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Article

Differences in Short-term Memory Before and After Exposure to Dangdut Music and Classical Music

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Abstract: The quality of education in Indonesia is still relatively low when compared with other countries. To improve student achievement, stimulation can be provided to improve learning abilities and memory abilities. The learning and memory process will be optimal if a person is in an alpha brain wave state (8 to 12 Hz). Music that has a tempo of around 60 beats per minute, such as classical music, has the ability to stimulate alpha brain waves. Dangdut music is more familiar to Indonesian people and there is dangdut music which can change alpha brain waves to be more dominant. This type of research is a pre-experimental design with a crossover design. This research aims to see the differences between dangdut and classical music in improving short-term memory. The sampling technique used was purposive sampling with a sample size of 30 people. Short-term memory measurements were carried out before and after receiving music exposure for 30 minutes. Measurements were carried out using the digit span test method. The result was that there was a significant increase in short-term memory after exposure to dangdut and classical music. The conclusion of this research is that dangdut music and classical music both have an impact on improving short-term memory abilities equally well.

Keywords: short-term memory, dangdut music, classical music, brainwave, alpha wave

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1. Introduction

The quality of education in Indonesia is low compared to other countries. UNESCO Global Education Monitoring (GEM) Report research in 2016 placed Indonesian education in 10th place out of a total of 14 developing countries [1]. One way to increase Indonesia's ranking is to improve student achievement. To improve achievement, stimulation can be carried out by increasing learning ability and memory ability. In the process of learning and remembering, a person needs conditions that support entering information into memory (information intake), this process occurs in the hippocampus. Information intake will be optimal if a person is in an alpha brain wave state, namely when brain waves are at a frequency of 8 to 12 Hz. Alpha waves can increase the hormones serotonin and β-endorphin which play a role in neurogenesis in the hippocampus. Alpha brain waves can be achieved in several ways, one of which is with music [2–4]. Music with a tempo of 60-100 times per minute such as classical music has the ability to stimulate alpha brain waves. In the book The Mozart Effect written by Don Campbell, he says that the rhythm and tempo of classical music is around 60 beats per minute, which corresponds to the speed of the human heartbeat. The resting heart rate in humans is 60-100 beats per minute. The brain can enter alpha waves in this situation [5]. Based on research conducted on schizophrenic patients, the results showed that several dangdut music titles could change

the brain waves of schizophrenic patients from being chaotic to normal alpha brain waves when tested with EEG (Electro Encephalo Grafi). Dangdut music is music that is familiar and listened to by many people in Indonesia. Dangdut music, which is original Indonesian music, began to develop over time and was increasingly heard by Indonesian people [6].

2. Materials and Method

This research used a crossover design because each sample in the study received several treatments at different time periods. In this study, there were two treatments and two periods. Subjects in group I received dangdut music and group II received classical music in period I, then the treatments were swapped in period II. Period I and period II were separated by a washout period of 2 days. The data in this study is quantitative data in the form of short-term memory pre-test and post-test scores obtained by subjects before and after receiving music. Music is the independent variable in this research. The music is dangdut music with the title "Oplosan" and classical music with the title "Mozart Sonata K 448 for Two Pianos in D Major 2nd Movement". Meanwhile, the dependent variable in this research is short-term memory ability. The influence of dangdut music and classical music on short-term memory can be seen based on the difference in short-term memory pre-test and post-test scores. The Wilcoxon statistical test was carried out to see this difference. The Wilcoxon test was also carried out to see the difference between dangdut music and classical music in improving short-term memory.

The subjects in this study were 30 first year students at the Faculty of Medicine, University of Jember (N = 30). They consist of men and women aged 17-20 years. Subjects were selected based on certain criteria, having good sleep quality, normal stress levels, normal anxiety levels, normal depression levels, normal body mass index, no history of brain disorders, and were willing to participate in research. This research was conducted indoors. The room used is a room that has been conditioned with air conditioning. The environment around the room is maximized to be quiet and not noisy [7]. Short-term memory was measured using the digit span test method. The digit span test contains a series of random numbers that the subject must remember and rewrite sequentially (forward) and in reverse order (backward). This test was given before the subject listened to music (pre-test) and after the subject listened to music (post-test). The test can be accessed by each subject via cellphone. The score is given based on the number of numbers that can be remembered and rewritten correctly[8]. Dangdut music with the title "Oplosan" and classical music with the title "Mozart Sonata K 448 for Two Pianos in D Major 2nd Movement" were played to the subject with loudspeakers. After the research procedures were completed, the data were analyzed using SPSS version 26 software.

3. Results and Discussion

The distribution of subjects participating in the research can be seen based on their characteristics. Characteristics in the form of subject distribution based on age and gender can be seen as in Table 1. Based on Table 1, there are more female subjects (63.3%) than males (36.7%). Meanwhile, the age of the subjects involved in the research was 17-20 years with the largest number being 19 years old (46.7%) and the frequency of the number being 20 years old (3.3%). Short-term memory scores before and after exposure to dangdut music are as shown in Table 2.

Table 1 Sample Distribution Based on Age and Gender

Characteristics	Total n (%)
Age	
17 years old	3 (10.0)
18 years old	12 (40.0)
19 years old	14 (46.7)
20 years old	1 (3.3)
Gender	
Male	11 (36.7)
Female	19 (63.3)

* Statistical descriptive test

Table 2 Short Term Memory Score with Dangdut Music

Variable	Mean	Std. Deviation
Pre-test		
Digit span test forward	5.93	1.048
Digit span test backward	5.03	1.033
Post-test		
Digit span test forward	6.70	1.088
Digit span test backward	5.90	1.398

* Statistical descriptive test

The scores obtained before receiving exposure to dangdut music as shown in Table 2 were an average of 5.93 ± 1.048 for the digit span test forward and 5.03 ± 1.033 for the digit span test backward. Next, short-term memory measurements were carried out on the subjects after receiving exposure to dangdut music. After exposure to dangdut music, results were obtained with a mean of 6.70 ± 1.088 for the digit span test forward and 5.90 ± 1.398 for the digit span test backward. Meanwhile Table 3 shown the scores obtained before receiving classical music exposure has an average of 6.33 ± 1.398 for the digit span test forward and 5.23 ± 0.898 for the digit span test backward. Next, short-term memory measurements were carried out on the subjects after receiving exposure to classical music. The mean score obtained after receiving exposure to classical music was 7.20 ± 1.324 for the digit span test forward and 6.30 ± 1.291 for the digit span test backward.

Table 3 Short Term Memory Score with Classical Music

Variable	Mean	Std. Deviation
Pre-test		
Digit span test forward	6.33	1.398
Digit span test backward	5.23	0.898
Post-test		
Digit span test forward	7.20	1.324
Digit span test backward	6.30	1.291

* Statistical descriptive test

The digit span test score obtained after listening to music is different from the score before listening to music. The difference in short-term memory scores between before and after listening to dangdut music can be seen in Figure 1 (a and b).

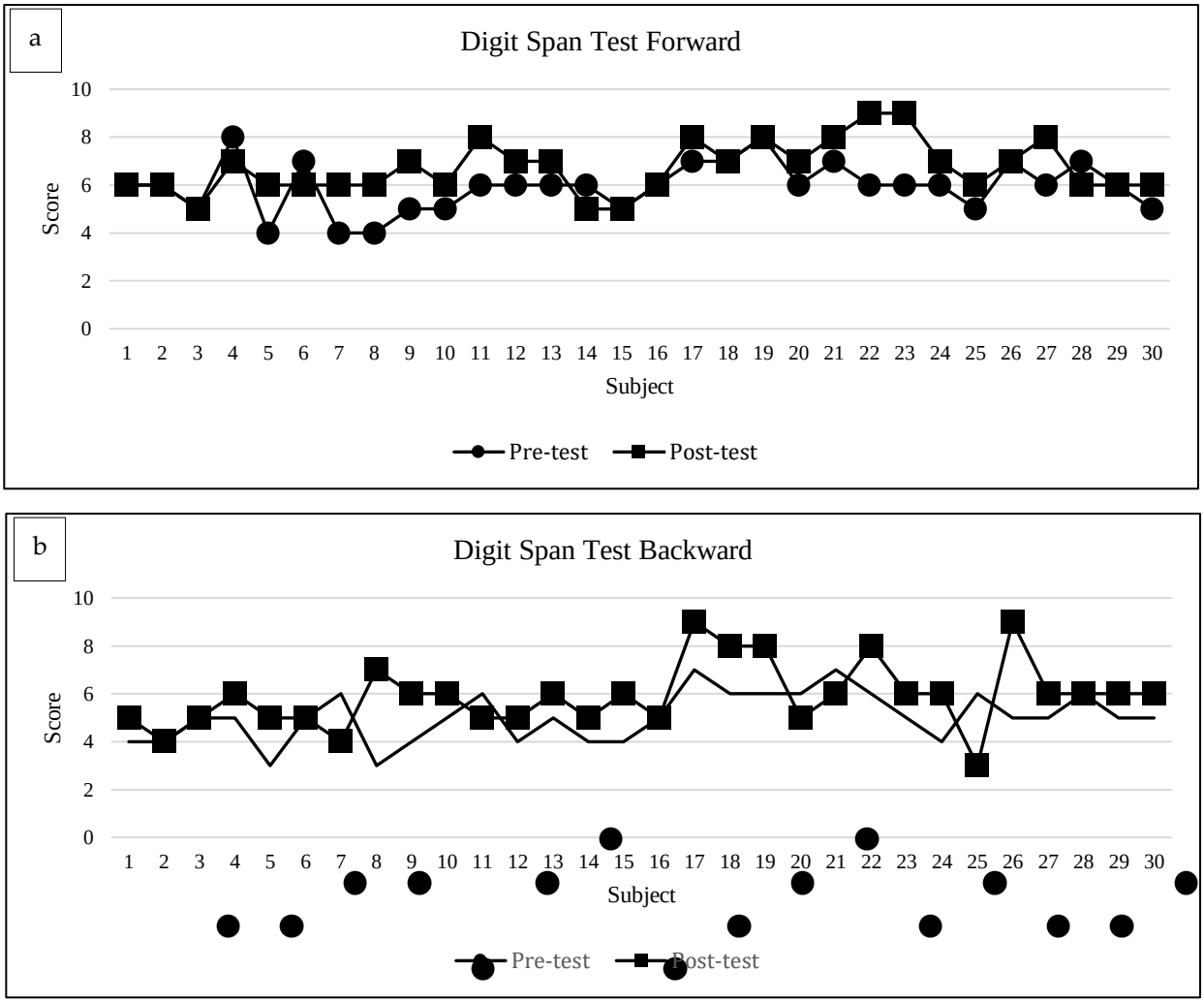

Figure 1. Difference in Memory Scores Before and After Exposure to Dangdut Music on (a) Digit Span Test Forward and (b) Digit Span Test Backward

Based on Figure 1a, there were 4 subjects whose scores decreased, 17 subjects whose scores increased, and 9 other subjects received constant scores (neither increased nor decreased) on the digit span test forward after listening to dangdut music. Based on Figure 1b, there were 5 subjects whose scores decreased, 20 subjects whose scores increased, and 5 subjects received constant scores (neither increased nor decreased) on the backward digit span test after being exposed to dangdut music. Based on the results obtained by the subject, a Wilcoxon short-term memory pre-test and post-test scores. The Wilcoxon test showed that there was a significant difference between the pre-test and post-test digit span forward test scores ($p = 0.002$). There was also a significant difference between the pre-test and post-test scores on the backward digit span test ($p = 0.006$). Dangdut music has an impact on improving short-term memory abilities.

Meanwhile, the difference in short-term memory scores between before and after listening to classical music can be seen in Figure 2 (a and b). Based on Figure 2a, there were 5 subjects whose scores decreased, 20 subjects whose scores increased, and 5 other subjects received constant scores (neither increased nor decreased) on the digit span test forward after listening to classical music. Based on Figure 2b, there was 1 subject whose score decreased, 21 subjects whose scores increased, and 8 subjects received constant scores (neither increased nor decreased) on the backward digit span test after being exposed to classical music. Based on the results obtained by the subject, a Wilcoxon test was carried out to see the difference in short-term memory pre-test and post-test scores. The Wilcoxon test showed that there was a significant difference between the pre-test and

post-test digit span forward test scores (p = 0.006). There was also a significant difference between the pre-test and post-test scores on the backward digit span test (p = 0.000). Classical music has an impact on improving short-term memory abilities.

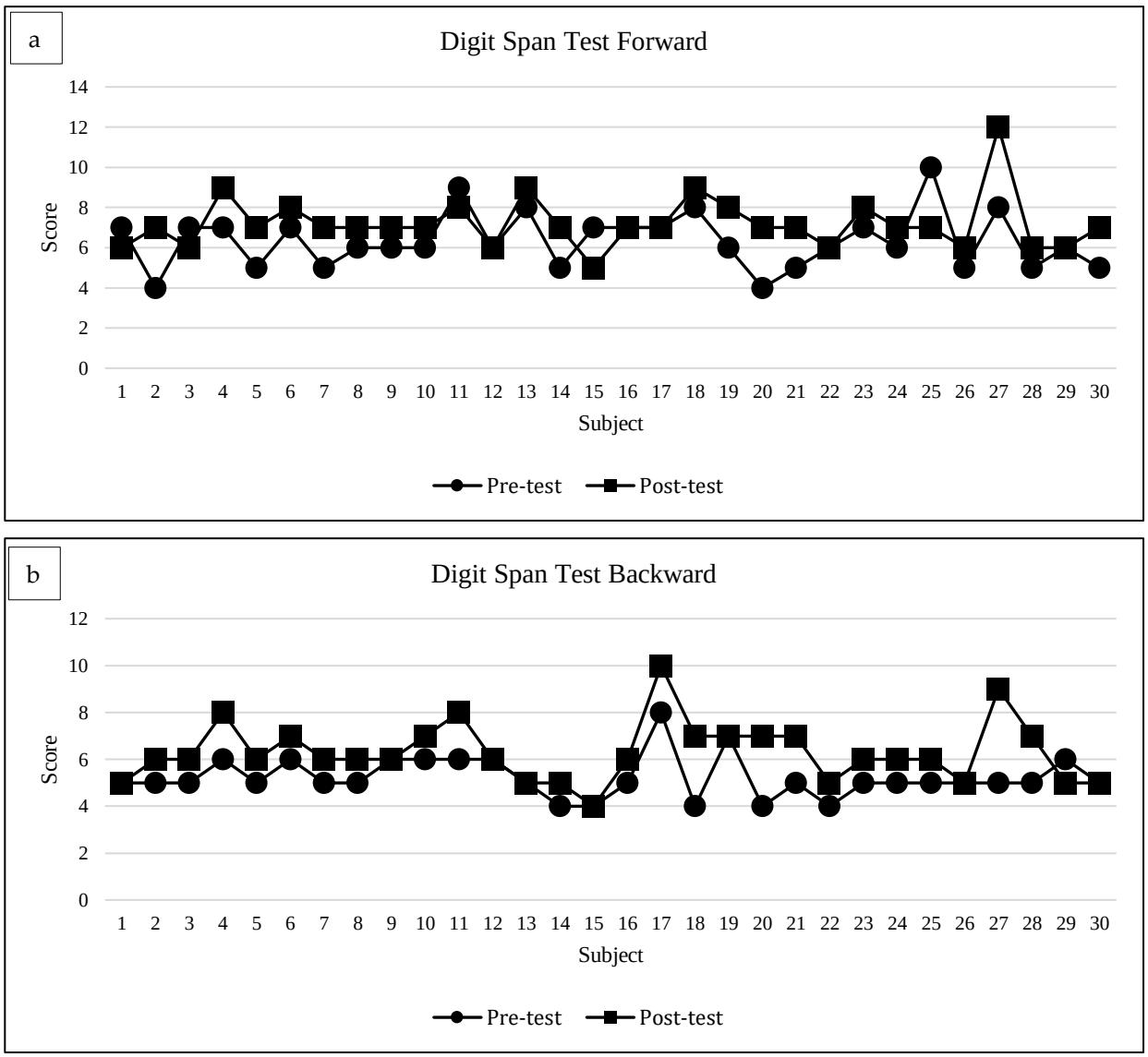

Figure 2. Difference in Memory Scores Before and After Exposure to Classical Music on (a) Digit Span Test Forward and (b) Digit Span Test Backward

The results in Table 2 show that there was an increase in the mean short-term memory score of the digit span test forward and digit span test backward in subjects after listening to dangdut music. Even though the average increased, there were subjects whose scores decreased after listening to dangdut music. Figure 1a shows that there were 4 subjects whose scores decreased, 9 subjects whose scores remained constant, and 17 subjects whose scores increased. Among the 4 subjects whose scores decreased, 3 subjects had higher stress scores and 1 subject had a higher anxiety score when compared to the majority of subjects. Figure 1b shows that there were 5 subjects whose scores decreased, 5 subjects whose scores remained constant, and 20 subjects whose scores increased. Among the 5 subjects whose scores decreased, 2 subjects had higher stress scores, 2 subjects had worse sleep quality scores, and 1 subject had higher anxiety scores when compared to the majority of subjects. Meanwhile, the results after exposure to classical music in Table 3 show an increase in short-term memory scores after listening to music, but the results in

Figure 2 also show an increase, decrease, and constant scores obtained by the subjects. Figure 2a shows that there were 5 subjects whose scores decreased, 5 subjects whose scores remained constant, and 20 subjects whose scores increased. Among the 5 subjects whose scores decreased, 4 subjects had higher stress scores and 1 subject had worse sleep quality scores when compared to the majority of subjects. Figure 2b shows that there was 1 subject whose score decreased, 8 subjects whose scores remained constant, and 21 subjects whose scores increased. Subject whose score decreased had worse sleep quality scores when compared to the majority of subjects. Stress can result in functional and structural changes in the hippocampus part of the brain.

These structural changes include impaired atrophy and neurogenesis[9]. Higher levels of anxiety are associated with lower short-term memory abilities. In terms of emotional components and underlying neural pathways, stress and anxiety overlap, but stress includes both avoidance (anxious) and proactive responses [10]. When tired due to lack of sleep, there can be a decrease in sensory acuity and reactions and also a decrease in motor speed. This can cause interference in the memory formation process. Poor sleep quality can also affect a person's attention. The worse the quality of a person's sleep, the greater the attentional dysfunction that appears [11]. Subjects who have a constant score can be influenced by several factors, one of which is the type of dangdut or classical music which is considered less enjoyable for the subject concerned.

According to previous research conducted by Sari and Grashinta, music can improve a person's cognitive abilities if the music is considered enjoyable by the listener[12]. Even though there were subjects whose scores did not increase, the majority of subjects experienced an increase in short-term memory scores after listening to dangdut music and classical music. These two types of music also had an impact in the form of significantly increasing short-term memory abilities in the subjects ($p > 0.05$). These results could be because the dangdut music with the title "Oplosan" used in this research can change alpha brain waves to become more dominant, in accordance with research conducted by Nindy and Wrahatnala in 2018 [6]. Classical music with the title “Mozart Sonata K 448 for Two Pianos in D Major 2nd Movement” can also improve short-term memory abilities through dominant alpha waves, as in previous research conducted by Pratiwi [13]. Dominant alpha waves are the optimal condition for the information intake process (entering information into the brain) which is associated with improving short-term memory in the subject [14].

When in alpha waves, the brain produces the hormone serotonin. Serotonin has seven groups of receptors, almost all of which are expressed in the central nervous system, mainly in the dentate gyrus (DG) of the hippocampus. The interaction between serotonin and its specific receptors can influence various signal transduction pathways and neuronal communication in the nervous system. Therefore, serotonin can influence memory which is closely related to the learning process through several mechanisms. The raphe nuclei located in the middle area of the pons and in the upper part of the brainstem are the beginning of the serotonergic neuron pathway. Serotonergic neuron terminals are located in all brain structures, but the hippocampus is one of the structures that has the most innervation of serotonergic neurons covering various areas in the hippocampus. Based on this, there are indications that serotonin has an important role in the neurogenesis process [2]. Apart from serotonin, the brain also produces endorphins (β-endorphins) when it is in alpha waves. β-endorphin is released by the anterior pituitary. It is thought that β-endorphins have an important role in various behaviors and conditions related to hippocampal neurogenesis [4].

4. Conclusions

Based on the research results, it can be concluded that dangdut music and classical music have an impact on improving short-term memory and this impact is equally good. For other researchers who wish to continue this research or conduct similar research, they can be asked about the subject's interest in the type of music that will be given as

treatment. It is also recommended to carry out further research by measuring the brain waves of subjects when they are shown music so that it can be known with more certainty that alpha waves can improve short-term memory.

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Institutional Review Board Statement: The ethical suitability test was carried out by the Ethics Commission of the Faculty of Medicine, Jember University. It is a non-invasive study.

Informed Consent Statement: All subjects have filled out and signed a consent form to become participants in the research. They were given detailed information about this research before the research was carried out. Subjects also have the right to ask questions and discontinue participation at any time during the test. The participation of the sample was voluntary, and the researcher's identity information was given in order for the members to be able to contact them at any given time.

Conflicts of Interest: The authors declare no conflict of interest.

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