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# The Effects of Various Kinds of Background Music on the I.Q. Scores of Ninth-Grade Students

L.C. Bud Johnston

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THE EFFECTS OF VARIOUS KINDS OF BACKGROUND MUSIC  
ON THE I.Q. SCORES OF NINTH-GRADE STUDENTS

A Thesis

Presented to

the Faculty of the Department of Educational Leadership

Western Kentucky University

Bowling Green, Kentucky

In Partial Fulfillment

of the Requirements for the

Specialist in Education Degree

by

L. C. Bud Johnston

July 31, 1985

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THE EFFECTS OF VARIOUS KINDS OF BACKGROUND MUSIC  
ON THE I.Q. SCORES OF NINTH-GRADE STUDENTS

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L. C. Bud Johnston

July 31, 1985

46 pages

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One hundred 9th-grade students were divided into four groups of 25 each through systematic sampling procedures. Each of the groups were tested, pre and post, by the Otis-Lennon Mental Ability Test, forms J and K. During the pretest for all groups, the background condition of silence was observed. During the posttest, one group was again tested in silence. The other three groups were each tested to one of three background conditions: pop music, hard rock music, and soft rock music. Pop music played was characterized as more mellow, more melodic, and less intense than rock music. Hard rock music played was characterized as the most intense form with the hardest-driving beat, as well as being the least melodic form of the three. Soft rock music played was characterized as similar to hard rock but somewhat less intense and hard-driving.

A comparison was made, through a series of 12 t-tests, between pretest and posttest means of all subjects, all male subjects, all female subjects, and each of the four groups--intact, males only, and females only. No significant differences in mean scores were found at the .01 or .05 levels of significance. The only two groups whose mean scores approached significance were the groups that listened to pop music and the males only from the pop music group. Lower posttest scores for certain individuals were noted. More of these individuals were found in the group that listened to pop music than in any other group.



## INTRODUCTION

Many adults find that a softer variety of background music is more appealing than heavy-beat and up-tempo music, which interferes with their concentration. There has been a very limited amount of research dealing with background music's effect on young people. Several studies have been conducted dealing with the issue of background music's effect on the mental activities of college-age and adult subjects. Only slightly over half of the studies reviewed in this paper, however, examined the effect of background music on subjects of elementary and high school age. Much of the research has utilized music not normally listened to by youth at the elementary through college levels.

Several pertinent questions may be asked: "Can young people mentally concentrate while heavy-beat music is present in the background?" and, further, "What effect does background music have on education-related activities?" Currently, parents and the American society at large are voicing their disapproval of the educational community. Issues such as lowered test scores and the need for academic learning to take place in the home as well as in the school have been raised. Since today's young people often listen to background music while doing their homework, background music's relationship to mental activity would seem to be a timely topic worthy of extensive investigation.

Rock music may be divided, for explanatory purposes, into two broad divisions: soft rock and hard rock. Soft rock has the heavy beat of hard rock, but it is not quite as intense in musical arrangement or vocal delivery. Often it is slower and somewhat mellower in form than hard rock

music. Hard rock music represents the contemporary music with the biggest beat; it is the hardest driving and most intense of all musical forms. A third form of music called popular (pop) music has an even more subdued beat. Hereafter, these three forms of music are referred to as "youth music."

The current study considered all three forms of youth music as background music and examined the relationship between IQ test results and background music. The IQ test was chosen as the mental activity to be undertaken while background music was being played because of the wide range of mental skills it demands of the subjects. Also, since the test was timed, a certain amount of pressure was placed on the subjects to finish the test and to sustain concentration.

The Otis-Lennon Mental Ability Test (1968) was the IQ test chosen as the measuring instrument because of its wide acceptance and the relatively short period of time required for testing. It was believed that the level of mental demands required by such an instrument might better allow background music to show its true effect on mental activity. If the mental activity were any less demanding, it was believed that any generalizing of the study's results which might occur would necessarily be more restricted than it would otherwise be.

#### Definition of Terms

Youth music refers to the music most regularly listened to by young people who are in their teen years. This term also refers to the music which is played the most often on American radio stations and which sells the most records of recorded music. This is the type of music that such prominent music trade magazines as Cashbox, Billboard, and Record World list as the most popular, by song and recording artist(s) in numerical sequence, in their monthly or periodical publications.

Pop music refers to youth music that often has more discernible lyrics than rock music, is less intense than rock music, and has a sweeter melodic pattern than rock music. It normally does not emphasize the amount of drum beat, instrumental beat, or heavy sound distortions so characteristic of rock music. Pop music might be considered the mellowest form of youth music.

Hard rock music refers to a kind of youth music which has, in form, all of the properties mentioned above as a contrast to pop music. In addition, of all youth music forms, it might be said to have the heaviest drum beat and instrumental beat, as well as being the hardest driving and least melodic. Hard rock normally will have more weird or unusual sounds than any other youth music form. It can be characterized as frantic and may, at its furthest extremes of intensity, even approach the sounds of noise and chaos rather than sounding like what traditionally has been thought of as music. Hard rock can indeed often become the sound of wild confusion.

Soft rock music describes a youth music form that, unlike pop music, may encompass at any one time any or all of the above characteristics attributed to hard rock music, but which is softer in sound than hard rock music. It is less intense, less hard driving, less heavy beated, and milder in form than hard rock music; yet it seems to lack the more melodic emphasis characteristic of pop music to the same degree that hard rock lacks this particular quality. Soft rock is still rock music, but--as the name implies--somewhat more subdued.

#### Statement of the Problem

The problem presented in this study was to determine which of four background conditions--silence, popular music, soft rock music, or hard rock music--would produce the most change, if any, in the mean scores of four

groups of 9th-grade students taking the Otis-Lennon Mental Ability Test. The null hypotheses deemed appropriate and tested in this study were as follows:

1. There will be no significant difference in mean IQ scores of a pretest taken by a group of students under the normal testing condition of silence and a posttest taken by the same group of students with the treatment condition of popular background music.

2. There will be no significant difference in mean IQ scores of a pretest taken by a group of students under the normal testing condition of silence and a posttest taken by the same group of students with the treatment condition of soft rock background music.

3. There will be no significant difference in mean IQ scores of a pretest taken by a group of students under the normal testing condition of silence and a posttest taken by the same group of students with the treatment condition of hard rock background music.

#### Limitations of the Study

Since the subjects for this study were all 9th-grade students, generalizing any results to other age groups must be restricted. Additionally, the subjects were all attending one high school in a particular community and state and were of the Caucasian race. They were, therefore, a group with characteristics not necessarily representative of similar populations elsewhere.

A second limitation of this study is found in the method used to select subjects. Random sampling was not used. Rather, systematic sampling techniques were utilized to create the four groups to be tested. One hundred 9th-grade students were placed in four equal groups, alphabetically.

A third limitation of this study has to do with the kind of mental activity tested. Background music's effect on only one kind of thinking

was tested, that of taking an IQ test. Further, only one IQ test, though highly respected, was used to measure thinking. Only in part can the taking of an IQ test represent thinking in general.

Only three kinds of music were used as background music accompanying testing, representing a fourth limitation of this study. The music used was popular, soft rock, and hard rock. Furthermore, the volume of the music was set at one level for all subjects. Had this level been set lower or higher, different results may have resulted from the present study.

## REVIEW OF LITERATURE

The first part of this review of literature examines the findings of physicians and therapists regarding music's effect on the human mind and body. The second part of this review examines the influence of background music on varied task performances. The third part deals with background music's effect on anxiety, hyperactivity, and testing. The fourth portion deals with background music's effect on arithmetic and math testing. The fifth portion deals with background music's effect on reading testing. The sixth and final portion deals with background music's effect on several kinds of verbal testing. In summary, this literature review reveals that music may be facilitative, nonfacilitative, or make no difference to the process of thinking. Many educational researchers have dealt with the effect of music on various kinds of performance. Some of the earliest research dealt with music's effect on worker performance in factories and on the job. Later studies have delved into music and its effect on more mental kinds of activity, such as test taking, reading comprehension, etc.

Capurso et al. (1952) have reported that most physicians hold that music exerts a strong influence on the higher cerebral centers and thence, through the systematic nervous system, upon other portions of the body, thus promoting digestive, secretory, circulatory, nutritive, and respiratory functions. Music has long been used in therapy of various kinds. Gaston (1965) has explained that required musical behavior may be adapted to psychological capacities and operational levels. These levels may have several bases: (a) mood, such as from sad to happy or from depressed

to manic; (b) motivation, from a low to a high desire for achievement; (c) intellectual, from lowest intelligence to most gifted; and (d) levels of knowledge pertaining to music. Gaston has indicated that, partly through the motivation intrinsic to music and partly through the appropriate structure provided by the therapist, the individual may be moved from a less desirable psychological level to one more desirable.

#### Background Music's Effect on Task Performance

Licht's (1946) early findings tend, in part, to concur with those stated by Gaston (1965). In Licht's view, music was not recommended as a background to work which requires mental concentration. He felt that if the melody was too interesting or popular at the time, it may have been distracting. He stated further that where the work is largely physical, soft music has been shown to be a desirable adjuvant.

One of the foremost pioneers in the field of industrial music is the Muzak Corporation. Wormer (1948), in his work with the Muzak Corporation in the United States, found that among all workers who listened to music while they worked, the music rated the highest was waltz music and popular music forms for the day. He found that of the 19,546 workers studied, only a little less than 4% had any objection to having music played at work.

Devereux (1969), using 31 telecommunications operators involved in a work situation requiring routine and complex activities (including some clerical work) in a 16-week study, found there was no significant change in overall work output as a result of the introduction of background music, nor was there a significant change in attitudes about music at work. The workers were somewhat favorably disposed toward the music before and after its introduction, and a number of operators considered that it helped them to work better.

In a study by Konz (1964), the effect of environmental change on the performance of repetitive tasks was investigated with background music serving as the environmental change. Twenty noncollege women were hired for 2 weeks. Each worked on four different tasks: manual assembly, mark sensing I.B.M. cards, addition, and anagrams. Each subject served as her own control. In addition to an output criterion for each task, errors were used as a criterion of performance for mark sensing and addition. The introduction of background music produced no significant differences in the group's productivity for any of the six criteria. The subjects' rank order of change in performance with music was not consistent from criterion to criterion. Therefore, no effect of music on performance was demonstrated.

Podvin's (1967) study, involving two moderately retarded children, investigated the influence of music on a work task (pegboard). One subject was the control subject and the other subject was the experimental subject in each of four treatment conditions. In treatment condition one, music was presented immediately following each correct response. The result was a significant increase in rate of correct responding and a significant decrease in rate of incorrect responding. In treatment condition two, music was presented unrelated to the activity of the subject. This condition yielded a lower rate of correct responding and a higher rate of incorrect responding. In treatment condition three, the withdrawal of music following each correct response yielded either an unstable pattern or a definite decreasing pattern of responding. In treatment condition four, withdrawal of music unrelated to the activity of the subject increased both correct and incorrect responding, as well as irregular patterns of responding. The author concluded that music can be helpful



in the rehabilitation of the handicapped and in the adjustment of normal individuals to their work. Podvin added that further investigation was warranted.

In this section, background music's beneficial relationship to physiological functioning of the human body and to psychological therapy has been discussed. Although a distraction factor was mentioned in regard to work requiring mental concentration, these studies indicate that music does not appear to hinder task performance. The results of only one very limited study determined that music helped performance. Nevertheless, background music is used extensively today in industry and business, pointing to the apparent belief that it is more helpful than harmful in relation to task performance.

#### Background Music's Effect on Anxiety, Hyperactivity, and Testing

In a study by Rohner and Miller (1980) of Western Kentucky University, music's effect on state anxiety was examined using 321 introductory psychology students as subjects. State anxiety was represented as a particular emotional mood that could be aroused or depressed according to the situation. Four types of music were used: (a) familiar-stimulating, (b) familiar-sedative, (c) unfamiliar-stimulating, and (d) unfamiliar-sedative. All of the music was classical music. The Eight State Questionnaire, forms A and B, was used to pre- and posttest state anxiety in the subjects. The results of this experiment proved to be statistically nonsignificant. However, a trend was noted for sedative music to have some anxiety-reducing effects upon high state anxiety students. The authors theorized that perhaps highly anxious subjects require more than 10 minutes of music to feel less anxious.

Anxiety's effect on reading comprehension while music is being played was examined by Stanton (1975). The author hypothesized that the beneficial

influence of background music on highly test-anxious students might well be concentrated in the initial period of task preparation and that continuance of the music while the task was being performed would contribute no additional facilitative effect. One hundred sixty-two 3rd-year and final-year college students were involved as subjects, collectively. Ninety-three 2nd-year students were tested similarly but individually. The three test conditions for a test-anxious group and a group low in test anxiety were silence, preparation music only, and music throughout the test. The test was a simple comprehension test (20 questions) following the reading of a 1,500-word passage. Results of this study confirmed the author's hypothesis. In addition, no differences were discernible in the three conditions for the low-anxiety subjects. Continuing the music during test-taking seemed not to produce poorer scores for high- or low-anxiety subjects.

Colbert's (1961) study dealt with the topic of high- and low-anxiety subjects and their ability to recall nonsense syllables and letter configurations under the influence of background music. The subjects were 49 undergraduate male and female students. The testing procedure consisted of the following: (a) testing half of the high-anxiety group and half of the low-anxiety group with musical stimulation, (b) testing half of the high-anxiety group and half of the low-anxiety group without musical stimulation, and (c) reversing the groups and testing procedures 1 week after the original testing. The conclusions drawn by the researcher were as follows:

1. The inclusion of musical stimulation can improve performance of some students on certain tasks.
2. Musical stimulation does not facilitate the performance of all students on the two experimental tasks.

3. Anxiety, as measured by the Taylor Manifest Anxiety Scale, is not shown to be a factor in determining the amount of improved performance with musical stimulation.

4. The results are consistent with "narrowed attention" concept proposed by other researchers.

Somewhat akin to anxiety is hyperactivity. Scott (1970) studied children with IQs from 89 to 97 who lived in a cottage-style, treatment-oriented home for children not able to adjust in their community because of emotional or behavioral problems. The study measured the children's ability to complete academic assignments under four different conditions, two with and without background music in an open classroom and two with and without background music, placing each child in a separate booth. The music used was popular with these children at the time.

Performance on a 10-minute arithmetic test was the dependent variable in this study. Results showed that children in the normal classroom setting scored significantly higher when music was played. Unexpectedly, children's scores in booths went down (three out of four students) when music was added. Also, the children all scored higher in booths with no music than in the normal classroom situation with no music. One final result: Although the scores of children in booths went down when music was added, they were still somewhat higher than their scores in the silent, normal classroom condition.

These studies would seem to indicate, overall, that background music may be facilitative for some high-anxiety and hyperactive subjects. The mixed results seemed to relate to how music was utilized in each of the studies. It would appear that not all subjects benefited from hearing background music while mental tasks were undertaken.

### Background Music's Effect on Arithmetic and Math Testing

In a study by Mowseian and Heyer (1973), an arithmetic test was combined with the Differential Aptitude Test, the Language Usage Spelling Test, and the Self-Concept of Ability Scale to test 167 10th-grade students. The subjects were tested in one of five conditions: (a) with no external noise, (b) with rock music, (c) with folk music, (d) with classical instrumental music, and (e) with classical vocal music. The results of this experiment indicated that the four types of music played during testing did not affect the subjects' test performance. Also, it did not affect self-ratings on a self-concept measure, regardless of the music type used as a distractor.

Lane (1977) studied the effects of three types of background music on selected behaviors in an elementary school setting. The subjects were 69 boys and girls, ranging in ages from 8 to 9 years. Math was the school subject used as a basis for considering performance. The purpose of the study was to see what effects stimulus progressive (SP), sedative music (SM), and popular music (PM) had on six dependent variables: math achievement, task-relevant behavior, reported feelings of tiredness and pleasantness, noise level, and teacher response. The conclusions and predictions from the study were as follows:

- 1 The classroom that receives soft background music in the above order should find students' math achievement increasing related to their academic aptitude.
2. The classroom that receives a background music of PM, SP, and SM will note a progressive math achievement trend.
3. Math achievement gains under PM will not be as great as under SM or SP.

4. The classroom that receives background music (SP, SM, and PM) will decline slightly in apparent task-relevant behavior, but with no accompanying achievement decline.

5. In classrooms that receive background music (SP, SM, and PM), students will report feelings of being more rested and pleasant.

6. In classrooms that receive background music (SP, SM, and PM), noise level will remain below the level at which the music may be heard.

Engel and Engel (1962) also studied music's effect on arithmetic testing of 5th-grade students. The 25 subjects in this study were from a regular 5th-grade classroom. The group was tested doing simple arithmetic under the conditions of musical distraction and silence. The outcome of this study showed no results with statistical significance.

Kopp (1958) investigated the effects of stimulating and relaxing music on children taking a 4th-grade arithmetic test. A sampling group of 319 4th-grade children from three public schools was divided into three test groups. The following were the procedures and the results:

1. Test Group I--Differences between scores on tests with relaxing music and those with no music showed no significance.

2. Test Group II--Differences between scores of tests with stimulating music and those with no music showed no significance.

3. Test Group III--Differences between scores on tests with relaxing music and those with stimulating music showed no significance.

Three of the four studies in this section showed background music had no significant effect on the math performance of elementary and high school students. One of these three studies also measured students' performance on aptitude and spelling tests. The one study that showed an increase in math performance was in a classroom situation with background music being played.

### Background Music's Effect on Reading Testing

Fogelson (1973) conducted an experiment with students in two 8th-grade English classes. One class was termed bright and the other was termed nonbright by educators. The classes were divided into four equal groups according to their Stanford-Binet IQs: (a) bright, without music; (b) bright, with music; (c) nonbright, without music; and (d) nonbright, with music. The Iowa Tests of Basic Skills' reading test was given. Groups without music were tested under standard conditions, whereas other groups were tested while hearing popular instrumental music. The following conclusions resulted from this study:

1. Playing popular instrumental music during test-taking adversely affected the reading test performance of 14 8th-grade students (all of those tested). Bright students without music out-performed those with music.
2. Ability interacted significantly with reading performance.
3. The seven nonbright students suffered greater score losses with music added than did the seven bright students.

Henderson, Crews, and Barlow (1945) used 50 freshman college women in an experiment to study music distraction and reading efficiency. These women were divided into three equally matched groups based on psychological examination scores and reading test scores. The Nelson-Denny Reading Test was used. Before taking the test, the subjects filled out a questionnaire primarily to determine whether they were accustomed to studying with the radio on or not. Both pretests and posttests were given in three different environments. The first group was tested with no distraction, the second group with classical music being played, and the third group with popular music being played. Tests were administered on three successive afternoons. The findings were

1. Popular music distracted a group of subjects significantly on the paragraph section of the test. Classical music showed no evidence of distraction in either the vocabulary or paragraph sections of the test, nor did the popular music show evidence of distraction upon vocabulary.

2. Students accustomed to studying with the radio were influenced as much or as little as students unaccustomed to studying with the radio.

While the popular music in this study was both instrumental and vocal, the classical music was all instrumental. Perhaps the findings could have been affected by this lack of uniformity.

Hall (1952) studied 278 8th- and 9th-grade students with regard to background music and reading comprehension. These students participated in the experiment during their regularly scheduled study hall period. The test used was the Nelson Silent Reading Test, vocabulary and paragraph section. Intelligence and achievement test scores were noted. The results of this study showed the following:

1. Approximately 58% of the 245 students tested showed a score increase when the test was given with background music.
2. The first morning period and the first and second afternoon periods showed the largest gain in scores with background music.
3. Those 9th-graders whose intelligence rating was in the lowest quartile led in amount of improvement with background music.
4. Of those 8th-graders whose achievement tests ranked them in the lower half of the class, 55.56% scored higher with music being played.
5. Boys showed a larger mean gain with music than girls.
6. Familiarity with study at home with radio music being played had no significant influence on the results.

7. The results of the students with musical training or experience did not vary significantly from those of the nonmusicians.

Another study, combining music with several adult reading improvement classes, was conducted by McCord (1961). The researcher and teacher of the classes admitted to the study having been more subjective and "clinical" in nature than rigidly statistical. Background music was played to the students in these classes at intervals during class sessions. The music played was subjectively evaluated by McCord as being "soothing." These were the results:

1. A substantial number of persons in the classes were convinced that the music taught them to read better.

2. The great majority of the students enjoyed having the music played during class sessions, and said that the music was relaxing. Those expressing dislike for the music generally did not like music or felt it made them sleepy.

Freeburne and Fleischer (1952) conducted a study regarding music distraction and reading rate and comprehension. Four kinds of music were used: classical, semiclassical, popular, and jazz. All of the music used was nonvocal, thereby eliminating what had been a complication in some other studies. Two hundred and eighty students in eight introduction to psychology classes were used as subjects. Approximately 40 subjects were assigned to one of five groups. Each of four groups listened to the above kinds of music. A fifth group was a control group. The reading material was expanded from the Robinson-Hall Test for Reading Ability. Results revealed no significant differences in the performance of the groups, except that the jazz group read significantly faster than the control group. No significant relationship was found between level of



intelligence and the influence of music distraction upon either rate or comprehension of reading.

The studies in this section showed quite opposite findings. Two studies indicated background music was beneficial, and two studies showed it was nonbeneficial to performance on reading tests given to junior high, college, and adult subjects. A fifth study utilizing college students as subjects revealed no significant differences in performance of groups tested with background music and a group tested without background music.

#### Background Music's Effect on Several Kinds of Verbal Testing

A study concerning music's effect on spontaneous writing was conducted by Donlan (1976). Fifty students from two intact classrooms in a high school were the subjects for a two-phase study. The researcher drew the following tentative generalizations from phase one of the study:

1. The quality and quantity of students' spontaneous writings are affected by music used as a stimulus.
2. As for quantity, only music which is vocal and unfamiliar appears to have an inhibiting effect on students' writing.
3. As for quality, only music that is vocal and unfamiliar appears to have an inhibiting factor on students' writing.

Tentative generalizations drawn from phase two of the study were:

1. Students will write more when the music stimulus is unfamiliar foreign language vocal, rather than unfamiliar English vocal.
2. Students will write less when the music stimulus is unfamiliar classical vocal, rather than unfamiliar popular vocal.
3. Students will write worse (quality) when the music stimulus is unfamiliar classical vocal, rather than unfamiliar popular vocal.

Whitley (1934) conducted four experiments using music related to the memory processes of college students enrolled in psychology classes. In the first two experiments, students were to learn as many words as they could in a given number of minutes. In all experiments, students were tested individually. In experiment one, music was played as a prior condition to the learning of joy and sorrow words. Both slow and fast music exerted a slightly detrimental effect upon learning, as compared with the normal condition (three groups in all). In the second experiment, music was played during the learning of monosyllabic words ( $N = 128$ ). Likewise, the normal condition showed a similar slight superiority over the musical conditions mentioned in experiment one. In the third experiment, an anticipation method was used in which it was assumed the list was learned when the subject was able to anticipate successfully each succeeding word before it was presented ( $N = 25$ ). Differences were very slight under five different conditions (one normal plus four kinds of music). The fourth experiment had to do with the possible influence of music upon the learning of poetry ( $N = 30$ ). Conditions were normal, tempestuous music, and slow music. Results indicated clearly the superiority of the normal condition over the two musical conditions. Least returns were obtained when tempestuous music was played. Whitley concluded that music is a slight distraction to a process of memorization.

Remembering nonsense syllables is another test of verbal ability which was investigated in a musical setting by Baugh and Baugh (1965). The subjects, 50 introductory psychology college students, were randomly assigned to five musical and experimental conditions: silent, classical, oriental, jazz, and rock-n-roll. Each subject was tested individually and was given 10 minutes to concentrate on 20 nonsense syllables. The

subject was then asked to write all he or she could remember, giving correct spelling and location in the list. Each subject, following the experiment, declared his or her musical preference on a questionnaire. The following were the results:

1. There was no significant difference in the effects of silence, classical, oriental, or jazz music on learning.
2. Any differences among the mean scores were found not to be a function of the subject's interest in music, as measured on the questionnaire.
3. Analysis of specific mean differences showed significant differences between rock-n-roll and silence, rock-n-roll and classical, and rock-n-roll and oriental. In each of these comparisons, rock-n-roll showed the least number of nonsense syllables learned.

Barnes (1976) examined the effects of relaxation and selected mood-appropriate music on recall in a public school setting, utilizing 117 high school psychology students. The results of the study showed that relaxation had a stabilizing effect on the recall of didactic material. Music, on the other hand, appeared to have the opposite effect. Statistical differences between control and experimental groups were found in both conditions. The test and retest method was used.

Mandell (1974) tested subjects to music, utilizing the language subtest of the California Achievement Test. The entire 12th grade of a high school was randomly divided into four groups, which were equally distributed by sex, and tested. Three of the groups each had a different type of music played in the background during testing, and one had none. Music used was (a) highly stimulating, (2) moderately stimulating, and (c) sedative-soothing. Text anxiety was induced by telling the subjects

they must get 85% of the questions correct or face taking a remedial English course. The results of the study showed no significant difference among the treatment groups or between sexes, nor was there any interaction between these factors and how music distraction affected mental test performance.

A study of 250 equally matched 7th-grade students was conducted by Williams (1961) on three separate occasions. One study was in 1947, one in 1948, and one 1953. Three different forms of the American Council on Education High School Psychological Examination were used as the testing instrument. Certain outcomes were as follows:

1. Popular music adversely affected mental test performance when tasks involved quantitative ability.
2. Popular music did not affect mental test performance involving linguistic ability.
3. Popular music adversely affected students of average and above average academic rank more than those of lower academic rank.
4. Popular music adversely affected boys more than girls.
5. Classical music did not affect mental test performance.
6. Stated attitudes regarding distractability were inconsistent with actual mental test performance.
7. Relative position in the group was not affected by music in the case of the girls but was somewhat affected by popular music in the case of the boys.

In a study by Stainback, Stainback, and Hallahan (1973), noise and background music's effect on task-relevant and task-irrelevant learning was tested on 64 educable mentally retarded students. The learning involved associating drawings of common household objects with drawings

of animals and in a particular manner. Four kinds of groups were tested under the following conditions: silence, noise distraction, music distraction, and music-noise distraction. A primary and an intermediate age group were tested in each testing condition. The results indicated there was a significant difference between the music and nonmusic groups on task-relevant learning scores in favor of the music group. No other significant differences were found between age groups, kinds of learning, or testing groups.

A somewhat different approach to music's effect on mental work was instigated by Schlichting and Brown (1970). Their study consisted of comparing a series of 12 biology lectures and an exam with background music to a similar series in which background music was lacking. Three college classes, totaling 225 students, were involved. Students' musical preferences, from highly preferred to monotonous and distracting, were used to determine the kinds of music to be played in the study. The authors found that the quality of music was of utmost importance. Students preferred soft jazz, semiclassical, slow popular, instrumental, movie themes, strings, bossa nova, and Beatles music, in that order of preference. Overall, the data suggested that music was beneficial for the majority of students, in that it improved their grades by approximately 4.6%.

The final study reported on in this section was devoted to determining background music's relationship to spelling achievement in the fifth grade. In this study, Herman (1968) used control and experimental groups in two above-average, two average, and two below-average classes. Ability was determined by the Otis Quick-Scoring Mental Ability Test. Semiclassical and marching music was used. Data gathered revealed that: (a) the playing of background music did not produce higher achievement in spelling as

measured by weekly or 4-week unit tests, (b) the use of background music did not affect pupils' interest in spelling, (c) semiclassical and march music had about the same effect on spelling achievement, and (d) background music played during spelling seat-work did not aid or hinder appreciably the spelling achievement of children on weekly and unit tests.

The studies in this section again show varied results: that background music may be detrimental, nondetrimental, or helpful. A tendency for popular music to negatively affect performance was again noted. Throughout the research discussed thus far, popular music has been shown to be the form most detrimental to various cognitive tasks.

The studies reviewed represent a wide variety in which background music's effect on the thinking process has been explored. There appears to be a lack of such research involving psychological testing to background music. Only one study reviewed utilized psychological testing as the dependent variable. Also few in number appear to be the studies which specifically name rock (or rock-n-roll) music as the independent variable, with the dependent variable being the measurement of a thinking process. Only two of the studies reviewed used this independent variable. Several studies tested subjects to background music which was described as stimulating or popular, but these terms are general and can refer to several kinds of music. Therefore, the focus of the present study was to examine the results of psychologically testing young people to background music most representative of the kinds they listened to.

## METHOD

The purpose of this study was to determine whether three kinds of contemporary youth background music would significantly affect posttest scores of three groups of 9th-grade students taking an intelligence test. Each group was treated with a different kind of background music. A pretest was first given each group to establish mean performance on an alternate form of the test. Subjects were assigned to treatment groups by selective sampling. The majority of the school's 9th-grade students selected their favorite artist(s) and albums from each of the three musical categories. These albums were used to furnish background music for each of the three musical treatment conditions. A fourth (control) group was pre- and posttested with the normal condition of silence.

### Subjects

The subjects for this study were selected from a population consisting of all 9th-grade students at Beech Senior High School in Hendersonville, Tennessee. There was a total of 129 9th-grade students in the initial population. Two factors contributed to the reduction of this number to 100 students who took part in this study: (a) since it was necessary for each subject to take part in two separate phases of the study, absenteeism during one or both testing sessions eliminated several subjects; (b) only those students who had secured written permission from a parent could participate. This sample represented 77.5% of the total target population and was divided into four equal groups of 25 each. The division was accomplished alphabetically, the first group being students whose last names began with the letters "A" through some of the "D"s. The second

group continued with the remainder of those whose last names began with "D" and continued through a portion of those whose last names began with "J." The third group represented the remainder of the "J"s through the "P"s, and the fourth group consisted of the "R"s through the "Y"s (and the remainder of the sample). Since all students in the sample were in the same grade, their ages were very similar in each of the four groups. Table 1 shows the mean ages for groups 1, 2, 3, and 4 at 14.6 years, 14.44 years, 14.48 years, and 14.6 years, respectively. The mean age for all subjects was 14.53 years. The ratio of males to females in all but one group was similar. In group 2, there were 11 males and 14 males. Groups 3 and 4 each consisted of 13 males and 12 females. Group 1, the control group, had 16 males and 9 females. In the entire sample, there were 53 males and 47 females.

#### Instrument

The measuring instrument used in this study was the Otis-Lennon Mental Ability Test (1968) forms J and K (equivalent forms of the test). It is published by The Psychological Corporation. This instrument was selected because of its high validity and reliability and because the various items in the test measure the verbal, numerical, and symbolic reasoning abilities associated with general mental ability. The alternate forms' reliability for this test and for this age group shows that forms J and K have a .94 coefficient of correlation. Additionally, this instrument was designed for use with classroom groups and is easily administered. The 40 minutes of actual working time for the test called for sustained concentration from the subjects but appeared not so long as to tire or threaten them. Finally, this instrument had not been used as a part of the testing program in the school where this study was conducted. Thus, the subjects were unfamiliar with it, enhancing its value for purposes of the study.



Table 1  
Number of Males and Females and Mean Ages  
For All Subjects and Treatment Groups

Group	N Males	N Females	Mean Age
Group 1 (Control)	16	9	14.6
Group 2 (Pop)	11	14	14.44
Group 3 (Soft-rock)	13	12	14.48
Group 4 (Hard-rock)	13	12	14.6
All Subjects	53	47	14.53

### Procedure

The procedure for data collection in the present study was accomplished in the following manner: A letter to grant or not grant permission for their child to take the Otis-Lennon Mental Ability Test, forms J and K, was sent to the parents of all 129 9th-grade students at Beech High School. The distribution and collection process was accomplished by the 9th-grade homeroom teachers. Of the total target population, 12 subjects' parents did not grant permission for their child to take the two forms of the test. These negative respondents eliminated 9.3% of the total target population. Absenteeism eliminated the remaining 17 students or 13.2% of the total target population. One hundred students remained for data-gathering purposes in this study.

A simple survey was taken to determine which musical groups or individual artists were the most popular of those who sang music in each of three categories of music: hard rock, soft rock, and pop music. Four 9th-grade English classes were asked to list their favorite artists and albums, in order of preference, in the three musical divisions. A thorough explanation was given to all students prior to the survey as to the exact meaning, as used in this study, of each type of music. The results of the survey showed the following categorical favorites: (a) the favorite hard rock group was AC/DC, and the favorite album of this group was Back in Black; (b) the favorite soft rock group was R.E.O. Speedwagon, and the favorite album of this group was Hi Infidelity; and (c) the favorite pop artist/group was The J. Geils Band, and the favorite album produced by them was Freeze Frame. As a result of this survey, these three albums were chosen as the independent variables to be played as background music for the treatment groups in this study.

The belief underlying allowing a majority of the 9th graders to select the background music to be used was that this music, highly popular with 9th graders, would tend to elicit more listening from them (and thus be more potentially distracting) than music chosen by others. Also, it was felt that any later generalizing of this study's results to typical activities of the subjects such as doing homework to music would necessitate utilizing in the study the music most representative of that normally listened to by the subjects.

The first testing for all groups involved no treatment conditions and occurred in silence. Form J of the Otis-Lennon Mental Ability Test was the measuring instrument. Groups 1, 2, 3, and 4 were tested in the same classroom at 10:00 a.m. on 4 successive days, 22-25 March 1982. All students were given the same set of instructions by the same person in charge of testing. Notice had been given that there were to be no interruptions of any sort during the testing period for those being tested. This notice was strictly adhered to. Students were seated alphabetically from the first row of desks to the last. The lighting level was the same for all groups. Questions asked by the subjects were answered preliminary to testing. The only help given students during testing time was provision of extra pencils for those whose lead broke and answers to a minimum of procedural questions. When students finished their tests, they closed their test booklets, turned their answer sheets face downward on their desks, and sat quietly until all tests had been completed, or until time was up for working on the tests--whichever came first. Students were not allowed to talk during the testing period.

The second testing for all groups involved treatment conditions for groups 2, 3, and 4 but not for group 1, which was tested again in silence. Form K of the Otis-Lennon Mental Ability Test was the measuring instrument.

Group 2 was tested exactly as before, except that pop background music was played. Group 3 was tested exactly as before, except for the addition of soft rock as the background music. Group 4 was tested exactly as before, except for the addition of hard rock background music being played. Vocal music was the predominate form of music on all albums used in each treatment condition.

Careful attention was again paid to the control of all extraneous variables in the second testing of the subjects. Groups 1 through 4 were tested in the same classroom as in the first testing. Again, they were all tested at 10:00 a.m. on 4 successive days, 19-22 April 1982. All extraneous variables involved in the first testing were carefully controlled in the same manner in the second testing. For groups 2, 3, and 4, tested to background music, the volume control setting on the record player was set at the same level for all groups. The record player was situated at the front and center of the classroom, and the volume control was set to play the albums quite loudly for all groups. The volume of the music played to testing might be described as loud enough to allow the students to converse between desk rows (approximately 4 feet apart) and still be heard by each other--had that been allowed.

## RESULTS

Analyses of data were accomplished through the Office of Academic Computing and Research Services at Western Kentucky University. The computer analysis master program utilized to obtain the statistical data was the SPSS program. The specific program utilized from the master program was SUBPROGRAM T-TEST, published in 1975 by McGraw-Hill Publishers. Data were sent to the University of Kentucky Computing Center where fifteen correlated  $t$ -tests were completed. The computerized results of these tests were then sent back to the Office of Academic Computing and Research Services at Western Kentucky University.

$F$ -tests were run to reveal the magnitude of differences between pre- and posttest results from groups 1, 2, 3, and 4.  $F$ -tests were also calculated for differences in pre- and posttest results of males in groups 1, 2, 3, and 4. In addition,  $t$ -tests were calculated for differences between pre- and posttest results of females in groups 1, 2, 3, and 4. Finally,  $t$ -tests were computed for differences between pre- and posttest results of the entire group, all males, and all females. The specific music condition associated with each group has been placed in each of the appropriate tables.

In order to determine the equivalence of the four groups, the pretest means were compared using a  $t$ -test for independent means. Table 2 contains the obtained  $t$  values. Inspection of these data indicates that group 1 differed significantly from group 2, but that all other combinations failed to reach a .01 level of significance. Thus, the selective sampling procedure did not achieve total equivalence between the four groups. This lack of

Table 2  
T-test Comparisons Between Group Means  
 for Pretest Equivalence

Group Comparison	<u>T</u> Value	df
Group 1 vs. 2	2.658*	48
Group 1 vs. 3	1.715	48
Group 1 vs. 4	1.538	48
Group 2 vs. 3	1.206	48
Group 2 vs. 4	1.416	48
Group 3 vs. 4	0.223	48

Note. Group 1 = control

Group 2 = pop

Group 3 = soft rock

Group 4 = hard rock

\* = significance at the .01 level of significance

df = degrees of freedom

equivalence must be considered when the posttest results are examined. All scores utilized as data in this study were Deviation IQ (DIQ) scores, which are, in effect, normalized standard scores with a mean of 100 and a standard deviation of 16 points. The DIQ is an index of a pupil's relative intelligence when compared with pupils of similar chronological age, regardless of grade placement. The standard error of measurement of the instrument, the Otis-Lennon Mental Ability Test, is 3.9 DIQ points for subjects whose ages are the same (14 years) as the subjects for this study. The null hypotheses tested in this study are

1. There will be no significant difference in mean IQ scores of a pretest taken by a group of students under the normal testing condition of silence and a posttest taken by the same group of students with the treatment condition of popular background music.
2. There will be no significant difference in mean IQ scores of a pretest taken by a group of students under the normal testing condition of silence and a posttest taken by the same group of students with the treatment condition of soft rock background music.
3. There will be no significant difference in mean IQ scores of a pretest taken by a group of students under the normal testing condition of silence and a posttest taken by the same group of students with the treatment condition of hard rock background music.

The results of this study showed that there were no significant differences found between the pre- and posttest means at the .01 or .05 levels. The computer generated  $t$  values, relating to the research hypotheses, have been summarized in Table 3. Table 4 compares pre- and posttest means for all subjects, all male subjects, and all female subjects. All male subjects' mean scores showed the most difference. However, no significant differences between mean scores were found for any of these three groups.

Table 5 compares pre- and posttest means for males only in each of the four groups. As indicated in Tables 4 and 5, the only pre- and posttest means that approached significance were those in group 2, as a whole, which was the group that listened to pop background music, and group 2--males only. The means for group 2, as a whole, were statistically different at the .066 level, and the means for group 2 males were statistically different at the .072 level. In both cases, posttest means were lower than pretest means. Group 2, as a whole, had a pretest mean of 109.60 and a posttest mean of 106.80. Group 2 males had a pretest mean of 107.9091 and posttest mean of 103.1818.

Table 6 compares pre- and posttest means of females only in each of the four groups. No significant difference was found between pre- and posttest means in any of these groups.

Fifteen correlated t-tests were used to analyze data resulting from this study. Pre- and posttest means were examined. None of the groups showed a significant difference between means. Pre- and posttest means for group 2 and group 2, males only, were statistically different at the .066 and .072 levels, respectively.



Table 3  
Statistical Data Derived from Pre and Post T-tests  
on All Groups

Group	Pretest Mean	Posttest Mean	<u>T</u> Value	df
Group 1 (Control)	100.4400	102.3600	1.57	24
Group 2 (Pop)	109.6000	106.8000	1.93	24
Group 3 (Soft rock)	105.3600	104.8800	0.37	24
Group 4 (Hard rock)	104.7200	105.5600	0.83	24

Note. df = degrees of freedom

Table 4  
Statistical Data Derived from Pre and Post T-tests on  
All Subjects, All Male Subjects, and All Female Subjects

Group	Pretest Mean	Posttest Mean	<u>T</u> Value	df
All Subjects	105.0300	104.9000	0.20	99
All Subjects (Males)	104.1509	103.7358	0.44	52
All Subjects (Females)	106.0213	106.2128	0.22	46

Note. df = degrees of freedom

Table 5  
Statistical Data Derived from Pre and Post T-tests  
on All Groups (Males Only)

Group	Pretest Mean	Posttest Mean	<u>T</u> Value	df
Group 1 (Control)	100.9375	102.0625	0.77	15
Group 2 (Pop)	107.9091	103.1818	2.01	10
Group 3 (Soft rock)	103.8462	102.3846	0.68	12
Group 4 (Hard rock)	105.2308	107.6154	1.71	12

Note. df = degrees of freedom

Table 6  
Statistical Data Derived from Pre and Post T-tests  
on All Groups (Females Only)

Group	Pretest Mean	Posttest Mean	<u>T</u> Value	df
Group 1 (Control)	99.5556	102.8889	1.49	8
Group 2 (Pop)	110.9286	109.6429	0.71	13
Group 3 (Soft rock)	107.0000	107.5833	0.40	11
Group 4 (Hard rock)	104.1667	103.3333	0.61	11

Note. df = degrees of freedom

## DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

The primary purpose of this study was to determine if various kinds of background music made any difference in the mean scores on an intelligence test taken by three groups of 9th-grade students within one high school. Three kinds of music were used: hard rock; soft rock; and pop. Each group was subjected to one of these forms of background music while taking the posttest. Each group had taken the same test earlier, in an alternate form, with no musical treatment condition. A fourth group was also tested twice, but in both testings with no musical treatment condition. This fourth group, referred to as group number 1 in the present study, and the lack of significance of difference in their mean scores helped establish two important factors--the reliability of the measuring instrument and that test familiarity did not significantly affect test scores.

It would appear that these findings for group 1 strengthen the experimental design and procedures of the present study. Other major areas of strength in design and procedures relating to this study are as follows:

1. All groups were pre- and posttested in close temporal proximity.
2. Extraneous variables were carefully controlled. All groups were tested at the same time period of the day in pre- and posttesting.
3. There was sufficient variation of the independent variable (3 kinds of music) between treatment groups.
4. A valid, reliable measuring instrument, the Otis-Lennon Mental Ability Test, was used.
5. A comparable administration of the measuring instrument for all treatment groups was enacted.

6. The total number of male subjects (53) and female subjects (47) was quite similar.

In the treatment groups listening to background music during the taking of the posttest, the male to female ratios were quite similar: Group 2 totaled 11 male and 14 female subjects. Group 3 totaled 13 male and 12 female subjects. Group 4 totaled 13 male and 12 female subjects. (Group 1, the control group, was composed of 16 male and 9 female subjects.)

The major findings of the present study, in general, supported the research hypotheses. No mean differences were shown at the .01 or the .05 levels of significance. Only two of the fifteen data groups approached significant differences in pre- and posttest means. It is interesting to note that these two groups were in the grouping treated with pop music as a background to testing. These two data groups--group 2 as a whole and group 2 males--were subjected to a kind of background music (during the taking of the posttest) that emphasized the vocal and lyric portions of the music to a much greater extent than did the soft rock and hard rock music listened to by treatment groups 3 and 4. It might be presumed that listening to words and perhaps contemplating their meanings is more distracting than listening to music which covers over the vocals with heavier beats and special musical effects, as is the case with hard and soft rock music.

From these findings, it seems apparent that efficiency at performing mental tasks for the majority of young people at the 9th-grade level suffers little or not at all from the playing of contemporary youth music during the process. It would appear that young people at this age level have the ability to "tune out" or "tune down" the music sufficiently to be able to function effectively on even a mental activity as difficult as taking an intelligence test.

Although the relationship between background music and adult mental behavior was not dealt with in this study, the assumption might be made that adults often find music more distracting than did the young people involved in this study. If that is the case, it is difficult to understand why since the ability to concentrate--like other such abilities--should increase with experience and years.

While the focus of this study was on group data, it was noted that individual test scores were affected by treatment conditions. The following are some incidental statistics, worthy of mention: The data in Table 7 indicates that within group 2, the group which showed the most mean difference in pre and post scores, there were more individuals who made a lower score under treatment conditions than there were in any other group. Sixteen of the twenty-five subjects made lower scores on the posttest than on the pretest. This figure compares with ten subjects making lower scores on the posttest in group 1, eleven subjects making lower scores on the posttest in group 3, and ten subjects making lower scores on the posttest in group 4. On the other hand, group 2 had the fewest subjects to show a post score improvement of any group. Only eight subjects showed improvement versus groups 1, 3, and 4 showing improvements by fourteen, twelve, and twelve subjects, respectively.

Individual statistics in Table 8 reveal that group 2 had more subjects with excessively lower post scores (eight points or more lower) than any of the other groups. Groups 1, 3, and 4 had none, two, and none in number of subjects, respectively, that scored eight points or more lower on posttests. Group 2 had five subjects scoring eight points or more lower on posttests.

Even a surface look at individual scores, in passing, indicates that although groups did not appear to be significantly affected by various kinds

Table 7  
Comparison of Individual Posttest Scores to Individual  
Pretest Scores for All Groups

Group	Number of Students with Lower Score	Number of Students with Higher Score
Group 1 (Control)	10	14
Group 2 (Pop)	16	8
Group 3 (Soft rock)	11	12
Group 4 (Hard rock)	10	12



Table 8  
Comparison of Lowered Individual Posttest Scores  
for All Groups

Group	Number of Students with Lowered Score of 8 or More Points	Number of Students with Lowered Score of 11 or More Points
Group 1 (Control)	0	0
Group 2 (Pop)	5	4
Group 3 (Soft rock)	2	1
Group 4 (Hard rock)	0	0

of youth music played in the background while they were being tested, nevertheless, certain individual's scores were perhaps made lower by the addition of the music.

The most apparent recommendation to evolve from the present study is the need for more research to investigate music's effect on various forms of young people's mental activities. An examination of the existing literature reveals that the majority of the research does not utilize contemporary youth music as an experimental variable. Few music effect studies were identified as having been published since the late 1970's. Therefore, more updated and related studies of thinking and listening habits of youth appear necessary. Youth music is, in fact, an ever-changing form of art which reflects new and innovative sounds. Thus, periodic study must be completed to ascertain the effect of innovation.

While the present study suggests little effect resulting from varying forms of music, further research should also be conducted utilizing psychological test results as the dependent variable and varying music forms as the independent variable. As previously stated, only one study reviewed utilized an intelligence test as the independent variable. That study was reported in 1961 by Williams on research actually completed much earlier. Thus, continuing research in this area is needed.

As has already been noted, there needs to be further research dealing with music's effect upon individuals--as contrasted with groups. The current study suggests that, for at least several subjects, background music may have had a negative impact upon performance. Indeed, there may be certain types of young people whose thinking is significantly impaired by music while others are not affected. The variables of individual attention span, concentration ability, and one's idiosyncratic experience with music should also be considered in relationship to test performance and music forms.

Lastly, the volume of music should be considered as an independent variable in another study. In the present study, the volume of the background music utilized was set at a constant level for all groups. The related study should consider the impact of varying levels of music volume.

APPENDIX

March 4, 1982

Dear Parent:

A majority of Beech's 9th-grade students will be taking part in a two-part test to be taken the week of March 15 and again the week of April 19 of this year.

Each testing session will last approximately forty-five minutes. These testing sessions are part of an experiment. Any results of these tests used outside Beech High School will be reported as numbers and not as names. Tests to be used are two forms of the Otis-Lennon Intelligence Test.

We would appreciate your cooperation in allowing us to test your child. Please check one of the boxes below and sign your name. Then fill in the name of your child. (Be sure to fill out separate forms for each of your children in the 9th grade.)

Please return this letter at once. We need all letters returned no later than Wednesday, March 10, if possible. Thank you.

I give permission to test my child.

I do not give permission to test my child.

Parent's Signature

Child's Name:

\_\_\_\_\_

\_\_\_\_\_

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