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Effect of Music on Attention, Creativity and Memory

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Abstract: ***Music has been known to have a profound effect on a person's behaviour and psychological processes, because music is hardwired into the human brain. Research has proven that music plays an important role in an individual's life and has various cognitive effects on the human brain. In this paper, the effect of music will be studied upon the aspect of work performance of a person engaged in a media organization. For this purpose, quantitative study will be conducted on 100 employees of age group 21 - 30, using software based psychological tool known as Pebl. The sample will comprise of people belonging to media organizations and data will be collected within duration of 2 months, from April till June 2019. For pretest and posttest analysis, SPSS software would be used. The cognitive dimensions that will be focused for this study are attention, memory and creativity. The null hypothesis for the research is that there is no significant difference between the pretest and posttest scores of the given sample due to intervention of music. Expected results are that music will have a significant effect on the performances of the sample, thereby increasing their work performance in the related field.***
Keywords: Music, music therapy, attention, memory, creativity.

I. INTRODUCTION

Music has been prevalent even before the dawn of man. The nature produced music through sounds of wind, water, rock and animals. It has been observed that animals have an imminent sense of music and use various forms of music to attract their partners. Whales and birds have been known to sing in specific rhythmic patterns. Adapting from the nature, man started incorporating music into his day to day life since the early age and today, it is an inseparable part of the human life. Infants can recognize music as good as any adult and can show response through music behaviour, such as clapping, tapping feet or singing along (Moorhead, 1977). The human brain is wired to recognize musical notes, contours and pitches, as well as differentiates between musical and non musical sounds (Olsho, 1984). Both children and adults can comprehend musical sounds as pleasing stuff and either segment or extend the musical pieces while remembering them (Trehub&Thorpe,1989).

Music's centrality to our day to day existence has motivated researchers and experts to contemplate the impact and effect that music has on people. Research done over the previous decades has brought about an array of results that uncover how music influences people. Music has numerous components that impact the performance of people on psychological domains (Seinfeld, Figueroa, Ortiz-Gil & Sanchez-Vives, 2013). These components have been intensely examined with regards to quality of life, social, psychological, physiological as well as educational settings. Nevertheless, the connection between music and work performance at the workplace has not been concentrated in depth. It is not generally realized to what great extent people's life is connected to music. This is not simply restricted to enjoying while listening to trending songs in playlists. The connection between Nature, life and music goes well beyond that. Right from the ticking of the clock to the sound of one's heartbeats, music is connected with our day to day life. Andrade and Bhattacharya (2003) stated that a person's body clock follows a particular pattern and the brain is hardwired to respond to all such rhythmic patterns. A newborn baby can instantly recognize his mother by listening to her heartbeat which he remembers from within the womb. When provided with appropriate tone and rhythm, the human brain naturally responds to it with high synchronization and functions in a much more efficient way (Baney, 2002). This very effect of music has been studied in this paper by testing whether there was any significant increase or decrease in the performing capability of a person viz. Attention, memory and creativity, before and after the intervention of classical music.

Owing to all such behaviors, it can be easily concluded that human brain has a special understanding capability for music as it is hardwired in it through centuries of evolutionary process involving wide variety of music. Meanwhile, the work culture existing across the corporate world today demands high amounts of physical and mental work. It may not be possible for a person to deliver his best at all times.

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Therefore, an attempt is made to study whether the intervention of music can help a person perform better at work, as music enhances creativity and attention while promoting social development of an individual (Weinberger, 1998).

A number of studies have been conducted in the past showcasing the connection between music and neurological functions, which prove affirmative of music impacting and improving our performance in spatial temporal reasoning and neuromotor functions (Nisbet, 2012). In another research, the effect of musical beats on brain was determined when the subject's basal ganglia and supplementary motor showed response when the subject was exposed to rhythmic beats (Grahn, 2009). Musical melodies have known to be helpful in recalling associated memories thereby facilitating learning. The human mind is wired to identify musical patternsand associate them with real world events and information saving themas graphical data like patterns and structures. This makes the brain recall those patterns when exposed to similar music (Wallace,1994).

Studies done by Adaman and Blaney (1995) suggest that musical intervention had significant positive effect on moods of people. Similarly, in order to make the human resources more efficient in organizations, background music is used to reduce employee stress. The study by M. K. D. Padmasiri and Dr. K. A. S. Dhammika (2014) on machine operator employees in garment manufacture industry in Sri Lanka found that intervention of background music has a significant and profound effect on the performance of the employees. It proved that stress can be reduced and work performance can be increased by using suitable background music which makes the environment worker friendly. However, there are some limitations to this study. It did not consider the preference of the sample and used a similar kind of music for the intervention.

In another research done by Teresa Lesiuk (2005), studies a very similar topic called the effect of music listening on work performance, studies the effect of music listening on state positive effect, work quality and time-on-task of computer information systems developers. It takes 56 software company employees as sample and proves that music listening has a positive learning and time on task effect for the employees and has implications on the organizational culture and performance as well (Lesiuk, 2005). But the limitation of this research is that it has been conducted on a very narrow population. The sample size is not adequate to imply the results on a global scale.

Variables taken in study

Attention, in psychology, refers to the focus of mental as well as physical awareness on some process, event or happening, which should not be affected or easily deviated by external factors or stimulus. It is according to attention that we calculate the content of consciousness and also the influence that it has on our overall conscious experience (Titchener, 1910). Attention is practically the current state of mind with regards to focus on a certain event, so it relates to the immediate experience of the person. Humans are known to be able to perform most tasks efficiently with proper attention, but still there is no total control over it and also, it has been proven to get influenced by external factors (McCallum, 2019).

Another factor studied upon in this research is the human memory, which is the term given to the structures and processes involved in the storage and subsequent retrieval of information. According to Matlin (2005), 'Memory is the process of maintaining information over time'. 'Memory is the means by which we draw on our past experiences in order to use this information in the present' (Sternberg, 1999). Memory is one of the most essential cognitive parts of our lives. Without a memory of the past life, one cannot operate in the present or think about the future. Learning anything new would be a challenge too without memory (McLeod, 2013). The term working memory determines a cognitive system that facilitates temporary storage and interpretation of the information received from complex cognitive tasks as language communication, learning, and thinking. Studies have shown that working memory requires the simultaneous storage and processing of information (Baddeley, 1992).

The third component of the study variable is creativity. Music is known to have profound effect on the cognitive behaviour and mood of the people, thus directly influencingcreativity.

Music based interventions can help a person take more creative decisions as the mood levels are up (Adaman & Blaney 1995). Therefore these cognitive components of the humanpsyche are studied in this research with respect to effect of western classical music, through a pre test and post test experiment pattern, the scores of which will be later analyzed using t-test through SPSS software.

II. METHOD

A. Aim

To find whether musical intervention can help improve the task performance of a person.

B. Objectives

1) To find the difference between pre test and post-test scores of samples for determining western classical music's effect onattention.

2) To find the difference between pre test and post-test scores of samples for determining western classical music's effect oncreativity.

3) To find the difference between pre test and post-test scores of samples for determining western classical music's effect onmemory.

C. Hypothesis

There is a significant difference in the attention, creativity and memory dimensions of task performance after music based intervention.

D. Procedure

This quantitative study uses the experimental pre test – post test method for its purpose.

One hundred employees (both male and female) working as editors, designers and content developers were taken as participants for this research. After filling up basic personal details and a mandatory consent form, which also included musical preferences of the volunteers, the participants were asked to complete three tasks on the Pebl software under controlled settings, without any musical intervention. After recording their score, same three tasks were repeated in the same order, this time with the intervention of music and the scores were recorded. All of the final pre test and post-test scores were then compared through T test in SPSS software to come out with a conclusion, thus accepting or rejecting the null hypothesis.

Study variable. Task Performance

Independent Variable. Western Classical Music piece *Dependent Variable*. Attention, Creativity and Memory *Sample*

This research has taken quantitative approach to collect data through experimental method from about 100 organizational employees aged between 21 and 30 years old, both male and female, predominantly in the creative field like editors, designers and content developers. This sample was chosen because this is the age group during which majority of the population is engaged in the initial period of their professional careers (Linton & Bryngelsson, 2000) and therefore would impact the industrial outputs in the next few decades, if successful. Jobs like editing, designing and content development require the employee to think out of the box in order to come out with results that are ahead of the competing market. People employed in such occupations also need to be attentive for details and have good memory to recall creative inputs (Donnelly, 1994; Raz, 2009).

Sampling technique. Snowball

Sample size. 100

Inclusion criteria. Samples who are aged between 21 and 30 years, working in media industry for jobs like editing, designing and content development, both male and female, are included. *Exclusion Criteria*. Population which is outside the desired age and working group, or diagnosed with any mental, physiological or psychological issues are excluded, as these impairments may cause uncertain deviations in thestudy.

E. Measures

For the purpose of assessment of the effect that musical intervention has on participants' cognitive abilities like attention, memory and creativity, the Blue Danube by Johann Strauss, a western classical music piece, was used during the post test. This is because classical music, being regarded as the purest and most powerful form of music, has the strength to connect emotionally as well as culturally and leave a lasting impact on a person's mind (Walker, 2005).

For the experiment purpose, Pebl software tool was taken as the tool. The software comprises of various validated tests designed to assess various cognitive abilities. For measuring attention, Stroop task was used. For memory, Digit span was used. For creativity, remote association task was used.

For the result analysis purpose, T test was carried out through SPSS software, to verify if there's any significant effect that classical music lays upon the cognitive abilities of a person in an organizational environment.

F. Result

The research follows a quantitative study method and therefore derived its results and data from experimental process. For this purpose, Pebl Software was used and the resulting data tables for the three different tests i.e. Remote Association Task (RAT) for creativity, Digit Span (DSPAN) for memory and STROOP Task for attention, are mentioned below.

RAT

Null Hypothesis: There is no significant difference between Pre Test and Post test scores of participants in Remote Association task.

Alternative Hypothesis: There is a significant difference between Pre Test and Post Test scores of participants in Remote Association task.

Outcome tables Table 1

Table 1 shows N, correlation and significance for the given variables.

Paired Samples Correlation

		N	Correlation	Sig.
Pair1	RAT PRE& RATPOST	100	0.028	0.78

As shown in table 1, the paired sample t test was computed for the given variables, where the N is (100), the correlation is (r=0.028) and the significance is (p=0.780).

Table 2

Table 2 shows mean, N, standard deviation and Standard error mean for the given variables.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	RAT PRE	8.93	100	4.226	0.425
	RAT_POST	11.61	100	3.331	0.335

As shown in table 2, the paired sample t test was computed for the give n variables, which comprises of RAT Pre Test (N=100, Mean=8.93, SD=4.226 and Standard Error Mean=0.425) and RAT Post Test (N=100, Mean=11.61, SD=3.331 and Standard Error Mean=0.335).

Table 3

Table 3 shows t value, df, and significance value for the given variables.

Paired Samples Test

	t	df	Sig.(2-tailed)
Pair 1 RAT_PRE-RAT_POST	-5.019	99	0

As shown in table 3, the paired sample t test is computed for the given variables, which comprises of RAT pre test and RAT post test (mean = -5.019, df = 99). The paired sample t test results show that there is a significant difference between pre test and post test scores of RAT (p=0, p<0.05) thus, rejecting the null hypothesis.

DSPAN

Null Hypothesis: There is no significant difference between Pre Test and Post test scores of participants in Digit Span Task.
Alternative Hypothesis: There is a significant difference between Pre Test and Post Test scores of participants in Digit Span task.
Outcome Tables Table 4
Table 4 shows N, correlation and significance for the given variables.

Paired Samples Correlations

		N	Correlation	Sig.
DSPAN PRE Pair1 DSPAN_POST	&	100	-0.01	0.919

As shown in table 4, the paired sample t test was computed for the given variables, where the N is (100), the correlation is (r=-0.010) and the significance is (p=0.919).
Table 5

Table 5 shows mean, N, standard deviation and Standard error mean for the given variables.

Paired SamplesStatistics

		Mean	N	Std. Deviation	d. Error Mean
Pair 1	DSPAN PRE	8.87	1001.382	0.139	
	DSPAN_POST	10.32	1001.284	0.129	

As shown in table 5, the paired sample t test was computed for the given variables, which comprises of DSPAN Pre Test (N=100, Mean=8.87, SD=1.382 and Standard Error Mean=0.139 and DSPAN Post Test (N=100, Mean=10.32, SD=1.284 and Standard Error Mean=0.129).

Table 6

Table 6 shows t value, df, and significance value for the given variables.

Paired Samples Test

	t	df	Sig.(2-tailed)
Pair 1 DSPAN_PRE-DSPAN_POST	-7.63	99	0

As shown in table 6, the paired sample t test is computed for the given variables, which comprises of DSPAN pre test and DSPAN post test (mean = -7.630, df = 99). The paired sample t test results show that there is a significant difference between pre test and post test scores of DSPAN (p=0, p<0.05) thus, rejecting the null hypothesis.

STROOP Task

Null Hypothesis: There is no significant difference between Pre Test and Post test scores of participants in STROOP Task.

Alternative Hypothesis: There is a significant difference between Pre Test and Post Test scores of participants in STROOP task.

Outcome Tables Table 7

Table 7 shows N, correlation and significance for the given variables.

Paired Samples Correlation

		N	Correlation	Sig.
Pair1	STROOP PRE& STROOPPOST	100	0.013	0.899

As shown in table 7, the paired sample t test was computed for the given variables, where the N is (100), the correlation is (r=0.013) and the significance is (p=0.899).

Table 8

Table 8 shows mean, N, standard deviation and Standard error mean for the given variables.

Paired Sample Statistics

	Mean	N	Std. Deviation	Std. Error Mean
STROOP PRE	70.74	100	6.201	0.62
Pair 1				
STROOP POST	71.61	100	1.254	0.125

As shown in table 8, the paired sample t test was computed for the given variables, which comprises of STROOP Pre Test (N=100, Mean=70.74, SD=6.201 and Standard Error Mean=0.620) and STROOP Post Test (N=100, Mean=71.61, SD=1.254 and Standard Error Mean=0.125).

Table 9

Table 9 shows t value, df, and significance value for the given variables.

Paired Sample Test

	t	df	Sig.(2-tailed)
Pair 1 STROOP_PRE-STROOP_POST	-1.378	99	0.171

As shown in table 9, the paired sample t test is computed for the given variables, which comprises of STROOP pre test and STROOP post test (mean = -1.378, df = 99). The paired sample t test results show that there is no significant difference between pre test and post test scores of STROOP (p=0.171, p>0.05) thus, accepting the null hypothesis.

III. DISCUSSION

In this paper, as the research question suggests, the focus was on finding whether music has any significant effect on a person's working performance. This was mainly in three cognitive areas namely attention, memory and creativity. The study was narrowed down and focused upon the effect that classical music has on people between the ages of 21-30 working as editors, designers and content developers predominantly in the media sector, in order to gain more specific outcomes. This was achieved by conducting a study through experimental method, taking 100 volunteers as the sample. Three objectives were determined for this study –

1) To find the difference between pre test and post-test scores of samples for determining western classicalmusic'seffectonattention.

2) To find the difference between pre test and post-test scores of samples for determining western classicalmusic'seffectoncreativity.

3) To find the difference between pre test and post-test scores of samples for determining western classical music's effect onmemory.

Further, it was hypothesized that there will be a significant difference in the attention, creativity and memory dimensions of task performance after music based intervention. The experiment was conducted on the participants through PEBL software. Under controlled settings, the participants were asked to complete three tasks on PEBL. These tasks were –

Remote Association task – For creativity test Digit Span task – For working memory test Stroop Task – For attention test

The experiment was carried out in a pre test and post test method where the participants were asked to complete the three tasks without any interventions, and then complete the same tasks in same order with the intervention of classical music. The classical music piece chosen here was The Blue Danube by Johann Strauss (Arr. André Rieu). The results of the pre test and post test of the experiment came out to be normally distributed and valid when analyzed through SPSS software, only to demonstrate in affirmative that classical music does have a significant positive effect on a person's task performance abilities in the cognitive areas like memory (p=0, p<0.05) and creativity (p=0, p<0.05). This is in line with the hypothesis.

However, the study shows that the same classical music does not significantly improve the attention in a person's task performance (p=0.171, p>0.05), which rejects the hypothesis stated. Therefore it can be said that the results shown by the study are mostly in line with the hypothesis and related studies which suggest that the human mind is wired for music and responds positively to it (Baney, 2002). Music is known to enhance creativity and memory while promoting social development of an individual (Weinberger, 1998). Another reason for utilizing music as an enhancer for performance is that stress can be reduced and work performance can be increased by using suitable background music which makes the environment worker friendly. This being said it becomes implicit to accept the fact that music does play a huge role in affecting human behaviour and can therefore be used effectively to improve work performance in variousfields.

IV. LIMITATIONS

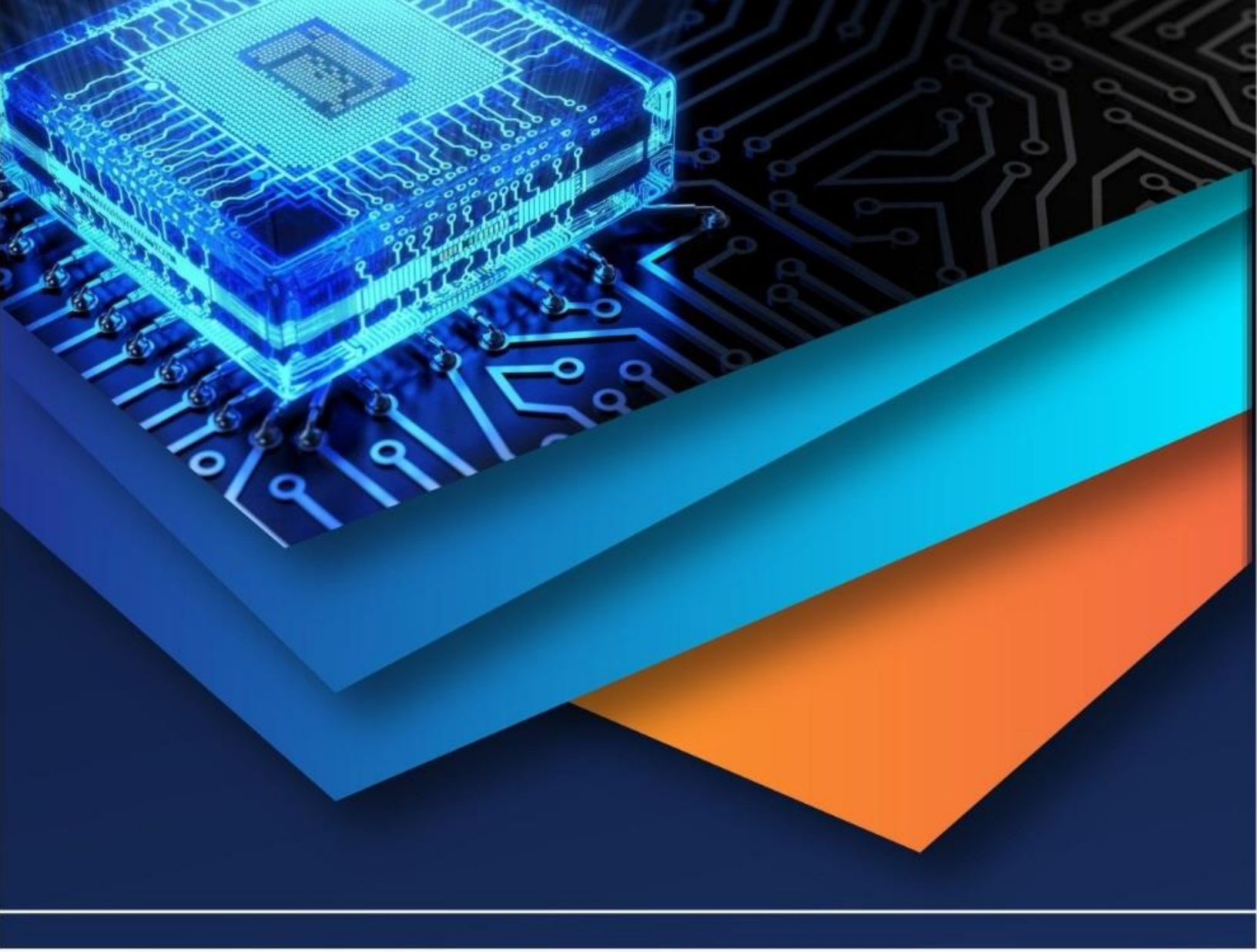
As this data covers major cognitive areas and functions required at workplace, it is also necessary to mention that a large sector is left unattended due to the narrow focused nature of the study. The study only takes into consideration the people working as designers, editors and content developers and that too in a particular age group. Though the test results confirmth positive effect of music in these domains, it would have been much more fruitful had the study area been wider covering other sectors as well. Also at the same time, effects of other genres of music could have been explored resulting in positive or even negative effects on persons and their behaviors.

V. CONCLUSION

As per the results fetched after obtaining data from experiment and its analysis through SPSS software, it can be concluded that the musical intervention had a positive effect on the performance of the participants in the areas of creativity and memory. The same can be applied to more number of similar population groups with similar forms of music. This is backed up by the literature reviewed of studies on related fields, which suggest the effect of various different atmospheric elements on human behavior, sound, or more specifically music, being one of them. However, more study is needed for working attention and the affect of other forms of music on the three cognitive aspects taken into consideration for the purpose of this paper.

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