**ORIGINAL RESEARCH**

# A Study of Music with Lyrics and Music Without Lyrics on Concentrating Ability of Medical Students

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## ABSTRACT

**Background: Students who are used to listening to music claim that the music helps them in concentrating. There are studies which support this claim. However, there are also studies which show that music does not help in concentrating ability and in fact it distracts them from their studies. The aim is to Study the effect of music without lyrics (instrumental music) and music with lyrics and to Compare the effects of both on the concentrating ability of medical students.**

**Materials and Methods: Study Design: Institutional based Observational study. Study area: The study was done in the Dept. of. Physiology in a Medical college. Study Period: April 2020 to march 2021. Study population: MBBS students who were joined in the medical college. Sample size: A total of 202 students were included in the study. Sampling method: Simple Random sampling method. Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study. Study tools and Data collection procedure: Stroop test card: A stroop colour word test card was prepared. It contained 50 words arranged in 10 rows and 5 columns. Five words denoting five different colours were used (RED, BLUE, GREEN, PINK & BLACK). It was made sure that each word was repeated 10 times and each colour appeared 10 times in the test card and no word was printed in its own colour. Sample stroop test card to allow the students understand the test. Philips Go Gear Mix MP3 music player was used to play the music. Mozart's Serenade no.13 / EineKleineNachtmusik was used as the instrumental music. The title track from old kannada song used as the song. Statistical Analysis: The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%).**

**Results: A total of 202 students volunteered for the test. They were allotted to 3 groups (by selecting one of the three carom coins). The control group had 70 students, who performed the stroop test without listening to any music. The instrumental group had 66 students, who performed the stroop test while listening to Mozart's Serenade No.13 / EineKleineNachtmusik. The song group had 66 students, who performed the stroop test while listening to the title track from old kannada song.**

**Conclusion: The current study found that listening to music with lyrics does not significantly affect the concentrating ability of the students while performing stroop test. Listening to music without lyrics (instrumental music) does not significantly affect the concentrating ability of the students while performing stroop test. There is no**

**difference in the concentrating ability of students while performing stroop test when listening to either music with lyrics or without lyrics.**

**Keywords: Stroop Test, Functional Magnetic Resonance Imaging (fMRI), Music and speech.**

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## INTRODUCTION

In today's competitive world, education is of paramount importance. Students who have realized this are giving their best through rigorous study sessions. A continuous study session will get monotonous after a while. Music has become one of the most common tools to break this monotony.

Concentration or the lack of it usually determines the outcome of any work. Concentration, as a faculty assumes even a bigger role in a student's academic career, especially when he/she is preparing for any competitive exam.

Students who are used to listening to music claim that the music helps them in concentrating. There are studies which support this claim. However, there are also studies which show that music does not help in concentrating ability and in fact it distracts them from their studies.

In his book "Musicophilia : Tales of Music and the Brain",[1]Dr. Oliver Sacks examines the powers of music through the individual experiences of patients, musicians, and everyday people–from a man who is struck by lightning and suddenly inspired to become a pianist at the age of forty-two, to an entire group of children with Williams syndrome who are hyper musical from birth; from people with "amusia," to whom a symphony sounds like the clattering of pots and pans, to a man whose memory spans only seven seconds–for everything but music.

Neurologists have long been fascinated by musical curiosities they occasionally meet in their clinical practice. With the advent of techniques such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET) and trans-cranial magnetic brain stimulation (TMS) it has become possible to study the perception and production of music in detail.[2]

Music and speech represent the most cognitively complex uses of sound by the human species. These two domains share a number of properties, including the fact that they take advantage of modulations of acoustic parameters. They also differ from each other in the factthatspeechisproducedbyasingle instrument –thehumanvoice, whereas music can be produced by practically anything capable of generating sound, including, of course, the voice.[3] The current study tries to find out whether there are any differences in the way that humans respond to music with words (lyrics) and music without any words (instrumental music).

So the present was undertaken to study the effect of music without lyrics (instrumental music) and music with lyrics and to compare the effects of both on the concentrating ability of medical students.

## AIM:

To Study the effect of music without lyrics (instrumental music) and music with lyrics and to Compare the effects of both on the concentrating ability of medical students.

## MATERIALS & METHODS

**Study Design:** Institutional based Observational study.

**Study area:** The study was done in the Dept. of. Physiology in a Medical college.

**Study Period:** April 2020 to March 2021.
**Study population:** MBBS students who were joined in the medical college.
**Sample size:** A total of 202 students were included in the study.
**Sampling method:** Simple Random sampling method.

**Inclusion Criteria:**
1. The participant must be a student.
2. The age of the participant must be 17-25 years.

**Exclusion criteria:**
1. Any current illness that will affect their cognitive abilities or their hearing abilities.
2. Uncorrected long-sightedness.
3. Colour blindness.

**Ethical consideration:** Institutional Ethical committee permission was taken prior to the commencement of the study.
**Study tools and Data collection procedure:** Stroop test card: A stroop colour word test card was prepared. It contained 50 words arranged in 10 rows and 5 columns. Five words denoting five different colours were used (RED, BLUE, GREEN, PINK & BLACK). It was made sure that each word was repeated 10 times and each colour appeared 10 times in the test card and no word was printed in its own colour.
Sample stroop test card to allow the students understand the test.
Philips Go Gear Mix MP3 music player was used to play the music. Mozart's Serenade no.13 / EineKleineNachtmusik was used as the instrumental music. The title track from the popular old kannada song was used as the song.
Sennheiser HD 180 on-the-ear wired headphone was used to listen to the music.
Jaeger chart was used to exclude any student with uncorrected long- sightedness.
Ishihara's test chart book was used to exclude any student with colour blindness.
3 white carom board coins were used. The letter C or I or S (denoting Control group, Instrumental group & Song group respectively) was written on one side of each coin and they were placed on the table with the written side facing down.
Each student was asked to pick one coin among the three white carom coins placed on the table. Based on the coin selected, the student will be assigned to one of the three groups (If the student selects the coin C, then he/she will be allotted into the Control group. If the student selects the coin I, then he/she will be placed in the Instrumental group. If the student picks the coin S, then he/she will be placed in the Song group).
Every student was given a sample stroop test card to familiarize them with the test. Once they understand the test, they were given the original test card. One minute time was given to each student. The students in the Control group performed the task without listening to any music. The students in the Instrumental group will put on the headphones and perform the task while listening to instrumental music (i.e. music without any lyrics) played on the MP3 player. The students in the Song group will put on the headphones and perform the task while listening to the song played on the MP3 player.
Once the test starts, the participating student will read out the number and the colour in which the word has been written underneath the number. The participant will continue doing so for duration of 1 minute. An evaluator would be sitting close to the participant, listen to him / her and keeps the score of the student i.e. whenever the student reads out the wrong colour, the evaluator would mark it down as a wrong answer. The music will stop playing at the end of 1 minute for both the instrumental and song group students. A timer set in the mobile phone would ring indicating the end of 1 minute to the control group students. The number of words

the student reads out aloud in 1 minute will be recorded as the initial score by the evaluator. The evaluator would then subtract the number of wrong answers from the initial score. This value would be recorded as the corrected score.

**Statistical Analysis**

The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%).One way ANOVA test was used to find out the statistical significance. P values of <0.05 were considered statistically significant. Data analysis was performed by using SPSS Version 20.0.

## RESULTS

A total of 202 students volunteered for the test. They were allotted to 3 groups (by selecting one of the three carom coins). The control group had 70 students, who performed the stroop test without listening to any music. The instrumental group had 66 students, who performed the stroop test while listening to Mozart's Serenade No.13 / EineKleineNachtmusik. The song group had 66 students, who performed the stroop test while listening to the title track from the old kannada song.

**Table 1: Age distribution of the study population**

| Group | Mean | Std. Deviation | N |
|---|---|---|---|
| Control | 18.1571 | .82770 | 70 |
| Instrumental | 18.2879 | .75986 | 66 |
| Song | 18.2879 | .65080 | 66 |
| Total | 18.2426 | .75017 | 202 |

**Table 2: Sex distribution of the study population**

| | | | Group | | | Total |
|---|---|---|---|---|---|---|
| | | | Control | Instrumental | Song | |
| Sex | F | Count | 40 | 34 | 33 | 107 |
| | | % within sex | 37.4% | 31.8% | 30.8% | 100.0% |
| | M | Count | 30 | 32 | 33 | 95 |
| | | % within sex | 31.6% | 33.7% | 34.7% | 100.0% |
| Total | | Count | 70 | 66 | 66 | 202 |
| | | % within sex | 34.7% | 32.7% | 32.7% | 100.0% |

**Table 3: Scores in the study population**

| | | N | Mean | Std.Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Initial score | Control | 70 | 49.6857 | 6.14686 | 38.00 | 66.00 |
| | Instrumental | 66 | 48.0152 | 7.09169 | 24.00 | 63.00 |
| | Song | 66 | 48.1061 | 6.93293 | 31.00 | 65.00 |
| | Total | 202 | 48.6238 | 6.73648 | 24.00 | 66.00 |
| Corrected score | Control | 70 | 48.0571 | 6.52506 | 36.00 | 63.00 |
| | Instrumental | 66 | 46.9545 | 7.92742 | 16.00 | 63.00 |
| | Song | 66 | 46.9697 | 7.27899 | 31.00 | 65.00 |
| | Total | 202 | 47.3416 | 7.23501 | 16.00 | 65.00 |

From the [Table 3], it can be seen that the students in control group had better initial scores and corrected scores when compared with the students of instrumental group and song group.

**Table 4: ANOVA values for scores in the study population**

| | | F | P value |
|---|---|---|---|
| Initial score | Between Groups | 1.339 | .265 |
| | Within Groups | | |
| | Total | | |
| Corrected score | Between Groups | .521 | .594 |
| | Within Groups | | |
| | Total | | |

In this study, the p-values for both initial scores & corrected scores (0.265 & 0.594 respectively) are more than 0.05(not significant). Even though the control group had better initial and corrected scores than instrumental and song groups, the effect of music is found to be statistically insignificant.

**Table 5: Post Hoc Tests - Multiple Comparisons**

| Dependent Variable | (I) group | (J) group | Sig. |
|---|---|---|---|
| Initial score | Control | Instrumental | .448 |
| | | Song | .518 |
| | Instrumental | Control | .448 |
| | | Song | 1.000 |
| | Song | Control | .518 |
| | | Instrumental | 1.000 |
| Corrected score | Control | Instrumental | 1.000 |
| | | Song | 1.000 |
| | Instrumental | Control | 1.000 |
| | | Song | 1.000 |
| | Song | Control | 1.000 |
| | | Instrumental | 1.000 |

## DISCUSSION

The current study deals with the ability to concentrate. Concentration is an attentional process that involves the ability to focus on the task at hand while ignoring distractions. Cognitive research shows that it is vital for success in any field of skilled performance.[4]

The topic of attention is central to cognitive neuroscience because it explores the mechanisms by which "voluntary control and subjective experience arise from and regulate our behavior".[5] William James (1890) remarked famously that "Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one of what may seem several simultaneously possible objects or trains of thought. Focalizations, concentration of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others".[6]

According to Guyton and Hall Textbook of Medical Physiology,[7] a function that has been ascribed to the prefrontal areas of brain is elaboration of thought, which means simply an increase in depth and abstractness of the different thoughts put together from multiple sources of information.

This ability of the prefrontal areas to keep track of many bits of information simultaneously and to cause recall of this information instantaneously as it is needed for subsequent thoughts

is called the brain's "working memory," which may explain the many functions of the brain that we associate with higher intelligence.

By combining all these temporary bits of working memory, we have the abilities to (1) prognosticate; (2) plan for the future; (3) delay action in response to incoming sensory signals so that the sensory information can be weighed until the best course of response is decided; (4) consider the consequences of motor actions before they are performed; (5) solve complicated mathematical, legal, or philosophical problems; (6) correlate all avenues of information in diagnosing rare diseases; and (7) control our activities in accord with moral laws.

It is this ability to "delay action in response to the incoming sensory signals so that the sensory information can be weighed until the best course of response is decided" that is being tested in stroop test. In the stroop test, two simultaneously different visual cues are given to the participant at the same time. The brain has to process the written language and perceive the colour in which the words are written. The brain utilizes the wernicke's area (Broadmann area 22) to understand the written language. It is located in the posterior end of the superior temporalgyrus(21). Wernicke‟s area is also known as "sensory speech area".

A study by Hoi-Chung Leung et al,[8] attempted to define the neural circuits differentially activated by cognitive interference. Event-related functional magnetic resonance imaging (fMRI) was used to identify areas of the brain activated by the Stroop word-colour task. Infrequent, incongruent coloured word stimuli were used to elicit strong Stroop interference. It was found that performance of the Stroop task specifically activated the anterior cingula, insula, premotor and inferior frontal regions.

Response inhibition can broadly be defined as the process by which a pre- potent, routine, or dominant response is deliberately withheld. This principle is applied while performing stroop test, wherein the natural impulse to read a word upon seeing the word has to be inhibited voluntarily and the colour in which the word has been printed in must be read out aloud. Response inhibition is a hallmark of executive control.[9]

Adam Hampshire et al,[10] attempted to study the role of the right inferior frontal gyrus (RIFG) in inhibition and attentional control. They conducted an fMRI study to clarify the role of the RIFG in executive control by holding the stimulus conditions of one of the most popular response inhibition tasks–the Stop Signal Task–constant, whilst varying the response that was required on reception of the stop signal cue. The results of their study reveal that the RIFG is recruited when important cues are detected, regardless of whether that detection is followed by the inhibition of a motor response, the generation of a motor response, or no external response at all. They also found that the RIFG, along with the left IFG, the PPC (posterior parietal cortex) and the pre- SMA (supplementary motor area, which includes the cingulate cortex), form a network that rapidly tunes to represent those inputs and responses that form the currently intended task schema.

Pardo et al,[11] conducted a study to localize a human system for sustained attention by positron emission tomography. They used PET measurements of brain blood flow in healthy subjects to identify changes in regional brain activity during simple visual and somatosensory tasks of sustained attention or vigilance. They found localized increases in blood flow in the prefrontal and superior parietal cortex primarily in the right hemisphere, regardless of the modality or laterality of sensory input.

Hopfinger et al,[12] studied the neural mechanisms of top-down attentional control. They used event-related functional magnetic resonance imaging (fMRI) during a cued spatial-attention task to dissociate brain activity related to attentional control from that related to selective processing of target stimuli. They found superior frontal, inferior parietal and superior temporal cortex was selectively activated by cues, indicating that these structures are part of a network for voluntary attentional control.

The current study uses two kinds of auditory stimuli. (1) Serenade no.13 / Eine Kleine Nachtmusik by Wolfgang Amadeus Mozart. (2) The title track from a popular Telugu television show.

Zatorre et al,[13] argue that the auditory cortices in the two hemispheres are relatively specialized, such that temporal resolution is better in left auditory cortical areas and spectral resolution is better in right auditory cortical areas. They propose that cortical asymmetries might have developed as a general solution to the need to optimize processing of the acoustic.

Chauvel et al,[14] studied the perception of music in epileptic patients who underwent unilateral temporal cortectomy. The results showed that a right temporal cortectomy impaired the use of both contour and interval information in the discrimination of melodies and a left temporal cortectomy impaired only the use of interval information (rhythm). Moreover, they underlined the importance of the superior temporal gyrus in melody processing. The excision of a part of the auditory areas (posterior part of the superior temporal gyrus) was found to be most detrimental for pitch and temporal variation processing.

Platel et al,[15] studied six young healthy subjects (right-handed, French, without musical talent), using a high-resolution PET device to explore the cerebral structures involved in the appreciation of music. In three tasks, they studied the effects of selective attention to pitch, timbre and rhythm; a final task studied semantic familiarity with tunes. Activations preferentially in the left hemisphere for familiarity, pitch tasks and rhythm, and in the right hemisphere for the timbre task were identified on PET scanning. The familiarity task activated the left inferior frontal gyrusand superior temporal gyrus. The pitch task activated the left cuneus/precuneus. The rhythm task activated left inferior Broca's area with extension into the neighboring insula.

Mellet et al,[16] used positron emission tomography (PET) to monitor regional cerebral blood flow variations while subjects were constructing mental images of objects made of three-dimensional cube assemblies from auditorily presented instructions in darkness. This specifically activated a bilateral occipito-parietal-frontal network, including the superior occipital cortex, the inferior parietal cortex, and the premotor cortex. Activation of the primary visual areas was not observed. These results provide evidence that the so-called dorsal route known to process visuo-spatial features can be recruited by auditory verbal stimuli.

A study by Psyche Loui,[17] et al found that the combination of vocal and instrumental sounds in music could produce a more pronounced effect on to instrumental music alone.

Mary Louise Serafine et al,[18] examined whether the memory representation for songs consists of independent or integrated components (melody and text). They found that melody and text are not stored as independent components. This is in accordance with the findings in the current study, where no difference was found between the stroop test scores of students in the instrumental group and song group.

The current study shows that there is no effect of music (either instrumental or instrumental plus vocal) on students‟ ability to perform stroop test. This could be explained by the concept of momentary intentions of Kahneman‟s model. During the test time of 1 minute, the students were able to focus on the test alone while neglecting the music.

## CONCLUSION

The current study found that listening to music with lyrics does not significantly affect the concentrating ability of the students while performing stroop test. Listening to music without lyrics (instrumental music) does not significantly affect the concentrating ability of the students while performing stroop test. There is no difference in the concentrating ability of students while performing stroop test when listening to either music with lyrics or without lyrics.

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