



**Faculty of Cognitive Sciences and Human Development**

**THE ROLE OF POSITIVE AND NEGATIVE EMOTIONS IN  
WORKING MEMORY PERFORMANCE AMONG FCSHD  
UNDERGRADUATES IN UNIMAS**



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**THE ROLE OF POSITIVE AND NEGATIVE EMOTIONS IN WORKING  
MEMORY PERFORMANCE AMONG FCSHD UNDERGRADUATES IN  
UNIMAS**

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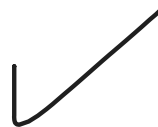


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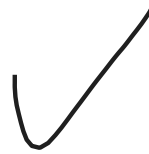
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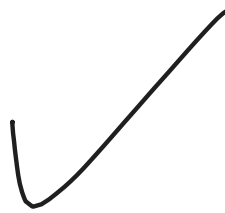
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## **ABSTRACT**

A quantitative study was conducted among University Malaysia Sarawak (UNIMAS) undergraduates to explore the role of positive and negative emotions in working memory performance. A total of thirty participants were randomly assigned to one of three groups (positive emotion, negative emotion, and neutral emotional stimulus), each with ten participants. The Positive and Negative Affect Schedule (PANAS) was used to assess participants' emotional states after the induction of emotions through carefully selected film clips. The Backward Digit Span Test (BDT) was used to assess working memory performance after emotion induction. The results of the study were analyzed using a One-way Analysis of Variance (ANOVA), which yielded a p-value of 0.099, indicating that there is no statistically significant difference in the mean scores of positive, negative, and neutral emotion stimuli on verbal working memory performance. Despite this, the mean score and standard deviation indicated that those exposed to positive emotions scored higher than those exposed to negative or neutral emotional stimuli. Thus, the findings show the complexities of the relationship between emotions and working memory performance, indicating that further research is needed to further explore this dynamic.

**Keywords:** Positive Emotions, Negative Emotions, Working Memory, Undergraduates, Emotionally Charged Film Clips

## ABSTRAK

Satu kajian kuantitatif telah dijalankan dalam kalangan pelajar prasiswazah Universiti Malaysia Sarawak (UNIMAS) untuk meneroka peranan emosi positif dan negatif dalam prestasi memori kerja. Seramai tiga puluh peserta telah ditugaskan secara rawak kepada salah satu daripada tiga kumpulan (emosi positif, emosi negatif, dan rangsangan emosi neutral), masing-masing dengan sepuluh peserta. Positive and Negative Affect Schedule (PANAS) digunakan untuk menilai keadaan emosi peserta selepas induksi emosi melalui klip filem yang dipilih dengan teliti. Backward Digit Span Test (BDT) digunakan untuk menilai prestasi memori kerja selepas induksi emosi. Keputusan kajian dianalisis menggunakan One-way Analysis of Variance (ANOVA), yang menghasilkan nilai  $p$  sebanyak 0.099, menunjukkan bahawa tiada perbezaan yang signifikan secara statistik dalam skor purata rangsangan emosi positif, negatif, dan neutral terhadap prestasi memori kerja lisan. Walaupun begitu, skor purata dan sisihan piawai menunjukkan bahawa mereka yang terdedah kepada emosi positif mencatatkan skor lebih tinggi berbanding mereka yang terdedah kepada emosi negatif atau rangsangan emosi neutral. Oleh itu, penemuan ini menunjukkan kerumitan hubungan antara emosi dan prestasi memori kerja, menunjukkan bahawa kajian lanjut diperlukan untuk meneroka dinamik ini dengan lebih lanjut.

Kata kunci: Emosi Positif, Emosi Negatif, Memori Kerja, Pelajar Prasiswazah, Klip Filem Bermuatan Emosi

# CHAPTER ONE

## INTRODUCTION

### 1.0 Introduction

This chapter provides a detailed discussion of the research foundation. It includes the study's background, problem statement, research objectives, research questions, hypotheses, framework, significance, and definitions of key terms.

### 1.1 Background of study

The impact of emotions, both positive and negative, on cognitive processes, particularly in academic contexts, and the potential effect on working memory, is a topic of great interest and relevance. Emotion has a strong influence on attention, particularly in regulating attention selectivity and encouraging action and behaviour (Tyng et al., 2017). Emotions are deeply linked to cognitive, motivational, and behavioral processes, particularly in all educational contexts including studying and testing (Hayat et al., 2020). According to research, both positive and negative emotions may influence high school students' working memory abilities. Research has demonstrated that positive emotions improve working memory by regulating attention control, cognitive load, stress reduction, and learning. (Liu, 2022). However, research has indicated that it can be difficult for Malaysian undergraduates to develop emotional intelligence, particularly for those who have trouble controlling their emotions and managing academic emotions like boredom and test anxiety (MacCann et al., 2020). According to Liu (2022), negative emotions such as anger and anxiety have been linked to impairments in working memory and long-term memory, which explains why undergraduates struggle academically. The outcomes of these studies have significant importance for understanding the function of emotions influence working memory performance. Recognising the influence of emotions on working memory can inspire educational approaches for increasing students' cognitive performance and academic achievement.

The importance of working memory in cognitive processes depends on its function as a critical component of academic achievement. Study showed that working memory has been linked to several measures of academic accomplishment in studies, highlighting its importance in educational settings (Blankenship et al., 2015). Working memory frequently been linked to or associated with learning, executive function, intelligence, information processing,

understanding, problem-solving, and learning in humans ranging in age from infancy to old age. Furthermore, studies by Tyng et al. 2017 and Liu 2022 said that working memory is described as a limited capacity memory system that is affected by emotion, and the performance of working memory can be impacted by both positive and negative emotions by influencing our capacity to retain and process information in our minds for brief intervals of time. Consequently, the research reveals that both positive and negative emotions might have an impact on working memory efficiency, with emotional arousal being an essential role. Understanding the relationship between working memory and learning achievement is crucial for educators and researchers because it may lead to interventions and educational strategies that assist students with a variety of cognitive skills.

Undergraduates go through a distinct and difficult stage in their academic careers, highlighted by the transition from high school to higher education. Increased academic obligations, social adaptations, and a wide range of emotional experiences accompany this transition. Positive or negative emotional events have the capacity to influence memory processes and, as a result, academic achievement. Moreover, undergraduates depend greatly on strong working memory due to the crucial role it plays in managing complex information-processing tasks such as problem-solving, critical thinking, and learning.

Therefore, the aim of this research is to investigate at the effects of positive emotion, negative emotion, and non-stimulus on verbal working memory performance. Understanding the various effects of emotions on working memory performance in undergraduates could provide helpful insights into how emotions impact working memory with implications for academic achievement and overall well-being.

## **1.2 Problems Statement**

Working memory is a critical cognitive ability that is essential for academic achievement in undergraduate students. Recent study has focused on the impact of positive and negative emotions on working memory performance. According to research conducted by Hou and Cai (2022) and Liu (2022), both negative and positive emotions have been found to effect working memory. These findings suggest that negative emotions can limit working memory performance, whereas positive emotions may improve or impair working memory performance. However, existing research on the effect of emotional states on working memory performance remains unclear and inconsistent.

According to Hou and Cai (2022), positive emotion improved working memory performance. However, studies by Osaka et al. 2013 and Liu 2022 found inconsistent findings, showing that positive emotion had a negative impact on working memory performance. Furthermore, negative social emotions have been linked to impaired working memory performance in healthy adults spanning 30 years. As a result, further research is needed to determine which dimensions of emotion influence working memory performance, particularly among undergraduates.

Aside from that, Liu 2022 investigated the impact of positive and negative emotions on working memory performance in China high school students aged 16 to 19. Based on the research findings, both negative and positive emotions can affect a high school student's working memory, with positive emotions enhancing working memory renewal and negative emotions inhibiting it. Another study showed that working memory performance under negative affect is more vulnerable to higher cognitive workloads with different neural hemodynamic correlates (Feng et al., 2021). However, there has been limited study on the impact of positive and negative emotions on the working memory performance of undergraduates aged 18 to 25 years old, particularly in Malaysia. ✓

In conclusion, although some studies on the impact of positive and negative emotions on working memory performance have been conducted, there has been limited study on the impact of positive and negative emotions on working memory performance for undergraduates. Thus, further research is required to fully comprehend the difference between positive emotion, negative emotion and non-stimulus on verbal working memory performance in undergraduates, particularly in Malaysia. ✓  
gru)

### **1.3 Research objectives**

#### **1.3.1 General Objective**

To investigate the role of positive and negative emotions on working memory performance among FCSHD undergraduates in UNIMAS.

#### **1.3.2 Specific Objective**

- 1) To investigate the difference between positive emotion, negative emotion and neutral emotion stimulus on verbal working memory performance. ✓

### **1.4 Research Question**

- 1) Is there any difference between positive emotion, negative emotion and neutral emotion stimulus on verbal working memory performance?

### **1.5 Research Hypotheses**

- 1) Null Hypothesis (H<sub>0</sub>): There is no significant difference between positive emotion, negative emotion and neutral emotion stimulus on verbal working memory performance.
- 2) Alternative Hypothesis (H<sub>1</sub>): There is a significant difference between positive emotion, negative emotion and neutral emotion stimulus on verbal working memory performance. ✓

## 1.6 Research framework

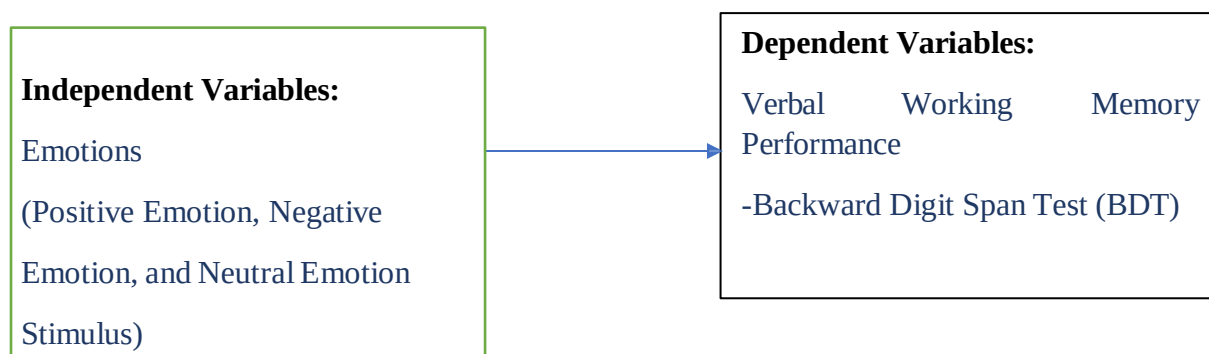


Figure 1: Research Framework

Figure 1 shows the research framework aims to explore the difference between positive emotion, negative emotion and neutral emotion stimulus on verbal working memory performance, Backward Digit Span Test, among Faculty of Cognitive Science and Human Development (FCSHD) undergraduates in UNIMAS. The study will investigate the effect between independent variables such as positive emotion, negative emotion and neutral emotion stimulus and their impact on the dependent variable, verbal working memory performance.

## 1.7 Significance of the study

The study has important implications for improving academic achievement among undergraduates. The research can contribute to the development of specific strategies and interventions aimed at improving cognitive functioning in academic settings, ultimately fostering improved academic performance by revealing the intricate relationship between positive and negative emotions on working memory performance.

The findings of this study can be utilised in creating evidence-based interventions in the educational context. Insights into the function of positive and negative emotions in working memory can be used to develop workshops, counselling services, and educational programmes that aim to educate students with appropriate emotion regulation strategies and working memory.

Furthermore, this study can be used in future research. The impact of positive and negative emotions on working memory among Faculty of Cognitive Sciences and Human Development UNIMAS undergraduates should be explored further by various institutions because it may help in improving cognitive abilities, developing emotional management strategies, and improving academic achievement.

Lastly, improving working memory performance correlates closely with academic achievement. Governments interested in encouraging high-quality education can use the study's findings to create programs and methods that specifically target the emotional aspects of working memory, potentially leading to improved academic achievements.

## **1.8 Definition of the terms**

### **1.8.1 Emotions**

Conceptual definition:

According to Cherry (2023), emotion is a multifaceted state of feeling that causes physical and psychological changes that influence thinking and behavior. These emotions include physiological arousal, cognitive experiences, and behavioral responses.

Operational definition:

Emotions will be measured using a self-report instrument, the Positive and Negative Affect Schedule (PANAS), and emotional states will be induced with validated stimuli, the emotionally charged movie clips.

### **1.8.2 Positive Emotions**

Conceptual definition:

According to Van Cappellen et al. (2022), positive emotions are a broad group of subjective emotional experiences characterised by positive affect, pleasant feelings, and a general sense of well-being. These emotions include happiness, pleasure, contentment, satisfaction, love, gratitude, amusement, and other positive feelings.

Operational definition:

Positive emotion was measured by using the Positive and Negative Affect Schedule (PANAS), a self-report questionnaire adopted from research by Díaz-García et al. (2020). Participants will be asked to rate their current emotional states on a Likert scale ranging from 1 (not at all) to 5 (extremely).

### **1.8.3 Negative Emotions**

Conceptual definition:

Humphrey et al. (2022) describe negative emotions as subjective, conscious experiences characterized by unpleasant, stressful, or undesirable feelings, thoughts, and physiological reactions. Besides that, Gruchola (2023) describes emotions as sadness, fear, anger, and disgust.

Operational definition:

Negative emotion was measured using the PANAS self-report questionnaire adopted from research by Díaz-García et al. (2020). Participants will be asked to rate their current emotional states on a Likert scale ranging from 1 (not at all) to 5 (extremely).

### **1.8.4 Working Memory**

Conceptual definition:

According to the Hartley and Hitch (2022), working memory is a cognitive system that enables the temporary storage and manipulation of information to facilitate goal-directed behaviour. It is engaged in many different cognitive processes, including language learning, problem solving, and decision making.

Operational definition:

Working memory is measured using a backward digit recall task, the Backward Digit Span Test (BDT), in which participants had to recall a series of digits presented in the reverse order. The

BDT consists of twenty-one trials ranging from 3 to 9 digits. The score of the BDT will be counted when the participants correctly repeat the reverse digits sequences. Each correctly repeated sequence contributes to the total score.

### **1.8.5 Positive Film Clip**

Conceptual definition:

Uhrig et al. (2016) define a positive film clip as a visual and auditory stimulus in the form of a short film segment that aims to induce positive emotions, feelings, or moods in those who are exposed to it. Positive film clips are intentionally selected or developed to induce feelings such as joy, happiness, satisfaction, inspiration, or amusement.

Operational definition:

The positive film clips include a 4-minute and 3-second CGI animated short film named "Joy and Heron" by Passion Pictures based on Beckyjohnen (2020) which is available on CGMeetup. Participants in the Positive Emotion group will be shown this specific video clip as part of the study's emotion induction method.

### **1.8.6 Negative Film Clip**

Conceptual definition:

According to Madelaine et al. (2015), a negative film clip in the context of this study is a cinematic sequence aimed at inducing negative emotions in participants such as sadness, grief, or empathy. It is used to induce specific emotional reactions to investigate the effect of negative emotions on working memory performance.

Operational definition:

The negative film clips chosen for this study include 5 minutes and 55 seconds of a 3D animated short film named "Trois Petits Chats" directed by Benoît Delaunay, Albané Hertault Lacoste, Maïwenn le Borgne, and Alexia Provoost based on Evans (2022) which is available

on YouTube. This clip was chosen for their known efficiency in producing negative emotional states. During the experiment, participants in the Negative Emotion group will be exposed to this negative video clip to elicit the required emotional response.

## **1.9 Summary**

The study focuses on the intricate relationship between positive and negative emotions and working memory performance among FCSHD undergraduates at Universiti Malaysia Sarawak (UNIMAS). The background emphasizes the role of emotions in cognitive processes, particularly in academic contexts, as well as the relevance of working memory in academic achievement.

The problem statement highlights inconsistencies in previous study findings about the impact of positive and negative emotions on working memory performance. While some research implies that positive emotions improve working memory, others show that they may have the opposite effect. Furthermore, there is a limited number of studies particular to the Malaysian context, especially among students aged 18-25.

In summary, the study addresses the gap in existing knowledge by providing insights into the intricate interplay between emotions and working memory performance in undergraduates, which could have potential implications for educational practices and interventions.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Introduction

The literature review aims to provide readers with a comprehensive overview of the role of positive and negative emotions in working memory performance among undergraduates. It is significant as it introduces the concept and framework, which underlines the main purpose of the research. This chapter will also cover related theories.

#### 2.1 Emotions

Emotions are mental states caused by internal or external stimuli. Emotions are an essential component of our brain function and play a role in action, response, and cognition. Emotions are classified as instinctual, emotional, and rational/social, and they provide useful information in clinical settings (Smith, 2023). According to Heyhoe et al. (2015), emotions are linked to mood, temperament, and personality, and they can give important information in clinical settings, impacting patient treatment and clinical judgment.

According to Gelbrich et al. (2023), emotion perception and expression are influenced by culture, with individuals more likely to accurately recognize emotions from their own social group. This research examines the influence of culture on emotions, including differences in how emotions are handled and the distinction between feeling and display standards. It also emphasizes how cultural distance influences emotional recognition.

Emotions among students, on the other hand, refer to the range of feelings and emotional experiences that students go through in educational settings. These emotions, which may be both positive and negative, could influence students' learning ability, motivation, and academic achievement (Pekrun et al., 2017). According to the study's findings, emotions among students in educational settings are frequent and intense, including learning, excitement, cheerfulness, pride, anger, fear, boredom, admiration, contempt, and envy. Emotions have the potential to influence motivation, cognitive function, and general well-being.

Another study by Valiente et al. (2022) found that emotions like anxiety, boredom, sadness, and anger are generally negatively related to measures of academic achievement like grades,

standardised test scores, and overall aptitude, even though the strength of the pattern varies depending on the type of emotion. In addition, according to the study, positive emotions such as pleasure, happiness, and enthusiasm have some positive relationships with academic perspective-taking, exploration, creativity, problem-solving, interest, effort, and accomplishment. The relationship between emotions and success could be mediated by the student-teacher interaction and the bonds students build with their classmates.

Overall, emotions are complex and multifaceted, and understanding their function and influence in different aspects of life is important. Emotions are not just universal, but also highly individualised, influenced by culture, social groups, and personal experiences.

### **2.1.1 Theory Related to Emotions**

#### **Schachter-Singer Theory**

In the 1960s, psychologists Stanley Schachter and Jerome E. Singer established the Schachter-Singer Theory, widely known as the two-factor theory of emotion. According to this theory, emotions are a combination of physiological arousal and cognitive interpretation (Mcleod, 2023a). According to the study's findings, when an emotion is felt, the body experiences physiological arousal, which is the body's initial response to a stimulus, such as increased pulse, sweating, and muscular tension. Following physiological arousal, the individual will perform a cognitive interpretation or appraisal of the experience to identify the emotional state.

Furthermore, according to another research by London and Richard (2017), Schachter's theory of emotion postulates that emotions are the result of cognitive and physiological factors interaction. Emotions, according to Schachter, occur not solely by physiological arousal but also by cognitive interpretation of the arousal. Emotions, according to the Schachter-Singer theory, are a combination of physiological arousal and cognitive assessment. According to the theory, when individuals experience physiological arousal, they look to their surroundings and their own thoughts to determine what type of emotion they are experiencing. This cognitive appraisal method plays an essential role in assessing the nature and intensity of emotional experience.

In conclusion, the theory emphasizes the interconnected relationship between physiological reactions and cognitive processes in emotional experience.

## 2.2 Positive Emotions

Positive emotions are important in social interactions and relationships because they serve a variety of social purposes (Keltner & Cowen, 2021). They allow for the development and negotiation of attachment relationships, cooperative alliances, hierarchies, and collectives. However, according to another study by Sels et al. (2021), these emotions are frequently overlooked in psychiatry, even though they are critical for emotional well-being and social interaction. Positive emotions meet three social functions: intimacy, impression, and influence. Intimacy functions are the advantages individuals gain by enhancing their relationships with others. Impression and influence functions are derived from the information that others acquire from positive emotional expressions. Positive emotions may be used to achieve goals in social situations such as maintaining social status or developing motivation in others to achieve critical goals (Sels et al., 2021).

Research was also carried out to determine the impact of positive emotions on academic achievement. According to Valiente et al. (2011), joy, hope, and pride are positively related to students' academic self-efficacy, academic interest and effort, and overall achievements. Furthermore, a weekly diary study discovered that positive emotions had a significant effect on academic achievement (Rodríguez-Muñoz et al., 2021). Another study by Carmona-Halty et al. (2019), additionally investigated the function of academic psychological capital and academic engagement in mediating the relationship between positive emotions and academic achievement. According to the findings, academic psychological capital and academic engagement serve as a bridge between positive emotions and academic achievement. This also demonstrates the relationship between positive emotions and academic success among undergraduates. This is supported by a study by Froiland (2018), which investigated the impact of a positive psychology course on gratitude and attitudes toward learning and discovered that students' positive emotions toward studying and assignments improved significantly.

Moreover, a survey-based study also found pleasant emotions in the teaching-learning process, such as enjoyment, curiosity, and interest, among undergraduate business students (García et al., 2023). According to the study, the researchers used a survey to determine favourable and unfavourable emotions in the teaching-learning process and discovered that students prefer fun learning, teamwork, and courses with interesting material. Additionally, in a study of class-related emotions in a math course, undergraduates reported greater positive emotional

experiences, such as pride and enjoyment, and less negative emotional experiences, such as worry and wrath (Zamir et al., 2023).

These findings emphasize the significance of encouraging positive emotions in students to improve their well-being and academic achievement.

### **2.2.1 Theory related to Positive Emotions**

#### **Broaden-and-Build Theory**

Barbara Frederickson proposed the Broaden-and-Build Theory, also known as the Broaden-and-Build Model or the Positive Emotions Theory, to address the lack of study on positive emotions and the greater emphasis on negative ones. Broaden and Build theory was developed to build on previous research in psychology on negative emotions and psychological maladjustment (Cuncic, 2023).

This theory posits that positive emotions expand an individual's thought-action repertoire, enabling them to explore new possibilities and engage in a wider range of activities. In turn, this increased range of activities and experiences contributes to the development of personal resources and resilience.

In educational settings, this theory suggests positive emotions can increase cognitive and social resources, improving students' well-being and academic performance. According to Celestine (2023), Fredrickson (2001), and Cuncic (2023), positive emotions may enhance students' creativity, open-mindedness, and resilience, as well as promote positive relationships with others. Furthermore, this theory may be used for practices that support students' well-being and positive growth.

In the context of working memory, the theory suggests that positive emotions may extend the scope of attention and cognition, leading to the discovery and development of personal resources that might potentially improve working memory and cognitive functioning (Fredrickson & Branigan, 2005). This is because the experience of positive emotions encourages the exploration of new ideas and perspectives, which in turn can lead to increased cognitive flexibility and the development of new cognitive strategies. Besides that, this theory is further supported by the idea that working memory can rapidly construct temporary bindings,

contain both declarative and procedural representations, and access information from long-term memory when necessary (Oberauer, 2020).

As a result, positive emotions are associated with an extended thought-action repertoire and the development of personal resources, which may have implications for working memory and cognitive processes.

### **2.3 Negative Emotions**

Negative emotions in learning have been studied, with an emphasis on determining their influence and possible advantages. Negative emotions are common in a variety of settings, including the workplace, politics, and academic teaching settings. Negative emotions also have been studied in the literature, with research emphasising their influence on learning and performance. Hökkä et al. (2019) conducted a literature review on emotions in workplace learning and discovered that negative emotions such as fear, anxiety, and insecurity were explicitly experienced emotions related to project failures, identity learning, critical action learning at work, intercultural learning, or well-being at work.

However, research also showed that negative emotions such as dislike, rage, grief, and fear might improve learning. Chatbots have been employed as companions in study to elicit negative emotions, with promising results in enhancing learning outcomes (Maldonado et al., 2022). However, the complexity of emotions and learning in reality must be considered. Negative emotions should be considered anchor points for disturbances in the learner's relationship to the world rather than as barriers to learning. They can also serve as beginning points for understanding individuals and engaging in pedagogical relationships (Rödel, 2021).

In software engineering classes, a unique way of teaching implicit user feedback through the study of actionable emotions has been presented. This technique has yielded great results in terms of assisting students in comprehending the influence of negative emotions on feedback (Lopez et al., 2022). Students' perceptions and attributions of negative emotions such as anger, embarrassment, boredom, and frustration have been investigated in the context of physical education, emphasizing the significance of analyzing emotions and employing adaptive teaching techniques (Johnson, 2021). Furthermore, the COVID-19 crisis and the transition to remote education have emphasized the influence of negative emotions on students' acceptance of remote learning components and perceived knowledge growth (Tzafilkou et al., 2021).

Rowe and Fitness (2018) used a social-functional perspective to investigate the impact of negative emotions on adult learning and achievements. The study discovered that negative emotions such as anger, boredom, and fear were often reported by both students and teachers, and understanding their influence was critical for developing skills for dealing with such reactions, which might lead to improved learning outcomes. Furthermore, Jerrim (2022) discovered that negative emotions, such as anxiousness, might influence academic performance in high-stakes exams. Finally, a recent study by Hong et al. (2023) investigated the relationship between negative emotions and cognitive task performance and discovered that negative emotions may be "more negative" for individuals with high metacognitive abilities for problem-solving. Overall, the findings show that negative emotions can have an influence on learning and performance, and recognizing their impact is critical for encouraging appropriate coping methods.

Studies such as Kotera et al. 2020 and Al-Naggar and Al-Naggar 2012 have shown that psychological distress is prevalent among Malaysian university students, particularly medical undergraduates. Emotional problems are common among Malaysian university students, with rates ranging from 28.5% to 48.3%. Another study on negative emotionality and its relationship with academic achievement among Malaysian medical students discovered that negative emotionality had significant effects on their academic performance regardless of where they lived (Malaysia or overseas) (Bhagat et al., 2016). Sixty first-year Malaysian medical students from Universiti Sultan Malaysia and USM-KLE IMP, Belgaum, India were involved in the study. To investigate negative emotionality, the Medico-Psychological questionnaire was employed. Lastly, according to the study's findings on negative emotions among Malaysian undergraduates shows that these emotions might have a significant effect on academic performance.

Therefore, understanding the influence of negative emotions on learning outcomes and practicing coping methods can lead to improved academic achievement.

### **2.3.1 Theories related to Negative Emotions**

#### **Cognitive Appraisal Theory**

Cognitive Appraisal Theory suggest that negative emotions might influence working memory performance. Emotion is a cognitive process that may either improve or impair working memory capacities. According to appraisal theories of emotion, thought must come first before experiencing emotion. Richard Lazarus was a pioneer in this field of emotion, and this theory is often referred to as the Lazarus theory of emotion. According to this theory, the sequence of events begins with a stimulus, then thoughts, and finally the simultaneous experience of a physiological response and emotion (Cherry, 2023).

According to Thagard and Aubie (2008), Richard Lazarus' cognitive appraisal theory of emotions suggests that cognitive appraisal, which is the subjective interpretation of a situation, impacts emotional experience. According to the findings of this study, cognitive appraisal and somatic perception interact to form conscious emotional experiences, and these processes are coordinated in working memory. Furthermore, negative emotions can impair the encoding and retrieval of information in working memory (Kensinger & Corkin, 2003). In addition, the theory explains how emotional consciousness develops when neural representations in working memory are highly activated.

As a result, existing research suggests that cognitive appraisal and emotional processes, especially negative emotions, are linked to working memory.

#### **Affective Information Processing Theory (AIPT)**

The Affective Information Processing Theory (AIPT) is a useful framework for exploring the influence of negative emotions on working memory performance. According to the AIPT, emotions can impact cognitive functions such as working memory. Moreover, the theory discusses how the existence of negative emotions can affect the way individuals receive information. When negative emotions are experienced, cognitive processes become biased towards the processing of threat-related information, resulting in a reduction in working memory capacity. Schweizer et al. (2019) showed that the influence of emotional information on working memory differs depending on the emotion's valence and task relevance.

Another study, conducted by Hou and Cai (2022), found that negative emotions can have significant effects on working memory in adults over 30 years. This study found that negative emotions have a stronger influence on spatial working memory than verbal working memory. Besides that, the AIPT could help in explaining the relationship between emotional and cognitive processes, providing information on the exact nature of the influence of negative emotions on working memory performance (Osaka et al., 2013).

Furthermore, the theory suggests that working memory performance in a negative emotional state is more vulnerable to greater cognitive demands, with distinct neural hemodynamic correlates than in a neutral affective state (Feng et al., 2021). This suggests that the AIPT can give insights into how negative emotions impact cognitive processes and the specific neural mechanisms involved.

In conclusion, the Affective Information Processing Theory (AIPT) provides a helpful framework for understanding how negative emotions affect working memory performance

## **2.4 Working Memory**

Working memory is the ability to retain and manipulate a small quantity of knowledge in an immediately accessible form, allowing for improved planning, comprehension, reasoning, and problem-solving. It is a critical cognitive function that serves as the foundation for cognitive development, learning, and education (Cowan, 2013).

Working memory is a critical component for academic achievement, particularly in subjects such as reading comprehension and mathematics. According to Cowan (2013), working memory is an important component of cognitive development, learning, and education because it allows individuals to retain and process new knowledge, create associations with the material being learned, and generate connections between ideas. Another study found that cognitive control, which is related to working memory, can impact student achievement (Amzil, 2022).

Moreover, training practices to improve working memory have been proven to enhance academic performance by increasing learning capacity (Nutley & Söderqvist, 2017). Based on the study, the relationship between working memory capacity, cognitive regulation, and academic performance among university students was investigated, and found that working memory and cognitive regulation interact to predict academic achievement.

Research has also shown that higher working memory capacity has been related to improved attention management, which helps individuals avoid distractions and perform better in activities that are relevant to their education (Christopher & Shelton, 2017; Emylyana & Mohamad, 2021). Furthermore, it has been shown that a higher memory load causes slower reaction times, demonstrating the influence of working memory on attention regulation (Christopher, 2015).

Overall, working memory is important for academic achievement, but further research is needed to better understand its influence and potential for improvement.

#### **2.4.1 Theoretical Framework Related to Working Memory**

##### **Baddeley and Hitch's Multicomponent Model**

The theoretical framework of working memory has developed throughout time, with several theories offered to describe its structure and functioning. A common framework is Baddeley and Hitch's multicomponent model, which proposes that working memory consists of modality-specific "slave" components for temporary storage and a central executive component that regulates the system (Ngiam, 2023). According to Ozimič (2020), it is made up of four interrelated components: the phonological loop, the visuospatial sketchpad, the central executive, and the episodic buffer. The phonological loop is in charge of retaining verbal-acoustic information via subvocal or overt repetition, whereas the visuospatial sketchpad is in charge of maintaining visuospatial information (Baddeley et al., 2020). These two subsystems are controlled by the central executive, which is also engaged in attentional control processes (Eva & Popov, 2018). The episodic buffer coordinates data from perception, long-term memory, and the model's other components (Leshchyshyn et al., 2019). Lastly, according to Mandrikova et al. (2017), the multi-component model was created utilizing a variety of experimental tools and was successful in accounting for a wide range of data on memory and associated cognitive areas.

## 2.5 Emotions and Working Memory

Working memory performance can influence a variety of circumstances. Emotion is one such component that may both affect and be influenced by working memory. According to research by Guo et al. (2020) and X. Liu et al. (2018), working memory capacity may be impacted by emotional states, including positive, negative, and neutral ones. Compared to neutral and positive emotional states, negative emotional states have been shown to reduce working memory capacity for biological motion (BM).

The study by Yang (2023), investigated the relationship between working memory performance and emotion. According to the study, emotional stimuli can affect working memory performance, with positive and negative emotions impacting accuracy and reaction times in working memory tasks.

Another study by Rczy and Orzechowski (2019) discovered that negative emotional states reduce working memory ability for biological motion, but positive emotional states improve accuracy in working memory tasks. In this study, the impact of mood and emotional content on working memory performance was investigated. It was shown that individuals performed more effectively when they were in a positive mood, but less effectively while processing positive words.

Furthermore, anxiety, a negative emotional state, has been related to reduced performance on working memory tests (Guo et al., 2020). In particular, the study investigates how emotional mood affects one's ability to access working memory for biological motion (BM). Positive and neutral emotional states are not significantly different from negative emotional states in terms of their ability to hinder working memory's capability for BM.

According to a study by Hou and Cai (2022), it has been discovered that negative emotional states may affect working memory capacity whereas positive emotional states can increase verbal working memory capacity. However, some variables, including age, personality differences, and task priority, can affect the precise impact of emotional states on working memory performance.

Therefore, further research is required to investigate the precise aspects of emotion that influence working memory, as well as the collective impact of emotional states and stimuli.

### **2.5.1 Positive Emotions and Working Memory**

The relationship between positive emotions and working memory performance has been studied in the literature. Positive emotions have been showed to improve working memory performance (Yang, 2023). The study showed a relationship between working memory and emotion, implying that manipulating emotional stimuli may improve working memory capacity.

Another study by Figueira et al. (2018), found a correlation between the trait Positive Affect and Working Memory (WM) Capacity, showing that positive affect influences cognitive processes by improving cognitive capacity. The study also found that the trait Positive Affect improves with WM Capacity, even when faced with an unpleasant state.

Aside from that, positive emotions have been shown to influence working memory through a variety of methods, including the use of positive clips. According to Figueira et al. (2018), positive affect improves both verbal and spatial working memory ability, but negative emotions, such as sadness, do not have the same impact. The use of positive clips in this study indicates the emotional content of the clips influenced the participants' working memory performance.

Besides that, Schmeichel et al. (2008) found that individuals with higher working memory capacity suppressed negative emotion expressions better than individuals with lower working memory capacity. This study suggests that an individual's working memory ability can influence emotional expression, which may be impacted by the usage of positive clips. Positive clips have also been found in studies to be more beneficial than other materials in improving working memory performance in studies such as Ribeiro et al. (2019) and Martin and Kerns (2011) surpasses the effectiveness of other materials.

In conclusion, these findings indicate that positive emotion might improve overall working memory function, but it may also lead to challenges when processing specific types of stimuli.

### **2.5.2 Past Research on the Positive Emotions and Working Memory**

It has been discovered that positive emotions improve working memory performance. Positive affective images have been shown to improve working memory capacity compared to neutral

images. According to Gökçe et al. (2021), positive emotions, such as happiness, improved working memory capacity. However, negative emotions, such as sadness, had no effect. The study also discovered that the specific valence and arousal of an emotional image were related to working memory performance: While higher valence increased working memory capacity, higher arousal decreased working memory capacity. These findings show that positive affective images can improve working memory performance and that the relationship between positive emotions and working memory is not solely determined by emotional valence.

Besides that, positive emotions have been studied for their influence on working memory updating, and it has been discovered that positive emotions can decrease verbal working memory throughout the updating phase (Siyu et al., 2019). The effect of different emotions on working memory (WM) was investigated in this study by examining brain network characteristic parameters such as node degree, shortest path length, clustering coefficient, and global efficiency during the period of working memory updating under three different emotion states.

Additionally, Hou and Cai (2022) discovered that, while positive emotions can improve working memory performance, the specific valence and arousal of emotional stimuli are connected to working memory capacity, with higher valence improving capacity and higher arousal decreasing it.

These findings indicate that the relationship between positive emotions and working memory is complex, and further study is needed to fully understand the influence of positive emotions on working memory.

### **2.5.3 Negative Emotions and Working Memory**

Negative emotions have been discovered to effect working memory. According to Hou et al. (2023), strong avoidance-motivated negative emotional states decrease the manipulation process of verbal and spatial working memory while the maintenance process is unaffected. In this study, the function of avoidance-motivational intensity in modifying the influence of negative emotion on different aspects of verbal and spatial working memory (maintenance versus manipulation) was studied. It concludes that negative emotional states that have high avoidance-motivational intensity impair working memory manipulation.

Another study by Xie et al. (2023), discovered that induced negative emotional states impair working memory recall variability and increase recall failures. The researchers in this study conducted a meta-analysis of existing evidence based on data from 13 experiments involving 491 participants who performed a delay-estimation working memory task under negative and neutral emotional states and discovered that the induced negative emotional state reduces working memory recall variability while increasing recall failures compared to the neutral condition.

Moreover, Osaka et al. (2013) discovered that negative emotions regulate working memory performance through distinct neural pathways. According to this study, working memory performance for spatial objects reduces during positive emotions but increases during negative moods. In a verbal working memory task, however, emotional moods had the opposite impact, with performance improving during positive emotions and decreasing during negative moods.

Furthermore, in a study of the effect of motivational dimensions on working memory, Hou and Cai (2022) revealed that exposure to negative emotional stimuli correlated with extended processing durations and decreased task efficiency, suggesting that emotional content captures attention and hinders the sustained maintenance of working memory through attentional updating. However, negative information is remembered more effectively than neutral information in long-term memory, and variations in processes essential to working memory might play a role in this emotional memory (Kensinger & Corkin, 2003).

Another study by K. Yang et al. (2023) discovered that extremely negative emotions might interfere with cognition, reducing cognitive function in tasks such as working memory. Negative emotional stimuli have been reported to impair task performance in working memory when compared to neutral stimuli.

In summary, negative emotions can have a variety of effects on working memory performance, including reduced performance, enhanced performance in certain tasks, and decreased recall variability. These changes might be attributed to emotional material occupying attention, altering working memory through distinct neural pathways, or inducing a more deliberate processing mood.

#### **2.5.4 Past Research on the Negative Emotions and Working Memory**

According to the processing efficiency hypothesis, which provides a theoretical foundation, unpleasant emotions can influence cognitive functions such as working memory by affecting

information processing efficiency (Hou & Cai, 2022). According to this theory, negative emotions might occupy cognitive resources, leaving less available for cognitive tasks and therefore impairing cognitive function (Hou et al., 2023). According to the study, high avoidance-motivational intensity could impact working memory performance by occupying cognitive resources, limiting the resources available for cognitive activities.

However, the influence of negative emotions on working memory is complicated and may vary depending on the task and emotion. According to Yang (2023), negative emotions such as anxiety can decrease working memory performance. Besides that, another study by Osaka et al. (2013) observed that sad mood induction had no significant effect on a specific working memory task. The study found that working memory performance for spatial objects decreased during positive moods but increased during negative moods, whereas the reverse impact was observed in a verbal working memory task.

On the other hand, according to Zhang et al. (2020), negative emotional stimuli can improve working memory capacity. According to the study's findings, negative emotions were found to improve working memory (WM) ability, while positive emotions did not influence working memory capacity. Based on two source localization methodologies, effective connectivity analysis demonstrated that long-range connections between the frontal and posterior regions represented the effects of positive and negative emotions on the working memory network.

In conclusion, the impact of negative emotions on working memory is a complex phenomenon that is still being studied from several theoretical perspectives. While some studies have found that negative emotions impair working memory, the effects can be task-specific and may also vary depending on the type of emotion. Overall, negative emotions may impact the quantity and quality of information maintained in working memory by influencing the scope of attention.

## **2.6 Improvement in Present Study**

In the present study, the influence of positive and negative emotions on working memory performance among FCSHD undergraduate students at UNIMAS was studied. To improve the study, several aspects were considered, such as using undergraduates for the study, selecting film clips based on research findings, using a control group, using a questionnaire after the

emotions are evoked, The Positive and Negative Affect Schedule (PANAS) questionnaire and conducting a backward digit recall task, the Backward Digit Span Test (BDT), using Wechsler Adult Intelligence Scale administration procedures.

Firstly, this study will be performed among undergraduates. This is particularly relevant for FCSHD undergraduates, who may have different experiences and emotional states than high school students, according to previous research by J. Liu (2022). Furthermore, focusing on university students, who are at a crucial stage of their academic and emotional development, could provide useful insights into how positive and negative emotions affect working memory performance.

Secondly, positive and negative film clips were chosen based on research findings. To ensure that specific emotions are evoked, the film clips were carefully chosen based on existing findings on the emotional content and impacts of various stimuli. Selecting film clips that have previously been analyzed and considered to be relevant to the study question, may minimize any biases that may result from personal preferences or unreliable evidence. This method provides for a more objective and systematic examination of the selected film material, leading to more rigid and reliable results.

Thirdly, implementing a control group. Including a control group that does not receive any emotion-evoking stimuli will help in determining the impact of emotions on working memory performance separately. This will help to clarify the relationship between emotions and working memory. This is because it can rule out the effect of these factors by comparing the experimental group to the control group, ensuring that any observed differences are due to the independent variable. This enables researchers to make more accurate and dependable findings from the study.

This study also includes administering questionnaires after the emotions are evoked. Using questionnaires to assess the emotional states of the participants after the emotion-evoking stimuli will give insight into the changes in emotions and their influence on working memory performance. This helps with understanding the dynamics of emotions and working memory. Furthermore, by comparing post-emotional evoked questionnaire responses, researchers may assess the efficacy of the methods.

Finally, the Backward Digit Recall Task was used in this study. Using the Backward Digit Span Test (BDT) to test working memory ability provides a standardized and reliable method of assessment. This is because the Backward Digit Recall Task is considered a

comprehensive measure of working memory, including both the storing and processing aspects of working memory. As a result, it is an effective tool for exploring the influence of positive and negative emotions on various components of working memory. Furthermore, employing Wechsler Adult Intelligence Scale procedures will ensure the consistency and validity of the results.

## **2.7 Summary**

In summary, the review of the literature provides an extensive overview of the relationship between emotions and working memory by taking into consideration various theories, frameworks, and empirical research. The relationship is complicated, covering both positive and negative emotions, task-specific influences, and the complexities of cognitive functions. The review's theoretical viewpoints and methodological considerations determine a solid framework for the current investigation, expanding the knowledge of how emotions influence working memory among FCSHD undergraduate students.

## CHAPTER THREE

### METHODOLOGY

#### 3.0 Introduction

The methodology describes in detail the procedures used to conduct the study so that the researcher has a clear image and understanding of what is required to complete the study. This chapter covers the research design, population and sample, instruments used throughout the study, pilot study, and data analysis procedures.

#### 3.1 Research Design

The study used a true experimental design, specifically a randomized posttest-only control group design. Experimental research is a type of quantitative research. According to Kotronoulas and Papadopoulou (2023), experimental research is a type of quantitative study that seeks to create evidence by manipulating interventions and controlling confounding variables through randomization and the use of control groups. Furthermore, according to the research, true experimental research, such as a randomized controlled trial, includes both randomization and a control group to control for confounding variables.

The randomized posttest-only control group design was chosen for the study because it provides for control of variables, random assignment, and the use of post-test measurements. True experimental designs provide accurate control of variables, which is crucial in showing clear relationships between emotions and working memory performance. According to Choueiry (2021), the posttest-only control group design is a type of experimental design used in research in which individuals are randomly assigned to either receive an intervention or not, and the result of interest is measured only once after the intervention occurs. Furthermore, the study will use self-report measures to explore participants' emotional states, as well as working memory tasks to evaluate working memory performance. This will provide further insight into the significant differences between emotions and working memory performance since it allows for an evaluation of the participant's subjective experiences.

In addition, the study uses the Between-Subjects Design to assign participants to groups. Simkus (2023b) stated that a between-subjects design, also known as a between-groups design, is a type of experimental arrangement where each participant is exposed to only one level of the independent variable. This current study consists of two experimental groups and one

control group. In this experiment, groups A and B represent positive and negative emotions, respectively, while group C is the neutral emotion stimulus which serves as a control group.

### **3.2 Population and Sample**

Non-probability sampling is employed in the present study to collect data from participants. According to Nikolopoulou (2023b), non-probability sampling is a strategy used in research to select samples based on non-random characteristics such as convenience, geographical proximity, or expert knowledge. Fleetwood (2023) added that non-probability sampling is a sampling strategy in which the researcher chooses samples based on subjective judgment rather than random selection.

There are numerous non-probability sampling techniques, however convenience sampling is chosen for this study. Convenience sampling is a non-probability sampling method used in research, where participants are selected based on their accessibility and availability to the researcher (Nikolopoulou, 2023a). Besides that, Simkus (2023b) suggests that this method uses minimal resources and is inexpensive than probability sampling. Furthermore, convenience sampling is useful when dealing with difficult-to-reach populations or when a sampling frame is unavailable. Apart from that, convenience sampling allows researchers to collect data quickly and easily, making it suitable for time-sensitive research or pilot data collecting.

As a result, the current study uses convenience sampling because of its ability to provide quick and easy access to participants. In university settings, undergraduates frequently face time restrictions due to academic schedules and project deadlines. Convenience sampling enables them to easily reach out to individuals who are readily available on the university campus or in the surrounding area. This strategy is very effective when the research project must be finished within a limited period.

#### **3.2.1 Sample Size**

A sample is a smaller and more manageable collection of individuals or items selected from a larger group or population. Chander (2017) emphasizes the importance of selecting an appropriate sample size for a study, advising against potential negative consequences of both too-big and too-small sample sizes.

30 undergraduate students from the Faculty of Cognitive Sciences & Human Development in UNIMAS are selected, ensuring a wide and representative sample. Liu (2022) recruited 30 volunteers to explore how positive and negative emotions effect working memory renewal. This evidence further supports the rationale behind selecting 30 participants for the current study. To recruit FCSHD volunteers for the study, announcements are made using social media platforms such as WhatsApp and Instagram. The consent form is included in the Google form provided to participants before the experiment (refer to Appendix C).

### 3.3 Instruments

In research, an instrument is a tool or method used to gather data or measure study variables. It is a research instrument that helps in the systematic and objective collection, examination, and investigation of a topic (Nida et al., 2022). In research, a questionnaire is a structured set of questions indicated to collect information from respondents. It is used to gather quantitative or qualitative data about the opinions, behaviors, or characteristics of participants (Mcleod, 2023b).

The Positive and Negative Affect Schedule (PANAS) questionnaires are used to better fit the study's objective (refer to Appendix B). According to Tran (2013), the Positive and Negative Affect Schedule (PANAS) is a commonly used self-report measure designed to assess positive affect (PA) and negative affect (NA) in individuals.

Furthermore, the Backward Digit Span Test (BDT) is used to measure working memory performance after the induction of emotional movie clips (refer to Appendix B). It is a subtest of the Wechsler Adult Intelligence Scale (WAIS) and the Wechsler Intelligence Scale for Children (WISC) (Holdnack et al., 2013).

Finally, positive, and negative film clips were used to induce positive and negative emotions. The film clips have been carefully chosen from existing studies. Incorporating video clips from previous research into the current study may be an effective and flexible instrument for engaging participants, capturing emotions, standardizing the research process, enhancing accessibility, promoting cooperation, and presenting findings in a captivating manner.

### **3.3.1 Instrument Structure**

#### **The Positive and Negative Affect Schedule (PANAS)**

According to the Hegarty (2023), the PANAS was created in 1988 by Watson, Clark, and Tellegen and consists of 20 questions, 10 items measure positive affect (e.g., excited, inspired), and 10 items measure negative affect (e.g., upset, fearful). Each item is rated on a five-point Likert scale, ranging from 1 being Very Slightly or Not at all and 5 being Extremely (Tran 2013).

Tran (2013) stated that the PANAS is designed to measure the extent to which affect has been experienced in a certain time frame. It can be used to evaluate current affect, dispositional or trait affect, mood fluctuations across time, or emotional responses to events. Besides that, the PANAS was created to measure affect in a variety of settings, such as the current moment, past day, week, or year, or in general (on average).

The PANAS score can be calculated by summing the scores for each set of items on the questionnaire. The positive impact (PA) items are summed to obtain a PA score, while the negative affect (NA) items are summed together to obtain an NA score. The PANAS potential scores range from 10 to 50 for each of the PA and NA scales. A score of 10 indicates the lowest level of positive or negative affect, while a score of 50 indicates the maximum level.

#### **Backward Digit Span Test (BDT)**

Holdnack et al. (2013) added that the Backward Digit Span Test (BDT) is a cognitive task that is used to evaluate working memory capacity. In the test, the participant reads a sequence of random numbers and is required to repeat them in reverse order. The length of the sequence is gradually raised to determine the individual's maximal capacity to retain and manipulate information.

The test has been adapted from Emrani et al. (2018) study, in which the test was conducted using Wechsler Adult Intelligence Scale administration procedures, with the exception that all 21 test trials were administered regardless of mistakes. The test consists of seven trials with 3, 4, and 5-digit span lengths, for a total of 21 trials.

In this study, the BDT consists of 21 trials ranging from 3 to 9 digits. The participants attempt to memorize the digits on the screen. All numbers are between 0 and 9. The digits are shown

one after the other for one second each. Participants need to recall several sequences. There will be 7 levels, each consisting of 3 trials. The digit sequence continues increasing until participants are unable to recall it.

Participants have 5 seconds to repeat the digits in reverse order for each trial. Participants who responded for more than five seconds were considered "forgetting". To calculate the Backward Digit Span Test (BDT) score, the number of correctly repeated sequences is counted. Each correctly repeated sequence contributes to the total score.

### **Positive Film Clip**

Passion Pictures' CGI animated short film "Joy and Heron" which is 4 minutes and 03 seconds long is a heartfelt and emotionally captivating story about opportunity, helping others, and the power of charity. The film has been considered disarmingly simple, with interesting characters and a strong plot that connects with audiences. Beckyjohnen (2020) believes that kindness has a rippling effect based on the short film. The short video employs kindness to set off a chain reaction of pleasant and positive. Kindness always makes a difference, not just for the recipient but also for the giver. Moreover, it efficiently conveys emotions such as friendliness, sharing, and empathy through the interactions between the dog and the heron, making it an appropriate inclusion in research aimed at eliciting and researching these specific emotions.

### **Negative Film Clip**

The short film "Trois Petits Chats" is a 3D animated film with the duration of 5 minutes and 55 seconds about a young cat who witnesses the death of his family. It is a French children's song that has been adapted into an animated short film, demonstrating emotional power of animation in portraying complex emotions and themes. According to Evans (2022), the film's storyline follows an intense, diagonal decline, delivering the audience into a whirlpool of loss and loneliness without any resolution. The plot arc stands in sharp contrast to the typical resolution found in feature films, leaving the audience with a lasting sense of sadness and devastation. Aside from that, Trois Petits Chats has received widespread praise for its ability to evoke intense emotions in viewers, particularly youngsters. The film's impact has been compared to those of other emotionally charged animated shorts, such as "Lava," which also explores the themes of loss and loneliness. Overall, Trois Petits Chats is a powerful and

emotionally impactful animated short film that explores themes such as loss, loneliness, and the tragic impacts of witnessing loved ones' deaths.

### **3.4 Procedures**

30 participants are selected among FCSHD undergraduate students at UNIMAS. The participants are randomly assigned to one of three groups: A (Positive Emotion), B (Negative Emotion), or C (neutral emotion stimulus). Each group consist of 10 participants. Each participant receives clear and comprehensive information about the study's objective, and procedures.

Participants in Group A are exposed to content that aims to induce positive emotions, the CGI animated short film "Joy and Heron" by Passion Pictures | CGMeetup which is 4 minutes and 03 seconds long.

Participants in Group B are exposed to content that aims to induce negative emotions, "Trois Petits Chats" directed by Benoît Delaunay, Albané Hertault Lacoste, Maïwenn le Borgne, and Alexia Provoost 3D Animated Short with the duration of 5 minutes and 55 seconds.

Participants in Group C are not exposed to emotionally charged content as a baseline.

Each participant will complete a post-emotion induction survey, known as the Positive and Negative Affect Schedule (PANAS), to measure their emotional states immediately following exposure to the emotion induction materials.

Following the self-report questionnaire, participants will complete the Backward Digit Span Test (BDT). Trials will be conducted for each digit span set ranging from 3 to 9 digits. Participants will receive feedback and answers to any questions they may have. The score will be calculated based on the accuracy of the digits correctly recalled.

### **3.5 Pilot Study**

A pilot study was carried out in the research process to determine the feasibility, reliability, and validity of the research design and instruments. According to Simkus, J. (2023c), pilot studies can evaluate the validity and reliability of research instruments, such as questionnaires or data-collecting procedures, to ensure that they are clear, accurate, and appropriate for the target

population. Furthermore, pilot studies may help investigate the feasibility of participant recruitment, ensuring that the target group is accessible and willing to participate in the main research. A pilot study can also save time and costs by identifying flaws in the processes proposed by the researcher, allowing for adjustments before the main study.

Therefore, to conduct a pilot study, the researcher chooses 5 volunteers to participate in the study, even though the number of actual participants for the main study would be 30. Aside from that, the pilot study allows evaluation of the effectiveness and clarity of research instruments (such as emotional induction materials, working memory tasks, and questionnaires). It helps to determine any ambiguities or flaws with the instruments that could affect data quality.

Besides that, the pilot study aims to evaluate the induction of positive and negative emotional movie clips. A normality test (refer to Appendix A) was carried out to determine whether the data of the pilot test for the BDT score was normally distributed. This was assessed using both the Kolmogorov-Smirnov and the Shapiro-Wilk tests. The Kolmogorov-Smirnov test yielded a statistic of 0.254 with a significance value (Sig.) of 0.200, while the Shapiro-Wilk test yielded a statistic of 0.914 with a significance value of 0.492. In both tests, the significance levels are above the usual alpha level of 0.05, suggesting that failed to reject the null hypothesis that the data follows a normal distribution. Based on these tests, it can be concluded that the BDT score data does not deviate significantly from normality and is normally distributed. The normality test is significant because it determines whether the data is appropriate for parametric statistical analysis tests such as ANOVA, which are frequently used in studies.

Furthermore, it allows to analysis of participant feedback on the clarity and effectiveness of instruments. Based on the feedback from the participants, adjustments are made to emotionally charged film clips to enhance effectiveness. Instruments are revised in response to participant feedback on unclear or challenging tasks or questions. Finally, it enables to evaluate the study's logistical features, such as procedure timing, and make improvements as appropriate to optimize efficiency and participant experience.

### **3.6 Data Analysis Procedures**

The data analysis procedures for this study are essential in understanding the complexity of the relationship between emotions and cognitive performance. This section describes the

systematic approach used for obtaining relevant insights from collected data. The analysis is divided into descriptive and inferential components, each with a specific role in highlighting patterns and correlations in the dataset. The study's procedures aim to give an in-depth understanding of how emotions affect working memory performance in targeted undergraduate's population.

### **3.6.1 Descriptive Data Analysis**

Abt (1987) stated that descriptive data analysis is a strategy for analysing quantitative data that involves summarising and interpreting information in a relevant way. It involves analysing the qualities and patterns of data to develop insights and create hypotheses. Descriptive data analysis may be used to discover key factors, assess correlations between variables, and make informed decisions based on the findings. It is a useful tool for research and statistical analysis. This section includes tables with demographic information such as gender, age, ethnicity, program, and year of study. Aside from that, descriptive statistics will be used to determine significant differences in emotional and working memory performance. For easier understanding, the results will be presented in clear and organized tables and figures.

### **3.6.2 Inferential Data Analysis**

According to Sen and Das (2023), inferential data analysis is a statistical approach for drawing conclusions about a population from a sample. The inferential data analysis for this study takes a comprehensive approach to investigating relationships and potential differences across groups. Statistical tests were carefully selected depending on the study's design and objectives.

Simkus (2023d) defines an ANOVA test as a statistical test used to evaluate if there is a statistically significant difference between two or more category groups by testing for mean differences using a variance.

The assessment of working memory performance, as evaluated by the Backward Digit Span Test (BDT), will also use One-Way ANOVA to analyze potential differences in mean BDT scores across the three groups. If the results of the One-Way ANOVA show significant differences, post-hoc tests will be performed to determine specific group differences. This study aims to determine if exposure to positive or negative emotions has a clear effect on working memory performance when compared to a control group.

According to Pav (2019), post-hoc tests are statistical methods used to identify the cause of differences in group means following an analysis of variance (ANOVA) test. These tests are useful for analyzing data and identifying discoveries while minimizing the chance of false positives. The literature proposes many techniques for post-hoc testing. Some approaches rely on pairwise comparisons and assume the data to be normal. These pairwise comparisons allow for the identification of significant differences between specific groups.

All tests will have a significance level ( $\alpha$ ) of 0.05 to determine statistical significance. The findings will be provided in tables and figures, including mean values, standard deviations, p-values, and effect sizes for all inferential tests. The interpretation of data will be examined with the study questions and hypotheses, emphasizing both statistical and practical significance.

### **3.7 Summary**

In summary, this study uses a true experimental design, specifically a randomized posttest-only control group design, to investigate the effect between emotions and working memory performance among FCSHD undergraduate students at UNIMAS. The research design uses a Between-Subjects Design, with participants assigned to Positive Emotion, Negative Emotion, or Control groups. Non-probability selection, especially convenience sampling, is used to select 30 participants, and the study includes a pilot study to test the feasibility and reliability of the research design and instruments.

The study uses the Positive and Negative Affect Schedule (PANAS) questionnaires to assess emotional states and the Backward Digit Span Test (BDT) to assess working memory performance. Positive and negative emotions are induced by well-chosen film clips. Descriptive data analysis will be used to summarize emotional and cognitive characteristics, while inferential data analysis, such as One-Way ANOVA and post-hoc testing, will be used to investigate group differences. Ethical factors including informed consent, confidentiality, voluntary involvement, and debriefing are critical to ensuring participant rights and well-being.

## **CHAPTER FOUR**

### **FINDINGS AND DISCUSSION**

#### **4.0 Introduction**

This chapter discusses the findings of the researcher's study as referred to the study's problem statement, research hypotheses, and research questions. This research managed to collect data from 30 participants. This chapter also provides the research findings, which involve descriptive statistics on the respondent's background, including gender, age, current year of study, and program. Meanwhile, the inferential statistics discover the statistical analysis using One-way Analysis of Variance (ANOVA) to assess the research hypotheses. Aside from that, this chapter defines the discussion part based on the research findings.

## 4.1 Demographic Data

### 4.1.1 Gender

| Gender | n  | %      |
|--------|----|--------|
| Male   | 7  | 23.33  |
| Female | 23 | 76.67  |
| Total  | 30 | 100.00 |

Table 4.1.1: Frequency and Percent of Participants' Gender



Table 4.1.1 indicated majority participants are female (n= 23, 76.67%), while 7 participants (23.33%) are male.

### 4.1.2 Age

| Age   | n  | %      |
|-------|----|--------|
| 18-20 | 1  | 3.33   |
| 21-23 | 25 | 83.33  |
| 24-26 | 4  | 13.33  |
| Total | 30 | 100.00 |

Table 4.1.2: Frequency and Percent of Participants' Age

Table 4.1.2 showed the largest age group is 21-23 years (n= 25, 83.33%), followed by 24-26 years (n= 4, 13.33%). The smallest age group is 18-20 years (n= 1, 3.33%).

#### 4.1.3 Current Year of Study

| Current Year of Study | n  | %      |
|-----------------------|----|--------|
| 1 <sup>st</sup> year  | 4  | 13.33  |
| 2 <sup>nd</sup> year  | 3  | 10.00  |
| 3 <sup>rd</sup> year  | 23 | 76.67  |
| Total                 | 30 | 100.00 |

Table 4.1.3: Frequency and Percent of Participants' Current Year of Study

Table 4.1.3 showed the largest year of study is 3<sup>rd</sup> year (n= 23, 76.67%), followed by 1<sup>st</sup> year (n= 4, 13.33). The smallest group is 2<sup>nd</sup> year (n= 3, 10.00%).

#### 4.1.4 Programme

| Programme                  | n  | %      |
|----------------------------|----|--------|
| Cognitive Science          | 9  | 30.00  |
| Human Resource Development | 2  | 6.67   |
| Psychology                 | 19 | 63.33  |
| Total                      | 30 | 100.00 |

Table 4.1.4: Frequency and Percent of Participants' Programme

Table 4.1.4 showed the psychology programme is the largest (n= 19, 63.33%), followed by Cognitive Science programme (n= 9, 30.00). The smallest group is Human Resource Development (n= 2, 6.67%).

#### 4.1.5 Backward Digit Span Task (BDT)

| BDT   | n  | %      |   |
|-------|----|--------|---|
| 1-3   | 5  | 16.67  |   |
| 4-6   | 16 | 53.33  | ✓ |
| 7-9   | 8  | 26.67  |   |
| 10-12 | 1  | 3.33   |   |
| Total | 30 | 100.00 |   |

Table 4.1.5 (a): Frequency and Percent of BDT

| Level | Digit Span | Score Range |
|-------|------------|-------------|
| 1     | 3 Digits   | 1-3         |
| 2     | 4 Digits   | 4-6         |
| 3     | 5 Digits   | 7-9         |
| 4     | 6 Digits   | 10-12       |
| 5     | 7 Digits   | 13-15       |
| 6     | 8 Digits   | 16-18       |
| 7     | 9 Digits   | 19-21       |

Table 4.1.5(b): Score Indicator Table of BDT

Table 4.1.5 (a) shows the majority scored within the range of 4-6, which under Level 2 (4 digits), comprised 16 participants (53.33%) fall within this category. This demonstrates that most participants were able to accurately recall and reverse digit sequences of 4 digits. This result indicates that most undergraduate participants have working memory capacity sufficient to perform tasks involving the reversal of 4-digit sequences but may struggle with longer sequences.

Following this, the second highest score range was 7-9, which fall under level 3 encompassing 26.67% (n=8) of the participants. This group performed better, recalling sequences of 5 digits

on average, suggesting that some participants can handle slightly more complicated tasks involving the reversal of 5-digit sequences.

The score of 1-3 for Level 1 with 16.67%, (n=5) of participants suggests that some of participants found even the 3-digit sequences challenging, potentially due to lower working memory capacity or other influencing variables such as lack of attention.

The lowest scores are 10-12 with 3.33%, (n=1) of participant, corresponding to level 4. Scores of this group indicate that relatively few participants can maintain 6-digit spans, indicating a greater cognitive load and difficulties at these levels.

## 4.2 Inferential Data (Main Findings)

### 4.2.1 Frequency, Mean and Standard Deviation of Backward Digit Span Test under Different Emotions

| Emotions                 | N  | M    | SD    |
|--------------------------|----|------|-------|
| Positive Emotion         | 10 | 6.70 | 2.541 |
| Negative Emotion         | 10 | 4.60 | 2.319 |
| Neutral Emotion Stimulus | 10 | 5.50 | 1.179 |

Table 4.2.1: Frequency, Mean and Standard Deviation on the scores of Backward Digit Span Test (BDT)

Figure 4.2.1 shows the frequency, mean scores and standard deviations of Backward Digit Span Test under different emotions. This study investigated the role of emotions on verbal working memory performance. 30 students were randomly assigned into three groups (n = 10): positive emotion, negative emotion, and neutral emotion stimulus. According to the table, positive emotion (M = 6.70, SD = 2.541) scored higher than both negative emotion (M = 4.60, SD = 2.319) and neutral emotion stimulus (M = 5.50, SD = 1.179).

The mean score for positive emotions was 6.70, with a standard deviation of 2.541. Higher mean scores indicate improved performance on the BDT under positive emotions. The mean score for negative emotions was 4.60, with a standard deviation of 2.319. Lower mean scores indicate poor performance on the BDT under negative emotions. Surprisingly, the mean score

for neutral emotion stimuli was 5.50, with a smaller standard deviation of 1.179. Participants did reasonably well due to the absence of emotional interference or individual differences.

#### 4.2.2 One-way Analysis Variance (ANOVA)

ANOVA

|                | BDT     |    |        |       |      |
|----------------|---------|----|--------|-------|------|
|                | Sum of  | df | Mean   | F     | Sig  |
|                | Squares |    | Square |       |      |
| Between Groups | 22.20   | 2  | 11.10  | 2.518 | .099 |
| Within Groups  | 119.00  | 27 | 4.407  |       |      |
| Total          | 141.20  | 29 |        |       |      |

Table 4.2.2: One-way Analysis Variance (ANOVA) on the scores of Backward Digit Span Test (BDT) based on total number of correct recalled.

To determine the difference between positive emotion, negative emotion, and neutral emotion stimulus on verbal working memory performance, the Backward Digit Span Test (BDT), a one-way analysis variance (ANOVA) was performed using the Statistical Package for the Social Sciences (SPSS). Table 4.2 shows the one-way ANOVA results for the BDT scores between groups. The one-way ANOVA revealed that there is no statistically significant difference in the mean scores between positive emotion, negative emotion, and neutral emotion stimulus on the verbal working memory performance [ $F(2, 27) = 2.518, p = 0.099$ ]. Since the significant value based on the results is  $p = 0.099$ , which is larger than 0.05 level of significance, it indicates that the null hypothesis is accepted.

### 4.2.3 Turkey HSD Multiple Comparison

#### Turkey HSD

|                                |                 | 95% Confidence Interval |               |      |                |                |
|--------------------------------|-----------------|-------------------------|---------------|------|----------------|----------------|
|                                |                 | Mean                    |               |      |                |                |
| (I) Groups                     | (J) Groups      | Difference<br>(I-J)     | Std.<br>Error | Sig  | Lower<br>Bound | Upper<br>Bound |
| Positive                       | Negative        | 2.100                   | .939          | .083 | -.23           | 4.43           |
|                                | Neutral emotion | 1.200                   | .939          | .419 | -1.13          | 3.53           |
|                                | stimulus        |                         |               |      |                |                |
| Negative                       | Positive        | -2.100                  | .939          | .083 | -4.43          | .23            |
|                                | Neutral emotion | -.900                   | .939          | .609 | -3.23          | 1.43           |
|                                | stimulus        |                         |               |      |                |                |
| Neutral<br>emotion<br>stimulus | Positive        | -1.200                  | .939          | .419 | -3.53          | 1.13           |
|                                | Negative        | .900                    | .939          | .609 | -1.43          | 3.23           |
|                                |                 |                         |               |      |                |                |

Table 4.2.3: Turkey HSD Multiple Comparison for all pairwise comparisons of mean verbal working memory scores between the three emotion type conditions: positive, negative, and neutral.

The table above shows the results of multiple comparisons with Tukey's Honest Significant Difference (HSD) test for the dependent variable BDT. The test examines the means of different groups to determine if there are any statistically significant differences.

The mean difference between the positive and negative groups is 2.100, with a standard error of 0.939 and a p-value of 0.083. This result shows that there is no statistically significant difference at the 0.05 level. The 95% confidence interval for the difference ranges from -0.23 to 4.43.

When comparing the Positive and Neutral Emotion Stimulus groups, the mean difference is 1.200, with a standard error of 0.939 and a p-value of 0.419. The high p-value suggests no significant difference between these groups, with a confidence range from -1.13 to 3.53.

The mean difference between the Negative and Positive comparisons is -2.100, which is essentially the inverse of the Positive and Negative groups comparison, with the same standard error and p-value. Thus, the interpretation remains the same.

The comparison of the Negative and Neutral Emotion Stimulus groups provides a mean difference of -0.900, with a standard error of 0.939 and a p-value of 0.609, showing no significant difference. The confidence interval for this comparison is -3.23 to 1.43.

The mean difference between the Neutral Emotion Stimulus group and the Positive group is -1.200, with a standard error of 0.939 and a p-value of 0.419, showing no significant difference. The confidence interval is -3.53 to 1.13.

Finally, the comparison between the Neutral Emotion Stimulus group and the Negative group yields a mean difference of 0.900, with a standard error of 0.939 and a p-value of 0.609. This indicates no significant difference, with a confidence interval of -1.43 to 3.23.

Overall, no comparisons show statistically significant differences at the 0.05 level, as all p-values exceed this threshold.

### 4.3 Discussion

Table 4.1.4 shows the frequency and percentage of participants' programs. Based on the table, there is a lack of students from counselling programme, indicating limited generalizability. Moreover, results tabulated in Table 4.2.2 demonstrate that there was no statistically significant difference in the means of verbal working memory performance between positive emotion, negative emotion, and neutral emotion stimulus conditions, it supports the null hypothesis ( $H_0$ ), which states that there is no significant difference between positive emotion, negative emotion and neutral emotion stimulus on verbal working memory performance. Despite the lack of statistical significance, analysing the means of scores in each

condition (refer to Table 4.2.1) provides insight into the trends discovered. Participants exposed to positive emotion had the highest mean score ( $M = 6.70$ ,  $SD = 2.541$ ), followed by those exposed to neutral stimuli ( $M = 5.50$ ,  $SD = 1.179$ ), and finally by those exposed to negative stimuli ( $M = 4.60$ ,  $SD = 2.319$ ).

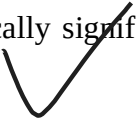
Besides that, the result of the current study shows that there is no statistically significant difference between positive emotion, negative emotion, and neutral emotion stimulus on verbal working memory performance ( $p=0.099$ ), which is greater than the 0.05 level of significance. Furthermore, multiple comparisons with Tukey's HSD test revealed no significant differences between any of the group comparisons at the 0.05 level, with all p-values above this threshold.

The findings of the current study fail to support previous studies due to conflicting findings in the literature concerning the impact of positive and negative emotions on working memory performance. Figueira et al. (2018) found that positive affect improves working memory, indicating that positive emotions may enhance verbal working memory performance. Furthermore, Feng et al. (2021) discovered that negative affect impairs working memory performance, especially under high cognitive stress, indicating that negative emotions consume cognitive resources, leaving fewer resources available for working memory tasks. These findings suggest that emotional states have a significant influence on cognitive processes.

However, the study contributes to previous studies that found that positive, negative, and neutral emotional states had no statistically significant influence on participants' verbal working memory performance. The findings of the research align with previous studies. According to Yüvrük et al. (2020), there was no significant effect of emotion on working memory accuracy in either of the two trials conducted. Nevertheless, it was demonstrated that motivational aspects of emotional states exerted a more pronounced influence on reaction times in working memory, suggesting efficiency in updating working memory.

Another study by Di Courtelary et al. (2024) explored the relationship between mood/emotional factors and working memory but found no significant effect on working memory performance. The researchers concluded that "no significant differences were found between the groups in working memory performance".

In summary, the research investigated how positive and negative emotions impacted working memory performance among FCSHD undergraduates at UNIMAS. Although the one-way ANOVA findings were not statistically significant, the trends observed in the data provide valuable insight.



## CHAPTER FIVE

### LIMITATION, IMPLICATION, RECOMMENDATION AND CONCLUSION

#### 5.0 Introduction

This chapter will discuss the limitations, implications, recommendations for future studies and conclusion.

#### 5.1 Limitations of Study

A significant limitation of this study is its small sample size. One of the main concerns regarding the small sample size is the limited generalizability of the findings. When the study has a small number of participants, it is difficult to generalize the findings to a larger population. In this study, only 30 participants were selected from a specific group (FCSHD undergraduates at UNIMAS) and divided into three groups (positive emotion, negative emotion, and neutral emotion stimulus), which may not reflect the entire FCSHD undergraduate population in UNIMAS.

Another limitation that can be included in the study is the failure of some emotion induction clips to effectively induce the intended emotions. For example, some participants had previously watched the clip, reducing their emotional impact. This is consistent with the findings of Chun et al. (2020), who discovered that repeated exposure to emotional pictures resulted in a reduction in physiological reactions to the emotional stimuli, indicating habituation. This limitation may have an impact on the validity and reliability of the study's findings, as inaccurate emotion induction may result in inconsistent results and affect the overall interpretation of how emotions influence working memory performance. As a result, when certain emotion induction clips fail to evoke the desired emotional states in participants, it might introduce confounding variables that complicate data analysis and interpretation.

Additionally, the methodology implemented in this study may influence the interpretation of the results. While a reliable test of working memory, the Backward Digit Span Test (BDT) focuses on a specific type of cognitive function. Other measures of working memory,

such as tasks requiring visuospatial working memory or complicated span tasks, may produce different findings. Furthermore, the PANAS survey used to assess emotional states post stimuli may not capture the aspects of the emotional experience, whereas alternative emotional assessment tools can provide more comprehensive insights.

Last but not the least, when examining individual differences in response to emotional stimuli, the complexity and variability of human emotions must be considered. Emotions are complex and may be influenced by various factors such as past experiences, cultural background, personality traits, baseline mood, and emotional intelligence. This could impact how individuals respond to emotional stimuli and, as a result, their working memory performance.

## **5.2 Implication of Study**

First and foremost, the findings show that most students have moderate working memory capacity, with most participants successfully handling 4-digit spans. This suggests that educational and cognitive tasks intended for this demographic should consider this level of complexity to maximize performance and engagement.

The study also emphasizes the need to consider emotional states when designing and interpreting cognitive assessments. Test administrators and psychologists should be aware that an individual's emotional state might impact their performance on working memory tasks. This understanding might lead to more accurate evaluations and interventions that are tailored to individuals' emotional needs.

Finally, the study highlights the complexities of the relationship between emotions and working memory, emphasising the need for further research. Future research should explore different types of emotions, diverse participant demographics, and various types of cognitive tasks to deepen our understanding. This can result in more targeted and effective cognitive improvement treatments for different demographics and settings.

### 5.3 Recommendations

Future studies should involve a larger, more diverse sample size. A larger sample size increases the study's statistical power, making it easier to determine significant differences between groups. It will also improve the generalizability of the results to a larger population. Including participants with various demographics, educational backgrounds, and age groups can provide a better comprehension of how emotions affect working memory in different populations.

Future studies could explore using multiple emotion induction methods or stimuli that induce emotions, such as music, real-life events, or virtual reality environments rather than solely based on video clips. This method can help reduce the likelihood of certain clips being ineffective for certain participants due to individual differences in emotional reactions. By diversifying the emotion induction methods used in the study, researchers can enhance the probability of effectively inducing the target emotions in a wider range of participants.

To examine working memory and other cognitive functions, use a larger set of cognitive assessments. While the Backward Digit Span Test (BDT) is a well-known measure of working memory, using other tests such as the n-back task, and complicated span tasks can provide a more comprehensive assessment of working memory and related cognitive processes. This might help to identify specific aspects of working memory that are most affected by emotional states.

Moreover, the use of the PANAS survey is effective in evaluating specific aspects of emotional states, it may not completely capture the complexities of emotional experiences post-stimulus. To address this, using a variety of emotional assessment tools, such as the Profile of Mood States (POMS), may provide more thorough insights into participants' emotional responses. Future studies may gain a more comprehensive knowledge of the relationship between working memory and emotional states by broadening the scope of cognitive and emotional assessments.

Lastly, by addressing these recommendations will allow future research to improve on the current study's findings and contribute to a deeper comprehension of the complex relationship between emotions and working memory.

## 5.4 Conclusion

In conclusion, the study investigated the role of positive and negative emotions in verbal working memory performance among FCSHD undergraduates at UNIMAS. Despite the lack of statistically significant differences between the groups exposed to positive, negative, and neutral stimuli, the observed trends provide valuable insights. Participants exposed to positive emotions tended to perform better on verbal working memory tasks than those exposed to negative or neutral stimuli.

The findings also revealed that, while negative emotions generally impaired working memory performance, however, some participants performed better under negative emotional conditions. This complexity highlights the need for further research to further comprehend individual differences and the specific conditions under which emotions impact cognitive functions.

Furthermore, the study emphasized the need to examine the efficiency of emotion induction methods, as well as the requirement for different and comprehensive cognitive assessments. Future research should improve on these findings by utilizing larger and more diverse sample sizes, a variety of emotion induction methods, and a broader range of cognitive assessments to accurately represent the complicated relationship between emotions and working memory.

By addressing these concerns, future research can improve the understanding of how emotional states influence cognitive processes and lead to more effective ways of increasing cognitive performance in a variety of contexts.

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## APPENDIX A

### RAW SPSS OUTPUTS

#### 1) Table shows Normality Test for Pilot Study

##### Tests of Normality

|          | Kolmogorov-Smirnov <sup>a</sup> |    |                   | Shapiro-Wilk |    |      |
|----------|---------------------------------|----|-------------------|--------------|----|------|
|          | Statistic                       | df | Sig.              | Statistic    | df | Sig. |
| BDTRange | .254                            | 5  | .200 <sup>*</sup> | .914         | 5  | .492 |

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

#### 2) Table shows Frequency and Percent of Participants' Gender

##### Gender

|       |        | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--------|-----------|---------|---------------|--------------------|
| Valid | Male   | 7         | 23.3    | 23.3          | 23.3               |
|       | Female | 23        | 76.7    | 76.7          | 100.0              |
|       | Total  | 30        | 100.0   | 100.0         |                    |

#### 3) Table shows Frequency and Percent of Participants' Age

##### AgeGroups

|       |       | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-------|-----------|---------|---------------|--------------------|
| Valid | 18-20 | 1         | 3.3     | 3.3           | 3.3                |
|       | 21-23 | 25        | 83.3    | 83.3          | 86.7               |
|       | 24-26 | 4         | 13.3    | 13.3          | 100.0              |
|       | Total | 30        | 100.0   | 100.0         |                    |

4) Table shows Frequency and Percent of Participants' Current Year of Study

| Current Year of Study |          |           |         |               |                    |
|-----------------------|----------|-----------|---------|---------------|--------------------|
|                       |          | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid                 | 1st year | 4         | 13.3    | 13.3          | 13.3               |
|                       | 2nd year | 3         | 10.0    | 10.0          | 23.3               |
|                       | 3rd year | 23        | 76.7    | 76.7          | 100.0              |
|                       | Total    | 30        | 100.0   | 100.0         |                    |

5) Table shows Frequency and Percent of Participants' Programme

| Programme |                   |           |         |               |                    |
|-----------|-------------------|-----------|---------|---------------|--------------------|
|           |                   | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid     | Cognitive Science | 9         | 30.0    | 30.0          | 30.0               |
|           | HRD               | 2         | 6.7     | 6.7           | 36.7               |
|           | Psychology        | 19        | 63.3    | 63.3          | 100.0              |
|           | Total             | 30        | 100.0   | 100.0         |                    |

6) Table shows Frequency and Percent of BDT

| BDTRange |       |           |         |               |                    |
|----------|-------|-----------|---------|---------------|--------------------|
|          |       | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid    | 1-3   | 5         | 16.7    | 16.7          | 16.7               |
|          | 4-6   | 16        | 53.3    | 53.3          | 70.0               |
|          | 7-9   | 8         | 26.7    | 26.7          | 96.7               |
|          | 10-12 | 1         | 3.3     | 3.3           | 100.0              |
|          | Total | 30        | 100.0   | 100.0         |                    |

**7) Table shows Frequency, Mean and Standard Deviation on the scores of Backward Digit Span Test (BDT)**

| Descriptives             |    |      |                |            |                                  |      |         |         |
|--------------------------|----|------|----------------|------------|----------------------------------|------|---------|---------|
| BDT                      |    |      |                |            |                                  |      |         |         |
|                          | N  | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean |      | Minimum | Maximum |
| Positive                 | 10 | 6.70 | 2.541          | .803       | 4.88                             | 8.52 | 2       | 11      |
| Negative                 | 10 | 4.60 | 2.319          | .733       | 2.94                             | 6.26 | 2       | 8       |
| Neutral emotion stimulus | 10 | 5.50 | 1.179          | .373       | 4.66                             | 6.34 | 4       | 8       |
| Total                    | 30 | 5.60 | 2.207          | .403       | 4.78                             | 6.42 | 2       | 11      |

**8) Table shows One-way Analysis Variance (ANOVA) on the scores of Backward Digit Span Test (BDT) based on total number of correct recalled**

| ANOVA          |                |    |             |       |      |
|----------------|----------------|----|-------------|-------|------|
| BDT            |                |    |             |       |      |
|                | Sum of Squares | df | Mean Square | F     | Sig. |
| Between Groups | 22.200         | 2  | 11.100      | 2.518 | .099 |
| Within Groups  | 119.000        | 27 | 4.407       |       |      |
| Total          | 141.200        | 29 |             |       |      |

**9) Table shows Turkey HSD Multiple Comparison for all pairwise comparisons of mean verbal working memory scores between the three emotion type conditions: positive, negative, and neutral**

| Multiple Comparisons     |                          |                       |            |      |                         |      |
|--------------------------|--------------------------|-----------------------|------------|------|-------------------------|------|
| Dependent Variable: BDT  |                          |                       |            |      |                         |      |
| Tukey HSD                |                          |                       |            |      |                         |      |
| (I) Groups               | (J) Groups               | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |      |
| Positive                 | Negative                 | 2.100                 | .939       | .083 | -.23                    | 4.43 |
|                          | Neutral emotion stimulus | 1.200                 | .939       | .419 | -1.13                   | 3.53 |
| Negative                 | Positive                 | -2.100                | .939       | .083 | -4.43                   | .23  |
|                          | Neutral emotion stimulus | -.900                 | .939       | .609 | -3.23                   | 1.43 |
| Neutral emotion stimulus | Positive                 | -1.200                | .939       | .419 | -3.53                   | 1.13 |
|                          | Negative                 | .900                  | .939       | .609 | -1.43                   | 3.23 |

## APPENDIX B

### MATERIALS/INSTRUMENT

#### 1) POSITIVE AND NEGATIVE AFFECT SCHEDULE (PANAS)

### Positive and Negative Affect Schedule (PANAS)

INSTRUCTIONS: This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you GENERALLY feel this way, that is, how you feel on the average.

|                  | Very slightly or not at all | A little | Moderately | Quite a bit | Extremely |
|------------------|-----------------------------|----------|------------|-------------|-----------|
| 1. Interested.   | 1                           | 2        | 3          | 4           | 5         |
| 2. Distressed.   | 1                           | 2        | 3          | 4           | 5         |
| 3. Excited.      | 1                           | 2        | 3          | 4           | 5         |
| 4. Upset.        | 1                           | 2        | 3          | 4           | 5         |
| 5. Strong.       | 1                           | 2        | 3          | 4           | 5         |
| 6. Guilty.       | 1                           | 2        | 3          | 4           | 5         |
| 7. Scared.       | 1                           | 2        | 3          | 4           | 5         |
| 8. Hostile.      | 1                           | 2        | 3          | 4           | 5         |
| 9. Enthusiastic. | 1                           | 2        | 3          | 4           | 5         |
| 10. Proud.       | 1                           | 2        | 3          | 4           | 5         |
| 11. Irritable.   | 1                           | 2        | 3          | 4           | 5         |
| 12. Alert.       | 1                           | 2        | 3          | 4           | 5         |
| 13. Ashamed.     | 1                           | 2        | 3          | 4           | 5         |
| 14. Inspired.    | 1                           | 2        | 3          | 4           | 5         |
| 15. Nervous.     | 1                           | 2        | 3          | 4           | 5         |
| 16. Determined.  | 1                           | 2        | 3          | 4           | 5         |
| 17. Attentive.   | 1                           | 2        | 3          | 4           | 5         |
| 18. Jittery.     | 1                           | 2        | 3          | 4           | 5         |
| 19. Active.      | 1                           | 2        | 3          | 4           | 5         |
| 20. Afraid.      | 1                           | 2        | 3          | 4           | 5         |

**Scoring:**

**Positive Affect Score:** Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 – 50, with higher scores representing higher levels of positive affect.  
Mean Scores: 33.3 (SD±7.2)

**Negative Affect Score:** Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 – 50, with lower scores representing lower levels of negative affect.  
Mean Score: 17.4 (SD ± 6.2)

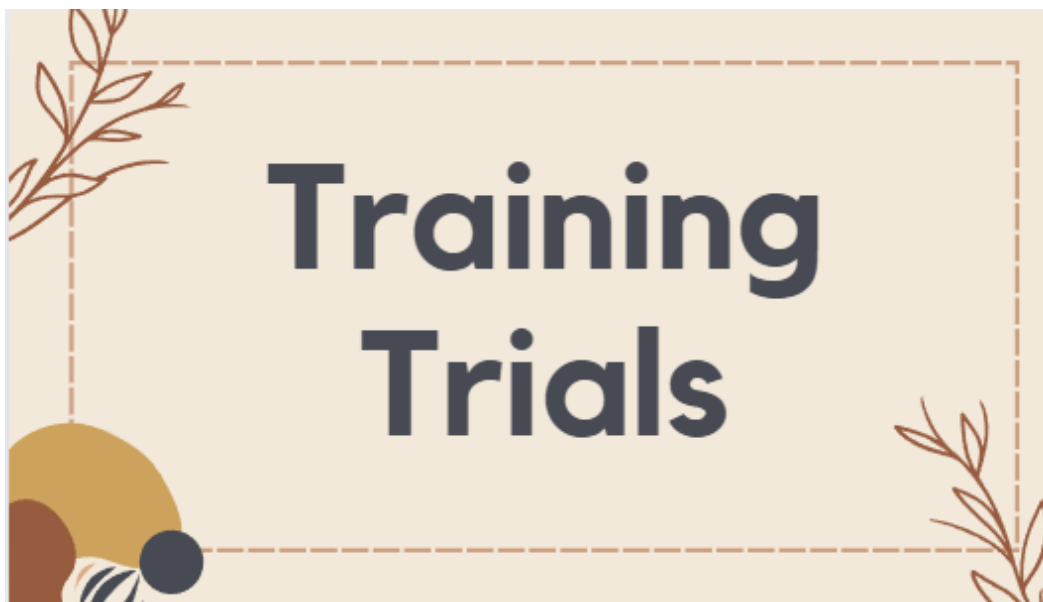
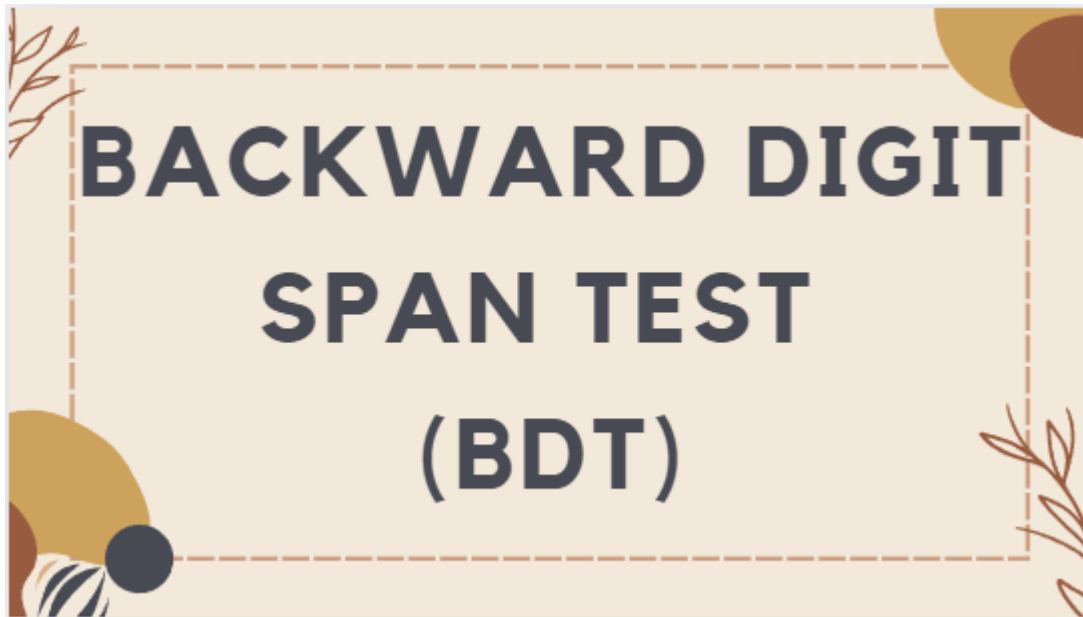
**Your scores** on the PANAS: Positive: \_\_\_\_\_ Negative: \_\_\_\_\_

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, 54(6), 1063.

## 2) Backward Digit Span Test (BDT)

Link to canva: [https://www.canva.com/design/DAF\\_kR2tUZ4/rFYRve-YvXowE3tPmrpA1Q/edit?utm\\_content=DAF\\_kR2tUZ4&utm\\_campaign=designshare&utm\\_medium=link2&utm\\_source=sharebutton](https://www.canva.com/design/DAF_kR2tUZ4/rFYRve-YvXowE3tPmrpA1Q/edit?utm_content=DAF_kR2tUZ4&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton)

Sample of Test:



9

6

2

## APPENDIX C

### ELECTRONIC INFORMED CONSENT FORM

#### ELECTRONIC INFORMED CONSENT FORM (BORANG PERSETUJUAN/KEIZINAN PESERTA ELEKTRONIK)

By clicking on the "agree" button indicates that:

*(Dengan menekan butang "setuju", saya mengesahkan bahawa):*

1. I have been read and understood the information for the above study. *(Saya telah telah membaca dan memahami segala maklumat maklumat tentang penyelidikan di atas).*
2. I have sufficient time to consider participation in the study. *(Saya telah diberikan masa yang secukupnya untuk mempertimbangkan penyertaan saya dalam penyelidikan ini).*
3. I understand that my participation is voluntary, and I can freely withdraw my participation from the study without giving a reason. I understand the risks and benefits related to my participation in the study. *(Saya juga faham bahawa penyertaan saya adalah secara sukarela dan pada bila-bila masa saya bebas menarik diri daripada penyelidikan ini tanpa harus memberi sebarang alasan. Saya juga memahami tentang risiko dan manfaat penyelidikan ini).*
4. While information gained in this study, it may be used in a conference presentation, and may also be published in a journal article, I will not be identified. Information concerning me will remain strictly confidential. *(Kajian ini boleh dibentangkan di persidangan dan kajian ini juga boleh diterbitkan didalam jurnal, dengan syarat diri saya tidak akan dikenal pasti. Maklumat mengenai diri saya akan disimpan secara sulit).*
5. I understand that study investigators, qualified monitors and auditors, the sponsor or its affiliates, and governmental or regulatory authorities, have direct access to my record in order to make sure that the study is conducted correctly, and the data are recorded correctly. All personal details will be treated as **STRICTLY CONFIDENTIAL**. *(Saya faham bahawa penyelidik, pemantau dan juruaudit terlatih, pihak penaja atau gabungannya, dan pihak berkuasa kerajaan atau undang-undang, mempunyai akses langsung dan boleh menyemak laporan saya bagi memastikan penyelidikan ini dijalankan dengan betul dan data direkodkan dengan betul. Segala maklumat dan data peribadi akan dianggap sebagai SULIT.)*

I have read and understood the informed consent form and have agreed to participate in this study willingly.

\*

☐ Yes, and I willingly agree to participate in the study.