IDENTIFICATION OF DOMINANT WAVE DURING THE RECITATION OF AL-MULK VERSE WITH (WITHOUT) UNDERSTANDING USING EEG SIGNAL

Norsiah Fauzan [1], Siti Naqiah Shahidan [2], Nur Hurunain Amran [3]

[1] Faculty of Cognitive Science and Human Development, University of Malaysia Sarawak
nursiahfauzan@gmail.com

[2] Faculty of Cognitive Science and Human Development, University of Malaysia Sarawak
naqiahshahidah@gmail.com

[3] Faculty of Cognitive Science and Human Development, University of Malaysia Sarawak
nainamran@gmail.com

ABSTRACT

This paper reports a case study on mind behavior during the recitation of Al Quran by using Electroencephalograph (EEG). EEG is a non-invasive electrophysiological assessment that applies computerized mathematical analysis to convert the raw waveform data into different frequency ranges including delta, theta, alpha and beta. The complex analysis provides brainwave analysis such as symmetry, phase, coherence, amplitude, power and dominance of those frequency ranges. This research intends to measure and identify EEG signals during recitation of Al Quran (without understanding) and recitation of Al-Quran (with Malay translation) from the verses read. The raw data from both conditions were analyzed to determine any brain wave changes from different bands. During Al-Quran recitation (without understanding), the highest amplitude of the power spectrum distribution was observed in Delta at the Frontal area (F1, F2, F4, F7 and F8), and Beta2 and Gamma on EEG, predominantly in the T3, T4 and T5 area. On the other hand, reading with Malay translation indicated a highest amplitude at the T3, T4 and T5 area. From earlier studies, we may conclude that the resting state of mind can be achieved by increasing the alpha band of EEG signal; however in this study, observations were made on the dominant wave frequencies while reciting Quran without understanding and with understanding the meaning of the verses read.

Keywords: *QEEG, Reciting Quran with Understanding, Brain wave*

INTRODUCTION

I heard 'Abdullah bin Mas'ud saying: 'The Messenger of Allah (ﷺ) said: "[Whoever recites a letter] from Allah's Book, then he receives the reward from it, and the reward of ten the like of it. I do not say that Alif Lam Mim is a letter, but Alif is a letter, Lam is a letter and Mim is a letter." (Narrated Muhammad bin Ka'b Al-Qurazi)

A Muslim focuses and engages in *dhikr* by reciting the Quran to strengthen their bonds with their Creator and maintain the feelings of spiritual peace in the face of challenges in their daily life. The meditative calmness during recitation guides the soul to the truth and allows *Tafakku*r that simply means reflecting upon the universe, permit access to a form of cognitive and emotional development that can emanate only from the higher level (i.e from God). An individual who recites the Quran with understanding will feel the sensation of receiving divine inspirations awakening and liberating both mind and intellect, hence permitting inner growth. In psychological terms, *tafakkur* means metacognition, the highest level of cognitive ability which simply means thinking about one's own thinking (Norsiah, 2004). Quran is a big chest of treasure Allah has given us to use and spend to benefit from in this worldly life. Reading Quran to understand its meaningful message and guidance of Allah are like opening up the chest to fill up empty pockets with the wealth of Allah to spend it on themselves and help others who are in need. Consequently, they are relieved from difficulties of this short life and not fear poverty. On the other hand, reading Quran without understanding but reading in Arabic are like

opening up this chest and spending their time rubbing the gold and diamonds, the wealth of Allah and feeling the good sensations at those moments only. Then, they return to their lives empty pocketed and blind.

In this case study, EEG signals or the neuroelectrical activity during recitation of Al Quran (without understanding) and recitation of Al-Quran (With Malay translation) from the verses read is measured using QEEG. QEEG is a non invasive electrophysiological assessment that applies computerized mathematical analysis to convert the raw waveform data into different frequency ranges including delta, theta, alpha and beta (Chan, Sze, & Cheung, 2007). The raw data from both conditions were analyzed to determine any changes of brain wave from different bands.

OBJECTIVES

a) To identify the dominant brain wave during recitation of *Al-Mulk* verses from the Al-Quran "with understanding" and "without understanding" the verses.

b) To determine the regions of interest related to the task of reciting the verses in both conditions.

SCOPE OF PROJECT

EEG data were recorded by means of the Mitsar amplifier from 19 electrodes (Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, O2 sites in the International 10-20 system) with 250 Hz sampling rate in 0.3 – 70 Hz frequency range in the resting eyes opened (EO) conditions. The electrodes were attached to the scalp to get the brain signals from the subject. Then EEG Band from the recordings during the recitation of *Al Mulk* verse in both conditions for each 19 electrodes were analyzed and observed.

SIGNIFICANCE OF RESEARCH

The significance of this research is to help the users and researchers to observe, analyze and later practice the mind therapy using the appropriate verses for the different cognitive goals. However, to the muslim the daily practice of reciting Al-Quran is the most important *dhikr* especially reciting with understanding and consequent-ly internalizing the meaning will lead to a resting state and calm mind.

Subject

The subject is a 21 years old female student free from cardiac, pulmonary, metabolic and other neurological disorders that might reflect autonomic nervous system dysfunction. The signals were taken twice for each task. There was time interval of 3 minutes between each recording of the tasks. At first, the subjects perform under open eyes followed by closed eyes conditions, recitation of Quran with understanding and recitation of Quran with Malay translation.

Instrumentation/Research materials

This project used Surah *Al Mulk*, verse 1 till 10 for recitation of Al Quran (without understanding), while using Al-Quran with translation in the Malay language to understand the meaning of the verse for the second task   (Re-citation with understanding).

The raw EEG signal (after filtered) was processed to frequency domain signal by using the Fast Fourier Transform to yield a power spectrum distribution. The data from both conditions were compared using FFT.

Procedures

EEG data were recorded by means of the Mitsar amplifier from 19 electrodes (Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, O2 sites, A1 and A2 mounted at the right and left ears of the subjects as references based on the International 10-20 system). The sampling frequency used was 250 Hz and ninete

en electrodes were placed on the scalp of the subjects. The impedance was less than 10kΩ for each electrode. In the EEG, the Acquisition System Setting should be set before recording of the brain waves.

Set of real data of EEG was collected from subjects during the resting eyes opened (EO) conditions, Recitation without Understanding Meaning and Recitation with Understanding. The EEG was recorded according to this controlled environment. The subject sat on a chair in a dim, quiet room with temperature between 22 and 25 °C and will relax their body and mind. After all of the electrodes were attached, conductive gel will be inserted into the electrodes tube in order to minimize the impedance between the scalp and electrodes.

The subjects were instructed to relax and also told to minimize their body movement to minimize the artifact that will be created or produced. The subjects started to recite Quran and after three minutes of stabilization, the EEG data were recorded for 12 minutes.

DATA ANALYSIS

The EEG power spectrum distributions were converted and then calculated using Fast Fourier Transform (FFT) to yield a spectrum over the range of 0 to 500 Hz. The artifacts were removed. The amplitude was identified and the frequency at that amplitude was referred. The frequency was then classified in which EEG bands range they are in, such as sleeping state (Delta 0.5-4Hz), dreamy state (Theta 4-8Hz), resting state and calming mind (Alpha 8-13Hz), attention and alert state (Beta 13-30Hz) and in absolute concentration and extremely high frequency state (Gamma 36-44Hz) during reciting Quran in two conditions : Reciting without understanding and Reciting with understanding.

FFT will computes nineteens (: Fp1, Fp2, F7, F8, C3, C4, P3, P4, O1, O2, F7, F8, T3, T4, T5, T6, Cz, Pz) graph of Power Spectrum Density of each electrodes per locations which contains all waveform band in the graph (Beta, Alpha, Theta, Gamma and Delta waveband). Then, EEG bands from both conditions from a subject were compared based on the Regions of interests (ROIs). Analysis were carried out to observe the pattern of the increment and decrement between reciting Quran with/without understanding include the observation of dominant waves at differed location based on 10/20 system.

Table 1

Table of EEG power spectra for bandranges

Fragment: 15:36:47, Offset: 0.00 s, Length: 180.24 s, Number of epochs 1.

	Delta	Delta	Theta	Theta	Alpha	Alpha	Beta1	Beta1	Beta2	Beta2	Gamma	Gamma
	uV^2	Hz	uV^2	Hz	uV^2	Hz	uV^2	Hz	uV^2	Hz	uV^2	Hz
Fp1-Av	24.4	0.98	2.6	5.86	5.9	10.74	0.9	17.58	4.5	23.44	2.3	34.18
Fp2-Av	45.3	0.98	3.9	4.88	7.8	11.72	0.8	18.55	5.0	23.44	3.5	39.06
F7-Av	111.3	0.98	5.4	4.88	6.3	8.79	1.2	17.58	3.9	23.44	1.2	34.18
F3-Av	28.6	0.98	1.7	3.91	3.9	9.77	0.9	13.67	2.6	23.44	2.2	34.18
Fz-Av	5.1	3.91	12.0	5.86	9.0	6.84	1.1	17.58	2.5	23.44	2.0	34.18
F4-Av	3.6	3.91	9.0	3.91	6.3	11.72	1.3	17.58	2.5	23.44	1.7	33.20
F8-Av	85.9	0.98	3.5	3.91	6.1	6.84	1.1	16.60	1.8	23.44	1.2	39.06
T3-Av	29.6	1.95	4.0	3.91	26.1	10.74	11.5	13.67	20.2	23.44	21.7	32.23
C3-Av	2.6	0.98	0.3	6.84	2.9	8.79	0.3	19.53	1.1	19.53	1.4	35.16
Cz-Av	8.0	0.98	4.6	4.88	3.2	8.79	0.6	18.55	1.0	23.44	1.1	39.06
C4-Av	6.6	1.95	1.4	5.86	1.9	8.79	0.5	16.60	0.5	19.53	1.6	32.23
T4-Av	12.2	0.98	8.0	3.91	7.8	11.72	10.2	18.55	15.6	23.44	20.4	34.18
T5-Av	12.4	2.93	2.1	3.91	19.0	11.72	5.5	19.53	39.0	23.44	13.1	39.06
P3-Av	8.5	1.95	0.6	6.84	3.4	8.79	0.6	15.63	0.4	20.51	1.1	37.11

Pz-Av	11.6	0.98	1.1	3.91	2.0	7.81	0.8	19.53	1.7	19.53	0.7	34.18
P4-Av	10.8	1.95	0.8	3.91	2.3	7.81	0.8	19.53	1.9	19.53	1.0	34.18
T6-Av	9.7	0.98	0.9	3.91	3.0	11.72	1.9	18.55	5.7	23.44	8.9	34.18
O1-Av	9.9	1.95	0.9	3.91	2.2	7.81	1.0	19.53	1.9	19.53	0.6	34.18
O2-Av	10.2	1.95	0.9	3.91	2.1	7.81	1.0	19.53	1.9	19.53	0.7	34.18

High amplitude of delta were located at the Frontal lobe (Fp1, Fp2, F4, F7 and F8), and high Beta at the temporal lobe (T3, T5) while reciting Al Quran without understanding. The findings differed from previous research by Norfazrena Kamal (2010) that revealed an increasing alpha band at P3, P4 and Pz representing the resting state and calming mind of human beings.
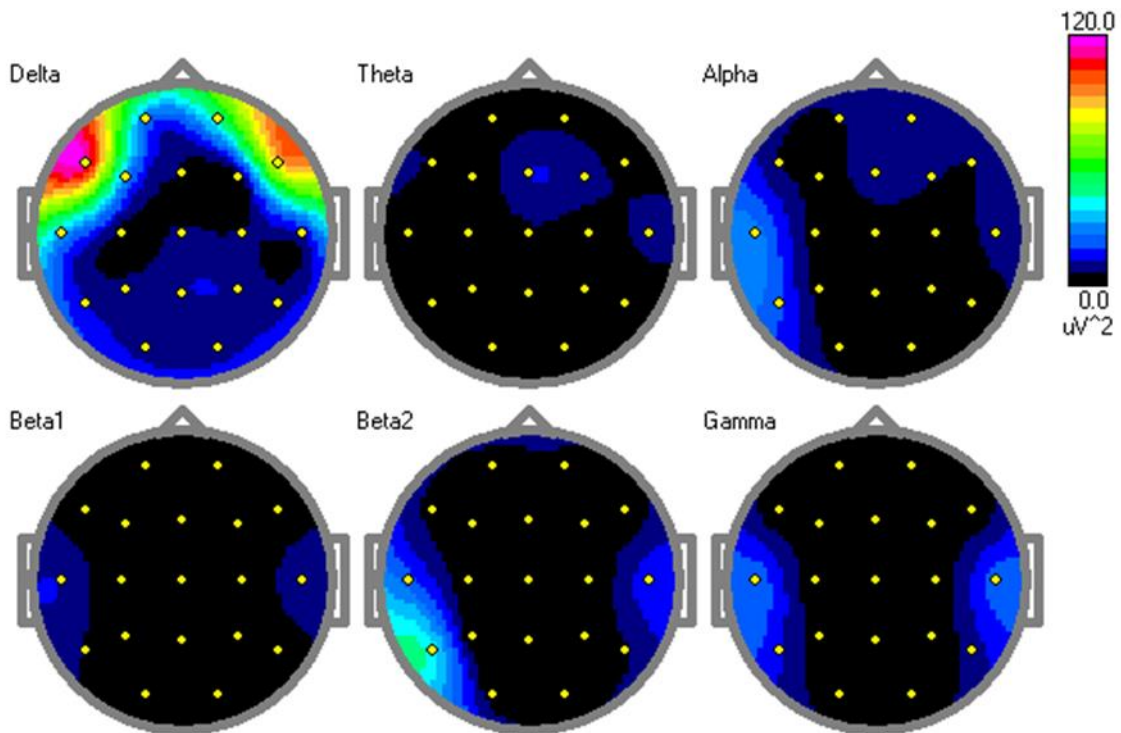

Figure 1 Maps of EEG power spectra for band ranges

Table 2
Table of EEG power spectra for bandranges

Fragment: Reading with Understanding 15:32:53, Offset: 0.00 s, Length: 180.61 s, Number of epochs   1.

	Delta	Delta	Theta	Theta	Alpha	Alpha	Beta1	Beta1	Beta2	Beta2	Gamma	Gamma
	uV^2	Hz	uV^2	Hz	uV^2	Hz	uV^2	Hz	uV^2	Hz	uV^2	Hz
Fp1-Av	46.21	0.98	10.67	3.91	4.10	8.79	6.61	15.63	11.43	26.37	7.53	29.30
Fp2-Av	14.54	3.91	12.32	3.91	1.91	13.67	8.10	14.65	12.26	25.39	4.78	29.30
F7-Av	45.74	0.98	8.05	3.91	2.68	7.81	0.92	19.53	5.58	29.30	5.18	29.30
F3-Av	9.88	1.95	11.74	4.88	7.94	7.81	3.86	13.67	8.99	26.37	3.96	29.30
Fz-Av	2.44	3.91	5.64	3.91	4.05	7.81	3.85	15.63	9.66	26.37	5.08	35.16
F4-Av	2.24	3.91	4.08	3.91	1.17	9.77	4.27	15.63	4.31	26.37	4.14	35.16
F8-Av	7.38	3.91	12.67	3.91	5.15	7.81	6.85	17.58	4.92	25.39	3.44	35.16

|											
T3-Av	44.51	0.98	8.70	4.88	21.64	11.72	57.11	15.63	97.37	26.37	89.92	35.16
C3-Av	1.74	1.95	3.31	5.86	2.86	6.84	1.40	17.58	2.19	25.39	0.91	35.16
Cz-Av	14.24	0.98	1.11	5.86	2.19	8.79	1.81	15.63	6.11	26.37	3.81	35.16
C4-Av	8.41	0.98	0.49	5.86	1.69	11.72	0.31	19.53	3.92	22.46	2.56	29.30
T4-Av	5.97	0.98	3.72	4.88	5.04	11.72	10.79	17.58	75.24	23.44	36.58	29.30
T5-Av	7.31	3.91	10.42	3.91	10.17	11.72	35.87	16.60	65.06	20.51	39.77	29.30
P3-Av	4.16	0.98	3.12	3.91	0.95	7.81	1.14	17.58	1.97	24.41	0.55	32.23
Pz-Av	18.67	0.98	3.25	3.91	3.27	7.81	1.31	15.63	4.47	26.37	1.79	38.09
P4-Av	15.17	0.98	3.04	3.91	5.45	7.81	0.45	16.60	0.94	23.44	1.12	35.16
T6-Av	8.52	1.95	6.13	3.91	3.34	13.67	25.13	15.63	53.49	22.46	15.93	35.16
O1-Av	11.33	3.91	12.71	3.91	21.21	7.81	6.43	16.60	13.81	21.48	3.53	36.13
O2-Av	10.71	3.91	10.88	3.91	22.01	7.81	8.56	15.63	12.67	21.48	5.81	36.13
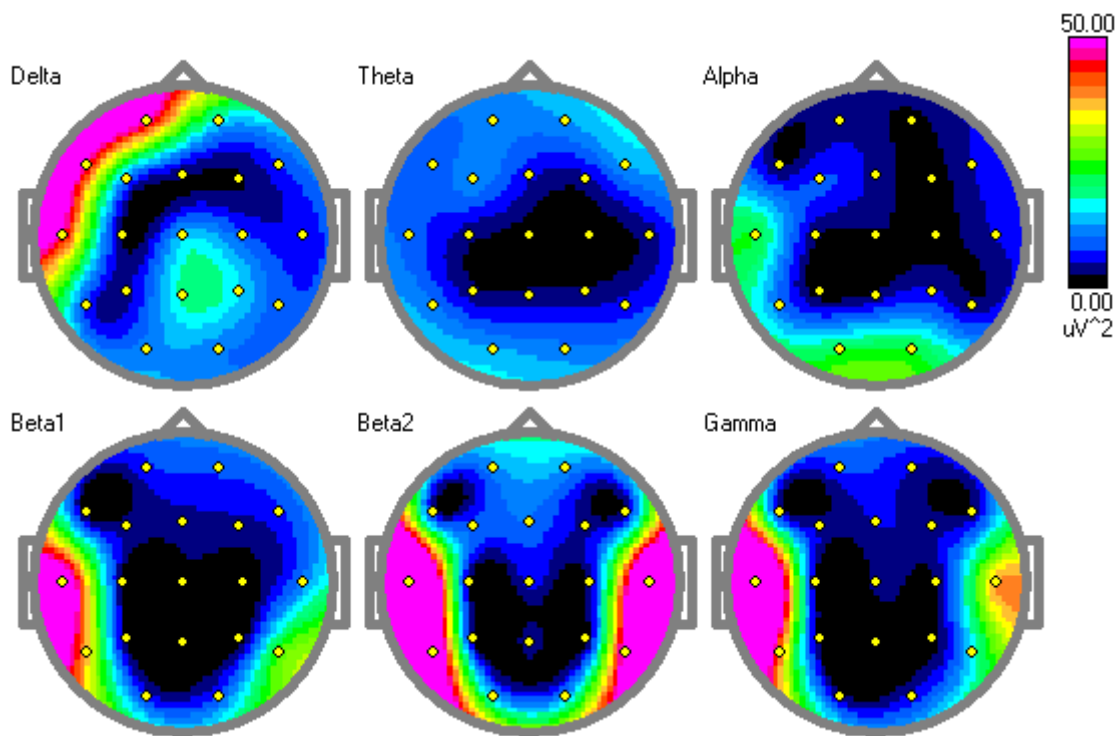
Figure 2. Maps of EEG power spectra for band ranges

The comparison between reciting Quran with understanding and reading without understanding were obvious in Alpha Band which were observed to be high at T3 and T5, and O1 and O2 from Table 2; high amplitude of delta were found at the Frontal lobe (Fp1, Fp2, F7), Temporal lobe (T3, T4) and Parietal (Pz, P4) and Occipital lobe (O1 and O2). High amplitude of Beta wave was observed at T3, T6 and T5 (During reciting with understanding).

DISCUSSIONS

The results from this research differed from the previous studies by Norfazrena Kamal (2010) where re citation of Quran could increase the Alpha Bands at the Parietal region (Pz, P4 and P3). The verse used in their research was *Az-zumar* 23

Az-Zumar 23

Allah has revealed (from time to time) the most beautiful Message in the form of a Book, consistent with itself, (yet) repeating (its teaching in various aspects): the skins of those who fear **their Lord tremble thereat   then their skins and their hearts do soften to the celebration of Allah**`s praises. Such is the guidance of Allah. He guides therewith whom He pleases, but such as Allah leaves to stray, can have none to guide.

In this research *Al Mulk 1-10* were recited by the participant

Blessed is He in Whose Hand is the dominion, and He is Able to do all things. Who has created death and life, that He may test you which of you is best in deed. And He is the All-Mighty, the Oft-Forgiving; Who has created the seven heavens one above another, you can see no fault in the creations of the Most Beneficent. Then look again: "Can you see any rifts?" Then look again and yet again, your sight will return to you in a state of humiliation and worn out. And indeed We have adorned the nearest heaven with lamps, and We have made such lamps (as) missiles to drive away the Shayatin (devils), and have prepared for them the torment of the blazing Fire. And for those who disbelieve in their Lord (Allah) is the torment of Hell, and worst indeed is that destination. When they are cast therein, they will hear the (terrible) drawing in of its breath as it blazes forth. It almost bursts up with fury. Every time a group is cast therein, its keeper will ask: "Did no warner come to you?" They will say: "Yes indeed; a warner did come to us, but we belied him and said: 'Allah never sent down anything (of revelation), you are only in great error.'". And they will say: "Had we but listened or used our intelligence, we would not have been among the dwellers of the blazing Fire!"

There are differences in the brain activation as shown in Figure 1 and 2 (Brain Topography) when the participant were given the meaning of the verse. The dominant activation were delta wave at the Frontal region such as Fp1, Fp2 and F7, F8, and T3, T4. The participants were not familiar with the verse but were able to read the verse without understanding its meaning.

However, in the second conditions, the participant's beta wave increased at both sides of the temporal lobe and occipital lobe that shows activation at the Superior Temporal Gyrus (Wernicke area) and phonological loop. It was observed that the participant's semantic coding were activated when analyzing the meaning. Gamma waves were quite high due to the emotional understanding of meaning in the Malay Language. The excessive beta at the temporal might be influenced by the orthographical features of the Arabic language and the analysis of meaning in the Malay translation.

The visual areas at the occipital lobe were activated due to the high processing demands of the reading task in Arabic language and semantic coding in the Arab Malay language. Finally, it is implied that the electrical impulses or vibration of the brain cells differed depending on the verse read. For example, reading *Az-Zumar 23* without understanding the meaning implicates on the vibration of Alpha wave frequencies, whereas reading *Al Mulk*, with and without understanding the meaning implicates on the beta at both sides of thetemporal lobe and Alpha at T3, T5 and occipital lobe.

Most importantly, the research suggests that the learner acquisition and retention of information required an understanding of the verses read. In other words, one of the effective techniques to memorize the verse or Al Quran is to understand the whole meaningof the verse read first. It is recommended that the "Understanding of meaning" phase should be considered as one of the strategies to memorize the Quran. According to Abduldaem Al-Kaheel (2014), this is an important issue namely we take into account the method of information storage, so that it can be easily retrieved because if storage is associated with

understanding, it will be more effective during retrieval. Therefore, we have to understand what we have memorized from available explanations.

REFERENCES

AbduldaemAl-Kaheel. (2014). Innovative way of memorizing the Al-Quran. Retrieved from http://kaheel7.com/eng/index.php/secrets-of-quran-a-sunnah/281-innovative-way-to-memorize-the-quran-4 , 20th May, 2014.

Abdullah, A. A., Omar, Z. (2011). The Effect of Temporal EEG Signals while Listening to Quran Recitation. Proceeding of the International Conference on Advanced Science, Engineering and Information Technology, *372-375*

Hadith. (2014) . Chapters on the virtures of the Al Quran. Retrieved from http://sunnah.com/urn/731520 on 20th May, 2014.

Norsiah Fauzan. (2004). Metacognitive Learning Strategies Evidence from metacognition, motivation and Learning. Profess, Sarawak.

Nurul Fazrena Binti Kamal. (2010). *Identification of resting state and calming mind during reciting Quran using EEG signal*. Master Thesis , UTM

Sedek, A, Mustaffa, A, Ishak, S, Khadher, A, Fauzi, D, Faisal, A. S., Mohd Yakub Zulkifli M., Mohd Roslan M. N. (2013). Effective Techniques of Memorizing the Quran: A Study at Madrasah tahfiz Al-quran, Terengganu, Malaysia. *Middle-   East Journal of Scientific Research, 13* (1), 45-48.

Tirmidhee no. 2910 - حـ سن [Hasan] Page 34 Chapter: Etiquettes and Virtues of Reciting the Qur'an '40 Hadeeth on the Qur'an' edited by A.B. Al-Mehri. Retrieved from http://quranproject.org/40-Hadith-on-the-Quran--575-d