adjusted df	.851	1	54.553	.360
	Based on trimmed mean	.983	1	58	.326

Score

Stem-and-Leaf Plots

Score Stem-and-Leaf Plot for

Gender= Male

Frequency	Stem &	Leaf
1.00	2 .	0
.00	2 .	
14.00	3 .	00000000000000
.00	3 .	
11.00	4 .	00000000000
.00	4 .	
3.00	5 .	000
1.00 Extremes		(>=6)

Stem width: 1

Each leaf: 1 case(s)

Score Stem-and-Leaf Plot for

Gender= Female

Frequency	Stem &	Leaf
1.00	2 .	0

.00 2 .

15.00 3 . 000000000000000

.00 3 .

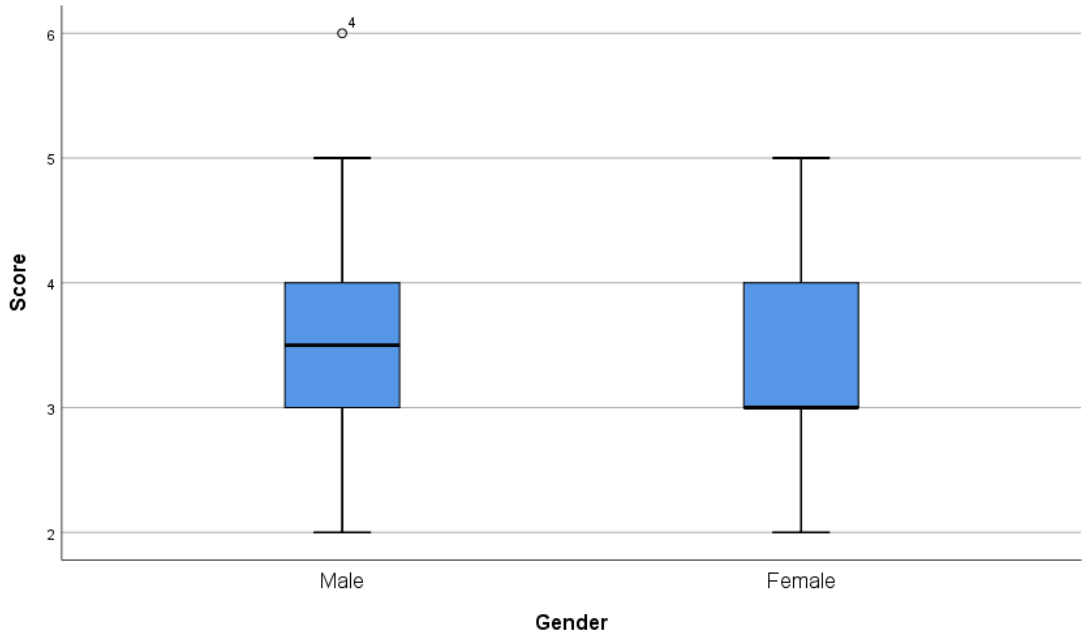
12.00 4 . 000000000000

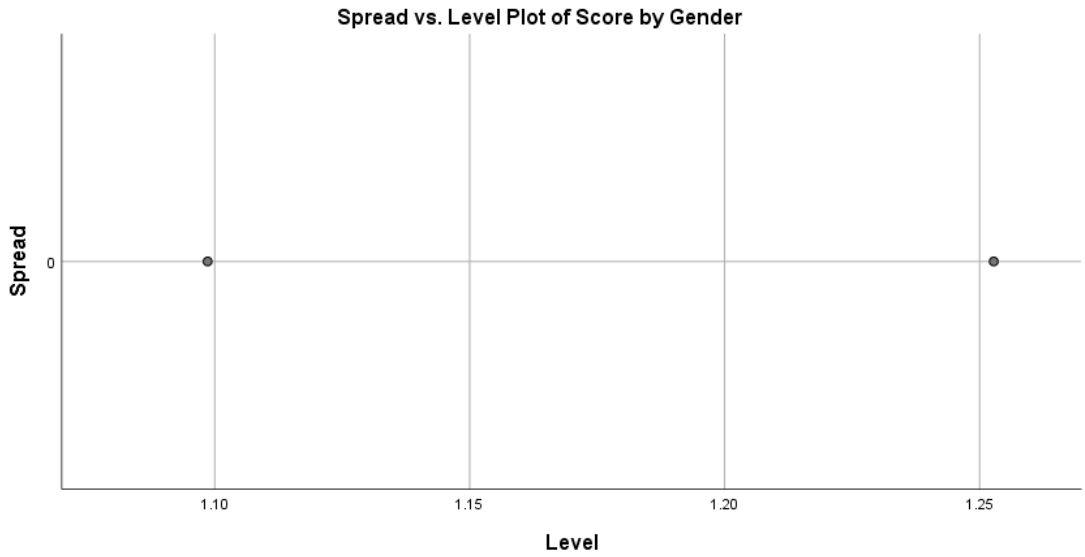
.00 4 .

2.00 5 . 00

Stem width: 1

Each leaf: 1 case(s)





* Plot of LN of Spread vs LN of Level

Slope = .000 Power for transformation = 1.000

APPENDIX B

MATERIALS/INSTRUMENT

B.1.1) Informed Consent Form

Informed Consent Form

This is the informed consent form for the research conducted by Kong Xian Cheng, student from Faculty of Cgnitive Science and Human Development of University Malaysia Sarawak (UNIMAS). This research is research that study the effect of gender on the cognitive ability.

This research has a task that require ……(Name), …….. (No. IC) below stated as participant, to finish. The task contains 10 items which require participant to complete. The task is task that require participant to read, calculate and memorize. The details of the task will only be revel after participant agree to involve in this research.

There are several reminders to the participant:

1. Participant has the freedom to request to stop the task anytime when doing the task. The task will be immediately stop as requested.

2. Participants should not reveal any details of the task to other people as others may become the participant in this research.

3. Information that collected from participant will be keep in secret and will not be reveal by anyone except request for court action.

4. Information that collected from participant will be used for research purpose only.

5. Participant can ask for information about this research after the task is done.

If participant agree to be involved in this research, please sign below at the correct column.

Participant signature:
Participant name :
Date :

B.1.2) Reading Span Task Instrument

Reading Span Task

Participant's Gender: ……

Participant's Age: ……

Instruction:

1. This reading span task contain 10 items (1 trial item and 9 test items)
2. For each item in this task, you are required to read the sentences in the item immediately after you received the specific page.
3. After finish reading and paper is being collected back by researcher, you will be asked to recall the last word of each sentence in the item.
4. The task will be ended if you failed to recall all words in neither item nor you have finished all 10 items

Trial Items.

These tools are used with the main goal of communicating and sharing personal content. Subject index allows you to do a quick search of topic dealt with in a book.

Test Item 1:

Obesity was widely perceived as a symbol of wealth and fertility at other times in history. A student taking short or long quotations from a source without identifying the source.

Test Item 2:

This version uses different language and sentence structure from that of the original. Topen has become an almost instant celebrity as strangers have even asked him for autographs. The course in informational technolohy was studied by mostly adult students with varying abilities and familiarity.

Test Item 3:

The daily exposure to digital technologies forms their perceptions, skills and thinking style. This is because the human mind does not read every letter by itself. There are certain things are already known about Aids such as it is a dangerous disease. Silent reading involves looking at a text and saying the words silently to yourself.

Test Item 4:

It is important to understand what is involved in the reading process itself. Simply making students do assignments together is not preparing them for teamwork in industry. I know two writers who seem to have learned how to deal with the problem. He now has a new and rather desperate way for remember something. You might sometimes spend money on a lunch you could not normally afford.

Test Items 5:

Getting someone else to organize our time and money is very costly. When you feel like it, follow your own system that has established set of procedures. The reading comprehension section will only include multiple choice question as shown in this task. Visual aids are well done and are used to make presentation more interesting and meaningful. In oral presentations, there are many considerations to be made before facing the audience. Auditory learners prefer to hear what is being said in order to understand.

Test Item 6:

The interaction of the types of species between one another becomes an essential factor for survival. A sentence is taken from a source and only a few words are changed. The sequence of the process is marked with arrows in the diagram. As the data collection and analysis procedure have been done, past tense is used. Unlike information report, explanation report emphasizes largely on explaining each process that take places. This framework requires that team members conduct constant reviews related scope of the project. Managing challenges require that members of the tram to support one another.

Test Item 7:

This process requires clear communication and the consideration of all views by the project manager. One non-renewable resources is fossil fuels which gasoline and petrol is produced. It does not focus on recounting historical facts but indicate an action that occur regularly. Factual and precise language may involve technical vocabulary or jargons for precision in explaining. Writing skills acquired from this learning unit can be applied to the final year project report. In promoting products to potential customers, the advertising industry may create a huge number of jobs. It may cause people to place too much importance on materials goods. They would purchase unnecessary products just to show off their wealth and boost their inflated ego.

Test Item 8:

Some use of passive voice to help structure the text, but mostly active voice is used. Once the action disappears from the text, then so do those who perform them. In order to provide free education, the government may need to increase taxes. This is intellectual honesty, giving credit to the person who did the work. Paraphrasing is rewrite of text in your own words but keeping its original meaning. Culture shock is the state of being confused when in contact with different and unfamiliar civilization. It is widely considered to be the oldest form of health care in the world. Students with very limited vocabulary will have difficulty understanding the text above. Its purpose is not just to understand a text but to convey the information to someone else.

Test Items 9:

Readers should use these clues to draw conclusion using their prior knowledge and experience. She has a long flowing silky dark hair that makes her face look like the sun. Students are required to take English exam as a compulsory requirement for entrance to public university. It causes stress to many students and give them grades they do not deserve. He doesn't feel guilty about taking an afternoon off in the middle of the week. A good filing system includes a small notebook to list things to do and a diary. Based on the questioning circle below, you can design your own question after reading the text. Please refer to the course online site for more reading comprehension practise. Watch and listen for important details about what make an effective presentation. It should be clear to your audience when you are moving from one point to another.