

Study of Students' Concentration in the Classroom with Quranic Recitation Background using Electroencephalogram



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ABSTRACT

The classroom environment can affect the students' concentration during the learning session. The Quranic recitation is believed to be able to increase 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 the complexity of lecture content was conducted. It was found that Quranic recitation background during lectures can increase concentration process of students during the lecture with a higher level of complexity. This paper is expected to facilitate improvements in the classroom environment, which could lead to better students' achievement.

Key words: Electroencephalogram, Quran recitation, Classroom background.

1. INTRODUCTION

Over the years, educational researchers have investigated many factors considered to affect student learning in the classroom. The classroom environment is the primary factor need to be considered. Current studies of the classroom environment are historically preceded by research that examined classroom characteristics such as order, organization, rule clarity, teacher control, affiliation and support [1]. Student achievements also connected to student mindfulness and concentration inside the classroom [2]. 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 the subconscious mind and come to consciousness in the form of positive or negative thoughts [3].

Medical music therapy, which has been developed rapidly in the last 20 years, has been used effectively to alter emotions,

positive or negative thoughts [4]. Music activities have been proven to act as reinforce and could be beneficial to overall academic and social behaviours improvement [5]. The music helps a person to be in relaxing conditions states, which later can generate a focus state of mind [6]. One of the most beautiful, attractive and the most natural types of music is the spiritual music of Quranic recitation. Quranic recitation increases brain wave activity more than listening to classical music, which results in a more relaxing and alert condition. Reference [7] has studied the comparison of the alpha wave generation while listening to Quranic recitation and hard music. The results show that the alpha wave magnitude during listening to Quranic recitation is higher compared to rest condition and listening to hard music. Reference [8] 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. As a result, the beta wave activated during thinking and concentrating activity. Reference [9] reported that the delta wave increased when concentration is high. Other studies by reference [10] suggested that the Alpha and Beta waves could be related to the state of relaxation and attention. Reference [11] investigated on the best music therapy for students in helping them to focus on doing homework and activities related with their studies and found that Alpha waves and Beta waves 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 music therapy. However, most of the studies in the open literature did not simultaneously examine the effect of Quranic recitation to the students during the learning session in the 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 to identify brain wave changes of the subjects [12]. The findings of this study are 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 candidates from the Instrumentation and Control Engineering section with aged 20-25 years involved in the data collection session. All candidates 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 conducted. They are also not allowed to take any medication and caffeine and have been told earlier not to apply any hair gel during the data collection session — the electrodes placed at the scalp with the 10-20 system electrode placements.

The experiment conducted at room temperature (25°C) with air conditioning. The room environment was under soundproof. The experiment interface for data collection developed using MATLAB Graphical User Interface (GUI). Surah Al-Fatihah, Surah Al-Asr and Surah Al-‘Alaq used as Quranic recitation background during a lecture session. The source of the audio is in MP3 player. The surah kept on repeating until the learning session finished. The subjects have to experience two learning courses, which is a low level and a high level of complexity lecture. The lecture session video of engineering subjects with a duration of 8 minutes has recorded for both levels of complexity. The learning session conducted in the Malay language. It is undertaken purposely in monotonous and not attractive manners, to reduce the concentration level of the subjects. The subjects are instructed to sit at their comfortable position and resting with eyes closed in one minute. Then, candidates told to rest with eyes open for one minute. After that, the candidates have to watch the learning session video. During the session, if they lose their concentration, they have to click the 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 collect EEG [10] signal with electrodes, via integrated amplification, A/D transformation, PC auto analysis, Fast Fourier Transform (FFT) to form EEG that displays with colour depth. The electrodes are used to acquire the subjects’ data is connected between the candidate and the panel. The panel is connected with the computer to store the collected data.

The data collection conducted where the electrodes placed on the subject’s 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 centre of the forehead that acts as a reference pole. EEG32 Integrative Machine of Digital EEG Topography software has 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.

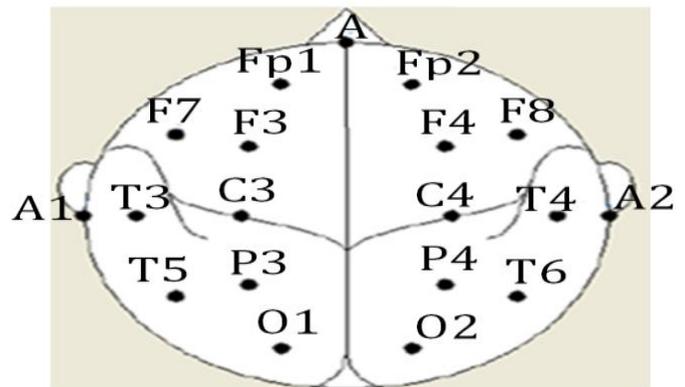
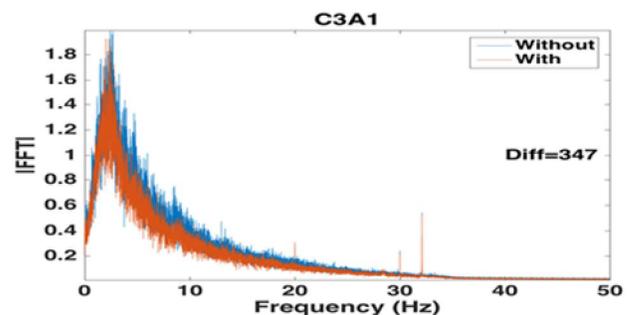
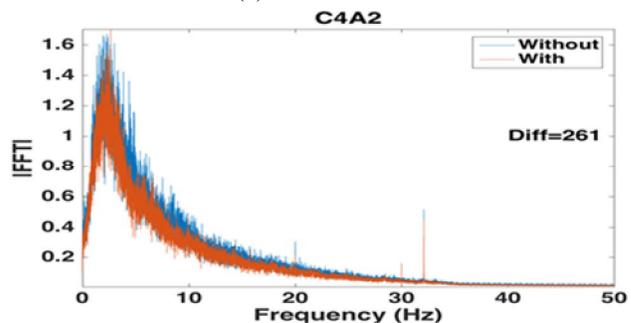


Figure 1: The electrode placement (16 channels)

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 recorded their EEG.

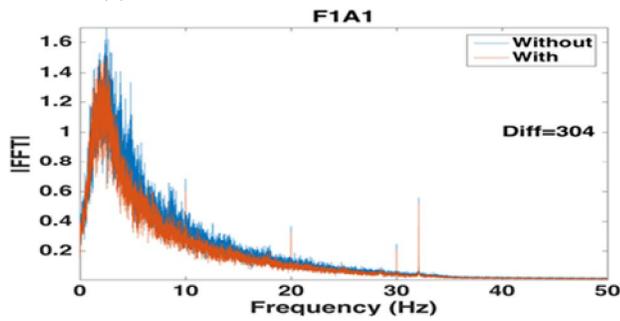


(a) Location C3A1

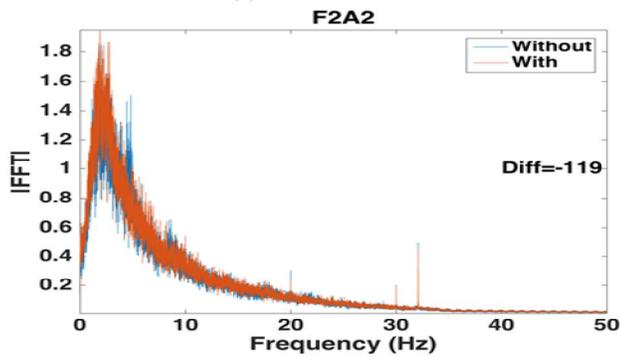


(b) Location C4A2

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

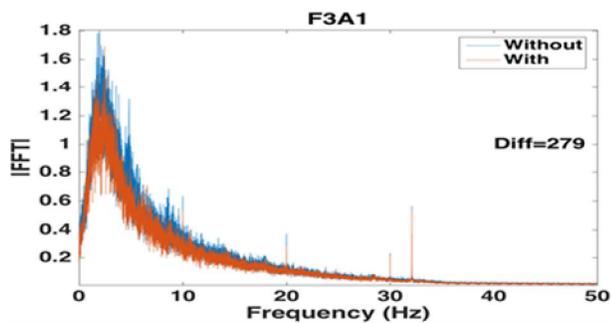


(a) Location F1A1

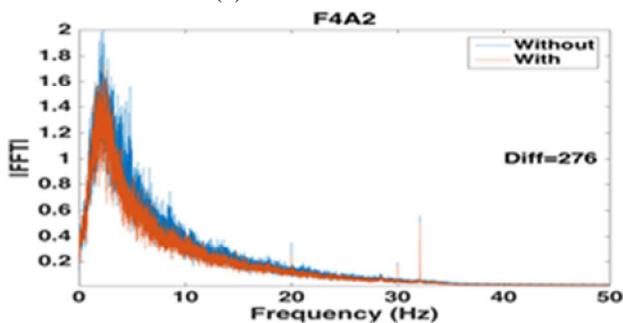


(b) Location F2A2

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

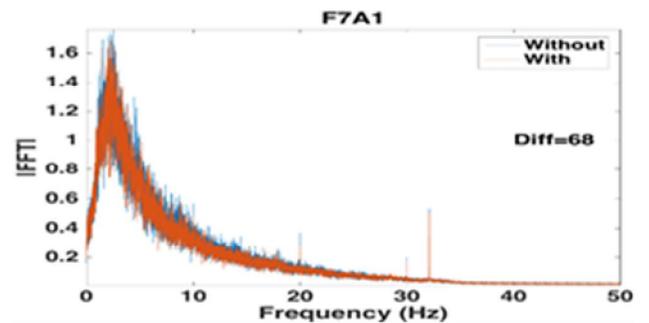


(a) Location F3A1

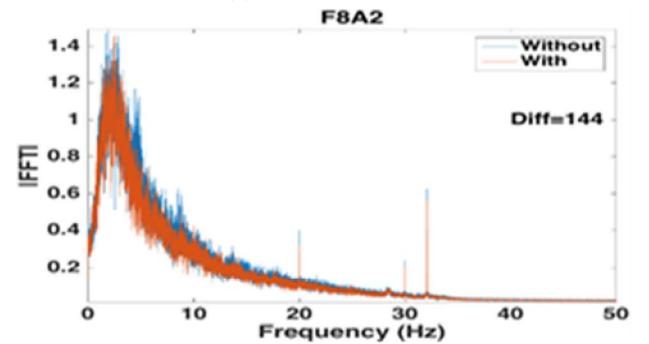


(b) Location F4A2

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

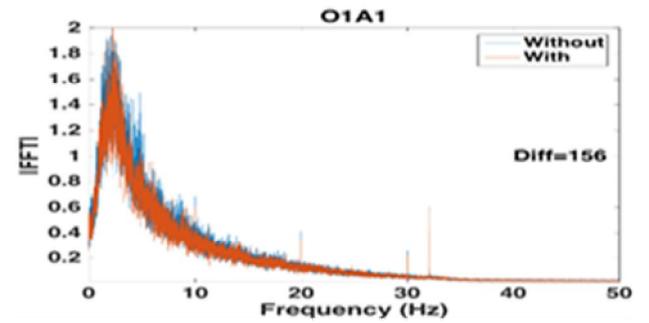


(a) Location F7A1

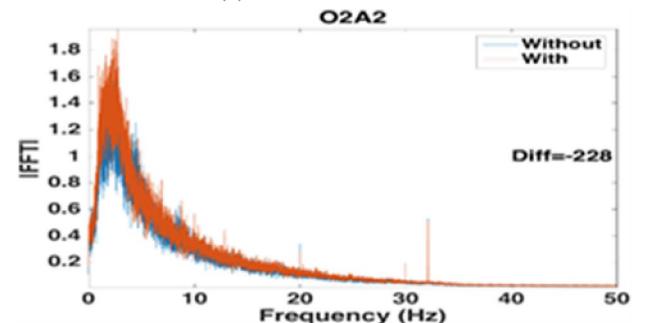


(b) Location F8A2

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

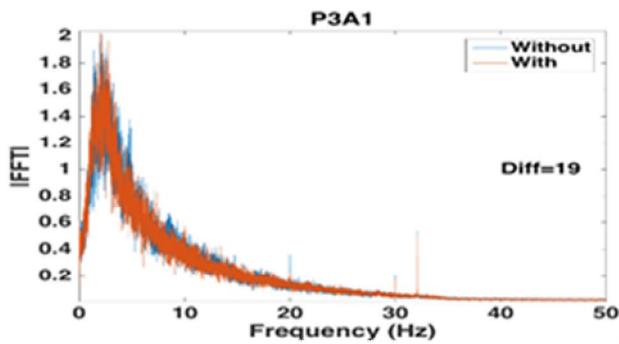


(a) Location O1A1

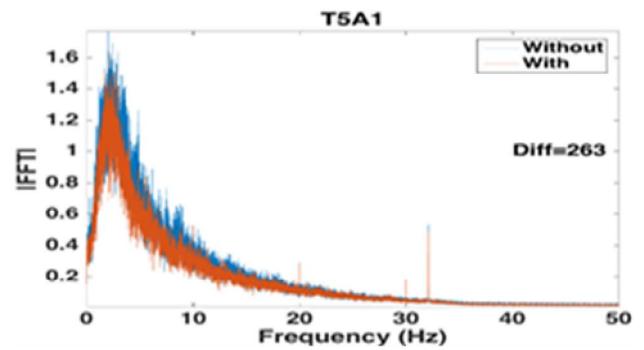


(b) Location O2A2

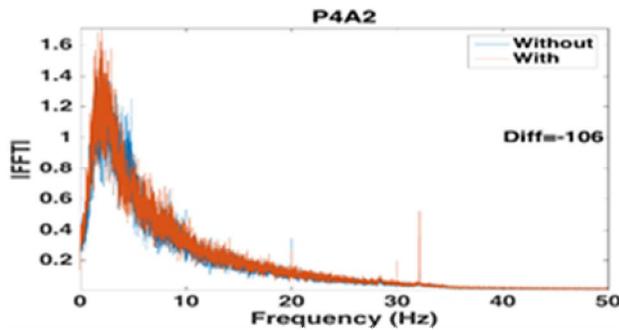
Figure 6: EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) O1A1 and (b) O2A2.



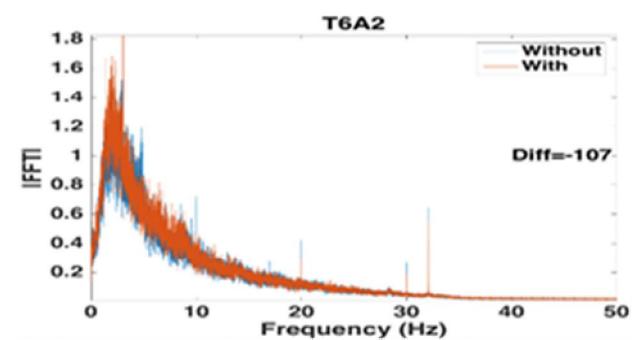
(a) Location P3A1



(a) Location T5A1



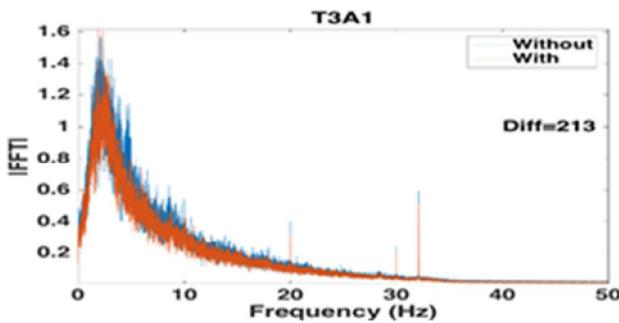
(b) Location P4A2



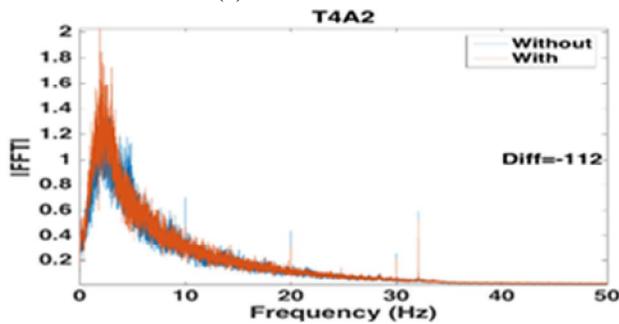
(b) Location T6A2

Figure 7: EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) P3A1 and (b) P4A2

Figure 9: EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) T5A1 and (b) T6A2



(a) Location T3A1



(b) T4A2

Figure 8: EEG Spectrum with and without Quranic Recitation Background for a simple lecture of location (a) T3A1 and (b) T4A2

Then, compare the EEG spectrum between both scenarios using (1):

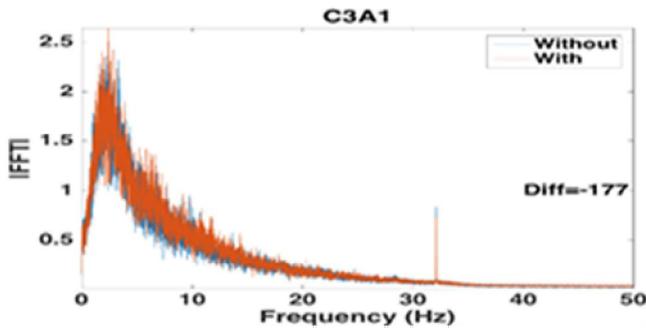
$$\text{Difference} = \text{FFT (without background EEG)} - \text{FFT (with background EEG)} \quad (1)$$

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 given in Table 1. The sum of energy difference is 1658. From Table 1 it shows that the Quranic recitation did not significantly help the participant to concentrate on understanding the given lecture.

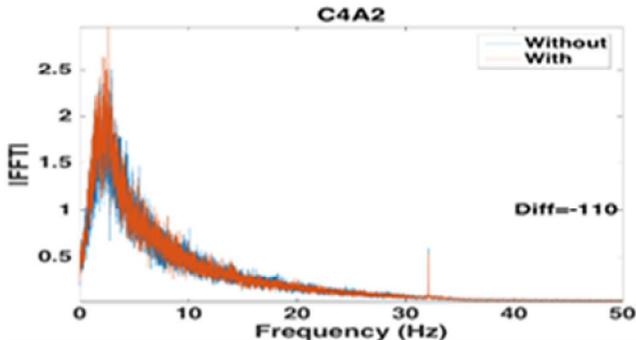
Table1: Energy spectrum difference of EEG for simple lecture

Location	Difference	Location	Difference
F1A1	304	O1A1	156
F2A2	-119	O2A2	-228
F3A1	279	F7A1	68
F4A2	276	F8A2	144
C3A1	347	T3A1	213
C4A2	261	T4A2	-112
P3A1	19	T5A1	263
P4A2	-106	T6A2	-107

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

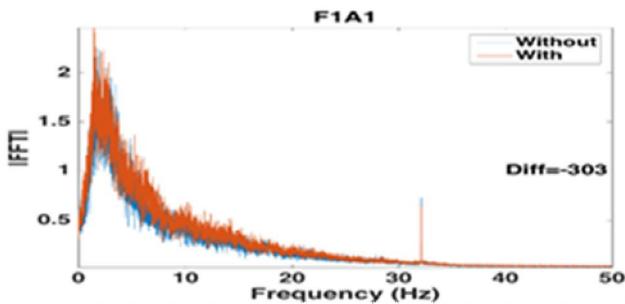


(a) Location C3A1

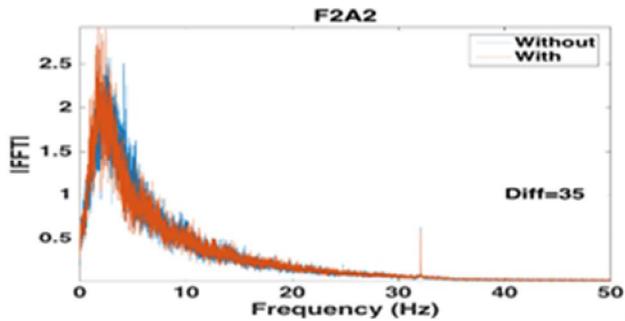


(b) Location C4A2

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

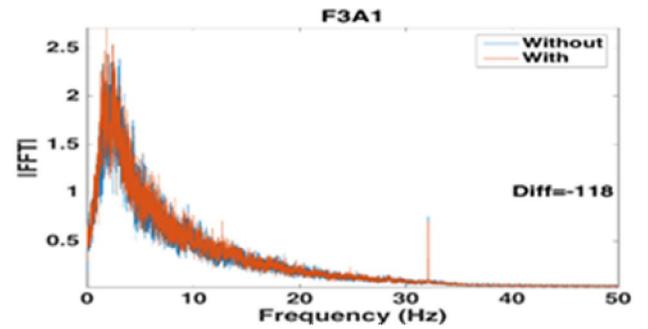


(a) Location F1A1

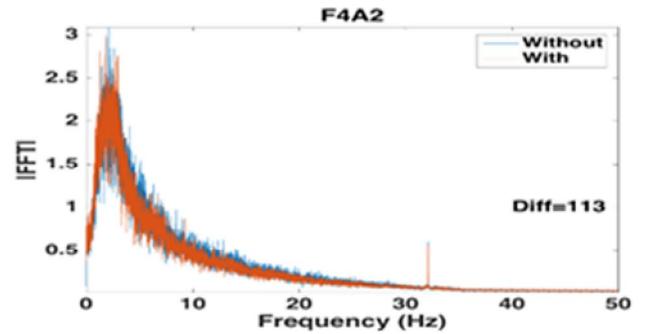


(b) Location F2A2

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

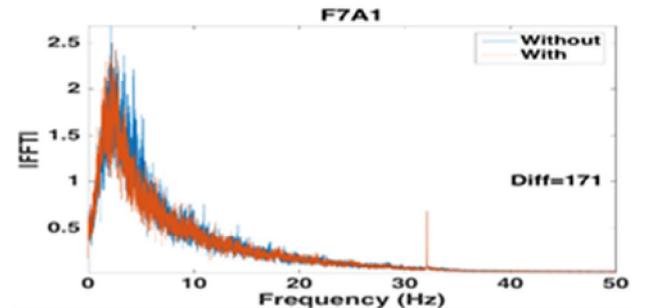


(a) Location F3A1

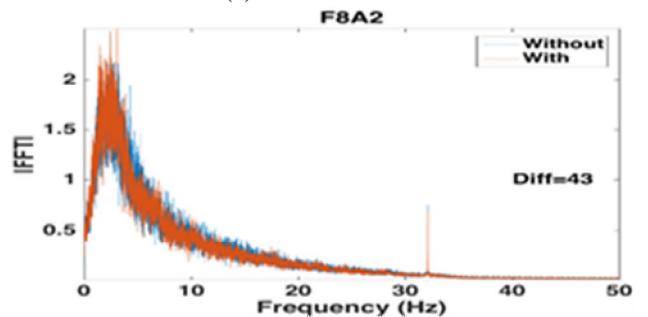


(b) Location F4A2

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

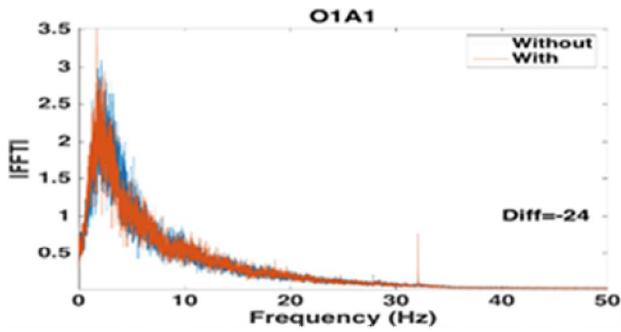


(a) Location F7A1

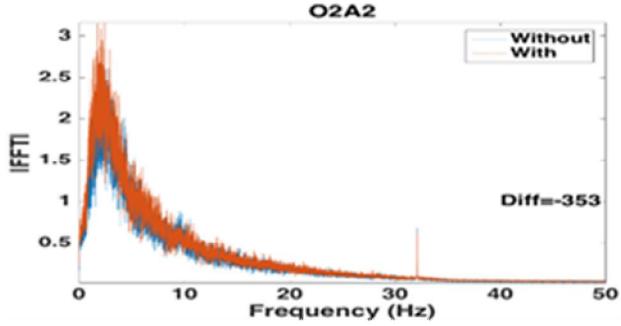


(b) Location F8A2

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

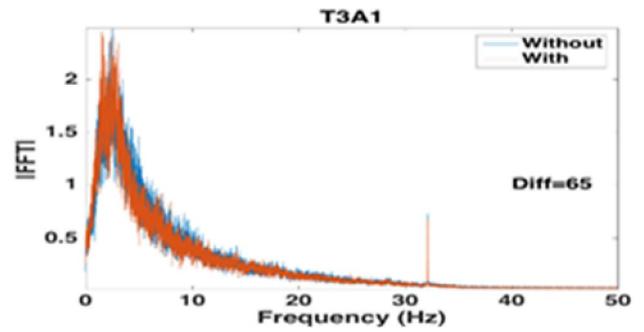


(a) Location O1A1

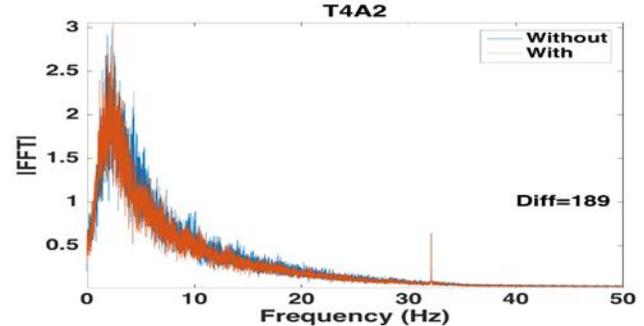


(b) Location O2A2

Figure 14: EEG Spectrum with and without Quranic Recitation Background for a complicated lecture of location (a)O1A1 and (b)O2A2.

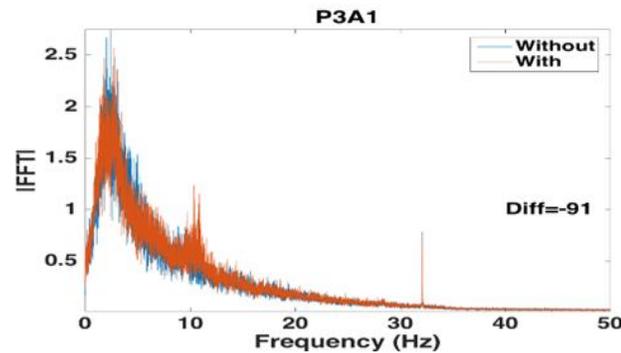


(a) Location T3A1

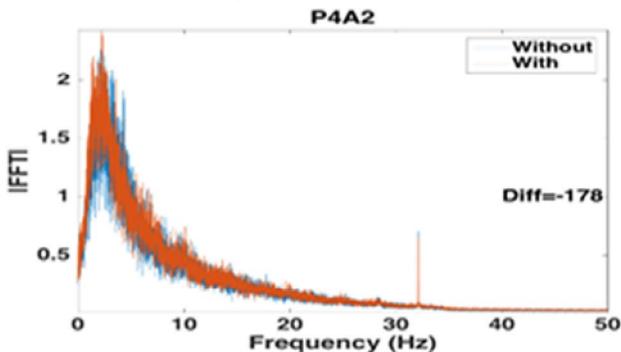


(b) Location T4A2

Figure 16: EEG Spectrum with and without Quranic Recitation Background for a complicated lecture of location (a) T3A1 and (b)T4A2.

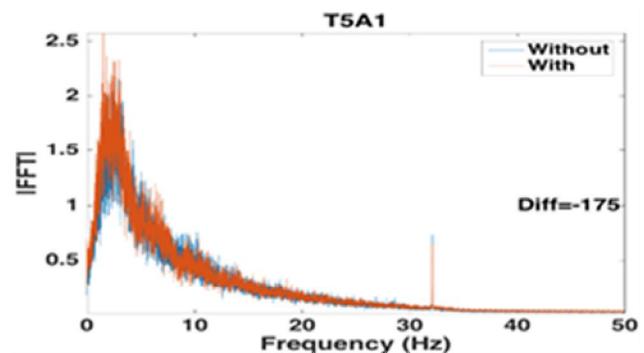


(a) Location P3A1

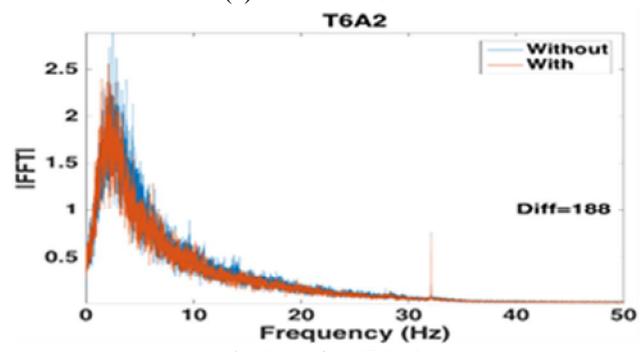


(b) Location P4A2

Figure 15: EEG Spectrum with and without Quranic Recitation Background for a complicated lecture of location (a)P3A1 and (b)P4A2.



(a) Location T5A1



(b) Location T6A2

Figure 17: EEG Spectrum with and without Quranic Recitation Background for a complicated lecture of location (a)T5A1 and (b)T6A2.

Based on the EEG spectrum, for a complicated lecture, the brain activities were more active to focus on understanding the lecture. The difference values using (1) given in Table 2. The sum of energy difference is 725.

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 primary and complicated lecture using (2), and the results tabulated in Table 3.

$$\text{Difference} = \text{FFT (complicated EEG)} - \text{FFT (basic EEG)} \quad (2)$$

Table 2: Energy spectrum difference of EEG for complicated lecture

Location	Difference	Location	Difference
F1A1	-303	O1A1	-178
F2A2	35	O2A2	-24
F3A1	-118	F7A1	-353
F4A2	113	F8A2	171
C3A1	-117	T3A1	43
C4A2	-110	T4A2	65
P3A1	-91	T5A1	189
P4A2	-178	T6A2	-175

As can be seen from Table 3, the brain requires more activities to understand complicated lectures. When no Quranic recitation background presents, the brain increased 13770 energy spectrums to focus more on the lecture. The 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.

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

Location	Difference	
	Without Background	With Background
F1A1	415	1022
F2A2	1029	875
F3A1	889	1286
F4A2	943	1107
C3A1	648	1171
C4A2	694	1066
P3A1	537	648
P4A2	698	770
O1A1	923	1102
O2A2	1118	1243
F7A1	838	734
F8A2	881	982
T3A1	752	899
T4A2	1400	1100

T5A1	509	948
T6A2	1096	801

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

4. CONCLUSION

The present study was designed to determine the effect of the Quranic recitation background during lectures to the student’s concentration. This study has shown that based on comparison of the frequency spectrum between the EEG signals for concentration activity while 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, brain activities are more active when a complexed lecture was given to focus on 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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