

THE EFFECTS OF SOUND ON READING COMPREHENSION AND SHORT-TERM MEMORY

DEBBIE A. DEEMS
DEPARTMENT OF PSYCHOLOGY
MWSC

Sponsored by BRIAN CRONK(cronk@mwsc.edu)

ABSTRACT

There are students of all ages that study with music in the background. So, the purpose of this study was to examine the effects of sound on reading comprehension and short-term memory. 42 high school freshman students consisting of 15 males and 27 females of Penney High School in Hamilton, MO were selected to take a reading comprehension and short-term memory test. Three of six study hall classes were selected to participate in the study. One group was tested with no sound, one group with tested while listening to the sound of mountain streams, and the last group was tested while listening to rock music. The results were all calculated using 3x2 between subjects ANOVA. After looking at the results, the only significance was between the students that normally study with music scored on an average higher than students that did not normally listen to music while studying. This study concurs with Etaugh and Michals (1975) who found that college students who normal listened to music while studying did better on the reading comprehension test.

INTRODUCTION

The Effects of Sound on Reading Comprehension and Short-term Memory

There are several types of music within our culture. Jazz, rhythm and blues, rap, rock, and classical are some examples of types of music people listen to. Each individual has their own preference for the type they like the best. People of all ages listen to music.

Music can affect us in many different ways. Music can cause arousal or it can lower arousal depending on the type of music we listen to. Several students listen to music while studying. Music can affect our moods as well as our ability to concentrate depending on how often we listen to music and the type of personality we have, according to some of the research. How will it interfere or will it aid in comprehension? Mentioned below are just a few examples of how music has affected different subjects.

Tucker and Bushman (1991) studied the effects of rock and roll music on mathematical, verbal, and reading comprehension. The results showed that mathematical and verbal performance decreased while the reading comprehension remained constant.

One factor that may affect studying with music is the complexity of the music that is listened to. Kiger (1989) performed a study testing reading comprehension with one of three conditions. One was no sound, second was low information-load music and the third was high information-load. He characterized the information-load as the amount of loudness, variety, complexity, and tonal range of the music. The results of his study showed participants who read passages in the presence of low information-load music

performed significantly better than either those who read in silence or with high information-load background music.

Kiger (1989) suggests a second explanation for his results. The arousal level that the music produces may affect the performance level. He states that high information-load may produce tension and anxiety which impair the performance of complex tasks. As for low information-load, Kiger (1989) shows a lowering of arousal and thus improves performance.

There seem to be conflicting studies on the effect of music on reading comprehension. But they are testing different music and different characteristics of the individuals. For example, Fogelson (1973) studied the effects of popular instrumental music to eighth graders that were classified as bright and non-bright students. The results of her study showed that the control group with no music outperformed the experimental groups. The non-bright students were more adversely affected by the music.

Another study done by Etaugh and Michals (1975) found that college students who normally listened to music while studying did better on the reading comprehension test. They also found that males did better than females while listening to music of their choice. However the males reported listening to music more than the females. This shows that unfamiliar sounds are more distracting than familiar ones.

Daoussis and McKelvie (1986) did a study using rock and roll music with introverts and extroverts. Their findings indicated a general model of arousal and performance in which the effects of extraversion and musical stimulation interact. The introverts did poorer on the condition of music than the condition without music.

There was significant improvement on reading comprehension with background music administered during the test in Hall's (1952) study. The major source of improvement was an increase in accuracy with the greatest benefit occurring in the students of below average intelligence and achievement.

Music has an affect on reading comprehension depending on the variables. Does music have an affect on memory? If studying to music affects reading comprehension, then how will it affect the memory of the material being studied?

Short-term memory has the main component of storage, while long-term memory has storage and processing components. Carlson and associates (1997) studied the affects of various kinds of music on the performance task in monkeys. What they found was playing Mozart's piano music during a delayed response testing caused a significant deterioration in the performance of the monkeys, while white noise improved it. They suggests that Mozart's music serves as a distractive stimulation during delayed response testing which affected working memory related neuronal processing and performance. On the other hand, white background music may improve delayed response performance by protecting against environmental distractions.

Patel (1998) suggests that recent event-related brain potential data shows that some aspects of syntactic processing between linguistic areas and musical syntactic processing may be shared. Although the cognitive operations between the two are different, they rely

on a common set of neural resources for processes of structural integration in working memory.

It has been suggested that short-term memory may be an integral component of reading comprehension. It may be expected that tasks known to interfere with short-term memory will exert similar interference effects on the comprehension processes. Boyle and Coltheart (1996) studied the effects of irrelevant sounds on phonological coding in reading comprehension and short-term memory. The irrelevant sounds consisted of irrelevant speech, accompanied and unaccompanied singing, instrumental music and silence. Accuracy was impaired by the complexity of the sentences but was unaffected by the irrelevant sounds. The word recall test was affected by irrelevant sounds.

Is there a significant difference between music and reading comprehension along with short-term memory? The elements that will be observed in this study are the effects of sound on reading comprehension and short-term memory. The conditions of the music will be no sound, natural sounds (waterfall and bird sounds), and rock music. The dependent variables will be reading comprehension and short-term memory. The hypothesis is that the natural sounds will show improvement in test scores over the no sound and rock music conditions.

METHOD

PARTICIPANTS

42 freshman high school students were tested in study hall classes at Penney High School in Hamilton, Missouri. Three of the six study hall classes were randomly selected by the principal to participate. There were 15 males and 27 females tested.

MATERIALS

A Panasonic portable stereo component CD system was used to play the natural sounds (mountain streams) and rock music (Bon Jovi). A pencil and paper test was given to measure the results. The reading comprehension tests were taken from the Gates-MacGinitie Reading Tests, Level F. The students were asked to answer 13 questions pertaining to the small paragraph of reading material. A short distracter test was then given. It asked for age, gender, and if they listen to music while studying and what kind of music. A short-term memory test was given. It had 14 questions pertaining to the reading material.

PROCEDURE

High school study hall students were randomly assigned one of three conditions. The first condition was no sound, second was natural sounds, and third was rock music. They were tested first for reading comprehension in one of the three conditions. They were to read the short paragraphs and then answer the questions that were just below the readings. When they had finished answering the questions, the music was turned off in the two sound groups. A short distracter test was given. Then the short-term memory test was given under the condition of no sound in all three groups. They did not have the reading material to help answer the questions. This part was to be from memory.

RESULTS

A 3 (control, sound, rock music) x 2 (study with, without music) between subjects factorial ANOVA was calculated comparing the final scores for subjects in one of the three conditions of sound and in the condition of listening to music or not listening to music while they studied. A significant main effect in reading comprehension for students who did not normally listen to music while studying was found ($F(1,36) = 6.303$, $p < .05$). Students who did normally listen to music while studying scored higher on the reading comprehension with the presence of mountain stream sound ($m = 9.29$, $sd = 2.98$) than students that normally did not listen to music while studying ($m = 5.86$, $sd = 1.95$). Students that normally listen to music while studying also scored higher with rock music ($m = 8.08$, $sd = 2.71$). The main effect for what they heard while completing the reading comprehension test was not significant ($F(2,36) = 2.05$, $p > .05$). The mean for the control group was ($m = 8.93$, $sd = 2.95$), the mean for the group with the mountain streams sound was ($m = 7.57$, $sd = 3.0$) and the mean for the group that listened to rock music was ($m = 7.5$, $sd = 2.93$) Finally, the interaction was not significant ($F(2,36) = 1.21$, $p > .05$). The type of sound did not affect the reading comprehension scores of the students, regardless of whether or not they normally studied with music.

DISCUSSION

The results of the study show students that usually study with music did better on the reading comprehension test than the students that did not normally study with music. The hypothesis was that the students that listened to the sound of mountain streams would do better on the reading comprehension and short-term memory tests than the students that listened to rock music or had no sound. This hypothesis was not supported.

Although the hypothesis was not supported, the results are supported by the study done by Etaugh and Michals (1975) which found that college students who normal listened to music while studying did better on the reading comprehension test. They also found that males did better than females while listening to music of their choice. However the males reported listening to music more than the females. This shows that unfamiliar sounds are more distracting than familiar ones.

This study was limited to students that were already assigned to the study halls classes that were randomly assigned. There were only 14 students per class. The hallways were noisy and a few interruptions did occur, such as other students walking into the classroom to see the instructor. This study was done right before lunch on three consecutive days. This may have caused a distraction as well.

This study was done in a rural community in the mid-west. The study may be different in different parts of the country and in larger suburban areas. There might be different results from older students or doing the study in a more controlled environment may produce altered results.

In the future, this study should be done with randomly assigned students in a more controlled environment. More students should be tested and varying their ages may show different results. The study should be done in different parts of the country and in various

size schools to see if the results significantly change. The time of day should also be varied to see if that varies the results.

REFERENCES

Boyle, R., & Coltheart, V. (1996). Effects of irrelevant sounds on phonological coding in reading comprehension and short-term memory. *The Quarterly Journal of Experimental Psychology*, 49A, 398-416.

Carlson, S., Raemae, P., Artchakov, D., & Linnankoski, I. (1997). Effects of music and white noise on working memory performance in monkeys. *Neuroreport: An International Research in Journal for the Rapid Communication of Neuroscience*, 8, 2853-2856.

Daoussis, L., & Mc Kelvie, S. J. (1986). Musical preferences and effects of music on a reading comprehension test for extraverts and introverts. *Perceptual and Motor Skills*, 62, 283-289.

Etaugh, C. & Michals, D. (1975). Effects on reading comprehension of preferred music and frequency of studying to music. *Perceptual and Motor Skills*, 41, 553-554.

Fogelson, S. (1973). Music as a distracter on reading-test performance of eighth grade students. *Perceptual and Motor Skills*, 36, 1265-1266.

Hall, J. C. (1952). The effects of background music on the reading comprehension of 278 8th and 9th grade students. *Journal of Educational Research*, 45, 451-458.

Kiger, D. M. (1989). Effects of music information load on a reading comprehension task. *Perceptual and Motor Skills*, 69, 531-534.

Patel, A. D. (1998). Syntactic processing in language and music: Different cognitive operations similar neural resources? *Music Perception*, 16, 27-42.

Tucker, A., & Bushman, B. J. (1991). Effects of rock and roll music on mathematical, verbal, and reading comprehension performance. *Perceptual and Motor Skills*, 72, 942.