

Mini Research: Analyzing the Relationship between Listening to Murottal Al Qur'an Surah Al Baqarah Verses 1-10 to Beta Waves with Learning Concentration

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Abstract: Concentration in learning has a big impact on determining learning outcomes. Some of the conditions experienced by students who find it difficult to maintain concentration during the learning process are caused by many factors. Among them is the atmosphere of a noisy learning environment. One way to determine the learning concentration condition is by measuring beta brain waves using Electroencephalography (EEG). This study aims to analyze the effect of the murottal stimulus of Al Baqarah verses 1-10 on beta brain wave activity and its relationship with learning concentration. The research method used is experimental. Subjects in this study were 6 students of UIN Walisongo Semarang, with inclusion criteria ranging from 20-23 years old, Muslim, not hearing impaired, physically and mentally healthy, and not using drugs. The stages of research consisted of 4 stages; first, the research subjects carried out the pre-test without stimulus; second subject measured their brain waves without stimulus; third, subjects measured brain waves with stimulus; and finally, the research subjects carried out the pre-test with stimulus. The analysis results using the T-test, which stated that the average comparison of beta brain waves in the two groups before and after being given the murottal Al-Qur'an stimulus showed a p-value of 0.0003 ($p < 0.05$). While the results of the pre-test and post-test T-test showed a p-value of 0.017 ($p < 0.05$). It shows that the murottal stimulus of Al Baqarah verses 1-10 effects changes in beta waves and the level of learning concentration.

Keywords: Learning concentration, Murottal Al Baqarah Verse 1-10, Brain Beta Waves, Electroencephalography

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I. INTRODUCTION

The learning process involves interaction activities between teacher-students and reciprocal communication in educational situations to achieve learning goals [1]. Apart from studying at university, a college student must also continue studying to get satisfactory results [2]. Concentration is the concentration of the mind on one thing by putting aside other things that are not needed [3]. Concentration can also be interpreted as the ability to focus attention within a certain period to complete a task without feeling distracted by outside distractions or by the individual himself [4]. Concentration has a great influence on the learning process. Concentration is a very difficult thing to do. It is because many factors influence students to continue to concentrate on learning. One of these factors is that when students feel bored, the student's focus is shifted to other things [5]. Al Qur'an has many benefits for listeners and readers; one of the benefits is cognitive development which can sharpen memory and think [6].

College student learning outcomes are only sometimes related to the ability to absorb and understand the learning materials taught by the lecturer [2]. Other things have an equally important influence on student learning outcomes, such as changes in attitudes towards friends, family, society,

surrounding environment, and skills achieved after learning [7]. Two indicators can be used as benchmarks for the success of the learning process, namely, the absorption of the subject matter and behavior change. One of the factors that influence the level of student absorption is the concentration [8]. The part of the brain that acts as a concentration regulator is the frontal lobe. Living human brain tissue is capable of producing fluctuating electrical waves called brain waves. Brain waves indicate the activity of a person's mind [9]. Information received by the brain through the senses is known as sensory input, and this information is received through sensory cells called neurons. Neurons send messages to the brain to receive signals from any of the senses. Sight through the eyes, smell through the nose, texture or temperature through touch or skin are all included in sensory input [10]. These brain cells function to process information in the form of electrical potential and then forward it to other cells through connections called synapses. Brain activation is a condition in which brain cells process and transmit electrical potentials called action potentials. When one cell is activated, it will activate nearby cells, causing synchronization between cells, which then causes a chain effect on other cells [11].

EEG is a non-invasive method of measuring electric fields in the brain. The voltage signals generated by the electrical

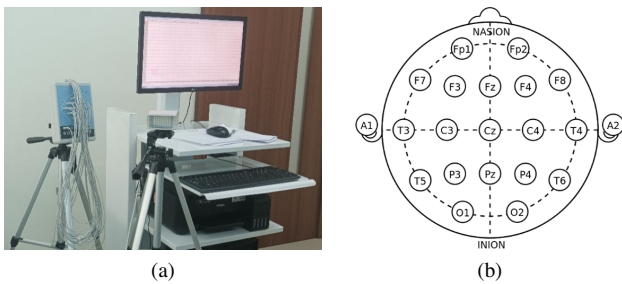


FIG. 1: EEG Instrument of (a) Conec KT88 and (b) electrodes layout of 10-20 system

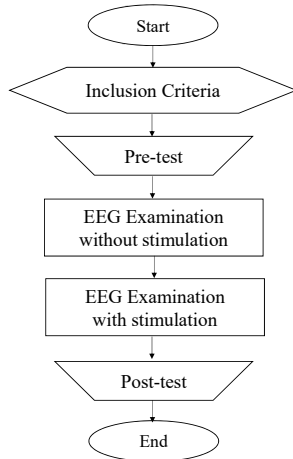


FIG. 2: Research procedure

activity in and around the neurons can be recorded by placing electrodes on the scalp. On the one hand, using EEG in clinical diagnosis has adapted to brain-induced neurorehabilitation treatments. On the other hand, EEG is not only used as a tool that plays an important role in connecting brain constructs with the field of experimental psychology but has also become a trusted neuroimaging method [12]. Technology development makes EEG one of the main tools used in diagnosing epilepsy. Besides that, it can also be used to detect abnormalities related to brain function [13]. Brain waves are distinguished based on their frequency, for naming brain waves are divided into delta waves with a frequency range between 1-2 Hz, theta waves with a frequency range between 4-7 Hz, alpha waves with a frequency range between 8-12 Hz, beta waves with a frequency range between 13-35 Hz and gamma waves with a frequency range between 35-42 Hz [14]. Having a suitable beta frequency allows us to achieve focus. When under optimal conditions, beta waves play a role in enhancing conscious focus, memory, and problem-solving abilities [15]. Beta activity can be categorized into different sub-bands: low beta waves (12-15 Hz) known as "beta one" waves and are usually associated with introverted quiet concentration, focus, and attention; mid-range beta waves (15-20 Hz) known as "beta two" waves and are associated with increased energy, anxiety and performance; and high beta waves (18-40



FIG. 3: Brain Wave Measurement

Hz) known as "beta three" waves and are associated with significant levels of stress, anxiety, paranoia, high energy, and high arousal [15,16].

Previous research conducted by Radyaputra [17] to analyze alpha and beta waves using an EEG instrument to compare a person's concentration when given a musical stimulus was proven to increase a person's concentration level. Followed by the research of Andita and Desyandri [18] to analyze the effect of providing a stimulus in the form of music on the learning concentration of elementary school children by using the literature review method stating that music can be used in relaxation to gain concentration in receiving learning. Furthermore, it is further strengthened by research conducted by Ali et al. [5], who researched the effect of murottal Al Qur'an on the concentration level of fifth graders with learning concentration disorders in Sriamur village, proving that it can increase concentration levels. However, these studies have yet to research the effect of murottal Al Qur'an on increasing concentration using the EEG instrument. Therefore, researchers will research several subjects to determine the effect of murottal Al Qur'an on increasing concentration using EEG medical instrumentation.

II. METHOD

The research method used in this research is experimental. It is a mini research with subjects consisting of 6 UIN Walisongo Semarang college students, with inclusion criteria: age range 20-23 years, muslim, no hearing impairment, physical and spiritual health, and not under the influence of drugs. The instrument used is Electroencephalography (EEG) type Conec KT88 in the Integrated Laboratory, Faculty of Science and Technology, Universitas Islam Negeri Walisongo Semarang. This instrument has 16 EEG Channels, 12-bit accuracy, 10 M input impedance and 5 Vp-p noise level. Fig. 1(a) shows the instrument of EEG Conec KT88. The electrode installation follows the 10-20 system, as Fig. 1(b) shows. EEG measurements are performed by placing electrodes on the scalp. Each electrode is generally represented by letters and numbers [19]. Letters mean the area of the head on the electrodes, generally marked with initials; for example, the F sign is defined as the Frontal Lobe and T is defined as the Temporal Lobe, and so

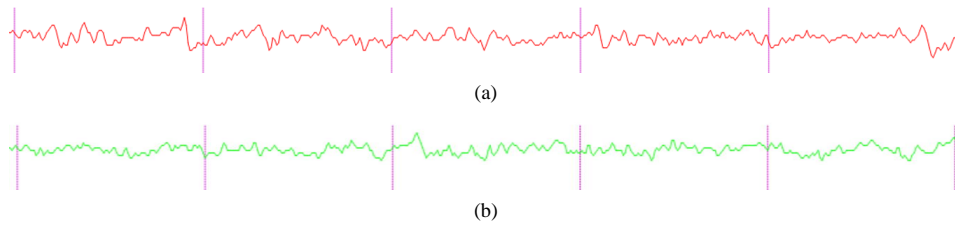


FIG. 4: Sample of a beta wave at electrode Fp1-A1 (a) without stimulation and (b) with stimulation

on. Numbers represent the right and left hemispheres of the brain; odd numbers indicate the left side of the brain and even numbers indicate the right side [13]. In addition, other instruments consist of MP3 murottal Al Qur'an surah Al Baqoroh verses 1-10 and Tes Potensi Akadeik (TPA) questions which consist of 6 multiple-choice questions.

The research procedure is shown in Fig. 2. This research consists of 4 stages. First, the subjects did the post-test in unstimulated conditions (silent). Second, subjects measured their brain waves using EEG in unstimulated conditions. Third, the subjects measured their brain waves with Al-Qur'an murottal stimulation. The last, the subjects worked on the post-test questions. The data was measured using EEG for 15 minutes, then the signal data with minimal noise was taken for processing. The processed signal is a beta signal, the measurement method based on the peaks or troughs per second within the frequency range of 13-30 Hz [20].

The data analysis technique used in this research is the T-test [21] using Microsoft Excel. The T-test is used to test the truth of the hypothesis, which states that between the two sample means taken. In this study, the value pushed is $p=0,05$ or $p=5\%$ which means that the maximum error that can be tolerated is 5% of the experiments that have been carried out. The first data to be compared was beta brain waves without stimulation and with murottal Al Qur'an stimulation. The second data is the number of correct answers when doing the pre-test and post-test.

TABLE I: Normalization Test Results using Microsoft Excel

Normalization Test	Beta wave without stimulation	Beta wave with stimulation	Pre-test	Post-Test
N	6	6	6	6
Mean	22.75	14.53	3.83	4.00
Std. Dev	1.01	0.43	1.34	1.53
Kolmogorov-Smirnov Test results	0.45	0.53	0.55	0.56
	Normal		Normal	

III. RESULTS AND DISCUSSION

Fig. 3 shows the process of measuring brain waves using the EEG Concec KT88 in a sitting and relaxed position. It is

recommended that the patient is in a relaxed and comfortable position, such as lying down or sitting relaxedly. Sufferers feel relaxed to avoid disturbances such as contractions of the head and neck muscles which can potentially cause artifacts in disorders [22, 23].

An example of a beta brain wave signal on the Fp1-A1 electrode is shown in Fig. 4. The beta wave taken is the beta wave in the frontal lobe (Fp1, Fp2, F3, F4, F7 and F8). The cognitive role played by the adult prefrontal cortex is considered the best result of biological processes that drive the highest expression in terms of temporal integration in language and academic performance [24]. The signal in each box is a beta wave every second (Hz), then the signals are averaged. Beta waves in the frontal lobe appear to decrease after being given murottal stimulation of the Al Qur'an surah Al Baqarah verses 1-10.

Beta wave results from 6 subjects that have been recorded using EEG without stimulation and with stimulation can be seen in Fig. 5(a). It can be seen that there is a decrease in beta wave activity without stimulation from 21-23.7 Hz and with stimulation 14-15 Hz. The average unstimulated beta wave activity is 22.8 Hz which is in the high-beta range associated with stress, anxiety, paranoia, high energy, and high arousal. Meanwhile, the average beta brain wave activity with stimulation is 14.5 Hz which is in the low-beta range associated with introverted quiet concentration, focus, and attention [15]. It shows that giving murottal stimulation to the Al-Qur'an surah Al Baqarah verses 1-10 reduces anxiety levels and increases concentration in a calm state. It is reinforced by the pre-test and post-test result in Fig. 5(b); two increases and one decrease in the number of correct answers. Beta waves appear when mental activity is full. This condition is needed in the process of thinking and solving problems. Research conducted by Budiman and Ardianty [25] stated that beta waves appear when someone feels anxious, worried, and thinking hard. Beta waves are needed in conditions that require high concentrations. Beta signals occur when a person is fully awake, so it is not good to use them when studying.

TABLE II: Result of T-test Using Microsoft Excel

Pair	N	Correlation	Significance
Beta wave without and with stimulation	6	0.739	0.0003
Pre-test and post-test	6	0.893	0.017

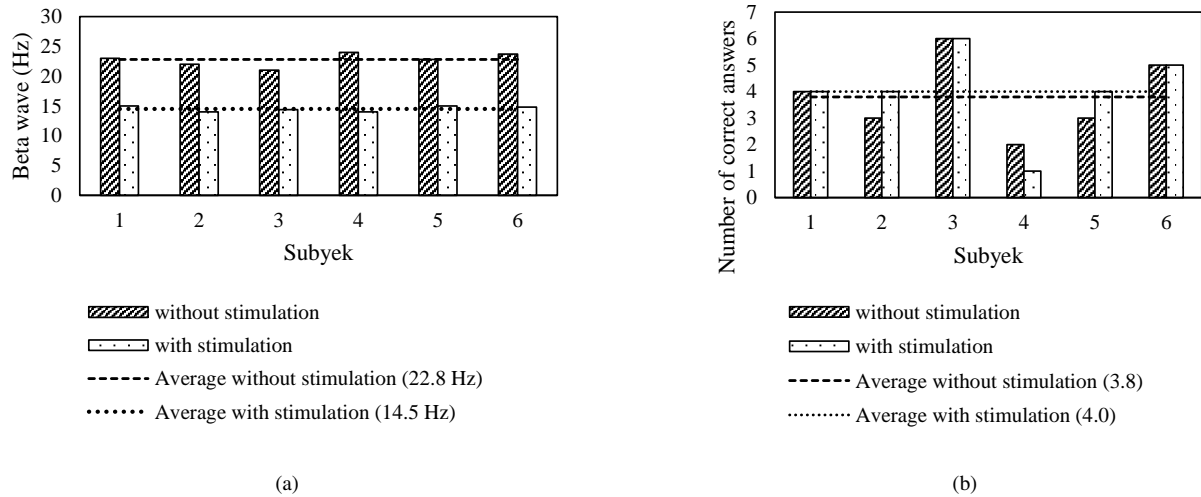


FIG. 5: Graph of (a) Beta Wave Activity Recording with EEG and (b) Result of Pre-test and Post-test

Then, the normalization test was carried out on the data to determine whether the data distribution was normally distributed. From the normalization test, it is known that the data is normally distributed. The data from the normalization test can be seen in Table I. A T-test is carried out after knowing that the data is normally distributed. The test results from the T-test can be seen in Table II. A significant p-value in the beta wave is 0.0003 and 0.017 in the test result. The provision of murottal stimulus significantly affects beta waves and test results. It shows that the lower the frequency value of the beta waves, the better to maintain concentration level during the test [26]. It is by following previous research by Hendrayana et al. [27], who investigated the relationship between beta waves and cognitive enhancement through brain jogging. The results of the paired T-test analysis showed a significant difference between the beta waves and cognitive function variables. It indicates that brain jogging therapy can influence beta wave activity and cognition. This interaction has a relationship between beta waves and cognitive function. Another study by Kokubo and Shoji [28], which examined the relationship between beta waves and examination results, showed that students who could maintain focus for a longer period tended to achieve better grades or experience significant improvement between the first and second tests. Although brain waves reflect a student's concentration level during an exercise, they also reflect overall brain activity. Students who think actively will show different brain wave patterns than students who only listen passively or remember information.

Learning requires more relaxed conditions so that learning can be absorbed optimally. This condition requires more brain conditions on alpha waves. Alpha waves are waves with a lower frequency than beta waves. Several learning strategies are applied to make brain activity in alpha waves so that it is more relaxed. One is the apperception technique, which carries waves in the alpha zone [29]. Some other strategies that can be used are to provide funny stories [30] and music in-

roductions before learning [31]. Like music, murottal sounds can also reduce brain activity from alert to more relaxed or toward alpha waves. Alpha and beta waves are needed in the learning process [32]. Beta waves are applied more when carrying out the problem-solving process and increasing the concentration level of students. Alpha waves make participants relax and comfortable in receiving learning material. The results of this study showed that murottal was able to reduce beta waves with a significant decrease. Therefore, it can be concluded that providing murottal stimulus can reduce the frequency of beta waves to further increase concentration while [5, 33]. Further research on the impact of murottal on concentration power needs to be carried out.

In this study, we only used 6 research subjects with certain criteria with mild pre-test and post-test questions. However, more subjects and questions are needed for a more comprehensive and general result. Moreover, we only focus on comparing the beta wave and test separately. We need to measure beta waves directly when the subject is doing the pre-test and post-test to measure the direct relationship between concentration and beta waves.

IV. CONCLUSION

Mini research has been conducted using 6 research subjects by measuring changes in beta brain waves without and with stimulation of the murottal Al Qur'an. In addition, the subjects carried out a pre-test and post-test to determine their concentration level. Research has been conducted using EEG Conec KT88 and the murottal Al Qur'an surah Al Baqarah verses 1-10. The beta wave decreased significantly with a p-value of 0.0003, while the post-test results significantly increased with a p-value of 0.017. It shows that the murottal effect can increase learning concentration.

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