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# The Effect of Quran as a Stimulus in Enhancing Working Memory and Mood

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The aim of this randomized experimental study was to determine the impact of listening to Quran on working memory and mood disturbance. While previous studies implemented neuroimaging to assess mood, the present study used self-reported subjective feelings in assessing mood disturbance. It also aimed to successfully posit Quran as a stimulus that induced positive emotions and improved cognitive functioning. Hence, the study hypothesized that listening to Quran would lower mood disturbance and enhance working memory performance among participants. Participants were 50 Maldivian university students randomly assigned to an experimental group (listened to Quran recitation) and control group (did not listen to Quran). A pre-test-post-test design was administered to obtain difference in mood disturbance. Participants performed a Letter-Number Sequencing task to determine the effect of Quran on working memory. Results showed a significant increase in working memory performance among participants in the experimental group compared to participants in the control groups. Additionally, post-test mood disturbance was significantly lower among participants in the experimental group compared to participants in the control group. Thus, it was concluded that exposure to Quran enhanced working memory and reduced mood disturbances among university students as predicted in the study. Although the study lacked external validity due to the nature of the research design, the findings could be successfully applied in the educational and counselling fields.

*Keywords:* Quran, working memory, mood disturbance

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The study of human cognition is a key area in psychology due to the complex nature of the social mind. Years of research have suggested mood and affect influence cognitive performances in the human brain (Ashby, Valentin & Turken, 2002; Husain, Thompson & Schellenberg, 2002; Schellenberg, 2005; Nadler, Rabi & Minda, 2010; Yang, Yang & Isen, 2013). These cognitive performances include a wide range of tasks, such as encoding and recall, decision making, and reasoning. Biologically, theorists suggest a role of dopamine in elevating positive mood and cognitive functions such as working memory (Ashby, Isen & Turken, 1999; Engle, Tuholski, Laughlin & Conway, 1999). Moreover, while some researchers suggest working memory is enhanced by listening to music, other researchers argue that any element that elicits positive mood arousal could enhance memory functioning (Husain, Thompson & Schellenberg, 2002; Schellenberg, 2005). Neurobiological findings propose that listening to Quran increases alpha band magnitudes in the brain, which indicates enhanced positive emotional states (Martin & Kerns, 2011; Irfan, Atique, Taufiq & Irfan, 2019). Furthermore, listening to Quran has also been related to memory enhancement in various studies (Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal & Fakhri Taha Alshaikhli, 2017). Therefore, studying the effect of Quran on mood and working memory across cultures, such as among students, could provide additional directions for memory enhancement strategies.

## Interaction of Emotion and Cognition

Allman, Hakeem, Erwin, Nimchinsky and Hof (2006) stated that emotion and cognition interacts and builds from the primitive stage of brain development. Evidence from neuroimaging studies and lesion studies indicate that the anterior cingulate gyrus in the neocortex plays a critical role in emotional self-control and cognitive function (Allman, Hakeem, Erwin, Nimchinsky & Hof, 2006). Research suggests that the functioning of emotions and cognition are closely interconnected in this area of the brain from birth (Allman, Hakeem, Erwin, Nimchinsky & Hof, 2006).

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Hence, Allman, Hakeem, Erwin, Nimchinsky and Hof (2006), suggested that competency of both emotional control and human cognition such as working memory weighs heavily on the stimulations received, and both facilitate in modulating each other. Therefore, the following literatures review the association between mood and memory, and the effect of different stimuli on mood and memory as well.

**Effect of Positive Mood on Working Memory**

Ashby, Isen and Turken (1999) in their study proposed the dopamine theory to explain how positive mood and affect influence cognitive tasks. The theory assumes that there is a release of dopamine in the limbic system during periods of positive affect. The theory proceeds to explain that this dopamine elevation further influences cognitive task performances such as working memory (Ashby, Isen & Turken, 1999). To test the assumptions of the theory, Ashby, Isen and Turken (1999) studied literature on the different parts of the brain associated with dopamine projection and cognitive tasks, which indicated that the prefrontal cortex was a substantial area associated with working memory (Miller, Erickson & Desimone, 1996; Curtis & D'Esposito, 2003). Studies on reduced levels of dopamine in the prefrontal cortex in monkeys and patients with Parkinson's disease were observed to have deficits in their working memory (Brozoski, Brown, Rosvold & Goldman, 1979; Gotham, Brown & Marsden, 1988). Other studies have demonstrated that introducing dopamine agonists in patients with Parkinson's diseases and healthy participants, reported improvements in working memory related tasks (Gotham, Brown & Marsden, 1988; Luciana, Depue, Arbisi & Leon, 1992). In contrast to these findings, Williams and Goldman-Rakic (1995) found that higher levels of dopamine antagonists damages cells in the prefrontal cortex, and only a small number of antagonists are required to facilitate memory enhancement. Based on these evidence, Ashby, Isen and Turken (1999) concluded that working memory is facilitated with a moderate level of dopamine release, hence, when positive feelings are induced, the release of dopamine enhances working memory.

Similarly, Husain, Thompson and Schellenberg (2002), introduced the arousal-and-mood hypothesis to posit a direct link between music and cognitive abilities. This hypothesis states that listening to music affects mood and arousal which in turn affects different cognitive abilities (Husain, Thompson & Schellenberg, 2002). Contradicting this statement, Schellenberg (2005), reformulated the hypothesis stating that music is only a stimulus that provokes mood and arousal and affects cognitive abilities. It was further elaborated that music is not a determining factor of cognitive functioning but rather an example of a stimulus that brings about the effect (Schellenberg, 2005). Therefore, the cognitive effect mediated by mood and arousal from music is unlikely to differ in results from exposure to a non-musical stimulus that has the same emotional impact. Furthermore, the arousal-and-mood hypothesis emphasized the cruciality of moderate levels of mood and positive emotions in enhancing cognitive functioning (Husain, Thompson & Schellenberg, 2002; Schellenberg, 2005). Hence, it is indicated that any moderately arousing stimulus which induces positive emotions could affect a variety of cognitive abilities.

Additionally, a number of experimental studies have demonstrated the role of emotional state in modulating working memory tasks (Gray, 2001; Phillips, Bull, Adams & Fraser, 2002; Osaka, Yaoi, Minamoto & Osaka, 2013). Gary (2001) conducted a study in three emotional conditions: approach, neutral, and avoidance. Emotions were induced by watching a video clip and emotions were self-rated before and after viewing the video, followed by a spatial-verbal memory task. Results indicated that approach emotional states hindered spatial performance and enhanced verbal performance and vise-versa for avoidance emotional state (Gary, 2001). Similar results were yielded from the Phillips, Bull, Adams and Fraser, (2002) study on the effect of positive emotions on Stroop and Fluency Tasks. Mood was induced by a mood-memory procedure, where participants think of a happy memory, and describe the event to the experimenter and answer further questions related to the event. Results suggested positive emotions impaired Stroop Task performance while improving verbal Fluency Task performance (Phillips, Bull, Adams & Fraser, 2002). These findings suggest strong evidence for the selective role of emotion on cognitive task performance.

On the contrary, Martin and Kerns, (2011) found positive emotional states inhibited Running Memory Task performance while enhancing Stroop Task and Flanker Task performances. This quasi-experimental study induced emotions in participants by viewing a comedy video clip of 15-minutes (Martin & Kerns, 2011). Additionally, another study demonstrated how listening to music, relaxation audios and silence change mood arousal and affect: Reading Span Task performance (Hirokawa, 2004). However, the results of the study showed no significant difference in working memory scores among participants but indicated changes in mood and arousal varied upon testing

conditions (Hirokawa, 2004). The difference in results from these studies may be subjected to the methodological variance in mood induction in the experiments. This indicates the effect of mood on working memory depends immensely on the method of mood induction as well as the nature of the working memory task (Gary, 2001; Phillips, Bull, Adams & Fraser, 2002; Martin & Kerns, 2011).

**Effect of Quran on Mood and Emotion**

There is a substantial amount of research done on the neurophysiological basis on listening to the holy versus of Al-Quran, and emotion activation in the brain. For example, Zulkurnaini, Kadir, Murat and Isa (2012), studied the expansion of Alpha band in brainwaves signals when listening to Quran and classical music in a quasi-experiment design. The study recruited 28 healthy university students, who listened to surah Yasin of Al-Quran and Pachelbel's Canon D major of classical music in three states: before, after and during listening, on an MP3 audio player. Listening was done in two separate sessions where participants were also interviewed after listening to each stimulus. It was found that Electroencephalogram (EEG) of the subjects indicated increased bilateral neural activity in the brain hemispheres while listening to Quran than music (Zulkurnaini, Kadir, Murat & Isa, 2012). Additionally, a surge in the Alpha band was also observed in participants while listening to Quran. This increase in the Alpha band indicates that the participants were in a calmer and positive emotional state while listening to Quran compared to music.

Furthermore, differences in Alpha band magnitude while listening to Quran and music were also studied by Al-Galal and Alshaikhli (2017), using a different methodology. In the study, researchers employed International Affective Picture System (IAPS) for emotions before listening to excerpts from Surat Yasin and Al-Inshirah, and Al- Mu'awwidhatayn with Al-Ikhlas and Mozart music for enhanced effect (Al-Galal & Alshaikhli, 2017). In contrast to the study by Zulkurnaini, Kadir, Murat and Isa (2012), mentioned above, participants in this study listened to the stimulus in a single session while their EEG was being taken (Al-Galal & Alshaikhli, 2017). This method was also implemented by Al-Galal, Alshaikhli, Abdul Rahman and Dzulkifli (2015) in a valance-arousal model study. Despite the difference in methodology, the results were similar where higher alpha band magnitudes were observed while listening to Quran recitation compared to listening to music (Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015; Al-Galal & Alshaikhli, 2017). Furthermore, listening to Quran and music changed the valence from negative to positive emotions equally but neither music nor Quranic recitations influenced arousal (Al-Galal, Alshaikhli, Rahman & Dzulkifli, 2015).

While all the previously mentioned studies utilized EEG as a means to measure emotional arousal, Zaidah and Imaduddin (2018), studied the effect of listening to four different melodies of Quran on the psycho-physiological measures of emotions, using self-reported data. The study measured heart rate and skin conductivity of participants as a physiological response and Positive and Negative Affect Schedule (PANAS) and Geneva Emotional Music Scale (GEMS) were used to measure their psychological mood and emotional response (Zaidah & Imaduddin, 2018). Results showed no significant impact of Quran recitation on the heart rate of the participants in all four melodies. While the non-melodious recitations had no significant effect on skin conductance, it was observed that melodious recitation had a significant effect on skin conductance (Zaidah & Imaduddin, 2018). Furthermore, the self-reported mood questionnaire showed no difference before and after listening to the recitations which were similar to the previous finding by Al-Galal, Alshaikhli, Rahman and Dzulkifli (2015). However, a significant difference in emotions was reported by participants, with the strongest outcome resulting from melodious Quran recitation. Hence, it was suggested that listening to Quran affects the emotional content of listeners, notably in lowering tension (Zaidah & Imaduddin, 2018). Therefore, this could be an indication of the importance of measuring subjective feelings, as psychological responses such as emotions might not be accurately delivered physiologically.

**Effect of Quran on Memory**

Muslims perceive Quran as a spiritual source that improves learning and memory performances in the brain. To test this assumption, Tamtaji, Behnaam, Taghizadeh and Yousefi (2018) conducted a laboratory maze experiment using rats to investigate the association between memory, learning and Quran. Quran was played to the rats which had been randomly assigned to the experimental group for two weeks and 5 hours. Results indicated that those in the experimental group took significantly less time to learn the maze and a significant difference was observed in their spatial memory performance (Tamtaji, Behnaam, Taghizadeh & Yousefi, 2018). Hence, it was suggested Quran enhanced memory and learning of the rats experimental

group. Although an animal model confines generalizability, the findings of the study were still essential for further research. Moreover, Fauzan and Abidin (2017) found similar results in working memory performance among university students by Neurofeedback training using Quran recitation as a stimulus. Subjects were administered Digit Span and Digit Symbol instruments from Weshler's Intelligence Scale before and after Neurofeedback training and exposure to Ayatul Kursi recitation, an excerpt from the Quran. After five sessions of training, the post-test performance showed significant improvement in scores of the subject in Digit Span and Digit Symbol task (Fauzan & Abidin, 2017). In addition to this, it was found that the Neurofeedback training showed increased length in Alpha bands at the sessions as well, similar to previous findings (Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal & Fakhri Taha Alshaikhli, 2017). Hence, it indicates that exposure to Quran improved working memory performance as a result of positive mood and affect. Nonetheless, the absence of random assignment was a major limitation in the study.

Another controlled study was also conducted on a sample of grade school female students (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014). Students were randomly assigned to control and experimental group, where both completed a pre-test and post-test of Weshler's Digit Span and Alphabet Succession task. Fifteen minutes of Quran was played for the experimental group between pre-test and post-test while the control group set idly. Results showed the experimental group scored significantly higher in the post-test compared to the control group indicating the effect of Quran on working memory (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014). However, as the participants in the control group were monitored during the 15 minutes, there is a possibility of anxiety arousal which could inhibit memory functioning. In addition to this, Saleh and Tamam, (2020) also recently studied the effect of Quran as a form of therapy in memory enhancement of students with Internet Addiction Disorder. The study used a pre-test post-test design, where students completed a spatial and verbal working memory task before and after listening to Quran (Saleh & Tamam, 2020). The students were also monitored on EGG during the task performance. The result of the study showed significant brain activity in the prefrontal cortex (Saleh & Tamam, 2020). As suggested from previous research, the prefrontal cortex is the primary brain area responsible for positive emotions (Ashby, Isen & Turken, 1999). Furthermore, results also showed students performed better in the post-test compared to the pre-test (Saleh & Tamam, 2020). Therefore, it was inferred that listening to Quran enhanced the working memory of students with Internet Addiction Disorder and Quran as a therapy to induce positive emotions (Saleh & Tamam, 2020).

To conclude, previous research suggests a strong association between positive mood and working memory performance (Gary, 2001; Phillips, Bull, Adams & Fraser, 2002; Allman, Hakeem, Erwin, Nimchinsky & Hof, 2006; Al-Galal, Alshaikhli, bin Abdul Rahman & Dzulkifli, 2015; Fauzan & Abidin, 2017). Biologically, it was found that dopamine played a major role in memory and cognitive enhancement. On the other hand, the arousal-and-mood hypothesis stated that music was the key factor in enhancing mood and memory. However, it was later suggested that music was only a stimulus and this effect can be mediated by any stimulus that induces emotions (Schellenberg, 2005). Additional studies indicated that negative and positive mood modulated working memory differently, suggesting that the association was relative to the method of mood induction and tasks administered (Gary, 2001; Phillips, Bull, Adams & Fraser, 2002; Martin & Kerns, 2011). Moreover, EEG studies of the brain demonstrated listening to melodious Quran recitation activated positive emotions (Al-Galal, Alshaikhli, bin Abdul Rahman & Dzulkifli, 2015). Correspondingly, research also showed that exposure to Quran recitations improved working memory due to positive emotional activity in the brain (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014; Fauzan & Abidin, 2017; Saleh & Tamam, 2020). However, there is extremely inadequate research that explores the effect of Quran on the mood and working memory of listeners. Additionally, there is also a lack of available research that explores subjective feelings among participants upon listening to Quran and the impact of it on working memory. As evident from past findings, psychological responses such as emotions might not always be physically observed (Zaidah & Imaduddin, 2018).

## Study Overview

Thus, this research aims to study changes in self-reported mood disturbance and memory performance among university students as a result of exposure to Quranic verses. Furthermore, it also aims to challenge the mood-and-arousal hypothesis of

music by Husain, Thompson and Schellenberg (2002) using Quran as a stimulus to demonstrate the effect of Quran on emotions and working memory. The main difference of this research compared to previous studies is that the current research only utilizes listening to Quran as the stimulus. Hence, there will be no comparison between music and Quran unlike previous findings.

Therefore, based on previous studies, the present research tested two hypotheses. First, significant evidence suggests Quran exposure enhances working memory performance (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014; Fauzan & Abidin, 2017). As such, the main hypothesis of this study predicts that participants who listen to Quran will score higher in the working memory task than the participants who do not listen to Quran. Secondly, evident from previous studies, this memory enhancement is attributed to positive mood elevation in participants (Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015; Al-Galal & Alshaikhli, 2017). Thus, the second hypothesis generated is that participants in the experimental group will report lower mood disturbance scores after listening to Quran compared to before listening to Quran and this will not be observed in the control group. The study was conducted on 50 students attending universities in Male' City, between 18 to 32 years of age. Mood disturbance was measured using Profile of Mood States (POMS) and working memory was tested using Letter-Number Sequencing test from Wechsler Adult Intelligence Scale – Third Edition (WAIS-III) in an experimental design.

## Method

### *Design*

A randomized, experimental, pre-test-post-test design was used to provide a high level of control. Subjects were randomly assigned to a control group and experimental group by a group generator with 25 participants in each group. For the independent variable, the experimental group listened to Quranic recitation, and the control group listened to a random audio clip on facts about Quran. The dependent variables were mood disturbance scores measured using the Profile of Mood States (POMS) and working memory performance measured from the Letter-Number Sequencing task.

### *Participants*

Fifty undergraduate Maldivian students (21 males, 29 females) aged between 18 years to 32 ($M$ = 23) from universities in Male' City volunteered to participate in the study. Twenty-seven students were from The Maldives National University, ten students from Villa College, eight students from Avid College, one student from Cyryx College, and four students from other colleges and universities. Participants were compensated MVR 50/- per participants for their time. Students who recently graduated from universities were also allowed to participate due to a shortage of volunteers from presently enrolled students. The study was authorized by the Ethics Board of The Maldives National University.

### *Materials*

*Audio stimuli***.** Audios for the experiment were played from high functioning speakers placed at a three-foot distance from the participants. Audio for the experimental group was a melodious recitation of Ayatul Kursi by Qari Muzammil Hasballah, which was obtained from YouTube (See Link 1 in Appendix B). The control group listened to an audio presentation about Quran which included the history of scriptures and facts about Quran which was also obtained from YouTube (See Link 2 in Appendix B). Duration for both audios lasted one minute 21 seconds.

*Mood disturbance questionnaire.* Mood disturbance of the participant was measured using the abbreviated and revised version of the Profile of Mood States (POMS) by Grove and Prapavessis (2016) (See Appendix C). The scale measured five negative subscales and two positive subscales. The negative scales were tension, depression, fatigue, anger, and confusion. The positive subscales were esteem-related effect and vigor. Items presenting different moods and emotions such as 'hopeless' and 'energetic' were rated on a four-point Likert scale ranging from 'Not At All' to 'Extremely'. Corresponding scores on the Likert scale were calculated for all items except 'Ashamed' and 'Embarrassed' which used reverse scoring. The total mood disturbance score was then calculated by finding the difference between the sum of negative subscale and the sum of positive subscale (See Appendix D).

*Working memory task.* To measure working memory, the Letter-Number Sequencing test from the Wechsler Adult Intelligence Scale – Third Edition (WAIS-III) was adapted from Mielicki, Koppel, Valencia, and Wiley (2018) and administered. Letter and numbers were projected on to a smartboard five feet away from participants for clear visuals. A number or letter was presented in the center per slide, and participants were to recall the numbers first in ascending order and then letters in alphabetical order and note it down in the sheets provided. For example, if the sequence was 1-C-2-B, the correct response was 1-2-B-C (See Appendix E). The test began with two-character strings and progressively increased in difficulty after every three strings where the most difficult trail of strings consisted of a total of eight characters. One point was given for each correctly recalled string. The highest number of possible correct responses for the test was 21 and the lowest possible score was zero. Scoring was stopped once the participant did not respond correctly to a whole set of strings of equal difficulty.

*Procedure*

As a blinded experiment participants were only informed that they were attending to participate in a psychology related task performance for research. The study was conducted in two conditions. Participants in the experimental condition listened to Quran recitation and participants in the controlled condition listened to an audio presentation about Quran in groups of five each. Grouping for both conditions was adapted to adhere to the availability of time and resources. Participants were seated comfortably in a well-lit and airconditioned classroom across a smartboard. Upon arrival, they were given informed consent verbally and on paper and self-reported demographic data was collected (See Appendix F and Appendix G). The participants then filled the POMS pre-test form. Those in the experimental group were then instructed to listen to Quranic recitation and those in the controlled group were instructed to listen to the audio about Quran facts. This was then followed by the POMS post-test form. They were instructed to attentively observe and recall the characters projected on to the smartboard after every blank slide, and to write their response on the answer sheets provided (See Appendix H). Participants practiced three trial samples before proceeding with the real test as replicated from Mielicki, Koppel, Valencia and Wiley (2018). The characters of letters and numbers were presented for 900 milliseconds each and 10 seconds were given to recall and write the characters in the correct sequence for each series. All instructions given to the participants were kept uniform through visual presentation to ensure consistency across the groups. After the experiment ended the participants were debriefed about the purpose of the study.

## Results

An independent sample T-Test was performed to compare the difference in working memory task scores between experimental and control groups. As predicted, working memory performance was higher among participants in experimental group ($M$ = 9.96, $SD$ = 1.93) compared to participants in the control group ($M$ = 7.08, $SD$ = 2.60), and this result was also statistically significant: $t$ (48) = 4.46, $p$ = .001, as hypothesized.

As can be seen in Table 1, the mean score for the working memory task for the experimental group was higher than the mean score for working memory task for the control group. Table 2 shows a statistically significant difference in the working memory task scores between participants in experimental and controlled conditions. This suggests that working memory task was performed better by participants in the experimental group. Therefore, the findings indicate that exposure to Quran enhances working memory performance in participants who listened to Quran compared to participants who did not listen to Quran, thus, supporting the main hypothesis of the study.

**Table 1**

*Descriptive of Working Memory Task Scores for Experimental Group and Control Group.*

| Group | | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Working Memory Task Scores | Experimental Group | 25 | 9.96 | 1.925 | .385 |
| | Control Group | 25 | 7.08 | 2.597 | .519 |

**Table 2**

*T-Test Results of Experimental Group and Control Group on Working Memory Task Scores.*

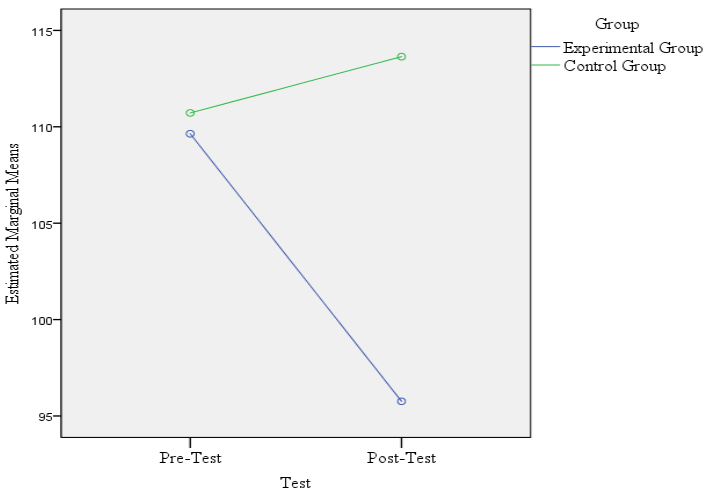
| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| Working Memory Task | Equal variances assumed | 4.038 | .050 | 4.455 | 48 | .000 | 2.880 | .647 | 1.580 | 4.180 |

To test the second hypothesis a Mixed Analysis of Variance (ANOVA) was then conducted to compare the mean differences in pre-test and post-test mood disturbance scores of the participants in the experimental group and control group. Results suggested there was no significant main effect of pre-test and post-test on mood disturbance scores $F$ (1, 48) = 3.62, $p$ = .063 of the participants. However, results indicated a statistically significant interaction between mood disturbance scores and testing conditions $F$ (1, 48) = 8.50, $p$ = .005. Participants in the experimental group reported lower post-test mood disturbance scores ($M$ = 95.76, $SD$ = 30.65) compared to pre-test mood disturbance scores ($M$ = 109.64, $SD$ = 29.48)). In contrast, participants in the control group scored higher in the post-test mood disturbance questionnaire ($M$ = 113.64, $SD$ = 34.57) compared to pre-test mood disturbance questionnaire ($M$ = 110.72, $SD$ = 28.01). Hence, the results indicate that listening to Quran reduced mood disturbance among participants in the experimental group compared to the participants in the control group as predicted in the study (See Table 3 and Table 4 in Appendix A).

As seen below, Figure 1 represents the mood disturbance levels reported by participants in the experimental group and control group before and after exposure to stimuli. The results did not show any significant difference in the pre-test scores obtained by the groups. However, the results show a decrease in post-test mood disturbance scores in experimental group, and an increase in post-test mood disturbance scores for the control group. This indicates a significant difference in the post-test mood disturbance scores between experimental and control group. Hence as hypothesized, it suggests that mood disturbance scores were lower in participants after listening to Quran compared to before listening Quran in the experimental group. In addition to this, it also suggests that mood disturbance was not lower among participants in control group after exposure to audio stimuli as predicted in the study.

**Figure 1**

*Mean Differences in Mood Disturbance Between and Within Participants in Experimental Group and Control Group*




Moreover, various aspects of the findings were explored for any relationship among variables, as indicated below. First, as results showed a significant decrease in mood disturbance scores among participants in the experimental group, a Pearson's correlation was calculated to find if there was a correlation between the decreased mood disturbance scores and enhanced working memory performance. Results showed a weak positive correlation; $r$ (23) = 0.133, between mood disturbance scores and working memory performance. However, this correlation was not statistically significant, $p$ = .525. This suggests that there was no correlation between mood disturbance scores and working memory performance

among participants in the experimental group in the present study (See Table 5 in Appendix A).

Additionally, to observe differences in positive and negative emotions reported, a paired sample T-Test was performed on participants in the experimental group. Positive emotions reported after exposure to Quran ($M$ = 26.64, $SD$ = 11.21) were higher than positive emotions reported before exposure to Quran ($M$ = 24.56, $SD$ = 8.85). However, this result was not significant; $t$ (24) = -1.70, $p$ = .103. On the contrary, negative emotions reported after exposure to Quran ($M$ = 24.16, $SD$ = 20.62) were lower than negative emotions reported before exposure to Quran ($M$ = 33.12, $SD$ = 22.05) and this result was statistically significant; $t$ (24) = 5.55, $p$ = .001. Thus, results suggest that listening to Quran decreased negative emotions but did not increase positive emotions (See Table 6 in Appendix A).

Furthermore, to ensure internal validity, a correlation was run on how regularly participants listened to Quran in daily life and memory performance among participants. The results suggest a weak, positive correlation $r$ (50) = 0.175 between the variables, and the correlation was not statistically significant, $p$ = .224. Hence, there is no correlation between Quran listening frequency and memory performance of participants (See Table 7 in Appendix A). This indicates that memory performance of participants was not associated to how often the participants listened to Quran in daily life.

## Discussion

The present study found that listening to Quran significantly increased working memory performance in the Letter-Number Sequencing task. The findings also indicate that there was reduced mood disturbance among participants who listened to Quran compared to participants who did not listen to Quran. These findings are consistent with the proposed hypotheses of the study that Quran enhances working memory performance and lowers mood disturbance. Moreover, the findings suggest that listening to Quran reduces the negative emotions of the listener as well.

The results of the present study support several literatures on Quran and working memory performance (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014; Fauzan & Abidin, 2017). Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki and Alian, (2014), found that Quran enhanced the working memory of grade school students. Similarly, the present study also observed related outcomes among university students. Moreover, the findings showed that listening to Ayatul Kursi from the Quran improved performance in Letter-Number sequencing task. Thus, supporting previous findings by Fauzan and Abidin, (2017), which suggested that listening to Ayatul Kursi improved Digit Span and Digit Symbol span task performance among participants. Hence, both findings indicate that exposure to Quran improved performance of participants in working memory tasks. Furthermore, the current study also supported previous findings on Quran and mood associations (Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal, Alshaikhli, bin Abdul Rahman & Dzulkifli, 2015; Al-Galal & Fakhri Taha Alshaikhli, 2017). Participants exposed to Quran recitation in the present study reported lower mood disturbance compared to the participants in the control group. This is relative to the brain activities and alpha band increases observed in EEGs in the previous studies as a result of improved emotions ( Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015). Subjective mood-disturbance reported by participants also support findings by Zaidah and Imaduddin (2018), which suggested that participants in the experimental group experienced lesser mood disturbance after listening to Quran compared to participants in the control group. Although the present study did not employ Neurofeedback Training, it can be inferred that the decrease in subjective mood disturbance and enhanced working memory was due to similar brain activities observed in the past study (Fauzan & Abidin, 2017). Additionally, even though the duration of exposure to Quran was shorter in the present study, the results were still comparable to previous studies with a longer duration of Quran exposure (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014). Moreover, the present study did not employ a visual system to reinforce the emotional output of listening to Quran as suggested by Al-Galal and Alshaikhli, (2017. Hence, the present findings are uniquely subjected to the impact of listening to Quran only.

Additionally, the present findings showed that negative emotions lessened significantly when participants listened to Quran, the same as previous research which suggested listening to Quran reduced the number of negative emotions (Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015).

Moreover, present findings did not identify a significant correlation between change in mood disturbance and working memory performance. Hence, current finding does not corroborate with past findings that identified a link between mood and working memory (Gary, 2001; Phillips, Bull, Adams & Fraser, 2002; Martin & Kerns, 2011). The dissimilarity could be owing to the difference in methodological variance where the present study employed self-reported data contrary to EEG readings in previous studies. However, the present findings successfully challenge the mood-and-arousal hypothesis by Husain, Thompson and Schellenberg (2002), as substantial evidence directs that listening to Quran also induces positive emotions and enhances cognitive functioning as much as music. Therefore, as suggested by Schellenberg (2005), it can be stated that Quran and music are only stimuli that influence mood and cognition. Hence, the mood-and-arousal hypothesis can also be explained using Quran listening.

The findings of the present study could be immensely valuable in educational aspects, especially for students. While methods to improve memory and learning in students are continuously tested in the research field, the present study along with other previous studies in this area provide evidence that Quran is a remarkable element in improving working memory performance among students of all age groups (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014; Fauzan & Abidin, 2017). Exposure to Quran for only a few minutes, without any other intervention, has shown to improve working memory performance in student groups (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014). Hence, it is suggested that academic institutes implement listening to Quran as a technique to improve memory of students. In addition to this, it can be suggested that strategically implementing Quran in therapy interventions could be beneficial as well. This is further supported by the suggestion from previous research that listening to Quran in sound therapy sessions and mindfulness therapy could facilitate clients in improving their positive emotions (Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015).

Despite the various important findings of the present research, there are potential limitations to the study as well. Firstly, as the study utilized an experimental design, there is a lack of external validity. It is unlikely that the same conclusions can be derived in a real-life context where many external factors that affect memory could be present. Secondly, Secondly, the participants of the study consisted only of university students from the capital city Male'. Thus, it might limit the generalizability to other more diverse settings. Moreover, in contrast to previous studies, the present study failed to demonstrate a positive relationship between positive mood enhancement and listening to Quran (Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015). This could be due to cultural desensitization, as all students were Muslim participants in the present study whereas non-Muslim students also participated in previous studies (Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015). Muslim participants are more probable to be familiar with the Quran compared to non-Muslims. Hence, a more suitable sample could be students from a different religiosity, which would have delivered a stronger causal relationship. Another limitation was the variance between the control group and the experimental group which was relatively narrow as the participants in the control group were also exposed to audio related to the Quran. Different results might likely be obtained if the control group did not receive any stimuli. Lastly, as mood disturbance is not a direct measure of positive mood, working memory enhancement may not be subjected to mood orientation as found in previous research (Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015). However, due to the controlled nature of the study and random assignment it is suggested that any influence from extraneous variables is limited.

In conclusion, the present study produced significant results indicating that exposure to Quran improves working memory performance as predicted in the study. Listening to Quran also reduced mood disturbance of participants in the experimental group compared to the control group, further supporting the proposed hypothesis of the study. Moreover, these findings were also supported by previous research in the field of psychology and Quran (Hojjati, Rahimi, Farehani, Sobhi-Gharamaleki & Alian, 2014; Zulkurnaini, Kadir, Murat & Isa, 2012; Al-Galal, Alshaikhli, Abdul Rahman & Dzulkifli, 2015; Fauzan & Abidin, 2017). Additional findings of the present study also suggested a significant reduction in negative mood among the participants who listened to Quran. These findings were successful at challenging the mood-arousal-hypothesis of music by Husain, Thompson and Schellenberg (2002), where it associated with mood-and-arousal.to Quran. These

findings were successful at challenging the mood-arousal-hypothesis of music by Husain, Thompson and Schellenberg (2002), where it can be argued that similar to music, Quran is also associated with mood-and-arousal. A correlation study using Quran as a mediating factor could lead to more accurate results that explain the link between mood and cognition. Likewise, differential research on the impact of reciting Quran and listening to Quran on memory and mood could also be a great contribution to future studies. Despite the limitations, this study demonstrates the prominence of using Quran in enhancing mood and memory, particularly among students.

**Acknowledgement**

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## Appendix A

**Table 3**

*Mixed ANOVA – Descriptives Stattistics for Experimental and Control Group Pre-Test and Post-Test Mood Disturbance Scores*

| | Group | Mean | Std. Deviation | N |
|---|---|---|---|---|
| POMS 1 | Treatment Group | 109.64 | 29.476 | 25 |
| | Control Group | 110.72 | 28.011 | 25 |
| | Total | 110.18 | 28.463 | 50 |
| POMS 2 | Treatment Group | 95.76 | 30.650 | 25 |
| | Control Group | 113.64 | 34.571 | 25 |
| | Total | 104.70 | 33.572 | 50 |

**Table 4**

*Mixed ANOVA results comparing mean differences in pre-test and post-test mood disturbance scores within participants of experimental group and control group*

| Source | | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| Test | Sphericity Assumed | 750.760 | 1 | 750.760 | 3.618 | .063 | .070 |
| | Greenhouse-Geisser | 750.760 | 1.000 | 750.760 | 3.618 | .063 | .070 |
| | Huynh-Feldt | 750.760 | 1.000 | 750.760 | 3.618 | .063 | .070 |
| | Lower-bound | 750.760 | 1.000 | 750.760 | 3.618 | .063 | .070 |
| Test * group | Sphericity Assumed | 1764.000 | 1 | 1764.000 | 8.500 | .005 | .150 |
| | Greenhouse-Geisser | 1764.000 | 1.000 | 1764.000 | 8.500 | .005 | .150 |
| | Huynh-Feldt | 1764.000 | 1.000 | 1764.000 | 8.500 | .005 | .150 |
| | Lower-bound | 1764.000 | 1.000 | 1764.000 | 8.500 | .005 | .150 |

**Table 5**

*Pearson's correlation results to find a correlation between decreased mood disturbance scores and working memory performance in experiment group*

| | | POMS 2 | Working Memory Task |
|---|---|---|---|
| POMS 2 | Pearson Correlation | 1 | .133 |
| | Sig. (2-tailed) | | .525 |
| | N | 25 | 25 |
| Working Memory Task | Pearson Correlation | .133 | 1 |
| | Sig. (2-tailed) | .525 | |
| | N | 25 | 25 |

**Table 6**

*Paired sample T-test results comparing positive and negative emotions reported before and after listening to Quran among participants in the experiment group*

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Positive 1 - Positive 2 | -2.080 | 6.137 | 1.227 | -4.613 | .453 | -1.695 | 24 | .103 |
| Pair 2 | Negative 1 - Negative 2 | 8.960 | 8.065 | 1.613 | 5.631 | 12.289 | 5.555 | 24 | .000 |

**Table 7**

*Pearson's correlation results to find a correlation between frequency of Quran listening and working memory performance in experiment group*

| | | Quran Listening | Working Memory Task |
|---|---|---|---|
| Quran Listening | Pearson Correlation | 1 | .175 |
| | Sig. (2-tailed) | | .224 |
| | N | 50 | 50 |
| Working Memory Task | Pearson Correlation | .175 | 1 |
| | Sig. (2-tailed) | .224 | |
| | N | 50 | 50 |

## Appendix B

**Links for Audio Clips**

**Link 1: Quran recitation for experiment group (1:18 – 2:29).**

https://www.youtube.com/watch?v=djtqsx4b6TA

**Link 2: Audio presentation for control group.**

https://www.youtube.com/watch?v=ZUakcBVZXHo

# Appendix C

## Profile of Mood States (POMS) Questionnaire

**Abbreviated POMS (Revised Version)**

~~Name:~~ _____ ~~Date:~~

Below is a list of words that describe feelings people have. Please CIRCLE THE NUMBER THAT BEST DESCRIBES HOW YOU FEEL RIGHT NOW.

| | Not At All | A Little | Moderately | Quite a lot | Extremely |
|---|---|---|---|---|---|
| Tense | 0 | 1 | 2 | 3 | 4 |
| Angry | 0 | 1 | 2 | 3 | 4 |
| Worn Out | 0 | 1 | 2 | 3 | 4 |
| Unhappy | 0 | 1 | 2 | 3 | 4 |
| Proud | 0 | 1 | 2 | 3 | 4 |
| Lively | 0 | 1 | 2 | 3 | 4 |
| Confused | 0 | 1 | 2 | 3 | 4 |
| Sad | 0 | 1 | 2 | 3 | 4 |
| Active | 0 | 1 | 2 | 3 | 4 |
| On-edge | 0 | 1 | 2 | 3 | 4 |
| Grouchy | 0 | 1 | 2 | 3 | 4 |
| Ashamed | 0 | 1 | 2 | 3 | 4 |
| Energetic | 0 | 1 | 2 | 3 | 4 |
| Hopeless | 0 | 1 | 2 | 3 | 4 |
| Uneasy | 0 | 1 | 2 | 3 | 4 |
| Restless | 0 | 1 | 2 | 3 | 4 |
| Unable to concentrate | 0 | 1 | 2 | 3 | 4 |
| Fatigued | 0 | 1 | 2 | 3 | 4 |
| Competent | 0 | 1 | 2 | 3 | 4 |
| Annoyed | 0 | 1 | 2 | 3 | 4 |
| Discouraged | 0 | 1 | 2 | 3 | 4 |
| Resentful | 0 | 1 | 2 | 3 | 4 |
| Nervous | 0 | 1 | 2 | 3 | 4 |
| Miserable | 0 | 1 | 2 | 3 | 4 |

PLEASE CONTINUE WITH THE ITEMS ON THE NEXT PAGE

| | | | | | |
|---|---|---|---|---|---|
| Forgetful | 0 | 1 | 2 | 3 | 4 |
| Vigorous | 0 | 1 | 2 | 3 | 4 |
| Uncertain about things | 0 | 1 | 2 | 3 | 4 |
| Bushed | 0 | 1 | 2 | 3 | 4 |
| Embarrassed | 0 | 1 | 2 | 3 | 4 |

THANK YOU FOR YOUR COOPERATION

PLEASE BE SURE YOU HAVE ANSWERED EVERY ITEM

Citation:
Grove, J.R., & Prapavessis, H. (1992). Preliminary evidence for the reliability and validity of an abbreviated Profile of Mood States. *International Journal of Sport Psychology, 23*, 93-109.

# Appendix D

## Profile of Mood States (POMS) Scoring Keys

**Abbreviated POMS (Revised Version)**

***** SCORING KEY *****

Scores for the seven subscales in the abbreviated POMS are calculated by summing the numerical ratings for items that contribute to each subscale. The correspondence between items and subscales is shown below.

| Item | Scale | Not At All | A Little | Moderate | Quite a lot | Extremely |
|---|---|---|---|---|---|---|
| Tense | TEN | 0 | 1 | 2 | 3 | 4 |
| Angry | ANG | 0 | 1 | 2 | 3 | 4 |
| Worn Out | FAT | 0 | 1 | 2 | 3 | 4 |
| Unhappy | DEP | 0 | 1 | 2 | 3 | 4 |
| Proud | ERA | 0 | 1 | 2 | 3 | 4 |
| Lively | VIG | 0 | 1 | 2 | 3 | 4 |
| Confused | CON | 0 | 1 | 2 | 3 | 4 |
| Sad | DEP | 0 | 1 | 2 | 3 | 4 |
| Active | VIG | 0 | 1 | 2 | 3 | 4 |
| On-edge | TEN | 0 | 1 | 2 | 3 | 4 |
| Grouchy | ANG | 0 | 1 | 2 | 3 | 4 |
| Ashamed | ERA | Reverse-score this item [0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0] | | | | |
| Energetic | VIG | 0 | 1 | 2 | 3 | 4 |
| Hopeless | DEP | 0 | 1 | 2 | 3 | 4 |
| Uneasy | TEN | 0 | 1 | 2 | 3 | 4 |
| Restless | TEN | 0 | 1 | 2 | 3 | 4 |
| Can't concentrate | CON | 0 | 1 | 2 | 3 | 4 |
| Fatigued | FAT | 0 | 1 | 2 | 3 | 4 |
| Competent | ERA | 0 | 1 | 2 | 3 | 4 |
| Annoyed | ANG | 0 | 1 | 2 | 3 | 4 |
| Discouraged | DEP | 0 | 1 | 2 | 3 | 4 |
| Resentful | ANG | 0 | 1 | 2 | 3 | 4 |
| Nervous | TEN | 0 | 1 | 2 | 3 | 4 |
| Miserable | DEP | 0 | 1 | 2 | 3 | 4 |
| Confident | ERA | 0 | 1 | 2 | 3 | 4 |
| Bitter | ANG | 0 | 1 | 2 | 3 | 4 |
| Exhausted | FAT | 0 | 1 | 2 | 3 | 4 |
| Anxious | TEN | 0 | 1 | 2 | 3 | 4 |
| Helpless | DEP | 0 | 1 | 2 | 3 | 4 |
| Weary | FAT | 0 | 1 | 2 | 3 | 4 |
| Satisfied | ERA | 0 | 1 | 2 | 3 | 4 |
| Bewildered | CON | 0 | 1 | 2 | 3 | 4 |
| Furious | ANG | 0 | 1 | 2 | 3 | 4 |
| Full of Pep | VIG | 0 | 1 | 2 | 3 | 4 |
| Worthless | DEP | 0 | 1 | 2 | 3 | 4 |
| Forgetful | CON | 0 | 1 | 2 | 3 | 4 |
| Vigorous | VIG | 0 | 1 | 2 | 3 | 4 |
| Uncertain… | CON | 0 | 1 | 2 | 3 | 4 |
| Bushed | FAT | 0 | 1 | 2 | 3 | 4 |
| Embarrassed | ERA | Reverse-score this item [0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0] | | | | |

| | |
|---|---|
| **TEN = Tension** | Note that 2 of the items on the Esteem-related Affect (ERA) subscale are reverse-scored prior to being combined with the other items. |
| **ANG = Anger** | |
| **FAT = Fatigue** | **Total Mood Disturbance (TMD)** is calculated by summing the totals for the negative subscales and then subtracting the totals for the positive subscales: |
| **DEP = Depression** | |
| **ERA = Esteem-related Affect** | TMD = [TEN+DEP+ANG+FAT+CON] – [VIG+ERA]. |
| **VIG = Vigour** | A constant (e.g., 100) can be added to the TMD formula in order to eliminate negative scores. |
| **CON = Confusion** | |

# Appendix E

## Letter-Number Sequencing task (WAIS-III)

C-7

2-K

Y-1

L-3-R

S-7-M

B-2-D

N-9-L-4

W-3-H-6

6-W-4-L-5-M-1-G

6-A-4-E-3

T-5-H-9-X

7-R-1-S-8

F-5-A-6-J-1

T-8-N-4-D-2

4-M-7-S-1-Q

P-1-D-6-L-8-E

2-R-8-F-5-T-9

G-3-V-1-J-4-H

3-F-7-P-2-C-5-T

B-9-R-4-A-2-H-7

## Appendix F

**Informed Consent Paper**

In this study you will be asked to complete a simple task for a psychology related experiment. All information you provide will remain confidential and will not be associated with your name or any identity. If for any reason during this study you do not feel comfortable, you may leave the laboratory and your information will be discarded. Your participation in this study will require **approximately 25-30 minutes.** When this study is complete you will be debriefed about the purpose of the experiment and theory. You will also be provided with the results of the experiment if you request them, and you will be free to ask any questions. If you have any further questions concerning this study, please feel free to contact me through phone or email: **Mariyam Hudha, Phone: 7501726, Email: maryam.hudha@outlook.com.** Please indicate with your signature on the space below that you understand your rights and agree to participate in the experiment.

***Your participation is solicited, yet strictly voluntary. All information will be kept confidential and your name or identity will not be associated with any research findings.***

_____ _____

Signature of Participant Date

## Appendix G

**Demographic Form**

**1) Gender:**

□ Male

□ Female

**2) Age:**

_____

**3) Which of the following university/college do/did you attend?**

□ The Maldives National University

□ Villa College

□ Avid College

□ Cyryx College

□ Clique College

□ Other (Please specify: _____)

**4) How often do you listen to Quran?**

□ Often

□ Sometimes

□ Rarely

□ Never

**5) Do you have any cognitive disability?**

□ Yes

□ No

## Appendix H

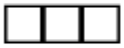
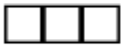
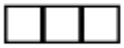
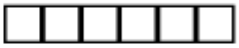
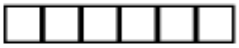
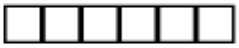
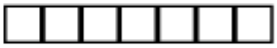
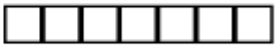
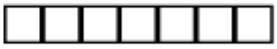
### Answer Sheet for Letter-Number Sequencing Task

**Sample**

1. 
2. 
3. 

---

**Test**

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 
17. 
18. 
19. 
20. 
21.