



THE EFFECTS OF MUSIC AND GENDER DIFFERENCE ON ATTENTION AND
MEMORY TEST PERFORMANCE AMONG UNDERGRADUATES IN MALAYSIA: A
FEASIBILITY STUDY

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The Effects of Music and Gender Difference on Attention and Memory Test Performance
among Undergraduates in Malaysia: A Feasibility Study

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This research project is submitted in partial fulfilment of the requirements for the Bachelor of Arts and Social Science (Hons) Psychology, Faculty of Arts and Social Science, Universiti Tunku Abdul Rahman. Submitted on August 2019.

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AREAL LEE ROMIE

FERNANDA GWEE QING ERR

MUSIC AND GENDER DIFFERENCE: ATTENTION AND MEMORY

APPROVAL FORM

This research paper attached hereto, entitled “The Effects of Music and Gender Difference on Attention and Memory Test Performance among Undergraduates in Malaysia: A Feasibility Study” prepared and submitted by Areal Lee Romie and Fernanda Gwee Qing Err in partial fulfillment of the requirements for the Bachelor of Arts and Social Science (Hons) Psychology is hereby accepted.

Supervisor

Mr. Tay Kok Wai

Date: _____

MUSIC AND GENDER DIFFERENCE: ATTENTION AND MEMORY

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Abstract

A feasibility study was conducted to determine the applicability of CANTAB on examining the effects of different stimuli (music) on attention and memory performance of Malaysian undergraduates. In a repeated-measures design, 13 undergraduates completed two CANTAB test, PAL and RVP in silence and while listening to self-selected music and 15 Hz alpha brainwave music. The results of the current study have supported alternative hypotheses that there are no significant differences between attention and memory in three different conditions. Participants were more distracted in self-selected music condition. Furthermore, significant difference in gender was also not found among undergraduates on attention and memory tests performance. In conclusion, this study suggested that the CANTAB is not feasible to measure the attention and memory tests performance in different music settings. Thus, future researchers were suggested to look on others more useful measurements or assessments to further investigate the related study. The discussion highlighted the theory of capacity model of attention.

Keywords: Attention, Memory, Silence, Self-selected Music, Alpha Brainwave Music, CANTAB

DECLARATION

Hereby, we declare that this project entitled “The Effects of Music and Gender Difference on Attention and Memory Test Performance among Undergraduates in Malaysia: A Feasibility Study” is a record of original work done by us under the guidance of Mr. Tay Kok Wai, submitted to Universiti Tunku Abdul Rahman in the partial fulfilment of the requirements for Bachelor Degree of Arts and Social Science (HONS) Psychology. The due acknowledgement has been given in the bibliography and references to ALL sources, be it printed, electronic or personal.

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List of Abbreviations

CANTAB	Cambridge Neuropsychological Test Automated Battery
PAL	Paired Associates Learning Test
RVP	Rapid Visual Information Processing Test
MCMC	Malaysian Communication and Multimedia Commission
Hz	Hertz
NETSCC	National Institute for Health Research Evaluation, Trials and Studies Coordination Centre
PALFAMS28	Paired Associates Learning First Attempt Memory Score 28
RVPA'	Rapid Visual Information Processing Test A-Prime
SPSS	Statistical Package for Social Science

Chapter I

Introduction

Background of Study

Music is usually defined as a ubiquitous art form that plays an important role in human experience and history (Levitin, 2007). It brings certain desired effects on humans when encountering into different background situations (Sigman, 2005). The upsurge in the new technologies has made an appearance out of listening to music while engaging in daily activities (Harmon, Troester, Pickwick, & Pelosi, 2008). There are different types of music available for various occasions and culture. Apart from culture music, people prefer a different kind of music while being in the car, at shopping mall, at a restaurant, party or cafe. It is also one of the best options for travellers to get rid of boredom during the long travel time. Rentfrow (2012) has found out an average person in the United States listen to the music about 18 hours per week. As per the survey done by the Malaysian Communication and Multimedia Commission (MCMC, 2017), it reported that the number of Malaysian internet users was increased to 72.7% in 2017. Recent technology advances in digital music have made our access to music very easy and resulted one can listen to at any place or time as per their own choice.

The notion of ‘good brain functions’ was thus widened with the engagement of music as Kuzmich (2010) explored the great lasting effects of music on certain human brain function. Music has long been known to have positive effects on learning (Kotsopoulou & Hallam, 2010; Strachan, 2015). Giles (1991) states that majority of students perform very well with the presence of the right music at the right time. Results from the past extant studies have shown music is one of the effective ways that can be beneficial to the students’ learning. Levitin (2007) states that people are able to recognize some subtle pitch, rhythm, or even the changes in

harmony. These sophisticated listening abilities of human can be explained that the elementary school students, who started to sing the ABC song, can easily memorize the 26 Alphabets. Besides, many of the students also claim that listening to music while studying is effective (Patton & Offenbach, 1978; Patton, Stinard, & Routh, 1983; Stacey, Anderson, & Fuller, 2010; Strachan, 2015). Studies of the effects of music on learning have been an area of concern to researchers for many years. A number of studies support the contention that listening to music may have positive influence on cognitive abilities (Furnham, Trew, & Sneade, 1999; Hall, 1952; Ravaja & Kallinen, 2004), as well as the psychological (Lin et al., 2009), behavioural (Hallam & Price, 1998), emotional functions (Cevasco, 2008), and even facilitates the athletes' performance in sport activities (Ghavam-Bakhtiar, Mikbakht, Ziaee, & Mohammadi, 2012; Hamzah & Shabri, 2014). In the light of these studies, it is expected that the content and approaches of music would be geared towards effectively to prove that it can be an indispensable form to influence or even enlighten our lives.

Concentration that individual pay is depends on the amount of the attention he or she commits to a certain task (Tze & Chou, 2010). Therefore, the study of attention should be done before examining the impacts of music on attention. A variety of studies have demonstrated that music stimulus increased the concentration on performing a task (Cockerton, Moore, & Norman, 1997; Flood, 2007; Keyhani & Shariatpanahi, 2008), while some claim that music stimulus negatively on attention. In a meanwhile, some studies have illustrated pop music as a distractor on cognitive performance (Furnham & Bradley, 1997; Dobbs, Furnham, & McClelland, 2011).

According to Goldstein (2011), memory is a process that retains, retrieves, and used information that is no longer present. An extensive amount of research in the field of music discussed that it places heavy demands on improving memory (Kang & Williamson, 2014;

Keyhani & Shariatpanahi, 2008; Rauscher, Shaw, & Ky, 1993), as well as enhancing the learning of language (Legg, 2009). Despite the fact that there are lots of positive evidences, there are contradictory studies that assert the negative effects of music on memory (Pietschnig, Voracek, & Formann, 2010; Ravaja & Kallinen, 2004). There is also evidence showed music has no beneficial effect on verbal learning (Jäncke & Sandmann, 2010).

A plethora of music genre available place higher demands on understanding how different types of music impact the performance. In the past decades, the idea of using Mozart Effect as background music promotes learning, improves attention, memory and more have presented positive effects in available studies (Campbell, 1997; Rauscher, Shaw, & Ky, 1995; Savan, 1999). Recently, the alpha brainwave music has become more popular. About 6,910,000 results of the key-words 'brainwave music' are available on the internet (Li, 2012). Several studies have found out that alpha brainwave music has been treated as a function of relaxation (Wagner & Tilney, 1983; Abdou et al., 2006). Researchers then think there is a need for studying the impact of alpha brainwave music on cognitive sensory, as well as the motor abilities (Li, 2012).

Problem Statement

In the early 1800s, Schopenhauer has expounded his thoughts regarding the importance of music. Keeping in view the effects of music, it deserves a far more profound and thorough attention as its impacts is beyond our own self and the way we understand ourselves (Schopenhauer, 1819). While many of the researchers have explored the potential music to enhance various types of performance, the effects of music on attention and memory show no clear trend.

According to Etaugh and Michals (1957), participants in their study claimed that the presented background music enhances their attention on reading comprehension. A few years later, Hallam and Price (1998) showed similar results that music helps students to score well on Mathematics. Strachan (2015) also found a positive result on music affects children's attention in the class settings. In fact, the results are mixed. There might be some contradictory findings provided evidence that listening to music could withdraw attention, or even worsening the performance (Dobbs, Furnham, & McClelland, 2011). In comparison, fewer explorations have been undertaken by past researchers that the potential of music to lift undergraduate's attention during a test. Therefore, to be able to make a solid statement, it is necessary to have a clear examination whether music could withdraw undergraduate's attention from test performance, thereby worsening the score achievement (Kämpfe, Sedlmeier, & Renkewitz, 2010).

Several reasons for suspecting that listening to music may interfere the memory (Kotsopoulou & Hallam, 2010; Dodge, n.d.). Interestingly, a study conducted by Groot (2006), hypothesized that participants have better performance in memorizing foreign language while listening to music compared to the silent setting. Stacey, Anderson, and Fuller (2010) however, found out that memory has no significant increases or decreases in the silent setting. One potential issue is that there is a lack of latest research claimed a clear effect of music on attention on different age groups especially with undergraduates. With the lack of consistent results, it becomes a salient reason why investigating the impact of music on memory among local undergraduates is important.

Many studies have highlighted how different types of music may influence the performance of cognitive tasks, but have shown ambiguous evidence on this issue. Some available studies confirm that loud, noisy, and lyrical music is most distracting (Bugter & Carden,

2012; Cassidy & MacDonald, 2007; Furnham & Bradley, 1997; Furnham & Stephenson, 2007; Kämpfe, Sedlmeier, & Renkewitz, 2010; Thompson, Schellenberg, & Letnic, 2011; Tze & Chou, 2010), while some studies addressed that soft, slow, and sedative music led to better performance on certain cognitive task (Cockerton, Moore, & Norman, 1997; Hallam, Price, & Katsarou, 2002). However, Mayfield and Moss (1989) have reported listening to rock music has greater benefit compared to slow-pace music.

Regardless of these studies, some studies have explored the potential of self-selected music to enhance cognitive as well as academic performance. For example, Cabanac, Perlovsky, Bonniot-Cabanac, and Cabanac (2013) confirmed their hypothesis that self-selected music could help in enhancing their academic performance. Self-selected music also has the potential to elicit better exercise performance (Biagini et al., 2012; Chizewski, 2016). Widerman (2013) suggested that participants might be negatively affected by researcher-selected music. Although there are advantages of self-selected music are shown in past studies, many of the studies provide only weak support for the idea that self-selected music can be beneficial to attention and memory test performance.

There exists no explicit technique to allocate various signs to each type of music as per the effect sizes in comparison because of vast types of music available in the literature. Notwithstanding, a large number of previous studies only dig into music genre, volume, and tempo. The tempo of music may be found commonly influence negatively in learning, but few of them showed the consistent results that which types of music place greater demands on attention and memory. This raises the question, does listening to music aid attention and memory, if so, what genre is the most effective. In sum, this study attempts to identify whether the alpha

brainwave music and self-selected music has an effect on the attention and memory test performance of the selected random undergraduates.

Some studies actually investigated that there is a gap between the academic performance between male and female students. Female students frequently reported outperform in academic than male students (Pomerantz, Altermatt, & Saxon, 2002; Ratminingsih, 2012). Although studies concluded that males have bad academic performance, they have been reported to have better performance in music (Green, 1997) than females (Bjorck, 2011). However, gender differences in attention and memory test performance are incompletely characterized. Therefore, there is little studies available clarified possible gender difference on attention and memory test performance with or without the background music present.

The current feasibility study aimed to determine whether the CANTAB (Cambridge Neuropsychological Test Automated Battery) is applicable to use as a tool to measure the attention and memory performance.

Research Objectives

1. To determine the suitability and the applicability of the CANTAB tasks (feasibility study) in measuring the effects of music on attention and memory performance.
2. To identify whether music has an effect on the undergraduate's attention and memory test performance in the Malaysian context.
3. To investigate how alpha brainwave music, self-selected music, and silent setting may pose an impact on undergraduate's attention and memory test performance.
4. To identify the gender differences in attention and memory test performance.

Research Questions

Below are the research questions in our study:

1. Does listening to music affect undergraduates' attention test performance among Malaysian undergraduates?
2. Does listening to music affect undergraduates' memory test performance among Malaysian undergraduates? Is there a relationship between career indecision and intuitive decision-making style?
3. Is there any gender difference in attention test performance?
4. Is there any gender difference in memory test performance?
5. How is the feasibility of attention and memory test from CANTAB on measuring the attention and memory tests performance in three different conditions?

Research Hypotheses

Research questions 1:

H₀: There is no significant difference in attention test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

H₁: There is a statistically significant difference in attention test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

Research question 2:

H₀: Null Hypothesis: There is no significant difference in memory test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

H₁: There is a statistically significant difference in memory test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

Research question 3:

H₀: There is no significant difference between males and females in attention test performance.

H₁: There is a significant difference between males and females in attention test performance.

Research question 4:

H₀: There is no significant difference between males and females in memory test performance.

H₁: There is a significant difference between males and females in memory test performance.

Research question 5:

H₀: The attention and memory test from CANTAB is not feasible on measuring the attention and memory performance in three different conditions.

H₁: The attention and memory test from CANTAB is feasible on measuring the attention and memory performance in three different conditions.

Significance of Study

In the early time, studies conducted that students regularly do homework with listening to music (Cantril & Allport, 1935; Beentjes, Koolstra, & Vroot, 1996) and the expanded technologies make sense for this practice to continue until today. On top of that, students practicing in music have been identified that they perform better on academic (Cabanac,

Perlovsky, Bonniot-Cabanac, & Cabanac, 2013). Perhaps music can be helpful in many way, this study unfold the possibility to experimenting with more than one genre of music.

Current study and its outcomes will bring a great contribution to the society's well-being as music has a crucial role in both aspects of attention and memory. Thus, the greater demand for undergraduates with better academic performance justifies the need for more effective teaching approaches. The investigation of the music effects on undergraduates attention and memory test performance furnishes significant findings to students, educators, and parents with regard to engagement with music can create positive and lasting effects on human.

In addition, different music may have different effects on attention (Shih, Huang, & Chiang, 2012). The expanded research of various types of music would be beneficial when people, especially students and educators attempt to use music as instruments to enhance learning. Therefore, this study will bringing a solid data to the society about what types of music promotes benefits of on enhancing the attention and memory, as well as improving students' performance in academic.

Furthermore, the investigation from the Malaysian undergraduates may lead the study provides an internal glimpse to undergraduates with more broaden information and understanding in the topic of music or no music stimulates attention and memory.

Last but not least, investigation of gender difference in task performing with or without the presence of background music has little research and is deficiency. Therefore, the aim of this study is to provide a rich source of support for the future researchers.

Definitions of Terms

Conceptual and Operational Definition

Attention. Attention is not a unitary phenomenon, but indicates different types of structures which are alertness, orientation, preconscious registration that means detection without awareness, selection which means detection with awareness within selective attention, facilitation, and inhibition (Schmidt, 2010). Moreover, attention is a mental activity that enables an individual to focus and this can lead to a person can absorb a restricted part of the large pool of data available through sensory and memory (Fernandez-Duque & Johnson, 2002; Styles, 2006; Ward, 2004).

In this research, Rapid Visual Information Processing Test, RVP (Cambridge Cognition, 2015) will be used to assess participants' sustained performance and visual constant attention. In the centre of the screen, there is a white box which single digits are displayed in a pseudo random sequence at a rate of 100 digits per minute. Participants are required to detect a set of target sequences, for instance, 2, 4, 6; 4, 6, 8; 3, 5, 7 and participants have to touch the button so that the responses are recorded. Nine target sequences appear every 100 numbers.

Memory. Memory is an active and constructive process as it has the function of storing and processing information, renewing existing knowledge when new data is obtained, and comparing one experience to another (Robertson, 2002). In addition, memory usually does not strengthen when the retrieval information is similar to the converted data (Nairne, 2005). According to McGaugh (2000), memory is developed through a temporary and delicate condition to a relatively permanent state.

In this study, Paired Associates Learning (PAL) will be used to assess participant's memory performance. PAL is a test which demands participants' recall of a position that was paired with an object earlier (Cambridge Cognition, 2015). The test includes a number of stages that the participants have to complete in order. For each stage, boxes are displayed on the screen

and these boxes open once at a time in a randomised order. One or more of the consisting a pattern. The patterns shown in the boxes are then appeared once at a time in the centre of the screen, and the participant is required to touch the box where the pattern was originally located.

Gender. In psychology, the term gender is utilized in the same meaning with the term sex, which is in relation on the classification of a person as a male or female based on biological traits (Crawford & Fox, 2007; Haig, 2004; Vanwesenbeeck, 2009).

In this study, the *Independent-sample T-test* will be utilized to check the significant difference among males and females (Myhre, 2014) on memory and attention test performance which based on participants' self-report.

Chapter II

Literature Review

Music has been proven to help improve memory, as well as increasing attention, and release tension (Brewer, 1995). In the review of the literature that related to this study, there were various studies about attention, memory, types of music, and also gender difference.

Background Music's Influence on Attention

It is important to look at the study of music influence attention because how well does an individual can concentrate depends on the amount of attention that he or she dedicated to certain task (Widerman, 2008). Research on the benefits of music on attention has been described in various available articles.

In the clinical setting, a study conducted by Khalaf-Beigi, Akbarfahimi, Ashayeri, Dorood, and Doostdar (2012) chose to focus on the effect of music activities on attention. The study recruited 55 patients with schizophrenia from the Association of Schizophrenic Patients and was randomly divided into both experimental group and control group. The result showed the positive effect of music on attention in participants (Khalaf-Beigi et al., 2012).

Strachan (2015) also reported a beneficial effect. Participants include 61 children with the age ranged from three to six years old. Observations of children's behaviour were done with both classrooms with and without background music. Students, as well as the teacher tended to smile more, talkative, and become more productive when background music was present. The final results concluded that music has a significant positive effect on children's attention in the classroom (Strachan, 2015). Although the results showed positive effect of music on attention in

learning setting, the evidence of the music enhance student's attention on test performance is still not conclusive.

Furthermore, a study was done by (Sujaya, 2013) in the Malaysian context. 80 elementary school children were chosen to participate in this study. Two classes have been divided into experimental setting and non-experimental setting. The result proved that students who were treated by background music tend to have higher reading comprehension scores than the students who were not treated by background music. It could be concluded that the implement of music has a positive result on the students' task performance.

Studies have emphasized there is a strong relationship between attentiveness and task performance (Haake, 2011; Tze & Chou, 2010). Conversely, Stacey, Anderson, and Fuller (2010) explored the effect of music on student academic performance. The sample included students from five difference public junior high school in southwestern Arizona. Two standardized reading comprehension and two environmental conditions, which include a typical classroom and another same classroom but with lyrical music playing. Over the two days of the experiments, participants were randomly assigned to one of four groups. The results showed that students performance declined significantly when listening to music compared to the quiet setting (Stacey et al., 2010). One thing should be highlighted, this study has not assessed the possible attentional deficits of students could have influenced their comprehension scores, and students were also unaware that music has place impact on the amount of their attention on completing the tests.

Kotsopoulou and Hallam (2010) decided to consider to effect of background music in the classroom on second year of both high school and university students from Japan, United Kingdom, United States, and Greece. 600 participants were separated into three age groups, 12 to

13, 15 to 16, and 20 to 21 years old. They were requested to complete a five-point Likert scale questionnaire regarding their use of music while studying. However, the overall results from this study indicated that despite students from different age groups or different cultural environment, they do not prefer playing music while studying extensively (Kotsopoulou & Hallam, 2010). Students aware that listening to music while studying could impair their attention on performing some tasks especially those involved with cognitive process.

Haake (2011) evaluated the background music affects working adults. Some of the participants described that listening to music in the office can influence attention. They have claimed that listening to music is impossible to concentrate properly on work. Thompson, Schellenberg, and Letnic (2011) stated that fast and loud music hinders performance. Their examination on 25 adults completing reading comprehension has suggested that participants could not focus on reading passages while listening to the background music. Nevertheless, research done by Kämpfe, Sedlmeier, and Renkewitz (2010) also concluded that there is not always a uniform effect of background music on attention.

Background Music's Influence on Memory

The research done by Kotsopoulou and Hallam (2010) shows that music not only hinders the attention of students on performing certain tasks, it may also report negative outcomes in memory. Participants in this study reported that listening to background music while studying will influence their memorizing performance.

Fassbender, Richards, Bilgin, Thompson, and Heiden (2012) have discussed the background music affects participants' memory for facts in a computer-animated history lesson.

The result showed music may hinder memory in a study or learning setting, but will increase the mood and performance in sports activities.

There are positive outcomes of music when applied in a therapy setting inclusive of all of its limitations. In the study conducted by Felix (1993), she concluded that background music has a positive effect on learning. Results showed that the children participants' retention is the best when baroque and classical types of music were played during the learning and testing (Felix, 1993).

Groot (2006) evaluated the effect of music on undergraduates. The sample for this study included 36 first year psychology undergraduates in the University of Amsterdam. Undergraduates were split in half, 18 in music condition, and another half in the silent condition. Interestingly, the overall results from Groot's (2006) experiment showed participants have better performance in memorizing foreign language while listening to music compared to those in a silent setting.

In sum, the various previous studies showed that music can lead to positive impact and also negative impact on attention and memory. Thus, this study aimed to further examine the effects of music on attention and memory.

Types of Music

The preference in music of students is playing a role in the total music experience in relevance to studying. For instance, analysis by (Schuster, 1985) proposes soft baroque music whereas Mammarella, Fairfield and Cornoldi (2006) recommend Vivaldi as a suitable genre to boost cognitive performance which is notably among the elderly. The musical favourable choice of college age students are constantly changing; so, a musical taste for baroque music utilized in

40-year-old analysis or music utilized in analysis within the older adults might barely be anticipated to attract the young adult of the 21st century (Schuster, 1985).

Self-selected music raises productiveness leading an individual to achieve certain goals. It has been proved that self-selected music can be utilized to boost overall productivity (Oldham, Cummings, Mischel, Schmidtke, & Zhou, 1995). Thus, self-selected music is playing a role to increase relaxation and motivation of an individual, and this will leads to positive impact towards students to develop calmness and productivity in study efforts.

In a research by Burns, Labbé, Williams, and McCall (1999), participants who listened to self-selected music for 15 minutes have higher perceived levels of relaxation against benchmark which is 57%, whereas participants who listened to hard rock music only scored 26% and only 39% for classical music for the similar extent of time.

Contrary to Delta and Theta, Alpha (8-12Hz) band normally is formed when an individual is in a conscious state (Murat et al., 2009), for example, when an individual takes a rest after finishing a particular work. The Alpha mode is built up during calm and relaxes circumstances (Kadir et al., 2010). The alpha band can enhance relaxed mood of a person, and this will leads to developing calmness (Kadir et al., 2010). In addition, a relaxed mood promotes a lower level of anxiety and this condition is not only able to help the progress of capturing information, but also boosting learning rate (Hassan, H., Murat, Z. H., Ross, V. & Buniyamin, N., 2012). Throughout this mode, the human brain will interpret data and take in nearly all of the information without difficulty because of the relax-but-aware brain state (Hassan et al., 2012). As a result, researches will usually aim on the Alpha brainwave to carry out the studies in relation to the impacts of music towards learning.

Gender Difference

In several of gender stereotypes, females always reported to have better short-term memory and remember things better than males. For example, birthdays, anniversaries, many more. However, males reported to have better performance working in the mathematics and science fields.

To prove the above statement, a study of Gemmert & Galen (1997) said that females tend to be more efficient and creates helpful method to enhance their memory. Females are also being good at recalling and remembering (Gemmert & Galen, 1997).

Gender difference found in a previously published study showed that females have better performance than males on tests of attention, memory, and social cognition. Females obtained more accurate scores than males on attention and working memory. Lower accuracy among males on attention has positive significant relationship with the higher percentage of attention deficit disorder among males (Ramtekkar, Reiersen, Todorov, & Todd, 2010).

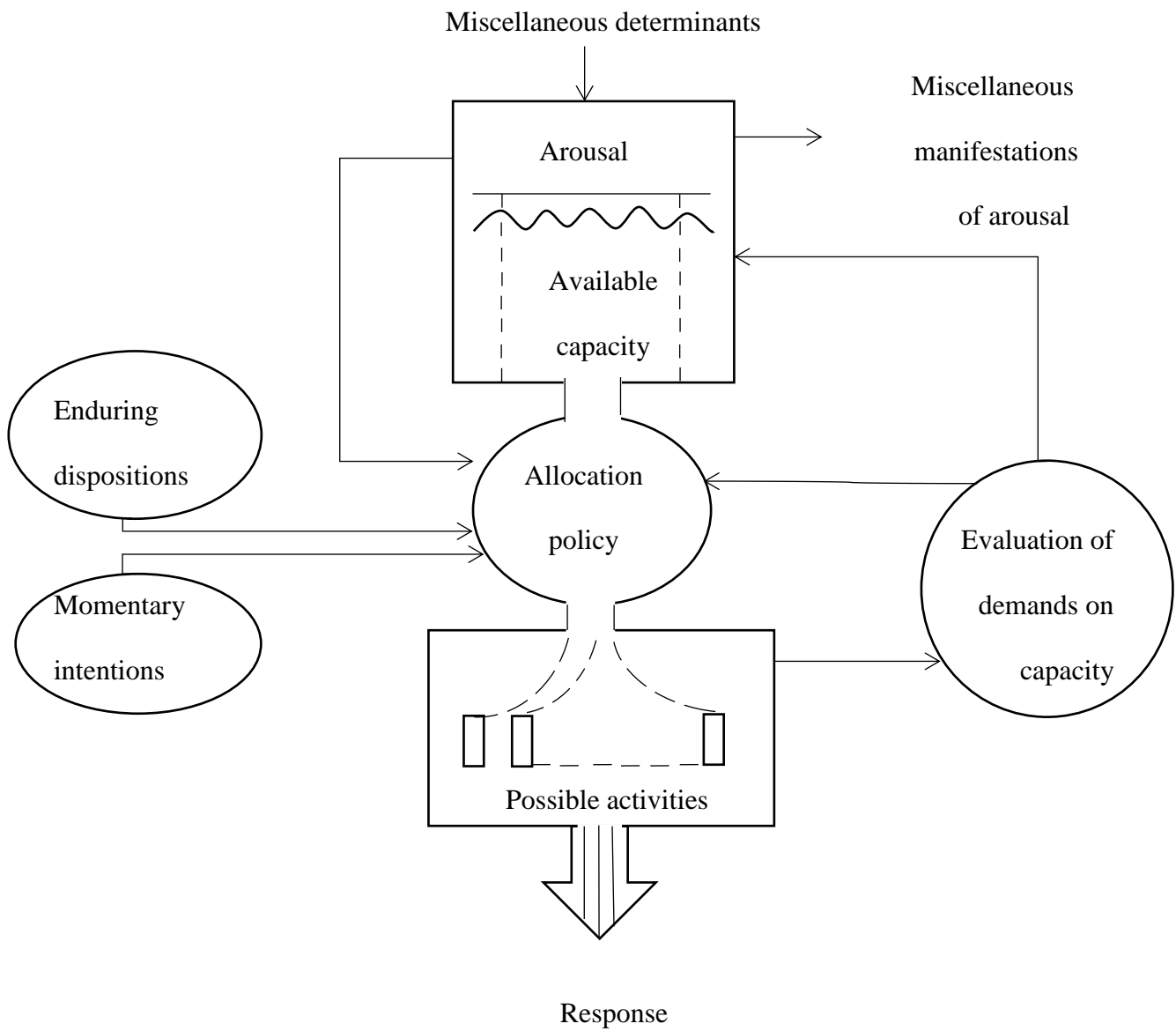
Theoretical Framework

Capacity Model of Attention. This study was based on Kahneman's capacity model of attention. Capacity theories are concerned with the amount of mental effort required to perform a task (Reed, 2010). Kahneman's (1973) argued that a capacity theory assume that a person has a limit capacity on performing mental work.

The capacity model of attention from Kahneman (1973) has provided a theoretical base on how cognitive tasks can be distracted by various types of music. Kahneman predicts that several activities are likely to interfere with each other, and this interference only happens when the demands of both activities exceed available capacity (Reed, 2010). This study focuses on

music affects undergraduate’s attention and memory tests performance. In addition, the main goal of this study is to determine the variables of alpha brainwave music and self-selected music creates the most amount of interference and which type of music creates benefits to enhance attention and memory.

Figure 1. *Theoretical framework of Capacity Model of Attention.*



Conceptual Framework

This study aims to investigate the effects of music in attention and memory test performance, as well as the gender difference in attention and memory test performance. In this study, music and gender difference represent the independent variables (IVs), whereas attention and memory represent the dependent variables (DVs).

Music can be classified into two types as shown in Figure 2. The music settings and no music setting are hypothesised to predict impacts on attention and memory test performance as well as the gender differences on both test performance by the theoretical base provided by capacity model of attention. This study intends to investigate whether the alpha brainwave music and self-selected music create improvement or interfere the attention and memory test performance.

There are two main concepts proposed by capacity model of attention. First, attention can be distributed among several types of concurrent activities and the arousal level of each activity could lead to either negative or positive outcomes in attention. The second concept is the pressure of every specific individual task that is carried out in an undisturbed setting is a factor that influences ones capability to carry out some mental activity at the same time. This study will be using two kinds of music to determine if the music would affect participant's concentration on the task.

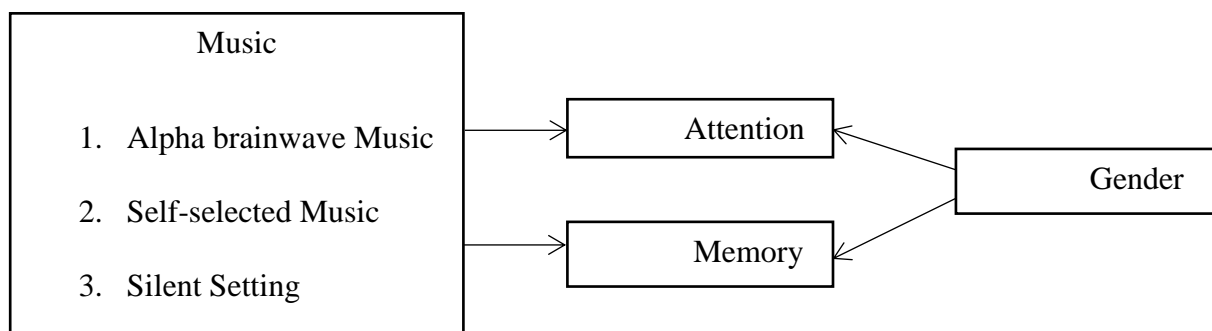


Figure 2. *The conceptual framework of “Effects of music and gender difference on attention and memory test performance among undergraduates in Malaysia”.*

Chapter III

Methodology

Research Design

A cross-sectional feasibility study was utilized by current study in order to examine the effects of music on attention test and memory test performance, as well as the possible gender differences in attention and memory test performance among Malaysian undergraduates, and to determine whether the CANTAB is feasible on measuring the memory and attention performance in silent condition, self-selected music condition, and alpha brainwave music condition among Malaysian undergraduates. The repeated measures design was used in current study to prevent the test sequence bias when investigating the effectiveness of both attention and memory tests. This design has been widely used in the experimental studies (Ball, McKenry, and Price-Bonham, 1983; Liu, Li, Cumberland, and Wu, 2005; Vickers, 2003). Moreover, this design may also be an alternate in increasing the precision of an estimate (Vickers, 2003).

Research Sample

Research population. This study comprised of 13 of undergraduates whose age ranged from 20 to 25 years old ($M = 22.5$). Participants were recruited using purposive sampling from the populations of Universiti Tunku Abdul Rahman (UTAR) undergraduates. The used of this non-probability sampling is to maintain the focus of the current study, as it is geared toward whether CANTAB is applicable in measuring the effects of no music, self-selected music, and alpha brainwave music condition on undergraduates' attention and memory tests performance, only those undergraduates who are preferring to listen to music while performing other tasks were engaged in current study in order to reduce the rate of error variability.

Research Location

This study was focused mainly on undergraduates that reside on the west side of Malaysia, conducted in Kampar, Perak as the experiment settings was located at the university's laboratory and library discussion room.

Sample Size Justifications

According to the National Institute for Health Research Evaluation, Trials and Studies Coordination Centre (NETSCC, 2012), feasibility study can be defined as a specific research being carried out prior to the main study with the purpose of answering the question 'can this study be done?', which is to predict any crucial parameters in the process of forming the main study. The current study recruited 13 Malaysian undergraduates with the sample size met the requirement of the feasibility study which is 12 recommended by Julious (2005). Previous studies have suggested that neither a large sample size nor format sample size calculation is required for feasibility or pilot study (Carhart-Harris et al., 2016; Orsmond & Cohn, 2015; Rand, Eng, Liu-Ambrose, & Tawashy, 2010; Tickle-Degnen, 2013).

Research Instruments

Paired Associates Learning (PAL). PAL is one of the memory tasks from CANTAB which assesses visual memory (CANTAB, Cambridge Cognition, Ltd; Robbins et al., 1994). In this test, participant has to complete a number of stages according to the order. Boxes from each stage will be randomly opened one at a time. A fixed pattern has been placed in one or more

boxes. Each of the patterns will be randomly appeared in the middle of the screen and participant is required to click the correct box that contains the particular pattern.

Boxes will be opened again if the participant has made an error. This is to remind the participant of the correct location of each pattern. Participants will proceed to the next stage once all the locations of patterns are correctly selected. The test is terminated when participants are unable to correctly complete the stage.

There are several modes that can be chosen. Recommended standard extended/tone had been chosen due to its applicability to test researchers' target participants. In this mode, the stages are ranged from 2-pattern stage to 12-pattern stage. Administration time is approximately 8 minutes or depending on the participants' performance. This test is flexible in changing the outcomes by analyzing the attempts. As such, by calculating the error score, the adjustment of error at those stages which were not attempted will be included.

A total number of 21 outcome measures were produced by this test. PAL First Attempt Memory Score 28 (PALFAMS28) was being chosen as it calculates the times which participant has accurately selected the correct location (box) of each pattern. Researchers have discussed with the support team from CANTAB on choosing the measure task. They have suggested PALFAMS28 which is more applicable to the current study (CANTAB, July 25, 2019).

Rapid Visual Information Processing Test (RVP) is one of the attention tasks which assess the measurement of an individual's sustained attention (CANTAB, Cambridge Cognition, Ltd; Robbins et al., 1994). A white box will appear on the screen. For each 60 seconds, there will be 100 single digits numbers ranged from two to nine appear in a pseudo-random order. A maximum of three target sequences of digits were presented at the same time and participant must respond to the sequences by clicking the button which is located below the white box. Nine

target sequences appear every 100 numbers. This test will be completed in approximately 10 minutes.

The RVP A-Prime (RVPA') outcome measure shows the sensitivity of participant to the target, ranged from 0.00 which represents as bad performance to 1.00 which represents as good performance. This metric measure how well is the participant in detecting the target sequences. CANTAB support team has suggested that the RVPA' is more applicable to the current study as the current study aimed to investigate whether different types of music conditions have impacts on participant's attention performance (CANTAB, July 25, 2019).

Self-selected Music. This study has employed the self-selected music due to its ability to flexibly cater to the participant's preferred music genre over the stimulus which will be played when participating in the test.

Alpha Brainwave Music. 15 Hertz (Hz) brainwave music was selected through YouTube. In one of the study, with the 15 Hz binaural beats produced a positive impact on cognitive functions (Beauchene, Abaid, Moran, Diana, & Leonessa, 2016; Beauchene, Abaid, Moran, Diana, & Leonessa, 2017).

No Music Condition. As a control condition, no music in the past studies has shown impacts on attention and memory performance (Modi, 2018; Musliu, Berisha, & Latifi, 2017).

Research Procedure

There were two experimental conditions and a control condition in current study. A repeated-measures design was adopted and the orders of these three conditions, self-selected music, alpha brainwave music, and no music, were counterbalanced. The first dependent variable which is RVP attention test was the within-subjects dependent variable with three conditions: (a)

no music condition, (b) self-selected music condition, and the (c) alpha brainwave music condition. The second dependent variable, PAL memory test was also within-subjects dependent variable with three conditions. These two dependent variables were chosen from the CANTAB, consisted of participant's attention and memory test scores. By using repeated measures design participants were randomly assigned to an order in both experimental and control conditions. For example, no music as condition one, self-selected music as condition two, and alpha brainwave music as condition three, order one participants experienced condition two first followed by the condition three and condition one, while order two participants experienced condition three first, followed by condition one and condition two. The current study has designed four orders.

Before the experiment started, information sheet and consent form were given to the participants to fill in. The information sheet including the purpose of the current study, what would the study involved, benefits and risk, confidentiality, payment and compensation, and researchers' email addresses were provided for participants.

Participants' basic demographic information including gender, age, current study year and semester, and faculty were requested. Participants were required to provide feedback on how the experiment goes and how the tests work. Presented only in English language, each participant has spent about 60 minutes to complete all the tests in three different conditions.

CANTAB has demonstrated high test-retest reliability with Cronbach's alpha ranged from .71 to .89 (Gonçalves, Pinho, & Simões, 2016). Besides that, some concurrent validity studies indicated that CANTAB tasks showed strong inter-test correlations with Cronbach's alphas .42-.52 (Matos Gonçalves, Pinho & Simões, 2017; Torgersen, Flaatten, Engelsen & Gramstad, 2012).

Data Analysis

Statistical Package for Social Science (SPSS) program 23.0 was used to calculate the test result from CANTAB. Descriptive statistics was run to understand demographic variables of the participants. For the first and second research questions, *One-way Repeated Measures ANOVA* was used to examine the effect of different conditions on attention and memory, with α level of 0.05. For the third and fourth research questions, *Independent-sample T-test* was used to examine significant differences between males and females on attention and memory tests. Furthermore, for the fifth research question, participants' performance and duration of the test have been taken into account to see whether CANTAB is feasible on measuring the memory and attention performance.

Chapter IV

Results

Descriptive Statistic

Demographic information of participants. The demographic information of participants in this study was shown in table 4.1. There are a total of 13 participants, ages ranged from 20 to 25 ($M = 22.5$, $SD = 1.19$). In the current study, there were six females (46.2%) and seven males (53.8%). All of the participants are currently pursuing studies in UTAR.

Table 4.1

Demographic Information of Participants (N = 13)

	<i>n</i>	<i>%</i>	<i>M</i>	<i>SD</i>	Min	Max
Age			22.5	1.19	20	25
20	1	7.7				
21	3	23.1				
22	3	23.1				
23	4	30.8				
24	1	7.7				
25	1	7.7				
Sex						
Male	7	53.8				
Female	6	46.2				

Note. *n* = number of participants; *%* = percentage; *M* = mean; *SD* = standard deviation; Min = minimum value; Max = maximum value.

Test of Normality

Skewness and kurtosis tests. Skewness and kurtosis are known as a well-established descriptive statistics for distributions (Pearson, 1895). Six distributions were investigated, involving the PAL first attempt score for three different conditions and RVP A' (A Prime) score for three different conditions. These distributions had values of skewness and kurtosis, ranged between -1.96 and 1.96 (presented in Table 4.2). Hence, the data of the current study have

represented a desirable skewness and kurtosis, which means that the data was normally distributed.

Table 4.2

Skewness and Kurtosis Table

	Skewness	Kurtosis
PALFAMS28C1	-.923	-.286
PALFAMS28C2	-.325	-.543
PALFAMS28C3	-.922	.084
RVPA'C1	-.720	-.111
RVPA'C2	-.227	-.246
RVPA'C3	.221	-1.335

Note. PALFAMS28C1 = PAL First Attempt Score Condition 1; PALFAMS28C2 = PAL First Attempt Score Condition 2; PALFAMS28C3 = PAL First Attempt Score Condition 3; RVPA'C1 = RVP A Prime Condition 1; RVPA'C2 = RVP A Prime Condition 2; RVPA'C3 = RVP A Prime Condition 3.

Assumptions Report

Dependent variable. In one-way repeated measures ANOVA, a dependent variable is required to be able to measure at continuous level. For the current study, the dependent variables are attention test and memory test performance, measured using CANTAB tests. Hence, according to Laerd Statistics (2013), these dependent variables have met the criterion of this assumption.

Independent variable. The requirement of related groups for this test is two and above. This is due to the performance of the same participant was measured on different types of groups or conditions on the same dependent variable (Laerd Statistics, 2013). Current study consists of

three conditions, which are no music condition, self-selected music condition, and alpha brainwave music condition.

No significant outliers. Outliers can be detected easily by using SPSS calculation. Current study showed that there is no significant outlier (see Appendix F).

Normally distributed dependent variable. The distributions of the memory and attention test scores in different conditions were normally distributed according to the reported results from skewness and kurtosis tests, and boxplot (see Appendix F).

Sphericity. The assumption of Sphericity has been met with $\chi^2(2) = .63, p = .73$ for memory, and $\chi^2(2) = .324, p = .19$ for attention. Thus, the assumptions of the current study have not been violated.

Inferential Statistics

RO₁: There is no significant difference in attention test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

H₁: There is a statistically significant difference in attention test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

One-way Repeated Measures ANOVA was conducted to examine the effect of three different types of conditions on attention and memory tests performance. In Table 4.3, three conditions revealed the same RVP test scores as no music condition ($M = 0.92; SD = 0.49$), self-selected music condition ($M = 0.92; SD = 0.37$), and alpha brainwave music ($M = 0.92; SD = 0.51$).

Table 4.4 shows the results of tests of within subjects' effects. Results revealed no significant effect of experimental conditions and control conditions on attention test performance, as $F(2, 24) = .01, p = .996, \eta^2 = .00$. Therefore, the result has failed to support hypothesis 1.

Table 4.3

Mean and Standard Deviation of Attention Test Scores in Three Different Conditions

Condition	<i>M</i>	<i>SD</i>
No Music	0.92	0.49
Self-selected Music	0.92	0.37
Alpha Brainwave Music	0.92	0.51

Table 4.4

Tests of Within Subjects Effects of Attention

Effect	<i>MS</i>	<i>df</i>	<i>F</i>	<i>p</i>	η^2
Attention	6.247	2	.01	.996	.00

Note. *MS* = mean square; *df* = degrees of freedom; *F* = *F*-ratio; *p* = significance level; η^2 = partial eta squared.

*RO*₂: There is no significant difference in memory test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

*H*₂: There is a statistically significant difference in memory test performance between undergraduates who listen to alpha brainwave music, self-selected music, and in silence during the task.

From Table 4.5, on average, the highest PAL test score were no music condition ($M = 14.85; SD = 4.86$), followed by alpha brainwave music condition ($M = 14.69; SD = 5.34$), and self-selected music condition ($M = 13.85; SD = 3.63$).

Table 4.6 shows the results of tests of within subjects' effects. Results showed no significant effect of experimental conditions and control condition on memory test performance, as $F(2, 24) = .23, p = .796, \eta^2 = .02$. Therefore, the result has failed to support hypothesis 2.

Table 4.5

Mean and Standard Deviation of Memory Test Scores in Three Different Conditions

Condition	<i>M</i>	<i>SD</i>
No Music	14.85	4.86
Self-selected Music	13.85	3.63
Alpha Brainwave Music	14.69	5.34

Table 4.6

Tests of Within Subjects Effects of Memory

Effect	<i>MS</i>	<i>df</i>	<i>F</i>	<i>p</i>	η^2
Memory	3.769	2	.23	.796	.02

RO_3 : There is no significant difference between males and females in attention test performance.

H_3 : There is a significant difference between males and females in attention test performance.

An *Independent-sample T-test* was conducted to compare the gender on attention and memory tests performance in three different conditions. Results shown in table 4.7 indicated that males' scores on no music condition ($M = 0.92, SD = 0.04$), self-selected music condition ($M = 0.93, SD = 0.04$), alpha brainwave music condition ($M = 0.93, SD = 0.06$) have no significant difference with females' scores on no music condition ($M = 0.92, SD = 0.06$), self-selected music condition ($M = 0.91, SD = 0.04$), alpha brainwave music condition ($M = 0.91, SD = 0.04$). This result suggested the three conditions do not have effects on attention test performance no music condition, $t(11) = -0.21, p = 0.835$, self-selected music condition $t(11) = 0.81, p = 0.434$, and

alpha brainwave music condition $t(11) = 1.07, p = 0.305$. Therefore, the null hypothesis was supported.

Table 4.7

Independent-sample T-test for the Difference between Gender in Attention Tests Performance

	Male		Female		t	df	p
	M	SD	M	SD			
V1RVPA	0.92	0.04	0.92	0.06	-0.21	11	0.835
V2RVPA	0.93	0.04	0.91	0.04	0.81	11	0.434
V3RVPA	0.93	0.06	0.91	0.04	1.07	11	0.305

Note. $t = t$ -value; $p = p$ -value.

RO_4 : There is no significant difference between males and females in memory test performance.

H_4 : There is a significant difference between males and females in memory test performance.

Result showed in table 4.8 indicated that the PAL scores of males, no music condition ($M = 14.00, SD = 4.51$), self-selected music condition ($M = 14.43, SD = 4.11$), alpha brainwave music condition ($M = 15.86, SD = 3.53$) have no significant differences with females' PAL scores on no music condition ($M = 15.83, SD = 5.49$), self-selected music condition ($M = 13.17, SD = 3.19$), alpha brainwave music condition ($M = 13.33, SD = 7.01$). This result suggested the three conditions do not have effects on memory test performance, no music condition $t(11) = -0.62, p = 0.522$, self-selected music condition $t(11) = 0.61, p = 0.555$, alpha brainwave music condition $t(11) = 0.84, p = 0.418$. Therefore, the null hypothesis was supported.

Table 4.8

Independent-samples T-test for the Difference between Gender in Memory Tests Performance

	Male		Female		t	df	p
	M	SD	M	SD			
V1 PALFAMS28	14.00	4.51	15.83	5.49	-0.62	11	0.522

V2 PALFAMS28	14.43	4.11	13.17	3.19	0.61	11	0.555
V3 PALFAMS28	15.86	3.53	13.33	7.01	0.84	11	0.418

*RO*₅: How is the feasibility of attention and memory test from CANTAB on measuring the attention and memory tests performance in three different conditions?

*H*₅: The attention and memory test from CANTAB is feasible on measuring the attention and memory performance in three different conditions.

Researchers have observed and received some feedback regarding the CANTAB tests. Comments made by two of the participants suggested that the RVP attention test might cause tired eyes and headache after completion of the tests (personal communication, July 4, 2019; personal communication, July 10, 2019). For PAL memory test, six participants reported that they felt very tired and sleepy when memorizing a large number of patterns over a relatively long duration (personal communication, June 27, 2019; personal communication, June 29, 2019; personal communication, July 4, 2019; personal communication, July 5, 2019; personal communication, July 10, 2019; personal communication, July 11, 2019). Besides, researchers also received some negative comments from three of the participants who had completed their tests at night session. Three of the participants suggested that the experiment is more suitable to conduct in the morning or in the afternoon, it is because they experienced tiredness at night and it might distract their attention and memory performance (personal communication, June 27, 2019, personal communication, 4 July, 2019; personal communication, July 11, 2019).

Chapter V

Discussion & Conclusion

Feasibility of CANTAB on Measuring Attention and Memory Performance among Malaysian Undergraduates

The objective of the current study aimed to determine the applicability of CANTAB on measuring attention and memory performance among Malaysian undergraduates. The result showed that the CANTAB tasks were not feasible to the current study. This has supported the statement that the coefficients of the test-retest measured by CANTAB were low (Cacciamani, Salvadori, Eusebi, Lisetti, Luchetti, Calabresi, & Parnetti, 2017).

CANTAB has been widely used in clinical populations especially in mild cognitive impairment (MCI) and Alzheimer's disease (AD) patients (Cummings, Gould, & Zhong, 2012; Juncos- Rabadán, Pereiro, Facal, Reboredo, & Lojo-Soane, 2014; Summers & Saunders, 2012), as well as attention deficit/hyperactivity disorder (ADHD; Gau & Shang, 2010). As the current study recruited 13 students which categorized in healthy populations, the results supported the finding that CANTAB tests provide low suitability in measuring the cognitive functions in normal cognitive function populations (Lenehan, Summers, Saunders, Summers, & Vickers, 2015).

Effects of Silent Condition, Self-selected Music Condition, and Alpha Brainwave Music Condition on Attention and Memory Tests Performance

While the first hypothesis predicted effects of silent condition, self-selected music condition, and alpha brainwave music condition on attention test performance cannot be confirmed, as the result was not found to be significant ($p = .996$). For the second hypothesis,

although previous studies showed that alpha brainwave music, self-selected music and silent will develop impacts towards memory, however, the results are not found in our research with the significant ($p = .796$).

Silent Condition

What was not expected, however, researchers hypothesized those participants who were in the silent condition while doing PAL memory test performed better than the self-selected music condition and alpha brainwave music condition, with a higher mean score of $M = 14.85$. This result had been speculated by previous studies indicated that individual perform better without the background noise (Bell, Röer, Dentale, & Buchner, 2012; Hughes, 2014). A study conducted by Proverbio, Nasi, Arcari, Benedetto, Guardamagna, Gazzola, and Zani (2015) supported the results of the current study that participants were more efficient under silent condition when doing a memory test. Although the results of comparing effects of no music, self-selected music, and alpha brainwave music on memory test performance were not significant. This might be due to the small sample size used in the current feasibility study.

Self-selected Music

Contrary to the first hypothesis, result from the current study indicated that self-selected music does not have a substantial effect on a participant's attention test performance. As consistent with the finding from Widerman (2013), the presence of self-selected music have actually interfered participants' sustained attention in performing the test. These results differ from the previous results done by Cassidy and Macdonald (2009). As opposed to the previous finding, this could be linked to the difference of music genre chosen by each individual will influence the attentiveness of individual while performing a task. For instance, three of the participants in the current study have chosen non-lyrical music and had positive effects on their

attention test performance, while most of the participants chose lyrical loud music and results in poor test performance. The results supported the capacity model of attention which certain types of music can actually distract an individual's cognitive tasks performance (Kahneman, 1973). However, the effect is still smaller.

Although no significant effect on three conditions on memory test performance were observed, results showed that participants have the lowest performance in memory test. This hypothesis has been supported by previous studies that the complexity of the music distractions decrease individual's cognitive performance (Furnham & Allass, 1999). Other than that, a study conducted by Reaves, Graham, Grahn, Rabannifard, and Duarte (2016), music are more likely to cause memory impairment on individuals' memory performance. As opposed to the previous studies, the results of the current study did not support the self-selected music condition affects memory tests performance. Mas-Herrero, Marco-Pallares, Lorenzo-Seva, Zatorre, and Rodriguez-Fornells (2013) found that there is a positive relationship between music-related factors and cognitive performance, but in contrary with the result, Kämpfe, Sedlmeier, and Renkewitz (2010) reported that background music has no effects on individuals' cognitive performance. Results of the current study was consistent with Kämpfe et al. (2010) which demonstrated that background conditions did not have significant difference on memory.

Alpha Brainwave Music

As opposed to what researchers have hypothesized, results from the current study have failed to support the previous studies that 15 Hz binaural beats promote improvement in attention and memory tests performance. Various elements of cognition moods and moods states (e.g.: attention, memory, creativity, and vigilance) are said to be influenced by binaural beats (Chaieb, Wilpert, Reber, & Fell, 2015; Kraus & Porubanová, 2015). Compared to silent condition,

participants in the current study exhibited better performance on PAL memory test while listening to alpha brainwave music, but showed no difference in RVP attention test.

Gender Difference on Attention and Memory Tests Performance

The third hypothesis predicted that there would be a significant difference between gender and the effects of three conditions on attention test performance. The results do not support the hypothesis.

In opposed to our findings, researchers had reported that females' memory recall ability is better than male in silent condition (Harmon & Sandberg, 2005). However, the finding of Jameson (2013) is consistent with our result which background conditions also did not have significant difference among male and female on attention and memory.

Conclusion

Several conclusions can be drawn from results of the current study. While many of the expected hypotheses were not determined, the current study has provided an understanding of the feasibility and applicability of CANTAB in measuring the effects of different types of music on attention and memory performance among undergraduates in Malaysia. Besides, the current study also indicates that there are no significant effects of both self-selected music and alpha brainwave music on attention and memory performance. As mentioned earlier, some participants might perform better in silent setting than music settings. The studying of listening to music can enhance individual's memory and attention performance might take a longer time to investigate.

Implications

Although findings from this study did not achieve expected overall results and did not demonstrate a strong correlation of background condition between memory and attention, it did emphasize findings to be explored in future research. Results showed certain preliminary findings with regards to aspects of cognitive functioning which is memory and attention. Positive impacts of music on cognitive performance will be discovered in continued music research. Thus, the findings can be referred for future research which is related to music and cognitive functioning.

Music listening and instruction can “prime” the brain for enhanced performance on spatiotemporal and other cognitive tasks (Leng & Shaw, 1991). Recently, more research has been supported to near transfer theories (Rauscher, 2002; Schellenberg, 2001), which mentioned that musical instruction and spatiotemporal reasoning tasks require related cognitive skills. So in the current study, when participants were undergoing the tests with background music, they might be able to improve other skills. For instance, running the experiment with background music requires visuo-spatial skills. Therefore, visuo-spatial skills can be developed when participants were practicing these abilities.

Limitation of the Study

The sample size was the main limitation of this research as bigger sample size can lead to more valid and reliable significant difference on the results. In the current study, with a sample of only 13 participants, the group differences are very difficult to detect.

The following limitation is due to the limited availability of participants, this research was carried out in a repeated-measured design. Other than that, our experiment also could be biased as participants have to complete the tests for 3 rounds, so the respondents would be not

familiar to the first round of the tests but they would be more familiar during the second and third time of the tests.

Recommendation of Study

As findings from this research did not show any significant difference between music and cognitive performance which is attention and memory among undergraduates, sample size has to be increased in order to achieve a strong significant difference in results. Furthermore, it would be interesting to conduct a modified version of current research, taking into consideration and adjusting for the limitations that stated above. For instance, considerations for future research include utilizing a more suitable type of CANTAB test or other tests. Another direction would be to select different types of background music as this might lead to achieve desired outcomes.

Further studies are suggested to establish more whether different types of music genre will affect the attention and memory performance, as the current study found out that some of the participants who chose lyrical music were perform weaker than those who had chosen non-lyrical music.

The results also suggested that CANTAB is not suitable in measuring the effects of music on attention and memory. Thus, future researchers should consider another test battery to investigate the effects of music on cognitive function.

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Appendices

Appendix A

INFORMATION SHEET FOR PARTICIPANTS**Study title**

The Effect of Music and Gender Difference on Attention and Memory Test Performance among Malaysian Undergraduates: A Feasibility Study.

Purpose of the study

The purpose of this study is to investigate the feasibility of CANTAB on measuring the effects of different types of music and gender difference on attention and memory test performance among undergraduates.

What would this involve?

Participants will be involved in a total of three distinct condition; two experimental conditions and one controlled condition which is then continued with subsequent tests assessing both attention and memory. The time duration that is allocated for the tests in three varying environment is about 25 to 30 minutes maximum. Relevant demographic data shall be collected as well.

The benefits and risks

You are contributing to your psychological understanding id specific kinds of music can have negative or positive impacts on the attention and memory of students. No risk is present in this study. Participants may withdraw from the study at any given time and will now be penalized or condemned in any way.

Confidentiality

The identity of each participant is kept anonymous and the outcomes of the said study shall be reported in a collective manner. The confidentiality of the participants is of utmost priority and importance.

Voluntary basis

Those who are willing to participate in this study may do so based on their own volition. As stated above, participants remain the right to either not join the study at all or if you would like to leave halfway through the study, you may do so with no consequences.

Payment and compensation

No payment is required to participate in this study. A small token of appreciation will be provided for your volunteerism to participate in this study.

If I have any question, whom can I ask at any time point of the study?

Areal Lee Romie

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Universiti Tunku Abdul Rahman

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Fernanda Gwee Qing Err

Undergraduate student in Bachelor of Arts and Social Science (HONS) Psychology

Universiti Tunku Abdul Rahman

Email: fernandagwee@utar.my

Appendix B

Agreement to Participate in the Study**The Effects of Music and Gender Difference on Attention and Memory Test Performance
among Malaysian Undergraduates: A Feasibility Study**

Hereby, I, _____, I/C No. _____ agreed to join the research study mentioned above voluntarily. This study is conducted by undergraduate students from Faculty of Art and Social Science, Universiti Tunku Abdul Rahman. I have informed and understand the purpose and procedure of the study. In understood that all information collected in this study will be kept confidentially and privately, and the data will only be presented in a collective manner. My signature below signifies that I have read, understood, and agreed all the information given. If I agreed to participate in the study, I understand my right to withdraw from the study at any point of it without penalty of any form.

Name of Participant: _____

Signature of Participant: _____

Date: _____

Name of Witness: _____

I/C No.: _____

Signature of Witness: _____

Research Team:

Mr. Tay Kok Wai (Main supervisor)

Areal Lee Romie (Student)

Fernanda Gwee Qing Err (Student)

Appendix C

Appreciation Token List

Thank you so much for your participation. Please kindly write your name and sign when you had collected our appreciation token (RM5). Thank you.

No.	Name	Date	Time	Signature
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				

Appendix D

Demographic Sheet

For the following items, please select the ONE response that is most descriptive of you or fill in the blank as appropriate.

Preferred Name: _____

Gender: Female / Male

Age: _____

Ethnicity: Malay / Chinese / Indian / Other (Please state: _____)

Current study year and semester: _____ (e.g.: Y1S3)

Student ID: _____ (e.g.: 1606123)

Email: _____

Appendix E

Shapiro-Wilk Normality Test Table

Shapiro-Wilk Normality Test Table

	Statistic	<i>df</i>	<i>p</i>
V1PALFAMS28	.885	13	.084
V2PALFAMS28	.959	13	.730
V3PALFAMS28	.878	13	.067
V1RVPA	.940	13	.454
V2RVPA	.970	13	.894
V3RVPA	.925	13	.290

Note. *df* = degrees of freedom; *p* = significant value.

Appendix F

Boxplots

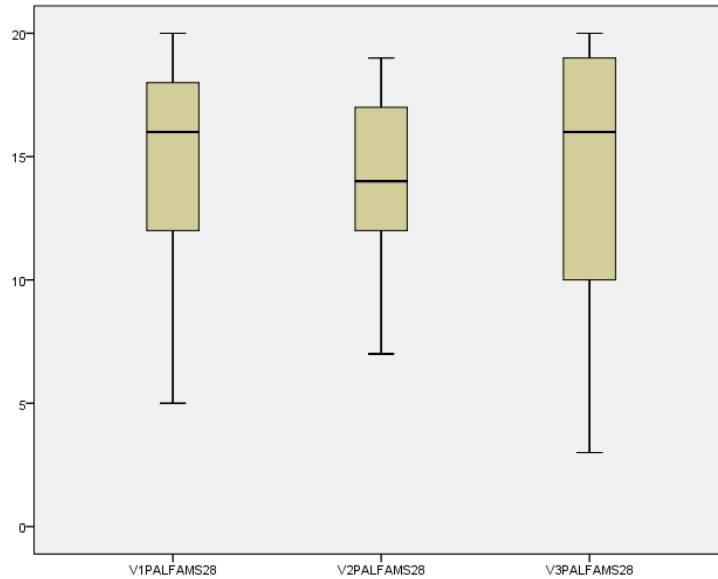


Figure 6.1. Boxplots for PAL Memory Test on No Music Condition, Self-selected Music Condition, and Alpha Brainwave Music Condition.

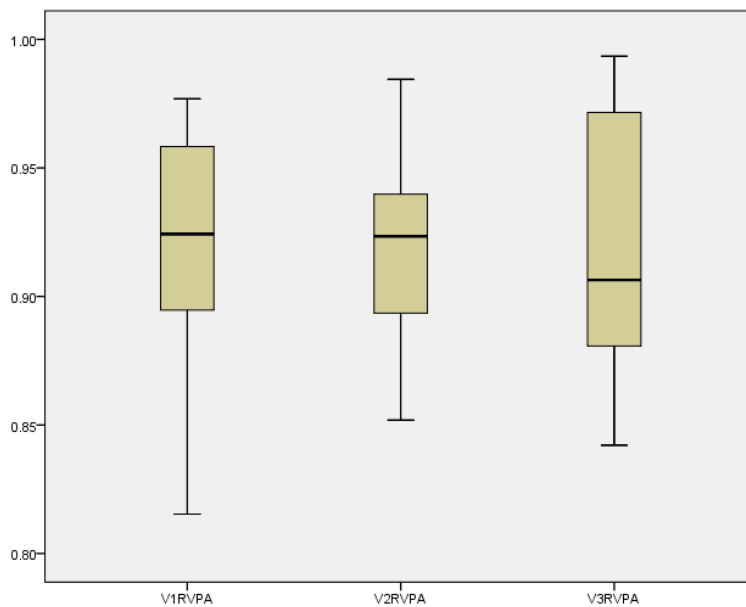


Figure 6.2. Boxplots for RVP Attention Test on No Music Condition, Self-selected Music Condition, and Alpha Brainwave Music Condition.

Appendix G

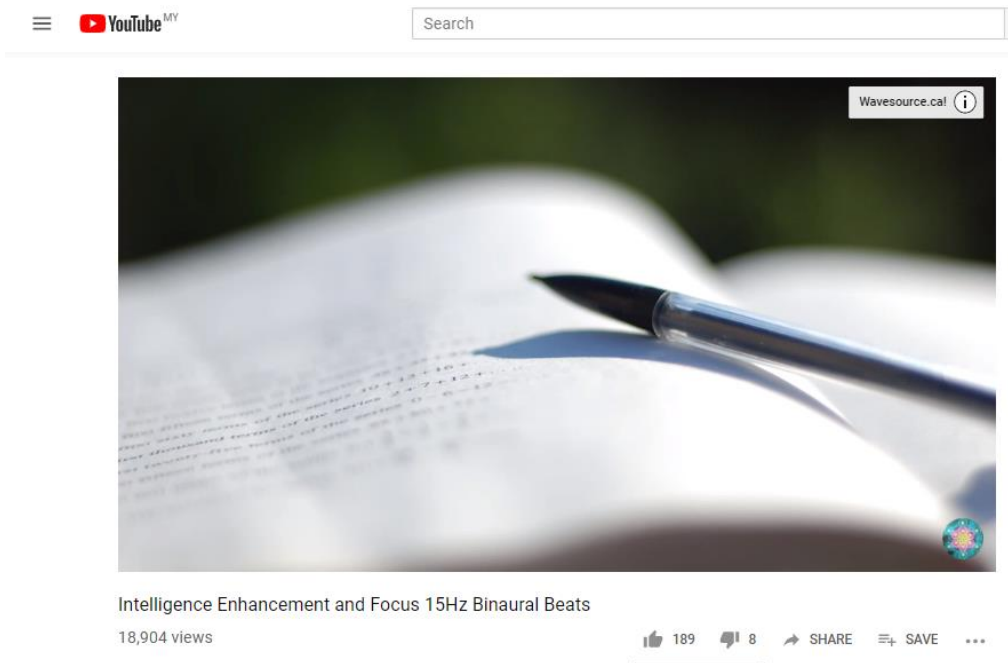


Figure 6.3 Screenshot of Alpha Brainwave Music 15 Hz Binaural Beats on YouTube

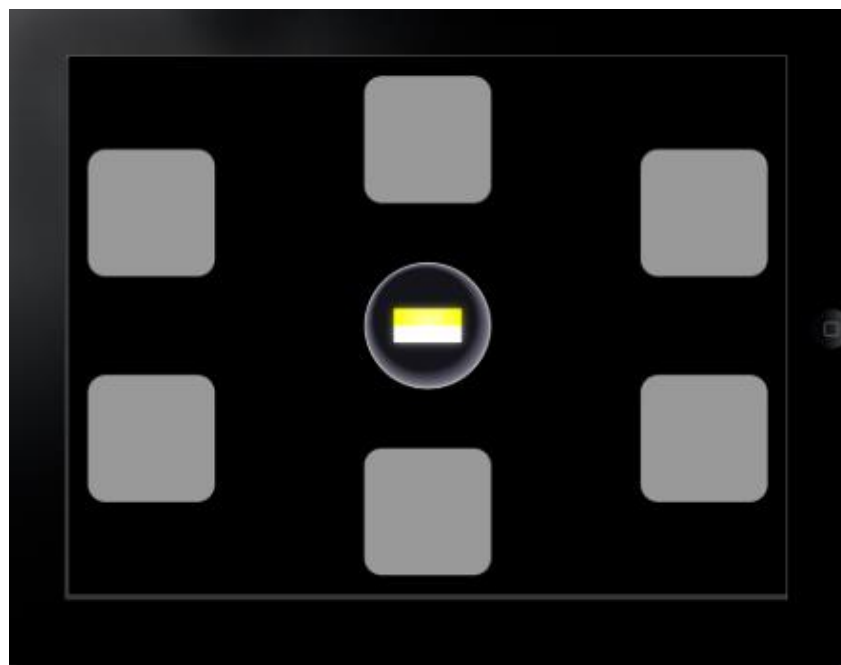


Figure 6.4 PAL Test

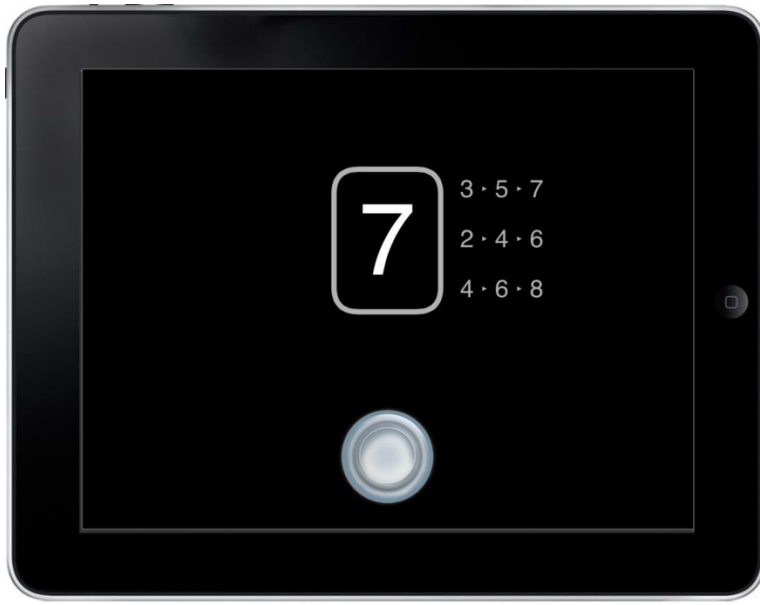


Figure 6.5 RVP Test

FYP2 - effects of music on attention and memory

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