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How Can Language Be Used to Reduce Zoom Fatigue? (A Neurolinguistic Study)

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***Abstract*—Hypnotherapy can solve cognitive problems and is considered effective in reducing stress levels. One of the cognitive problems present is the symptom of zoom fatigue due to the transition of the online learning system. However, in its implementation, hypnotherapy requires a language model that can support individuals to gain concentration. Therefore, this study investigates the effects of hypnotherapy stimuli on individuals with symptoms of zoom fatigue compared to relaxation music. Data were processed and collected from the involvement of 10 respondents through observation of EEG recordings using Muse Headband hardware and Muse Monitor software. Through this device, brain signal recording will be obtained, consisting of 4 points, namely AF7, AF8, TP9, and TP10. The study's results detected that the provision of a hypnotherapy stimulus gave a greater relaxation effect than listening to relaxation music.**

***Index Terms*—EEG, hypnotherapy, neurolinguistics, zoom fatigue**

I. Introduction

The COVID-19 pandemic has impacted all fields and sectors, including education. The innovation considered a solution to this problem is using an online distance learning system (Mpungose, 2021). All universities require lecturers to switch their services online using video conferencing (VCT) technology to complement the online learning system (e-learning). However, the continuous use of video conferencing methods can cause fatigue symptoms known as zoom fatigue.

Zoom fatigue results from the sudden mass adoption of technology that has disrupted the normal, instinctive, and subtle ways of communicating that have evolved throughout history to help humans survive. Zoom fatigue causes individuals to experience energy depletion, manifested in the degradation of motivation when doing tasks and self-control (Bullock, 2022). Video conferencing allows us to communicate in different ways with prolonged eye contact, reduced body movement, and the need to increase expression by forcing ourselves to stay focused on the camera (Dodge, 2020), thus requiring more focus ability than face-to-face chat. As a result, individuals will experience headaches, eye irritation, blurred and double vision, and excessive tears and winks. Other recognizable symptoms are difficulty focusing during video calls and an inability to track what is being discussed (Bullock, 2022). If the individual cannot recover and energize, it will cause prolonged chronic fatigue (Maslach et al., 2018). Therefore, efforts are needed to recover energy from fatigue.

One method that provides solutions to cognitive problems is hypnotherapy. It happens because an individual's physical function can be controlled by nerves that are influenced by the mind (Sahour et al., 2019). Several studies reveal hypnotherapy effectively reduces stress levels (Alizamar et al., 2018). In this case, the hypnosis method can effectively control pain through three main mechanisms: muscle relaxation, perceptual changes, and cognitive impairment. Often the pain is accompanied by reactive muscle tension; thus, this method creates more relaxation, reducing body pain (Sadock et al., 2009). During the hypnosis process, individuals will receive a relaxation induction that asks them to focus on suggestions that can cause mental and physical relaxation and reduce muscle tension (Sahour et al., 2019). Hypnotherapy can be beneficial in increasing the patient's ability to engage in relaxation (Komesu et al.,

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2011), reducing anxiety, and improving patients' perception of their ability to cope with their symptoms (Smith et al., 1999).

In its application, the hypnotherapy method requires a certain language model that can support the individual to focus his attention. The concentration of attention is useful for increasing suggestibility, which can encourage relaxation in the brain. It is evidenced by a meta-analysis of Flammer in 2003, which stated that from 57 studies analyzed, the success rate of hypnotherapy reached 64%. Hypnotherapy is successful in overcoming psychosomatic disorders that are macro or micro, such as; anxiety, stress, depression, and emotional instability, as well as helping clients quit smoking and controlling pain in some patients with chronic diseases. Therefore we need a language model containing suggestive power to relax individual conditions (Annisa et al., 2019).

Hypnotherapy methods have been widely used and provide benefits for the symptoms of certain diseases, including in the research: "The use of hypnotherapy as a treatment for functional stroke: A case series from a single center in the UK" (Sanyal et al., 2022); “The Effectiveness of Hypnotherapy in Reducing Stress Levels” (Alizamar et al., 2018); “The effects of hypnotherapy compared to cognitive behavioral therapy in depression: a NIRS study using an emotional gait paradigm” (Haipt et al., 2022); “Efficacy of hypnotherapy compared to cognitive behavioral therapy for mild to moderate depression - Results of a randomized controlled rater-blind clinical trial” (Fuhr et al., 2021); “Mindfulness-Based Cognitive Hypnotherapy and Skin Disorders” (Shenefelt, 2018). However, the use of hypnotherapy methods in overcoming the symptoms of zoom fatigue has never been studied.

Seeing the urgency above, the author considers a need for research related to hypnotherapy to overcome the symptoms of zoom. It is because the benefits of hypnotherapy are deemed relevant to be applied to the symptoms associated with cognitive fatigue, in line with an opinion (McMorris et al., 2018) which states that cognitive fatigue is generally viewed as a psychobiological state that occurs after a long period of activity that reduces brain performance. For this reason, this study will focus on developing a hypnotherapy language model that can be applied to individuals with symptoms of cognitive fatigue due to zoom fatigue.

II. Theoretical Framework

A. Zoom Fatigue

Professor Dr. Suzanne Degges-White of Northern Illinois University reports that zoom fatigue occurs when individuals spend too much time looking at screens which causes emotional, psychological, and physical exhaustion. It is because video conferencing requires increased cognition to focus on recognizing nonverbal cues, such as body language and facial expressions, which are evident in face-to-face conversations (Bullock et al., 2022). Zoom fatigue is a state of mental fatigue caused by staring at a screen for too long. It results in the complexity of interpersonal interactions due to the specific spatial dynamics of video conferencing (Nadler, 2020).

Recent evidence reports that video conferencing is more tiring than face-to-face meetings because of the continuous increase in attention (Bennett et al., 2021). Nadler (2020) theorizes that this fatigue arises from the concept of a third skin in which the individual is not involved as a human but is averaged into a third skin totality consisting of people, backgrounds, and technology. Another aspect that causes fatigue, according to Duval and Wicklund (1972), is a video feed that works like a mirror. It may help the individual to self-evaluate, but excessive self-evaluation will lead to feelings of stress and social anxiety for some women (Ingram et al., 1988). Zoom fatigue causes individuals to experience headaches, eye irritation, blurred and double vision, and excessive tears and blinking. Other recognizable symptoms are difficulty focusing during video calls and an inability to track what is being discussed (Bullock et al., 2022).

B. Hypnotherapy

Hypnotherapy is an individualized and multifaceted approach that generally involves relaxation, focused attention, visualization, and a suggestive component (Hadley, 2000; Osborne & Reed, 2019). This component has been used to treat psychological problems related to anxiety, depression, reduced motivation, and sleep disorders (Carrico et al., 2008; Hadley, 2000; Parekh et al., 2003; Turnbull & Ritvo, 1992). Hypnotherapy helps to identify, control, and accept reactions/emotions, especially by building self-esteem, self-confidence, and empowerment (Hogan & Nahum, 2001). Hammond's (2010) meta-analysis revealed that Hypnosis effectively reduced anxiety in his country during stressful situations (Hammond, 2010).

Hypnotherapy is considered effective because the individual's physique can be controlled by the autonomic nervous system, which their thoughts can influence. During Hypnosis, individuals receive a relaxation induction and are asked to focus on images for relaxation, which can lead to mental relaxation, followed by physical relaxation and reduced muscle tension. The relaxation that hypnotherapy provides is because hypnotic induction facilitates a sense of focus and openness to suggestions with relaxed images that provide a safe and peaceful mental environment in which to experience mindfulness. In addition, Hypnosis also facilitates the individual's ability to focus and relax more easily without criticism (Olendzki et al., 2020). Hypnosis can be effective in this case through three main mechanisms for controlling pain: muscle relaxation, perceptual changes, and cognitive impairment (Sadock et al., 2009).

C. Neurolinguistics

Neurolinguistics is a branch of linguistics whose study focuses on analyzing language disorders and brain damage affecting language structure (Scott, 2018). This theory is used to study language disorders based on neurological disorders. Mithun and Malmkjaer (1995) state three major parts of language skills: linguistics, psycholinguistics, and neurolinguistics. Currently, neurolinguistics has had great discoveries in making computational modeling. Most traditional models have used static and symbolic data structures through recording tools that produce linguistic product outputs (Piñango et al., 2017).

Electroencephalography (EEG) is a mapping method used to measure electrical activity in the brain, which is widely used in the medical field (Roy et al., 2019). This method performs a non-invasive measurement of the brain's electric field by placing electrodes on the scalp. It is intended to record the voltage potential resulting from the current flow in and around the neuron area (Biasiucci et al., 2019). Diagnostic EEG generally focuses on measuring waves; this method records various stimuli and responses that arise in the brain and describes cognitive structures and memory. EEG produces a picture of electrical activity in the brain, represented as waves with varying frequency, amplitude, and shape digitally or recorded on paper called an electroencephalogram. Therefore, as measured by EEG, the potential describes neuronal activity and can be used to study various processes and responses in the brain.

III. Method

In this study, a mixed methods case study design was used. Creswell and Creswell (2017) mention that this design aims to develop or generalize a case based on quantitative and qualitative results and their integration. The two basic variants of this design are the deductive and inductive approaches. The deductive approach is where the researcher establishes cases at the beginning of the study and documents the differences in cases through qualitative and quantitative data. The second is an inductive approach, in which the researcher collects and analyzes quantitative and qualitative data, forms cases — often multiple cases — and then make comparisons between the cases. In this research, an inductive approach will be used to make generalizations. The experimental method with a single-group design uses a one-shot case study. In a one-off case study, the researcher administers the treatment (stimulus) and then performs a final test to determine the effect of the treatment (stimulation). A descriptive technique was also used in this study because it would utilize further analysis to generate conclusions.

A. Participants

This research will involve 10 respondents consisting of 5 men and 5 women. All participants are right-handed native Indonesian speakers. The respondents had no history of hearing or neurological disorders. All respondents gave written consent (consent form) after being given a complete explanation regarding the experimental activities to be carried out.

B. Stimuli

We gave the respondents 60 minutes of audio hypnotherapy stimulus.

C. Data Collection

The data were collected by observing, recording, and measuring EEG using Muse Headband hardware and Muse Monitor software. The hardware is an EEG device with four recording channels, one reference channel, and a 200Hz recording sample. It is connected via Bluetooth to a device that has Muse Monitor installed. These devices will record electrical signals in the brain through electrodes installed based on the International System 10-20 points: AF7, AF8, TP9, TP10, and FpZ as reference points.

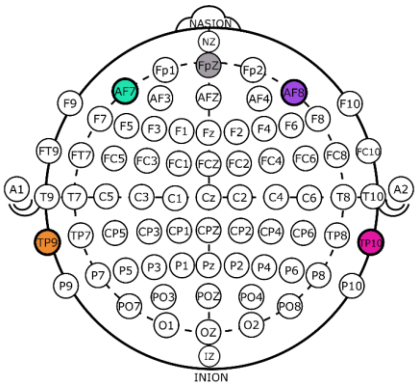


Figure 1. The International System 10-20 Electrode Placement

EEG data collection procedure describes the perlocutionary effect of hypnotherapy directive speech on brain activity. EEG data recording at the time the hypnotherapy speech was given. Recheck the results of the raw data (RAW) EEG recording.

D. Data Analysis

Before the data was analyzed, the RAW EEG data was cleaned of artifacts using Independent Component Analysis (ICA) (Makeig et al, 2004). Then the data were analyzed using Power Spectral Density (PSD) analysis. All data were analyzed using EEGLab 20.0 (Delorme & Makeig, 2004). The results are displayed in graphical form.

IV. Results and Discussion

The interpretation of brain wave conditions will be made after and before being given a hypnotherapy stimulus through the interpretation of power spectral density (PSD) data obtained from the EEGLab analysis results.

A. EEG Power Spectra Before and After Hypnotherapy

(a). Subject 01

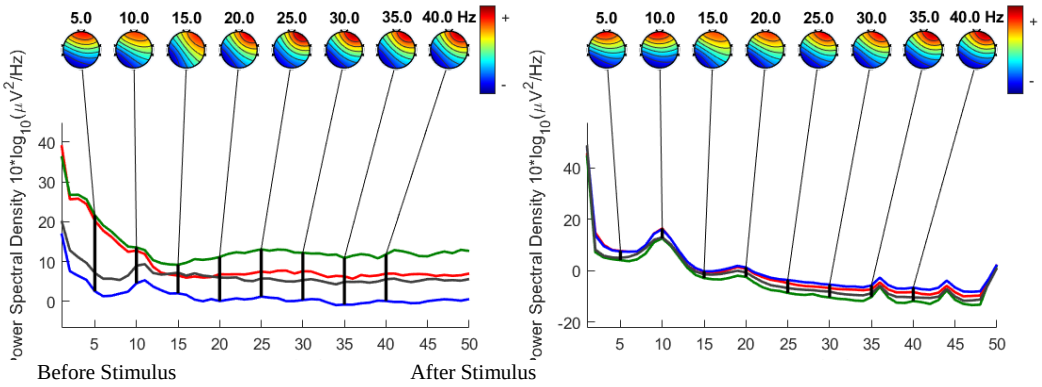


Figure 2. Comparison of Power Spectral Density of Subject 01

Based on the data above, it can be interpreted that after being given a hypnotherapy stimulus, the respondent's neural condition experienced a spike in alpha waves with a frequency of 10 Hz, which suppressed the rate of beta waves. Alpha waves occur in the frequency range of 8-12 Hz, which describes conditions when the brain is resting and meditating to produce a relaxed state in individuals. Alpha waves obtained after giving the stimulus had a larger spectrum than before therapy. Compared to r, there was a stagnant spike in beta waves with a frequency of 13-40 Hz. However, the stimulus succeeded in helping the respondent to obtain an increase in alpha waves which provided a relaxation condition through the acceptance of suggestions.

(b). Subject 02

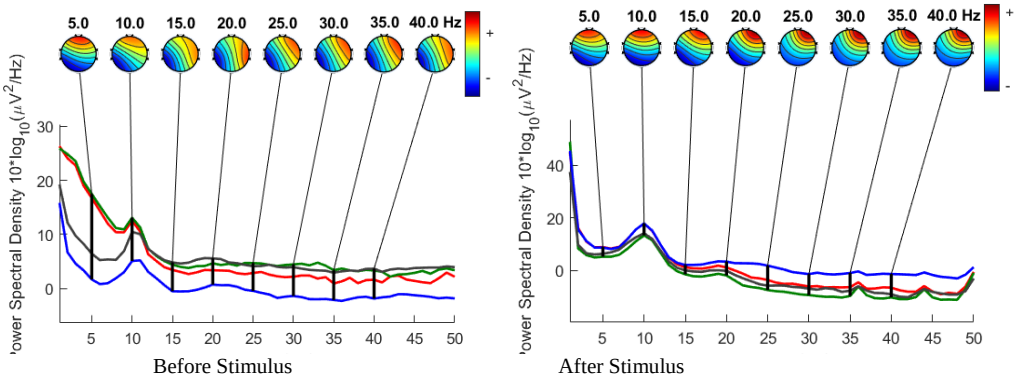
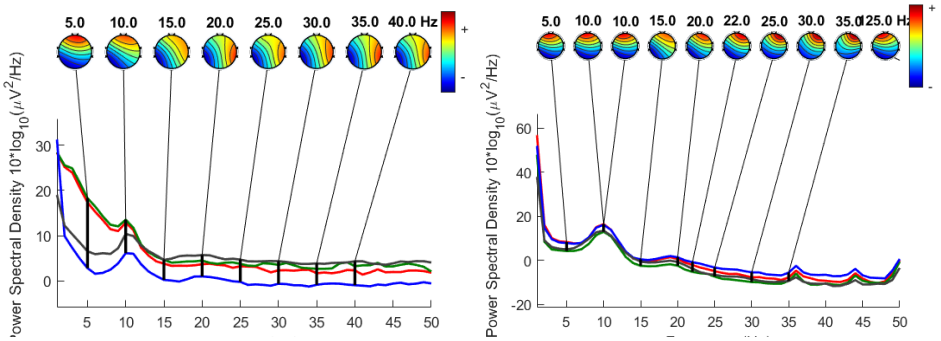


Figure 3. Comparison of Power Spectral Density of Subject 02

In Figure 3 above, the brain conditions both show significant alpha waves. The alpha wave increased with a frequency range of 10 Hz and successfully suppressed the beta wave after the stimulus therapy was given. The alpha wave spectrum unit in data that has been given a hypnotherapy stimulus shows greater strength, reaching 20 compared to before being given a stimulus that only gets a spectrum strength of below 20. Respondents with symptoms of zoom fatigue often feel fatigued related to the cognitive activity; when the respondent's neural condition is in alpha waves, it allows the brain to respond to relaxing activities that can reduce stress levels and help the condition to be more relaxed.

(c). Subject 03

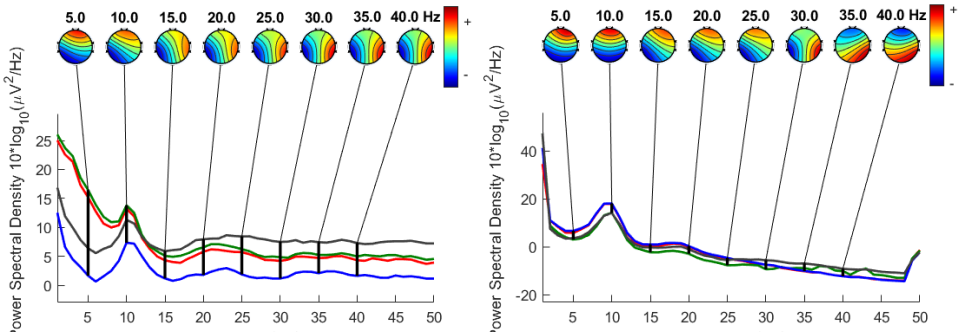


Before Stimulus After Stimulus

Figure 4. Comparison of Power Spectral Density of Subject 03

Based on the following data, an interpretation is obtained that the condition of the brain in this state describes a spike in alpha waves with a frequency of 10 Hz, which has succeeded in reaching spectrum units of 20. Alpha waves in this condition have succeeded in suppressing the rate of beta waves after being given a hypnotherapy stimulus. Although there is a small spike in the frequency range of 35 and 45 Hz, this is far from the significant gain of alpha waves. This small spike occurs because of a disturbance in the form of distraction that can affect the process of recording currents and signals in the brain.

(d). Subject 04

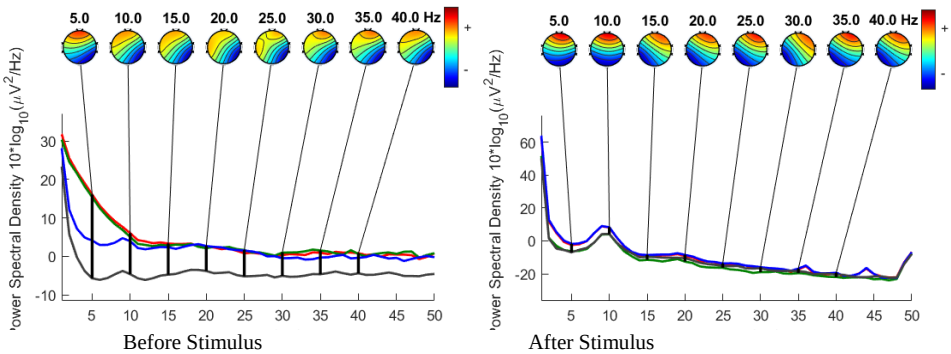


Before Stimulus After Stimulus

Figure 5. Comparison of Power Spectral Density of Subject 04

The condition of the brain wave picture in Figure 5 above experienced a significant spike in alpha waves in the 10 Hz frequency range. It succeeded in suppressing the frequency of beta waves. Before giving the stimulus, the alpha wave was only in the spectrum below 15, but after the hypnotherapy stimulus, the wave jumped almost to spectrum 20. The same thing happened with the beta wave, which experienced a decrease in spectrum strength after being given a therapeutic stimulus from a number below 10 to below a number 0.

(e). Subject 05



Before Stimulus After Stimulus

Figure 6. Comparison of Power Spectral Density of Subject 05

Based on the data above, it can be explained that there has been an increase in alpha waves with a frequency range of 10 Hz. The data shows a decrease in the beta wave spectrum from a number below 10 to below 0 before the hypnotherapy stimulus is given with the already given stimulus. When listening to the hypnotherapy stimulus, the individual is in a relaxed and relaxed state. Therefore the alpha wave spike is considered influential in suppressing the beta wave rate.

(f). Subject 06

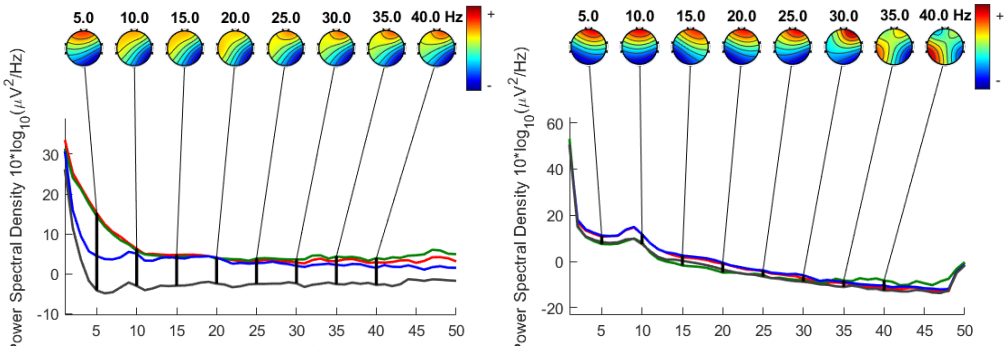


Figure 7. Comparison of Power Spectral Density of Subject 06

The description of the condition of the brain in the data above notes an increase in alpha waves with a frequency of 9 Hz, which has succeeded in reducing the rate of beta waves. Before the stimulus was given, there was a beta wave spike in the frequency range of 30-35 Hz with a spectrum value below the number 10. In contrast, after the beta wave stimulus was successfully lowered with a spectrum below 0. When the respondent was involved in the process of giving the hypnotherapy stimulus, the alpha experienced a spike that almost reached spectrum 20.

(g). Subject 07

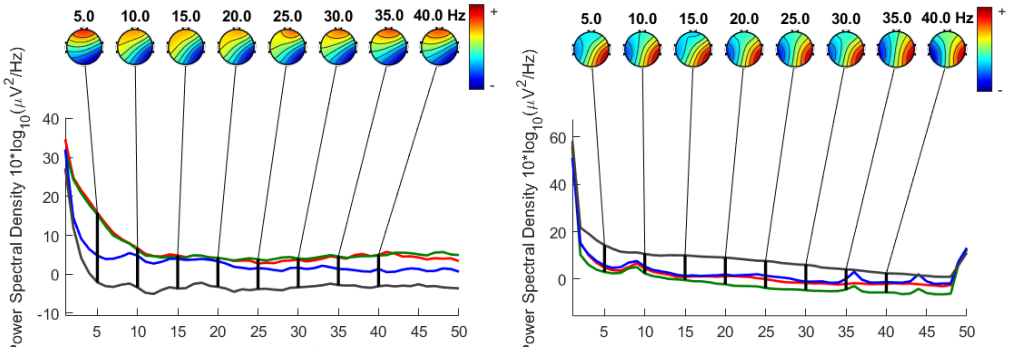


Figure 8. Comparison of Power Spectral Density of Subject 07

In Figure 8 above, it can be seen that there is no spike in alpha waves; this happens because the respondents do not have too much of a dominant impact on certain frequencies. Meanwhile, where respondents have been given a hypnotherapy stimulus, it is noted that there is an increase in alpha waves in the 10 Hz frequency range, followed by an increase in beta waves in the 35 and 45 Hz frequency ranges.

(h). Subject 08

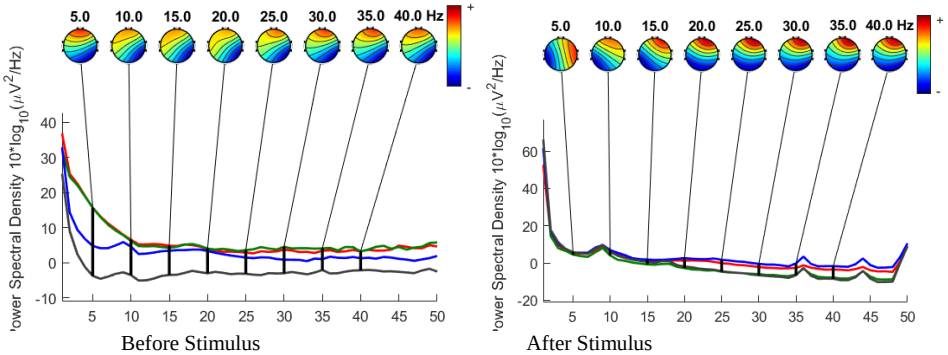


Figure 9. Comparison of Power Spectral Density of Subject 08

Based on Figure 9 above, it can be interpreted that there is a spike in alpha waves at a frequency of 9 Hz, which suppresses the increase in beta waves. In the condition of brain waves after being given a hypnotherapy stimulus, all of the frequencies converge and experience a significant alpha spike. It is inversely proportional to the before stimulus data, which looks not too dominant in certain frequencies.

(i). Subject 09

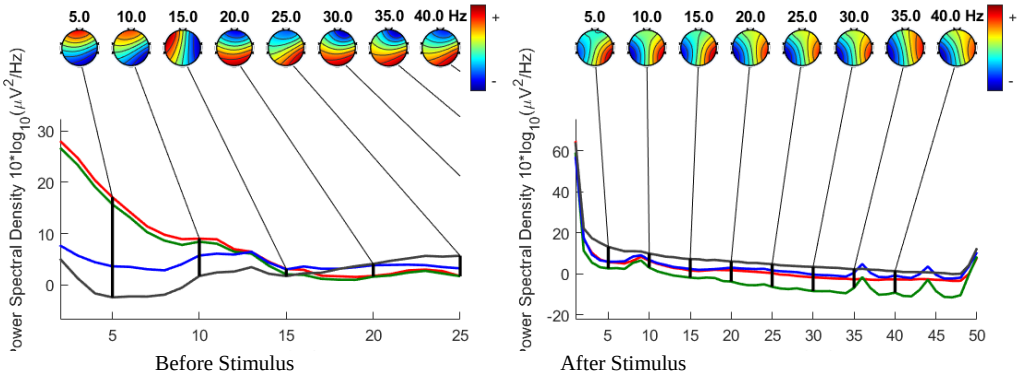


Figure 10. Comparison of Power Spectral Density of Subject 09

Based on Figure 10, an interpretation of the alpha wave spike with a frequency range of 9 Hz is obtained. Before being given a stimulus, there was an increase in beta waves in the 13 Hz frequency range, and the data showed that some brain areas had different frequency currents. However, after being given a stimulus, these areas began to coalesce, causing an increase in alpha waves with a spectrum below the number 20.

(j). Subject 10

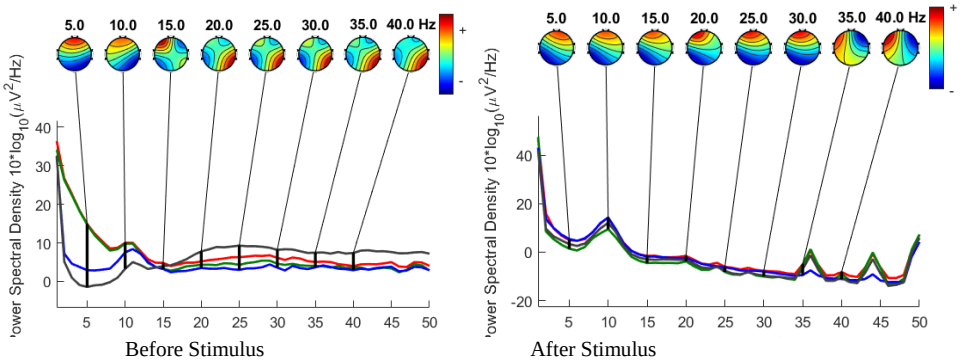


Figure 11. Comparison of Power Spectral Density of Subject 10

Based on Figure 11, a description of the existence of a spike in alpha waves with a frequency range of 10 Hz can be obtained, suppressing the rate of beta waves. Alpha waves occur during the transition between conscious and unconscious. When hypnotherapy begins, a person will be asked to accept all induction suggestions that will bring brain activity to relax and rest. The data shows a beta wave spike at a frequency of 35 Hz. Beta wave has a frequency of 12 to

38 Hz. This wave is considered a conscious state, indicating that the individual's brain will respond to everything around him. Beta wave spikes are caused by disturbances in the form of distractions that affect the process of recording signals in the brain. However, a significant increase in alpha waves successfully restrained the wave currents.

B. Grand Average of EEG Spectra

The following is an interpretation of the data generated from recording and measuring EEG via the Brain Computer Interface (BCI) with the Muse, the Brain Sensing Headband device. The Muse sensor is used as an EEG sensing device with five hardware sensors, one point is used as a reference point (NZ), and the other four points are used to record brain wave activity. These points consist of AF7, AF8, TP9, and TP10. The AF wave points focus on recording the anteriofrontal region, while the TP wave points focus on recording the temporoparietal region.

Data 2 Description of Channel Sensors With Muse the Brain Sensing Headband Device on Brain Waves After and Before Stimulus Therapy is Given

The wave points consist of AF7, AF8, TP9, and TP10. The AF wave points focus on recording the anteriofrontal area, while the TP waves focus on recording the temporoparietal area.

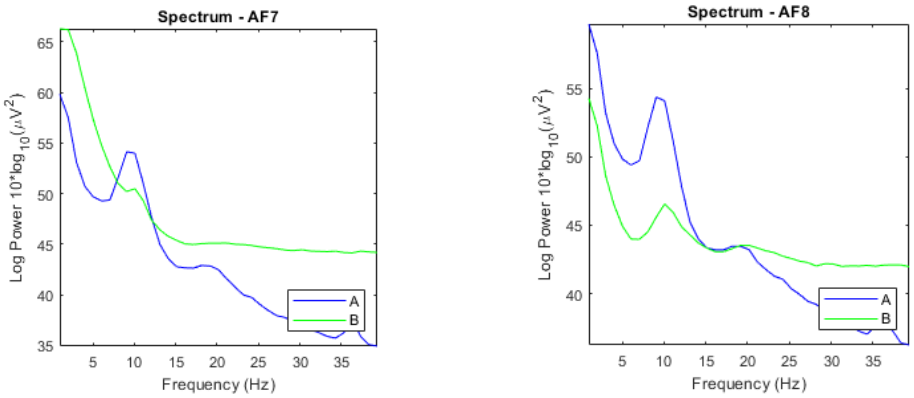


Figure 12. Grand Average of EEG Spectra Channel AF7 and AF8 (A: after being given a stimulus, B: before being given a stimulus)

The AF7 canal is located in the left frontal area. The frontal area serves as regulation and control in speech, movement planning, and recognition. In the AF7 data, it was noted that there was a spike in alpha waves with a frequency range of 10 Hz. The alpha waves rise in the condition of the brain that has been given a hypnotherapy stimulus. Meanwhile, before being given a stimulus, the respondents experienced a decrease in alpha waves and were in the stagnant line of beta waves in the frequency range of 15-35 Hz. Through this channel, it can be seen that hypnotherapy has a good effect because increasing the alpha brain waves will process the relaxation conditions needed by the respondent.

Furthermore, on the AF8 channel, there is a significant increase in alpha waves with a frequency of 10 Hz. Alpha waves are present in brain conditions that have been given a hypnotherapy stimulus. Although before the stimulus was passed, there was also a spike in alpha waves, the strength of the spectrum was 45, while in the condition of the brain that had been given the stimulus, the power of the spectrum was almost 55. The AF8 channel is located in the right frontal area. This canal is associated with the parietal area, which regulates information, stimuli, temperature, and body position. Looking at the AF8 data, it can be concluded that this area provides strong alpha waves and encourages relaxation.

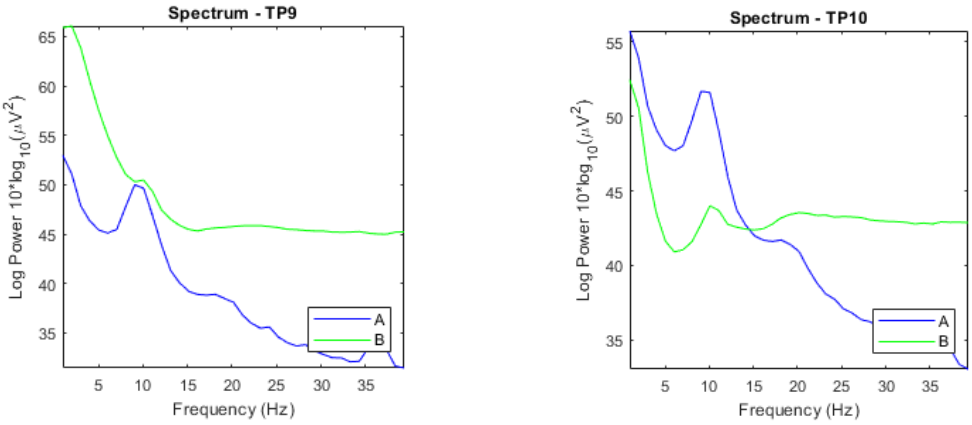


Figure 13. Grand Average of EEG Spectra Channel AF7 and AF8 (A: after being given a stimulus, B: before being given a stimulus)

On the TP9 channel, the alpha wave succeeded in suppressing the beta wave in the 10 Hz frequency range. Before being given hypnotherapy induction, beta waves were on spectrum 45 with a frequency of 15-35 Hz. However, after being given a hypnotherapy stimulus, the beta waves decreased in the spectrum below 40. It happens because the TP9 area is in the left temporal area and is associated with the occipital lobe, which helps individuals to recognize objects through the senses of sight and the written word. Through this area, the brain will get an interpretation of the objects seen and give the impact of obtaining a state of relaxation.

Furthermore, in the TP10 channel, there was a significant spike in alpha waves in the 10 Hz frequency range after being given a hypnotherapy stimulus. Before being given a stimulus, the brain responds to beta waves that experience spikes in the 20-35 Hz range. The alpha waves obtained succeeded in suppressing the rate of beta waves. The increase in alpha waves in this channel has a major impact on relaxation processing because the TP10 channel is located in the right temporal area. This area is important in forming memories and receiving information from ear stimuli. Therefore, the hypnotherapy stimulus given to the respondent succeeded in stimulating brain waves so that they were in a relaxed and relaxed condition.

V. Conclusions

Based on the research results and interpretation of the data above, the provision of a hypnotherapy stimulus induces a spike in alpha waves in the 10 Hz frequency range. Before giving the stimulus, the brain conditions responded to various frequencies that gave the rate for the increase in beta waves. However, the beta wave frequency was successfully lowered after listening to the hypnotherapy stimulus. It is a good impact because it means that the brain responds to a subconscious activation process that encourages a relaxed and relaxed state. In addition, the increase in alpha waves is also influenced by areas of the brain that have a function to control sound, visual stimuli, regulation, and information processing. Through this area, the hypnotherapy stimulus can be processed by neurons to create a state of concentration.

Acknowledgments

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