Evaluation of Students Concentration in Classroom with Quranic Recitation Background using Electroencephalogram


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Abstract

The classroom environment can affect the students concentration during learning session. The Quranic recitation is believed to be able to increase the brain activity related to the concentration level. In this study, the frequency spectrum of Electroencephalogram (EEG) signals from 16 points of the electrode placement on the head was analyzed to find the effect of Quranic recitation background during lectures. The comparison based on complexity of lecture content was conducted. It was found that Quranic recitation background during lectures can increase concentration process of students during lecture with higher level of complexity. This paper is expected to facilitate improvements in the classroom environment which could lead to better students achievement.
1 Introduction

Over the years, educational researchers have investigated many factors considered to affect student learning in classroom. One of the main factors which were widely discussed is the classroom environment itself (Qureshi, Janjua, Zaman, Lodhi, & Tariq, 2014). Current studies of classroom environment are historically preceded by research that examined classroom characteristics such as order, organization, rule clarity, teacher control, affiliation and support (Moos, 1979). Student achievements also connected to student mindfulness and concentration inside classroom (Lewis, 2001). Some authors connect levels of mindfulness and concentration with programs, beliefs and feelings they collected during the learning process. These feelings and beliefs are stored in subconscious mind and come to consciousness in the form of positive or negative thoughts (Leung & Lam, 2003).

Medical music therapy which has been developed rapidly in the last 20 years has been used effectively to alter emotions, positive or negative thoughts (Gooding, 2010). Music activities have been proven to act as reinforce and could be beneficial to overall academic and social behaviors improvement (Shekah, Hassan, & Othman, 2013). The music helps a person to be in relaxing conditions states which later can generate a focus state of mind (Nakamura et al., 1999). One of the most beautiful, attractive and the most natural types of music is the spiritual music of Quranic recitation. Quranic recitation increases the brain wave activity more than listening to the classical music which result in a more relaxing and alert condition. Abdullah & Omar (2011) has studied the comparison of the alpha wave generation while listening to Quranic recitation and hard music. The results shown that the alpha wave magnitude during listening to Quranic recitation is higher compared to rest condition and listening to hard music. Odeh, Hodali, Sleibi, & Salsa (2009) extended this work to prove that the alpha wave magnitude during listening to Quranic recitation was higher compared to resting condition and listening to hard rock music. It was ob-
served that the beta wave is activated during activity that includes thinking and concentrating. Harmony et al., (1996) reported that the delta wave is increased when concentration is high. Another studies by Bakri, Zakaria, Muhamad Zainuldin, & Abusafia (2014) suggested that the Alpha and Beta waves could be related with the state of relaxation and attention. Zulkurnaini, Kadir, Murat, & Isa, (2012) investigated on the best music therapy for students in helping them to focus in doing homework and activities related with their studies and found that Alpha waves and Beta waves were increased while listening to Rock, Mozart music, Quranic recitation and decreased when listening to Light and Jazz music. In summary, many results indicating the potential of Quranic recitation as a music therapy have been reported. However, most of the studies in the open literature did not simultaneously examine the effect of Quranic recitation to the students during learning session in classroom.

Therefore, this study aims to investigate the effect of Quranic recitation as a classroom background to increase their focus and concentration during their learning session. Electroencephalogram (EEG) was used to monitor and analyze the effectiveness of this idea specifically to identify brain wave changes of the subjects (Sinno & Tout, 2008). The findings of this study is expected to improve the classroom environment during the learning session which could lead to students achievement.

2 Methodology

2.1 Experimental Setup

In this study, 15 subjects from Instrumentation and Control Engineering section with aged 20-25 years involved in the data collection session. All subjects are in healthy condition with normal hearing and did not have any brain disease. Subjects are advised to get enough rest and sleep at least 6 hours before the experiment was conducted. They are also not allowed to take any medication and caffeine, and have been told earlier not to apply any hair gel during data collection session. The electrodes are placed at the scalp with the 10-20 system electrode placements. The experiment was conducted at room temperature (25°C) with air conditioning. The room environment was under soundproof.
The experiment interface for data collection was developed using MATLAB Graphical User Interface (GUI). Surah Al-Fatihah, Surah Al-Asr and Surah Al-Alaq were used as Quranic recitation background during lecture session. The source of the audio is in MP3 player. The surah was kept on repeating until the learning session is finished. The subjects have to experience two learning sessions; low level and high level of complexity lecture. The lecture session video of engineering subjects with the duration of 8 minutes has been recorded for both level of complexity. The learning session was conducted in Malay language. It is purposely to be conducted in monotonous and not attractive manners, in order to reduce the concentration level of the subjects. The subjects are instructed to sit at their own comfortable position and resting with eyes closed in one minute. Then, subjects have been instructed to rest with eyes opened for one minute. After that, subjects have to watch the learning session video. During the session, if they lose their concentration, they have to click specified button in the experiment interface. The button click time is recorded using the MATLAB GUI. For all of the sessions, the EEG signals have been recorded for with and without Quranic recitation as classroom background.

2.2 Hardware and Software

This study was performed using 16 channels EEG machine for the data collection. The EEG machine system can collects EEG (Bakri et al., 2014) signal with electrodes, via integrated amplification, A/D transformation, PC auto analysis, Fast Fourier Transform (FFT) to form EEG that displays with color depth. The electrodes are used to acquire the subjects data is connected between the subject and the panel. The panel is connected with the computer to store the collected data.

The data collection is conducted where the electrodes is placed on the subjects scalp. It consists of 16 electrodes set in place through point A, Fp1, Fp2, F3, F4, C3, C4, P3, P4, O1, O2, F7, F8, T3, T4, T5 and T6 as shown in Figure 1. The A pole (A1, A2) which located at the center of the forehead that act as a reference pole. EEG32 Integrative Machine of Digital EEG Topography software has been used for the data recording process. The data analysis was carried out using MATLAB.
3 Results and Discussion

Firstly, the investigation focused on differences of the frequency spectrum between the EEG signals during learning session using video with and without Quranic recitation background. In general observation for both situations, the average frequency spectrum exhibits less than 50Hz. Figure 2 to Figure 9 show the frequency spectrum up to 50Hz for EEG recording from 16 points of the head illustrated in Figure 1. The data presented are based on the average of data from 15 students that are required to watch a low level of complexity lecture video while their EEG was being recorded.

Figure 2. EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) C3A1 and (b) C4A2
Figure 3. EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) F1A1 and (b) F2A2

Figure 4. EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) F3A1 and (b) F4A2

Figure 5. EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) F7A1 and (b) F8A2

Figure 6. EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) O1A1 and (b) O2A2
We then compare the EEG spectrum between both scenarios using Equation (1):
\[
\text{Difference} = \text{FFT(without background EEG)} - \text{FFT(with background EEG)}
\] (1)

From this observation, there are differences of magnitude for the respective frequencies monitored in this study. The difference between EEG energy spectrum without and with Quranic recitation
background is given in Table 1. The sum of energy difference is 1658. From Table 1, it is observed that the Quranic recitation did not significantly help the participant to concentrate in understanding the given lecture.

Table 1: Energy spectrum difference of EEG for simple lecture

<table>
<thead>
<tr>
<th>Location</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3A1</td>
<td>304</td>
</tr>
<tr>
<td>F2A2</td>
<td>-119</td>
</tr>
<tr>
<td>F3A1</td>
<td>279</td>
</tr>
<tr>
<td>F4A2</td>
<td>276</td>
</tr>
<tr>
<td>C3A1</td>
<td>347</td>
</tr>
<tr>
<td>C4A2</td>
<td>261</td>
</tr>
<tr>
<td>F5A1</td>
<td>59</td>
</tr>
<tr>
<td>F4A2</td>
<td>-106</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1A1</td>
<td>156</td>
</tr>
<tr>
<td>O2A2</td>
<td>-228</td>
</tr>
<tr>
<td>F7A1</td>
<td>68</td>
</tr>
<tr>
<td>F8A2</td>
<td>144</td>
</tr>
<tr>
<td>T3A1</td>
<td>213</td>
</tr>
<tr>
<td>T4A2</td>
<td>-112</td>
</tr>
<tr>
<td>T5A1</td>
<td>263</td>
</tr>
<tr>
<td>T6A2</td>
<td>-107</td>
</tr>
</tbody>
</table>

Figure 10 to Figure 17 show the EEG spectrum with and without Quranic Recitation Background for complexed lecture.

Figure 10. EEG Spectrum with and without Quranic Recitation Background for a complicated lecture of location (a) C3A1 and (b) C4A2

Figure 11. EEG Spectrum with and without Quranic Recitation Background for a complicated lecture of location (a) F1A1 and (b) F2A2
Figure 12. EEG Spectrum with and without Quranic Recitation 
Background for a complicated lecture of location (a) F3A1 and 
(b) F4A2

Figure 13. EEG Spectrum with and without Quranic Recitation 
Background for a complicated lecture of location (a) F7A1 and 
(b) F8A2

Figure 14. EEG Spectrum with and without Quranic Recitation 
Background for a complicated lecture of location (a) O1A1 and 
(b) O2A2
Based on the EEG spectrum, when a complicated lecture was given, the brain activities were more active in order to focus in understanding the lecture. The difference values using Equation (1) is given in Table 2. The sum of energy difference is 725.

Table 2: Energy spectrum difference of EEG for complicated lecture
As can be seen from Table 2, brain activities are more active to concentrate more during a lecture when Quran recitation background is present during the learning process. This theory is proven when comparing the magnitude spectrum between a basic and complicated lectures using Equation (2) and the results is tabulated in Table 3.

\[
\text{Difference} = \text{FFT(complicated EEG)} - \text{FFT(basic EEG)}
\]  

(2)

As can be seen from Table 3, brain requires more activities in order to understand complicated lectures. When no Quranic recitation background presents, the brain increased 13770 energy spectrums to focus more on the lecture. Similar case when the Quranic recitation background is present during the lecture, the brain is more active with an increase of energy spectrum with a total of 15754.

From this study, it can be concluded that, having Quranic recitation background during lectures increase the concentration process of students.

Table 3: Energy spectrum difference of EEG between basic and complicated lecture
4 Conclusion

The present study was designed to determine the effect of the Quranic recitation background during lectures to the students concentration. This study has shown that based on comparison of the frequency spectrum between the EEG signals for concentration activity during watching a lecture video with and without Quranic recitation background, it is observed that the Quranic recitation did not significantly help the subject to concentrate in understanding the given lecture (simple lecture). However, the brain activities are more active when a complexed lecture is given in order to focus in understanding the lecture. This study will serve as a base for future studies, as it can conclude that, having Quranic recitation background during lectures can increase the concentration process of students.

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References


