*THE EFFECTS OF CONTINGENT MUSIC ON THE INTENSITY
OF NOISE IN JUNIOR HIGH HOME ECONOMICS CLASSES¹*

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The effects of quiet-contingent music on the general noise levels of four seventh- and eighth-grade classrooms were investigated. Following a baseline procedure, popular radio music was used to reinforce maintenance of noise below an acceptable level of intensity, 70 decibels, in three of the four classes. In the fourth class, a reversal design was used to show that the contingent presentation of the radio music was important to control the noise produced by the students. The teacher was free to engage in instructional activities because data collection and presentation of music were controlled by automatic apparatus.

Reinforcement contingencies are being applied to an expanding variety of education problems and populations (Zimmerman and Zimmerman, 1962; Harris, Wolf, and Baer, 1964; Hall, Lund, and Jackson, 1968; McAllister, Stachowiak, Baer, and Conderman, 1969; and Bailey, Wolf, and Phillips, 1970). A few characteristics may make the procedures of much of this research impractical or difficult to implement. These characteristics include: (a) the careful collection of data, which requires human observers, *e.g.*, Hall *et al.* (1968); (b) teacher administration of contingent reinforcers such as praise, *e.g.*, Allen, Henke, Harris, Baer, and Reynolds, (1967); toys and edibles, *e.g.*, Miller and Schneider, (1970); or access to special activities, *e.g.*, Hopkins, Schutte, and Garton, (1971); and (c) the application of reinforcement contingencies to individual students, *e.g.*, Schutte and Hopkins, (1970). Although these procedures

may be characteristics of the ideal classroom, each imposes additional demands on overworked teachers or requires that schools employ extra personnel.

Systematic approaches to children's problems have emphasized immediate reinforcement (Bijou and Baer, 1961; Becker, Englemann, and Thomas, 1971). In contrast, much behavioral research has employed delayed reinforcement (Hopkins *et al.*, 1971) or delayed reinforcement that is mediated by points or tokens that immediately follow desired behaviors (Birnbrauer, Wolf, Kidder, and Tague, 1965; Bushell, *et al.*, 1968). These delays of reinforcement may not support as efficient behavior development and maintenance as would more immediate reinforcement.

The present experiment employed an immediate reinforcement procedure to modify a common behavior, disruptive noise, in secondary school classrooms. The procedure included contingent presentation of music as a positive reinforcer. Music was presented as a group contingency in the sense that it was simultaneously presented to all of the students in a class dependent on the collective noise made by the students. The procedure employed relatively simple automatic data collection and programming equipment, thus requiring no extra work from the teacher.

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METHOD

Subjects

This investigation was conducted in two seventh-grade home economics classrooms (Group B and C) and in two eighth-grade home economics classrooms (Group A and D) at a junior high school in a rural county in Kansas. Classroom A consisted of 19 girls, classrooms B and C 18 girls each, and classroom D 17 girls. The students ranged in age from 12 to 15 yr. In each of the eighth-grade classrooms, at least two students were considered by the principal, counselor, and former teachers, to be severe disciplinary problems because of excessive truancy or frequent misbehavior in the classroom. Several of the students were on probation through the county juvenile court. One of the students in Group A was suspended from school by the principal for three days during the study. However, her suspension from school was unrelated to her behavior in the home economics class. This was the only time during the study that a student was removed from the classroom for disciplinary reasons. The seventh-grade classrooms contained no students who were on probation either informally through the school or formally through the juvenile court. Students with I.Q. scores below 70 were enrolled in the special education program and were not included in this investigation.

Setting

The study was conducted in the home economics-clothing room. This was the only classroom located on the lower level of the building and it was, therefore, reasonably isolated from noise originating from other sections of the school.

Sewing machines were located in the north-eastern half of the room perpendicular to the north and east walls. Individual equipment drawers were located on the west wall. In addition, the room contained five student work tables. Each table could seat up to six students. Two of the tables were located in the eastern

half of the room, three tables were located in the western half of the room. A large storage cabinet and a four-drawer file cabinet were also located in the western half of the room on the south wall. A voice-operated relay (VOR) was placed in the large cabinet and a radio was placed on the file cabinet. A microphone was hung directly above the west corner of the storage cabinet.

During this study, the students were working on individual sewing projects. All classes were relatively unstructured. The girls moved freely about the room to use the sewing machines, to work at the tables, or to talk in small groups. All of these activities were encouraged by the teacher. Her stated desires were to reduce the classroom noise to a level low enough that it would not interfere with the girls' activities and in a way that would not involve extreme uses of punishment.

Apparatus

A Grason-Stadler microphone, model E 7300A was used, which hung 8 ft above the floor by the storage cabinet. The microphone led to a Grason-Stadler, model E 73, voice-operated relay (VOR). The VOR was set to operate whenever the noise level in classroom A exceeded 76 dB as calibrated with a Bruel and Kjoer precision sound-level meter, type 2203. The VOR operated in classrooms B, C, and D whenever the noise level exceeded 70 dB. These levels were subjectively chosen by the classroom teacher as an acceptable amount of classroom noise for the particular activity that was planned for the period of the study. A higher threshold was chosen for Group A because, in the teacher's opinion, this group was the noisiest class and presented the most disciplinary problems. It was felt that if the threshold was set lower the subjects would receive reinforcement too infrequently.

Whenever the noise level exceeded the threshold setting, the VOR operated. The VOR in turn started one recording timer and stopped a second recording timer (Automatic Time Con-

trols, Inc., Model 5701A159P00BX). In addition, the VOR started a programming timer and under some experimental conditions turned off a radio, Sears model 6047. To minimize the contribution of the radio to the total intensity of noise received by the microphone, the radio was placed 6 ft from the microphone. The contribution of the radio to the total intensity of noise in the room was substantial but undetermined. Whenever the radio was turned off by the VOR, the programming timer controlled the time at which the radio came on again. The radio always remained off for at least 20 sec and came on after the noise level had been continuously below the threshold for 20 sec.

The radio was set on a station preferred by the majority of students. The peak loudness of the radio output was 52 dB as measured by the Bruel and Kjoer sound level meter from a distance of 6 ft.

Data Collection

Data were collected for an average of 20 min each day, five days per week, for from 23 to 30 days in the various classes. Data collection began 15 min after the tardy bell had sounded and ended 5 min before the passing bell sounded. The shortest period of data collection was 9 min, the longest period was 30 min. The duration of the data collection period varied because the classes were occasionally shortened or lengthened due to special school activities and assemblies. Major data were collected automatically by the timers attached to the VOR. One timer recorded the amount of time that the intensity of noise in the room exceeded the threshold of the VOR. A second timer recorded the number of seconds that the noise was below threshold. All data are reported in terms of the per cent of time that the intensity of noise was above the threshold of the VOR.

In addition, data were collected on the teacher's behavior using the method described by Bijou, Peterson, and Ault (1968). A two-definition code was developed that included two major types of teacher-pupil interaction. These

interactions were labelled "positive comments" and "negative directives". The definitions were as follows:

Positive comment: Any verbal comment by the teacher which directly or indirectly shows approval of a student's or a group of students' behaviors. Examples are:

"You're doing a good job."

"This (a student's project) looks very nice."

"I'm glad you're working so hard."

Negative directives: Any verbal comment by the teacher that directly or indirectly shows disapproval of a student's or a group of students' behaviors. This includes commands to engage in other behavior and verbal threats of punishment. Examples are:

"Get busy."

"Let's quiet down."

"If you don't quiet down you are going to the office."

The classroom teacher recorded these on two hand counters. The purpose of this measure was to ensure that the teacher's behavior remained relatively constant throughout the study.

The average number of "positive comments" recorded during the first eight days was eight per class. The highest number occurred on the fourth day in Group B. The average number of "negative directives" recorded per class during the first eight days was as follows: three for Group A, two for Groups B and C, and one for Group D. The daily counts for the remaining days of the study never varied from the average by more than one for either measure.

Reliability

After each session, the teacher recorded the readings from timer A and timer B on the data sheet. To assess reliability, the teacher instructed a student from the class as follows: "Copy the numbers you see (pointing to the timers) on this piece of paper, this is A (pointing to timer A) and this is B (pointing to timer B)." Recording reliability was assessed 22 times during

the entire investigation. Days on which reliability was assessed are indicated by "r's" on Figure 1. There was 100% agreement between the teacher's observations and the students' observations of the timers' readings.

To assess the reliability of the teacher's observations of her own behavior, students were trained to use the observation code. A student in each class was given the definitions of "positive comments" and "negative directives" and a list of five examples of each behavior. After reading the definitions and examples the student was given an opportunity to ask questions concerning the definitions or examples. The student then proceeded to record the teacher's behavior on a sheet of paper divided into two columns, "positive comments" and "negative directives". A minute timer was set for 5 min. The student and teacher compared the numbers of positive comments and negative directives each had recorded when the timer rang. The timer was reset and the procedure repeated three more times. In each class, observer reliability was assessed once during the first experimental condition. Because determining reliability disrupted the activities of a student for an entire period, more reliability checks were not made. The teacher's and students' data corresponded exactly for each 5-min interval compared.

Experimental Conditions

There were three different experimental conditions in this investigation: *No Radio*, *Radio Contingent on Quiet*, and *Radio Contingent on Noise*.

No radio. The number of seconds that the intensity of noise was above threshold was recorded. However, the radio was not turned on at any time. The teacher switched on the recording device with no mention of the study and ignored answering all questions about the apparatus during all conditions of the study.

Radio contingent on quiet. During this condition, the radio was turned on approximately 15 min after the tardy bell sounded. If the noise level in the room rose above the threshold

set for the class, the VOR switched the radio off for a minimum of 20 sec. If the level dropped and then quickly rose again above threshold, the programming timer automatically reset for 20 more seconds.

Radio contingent on noise. To show that the contingency of the presence of music was an important variable in controlling the behavior of the subjects, a third condition was used for Group A. The presence of music in the classroom was made contingent upon the maintenance of a noise level above the set threshold, 76 dB. During this condition, the VOR was set so that it turned the radio on only when the noise level rose above the threshold. If the noise level dropped below threshold, the radio switched off for a minimum of 20 sec. The radio came on when the intensity of noise in the room remained continuously above the threshold for 20 sec.

Experimental Design

The experiment employed two different designs. A reversal design was used with Group A. A multiple baseline design was used with Groups B, C, and D (Baer *et al.*, 1968).

Group A. In Group A, the *Radio Contingent on Quiet* condition was in effect from the first through the eighth day of the study. After eight days the radio was no longer played. When the subjects asked to turn on the radio they were told that it was "no longer working". The *No Radio* condition continued for nine days. From the eighteenth through the twentieth days of the investigation, the *Radio Contingent on Quiet* condition was again introduced. After this condition, on the twenty-first through twenty-sixth days of the study, the presence of radio music was made contingent upon the maintenance of a noise level above 76 dB, the *Radio Contingent on Noise* condition. Next, the presence of radio music was again made contingent on quiet. This condition continued for three days.

Groups B, C, and D. First, a baseline was established in each of these three classes during the *No Radio* condition. The presence of radio

music, contingent upon the intensity of noise remaining below 70 dB, was then introduced into Group D after seven days of baseline. After 15 days of baseline, the *Radio Contingent on Quiet* condition was introduced for Group C, and after 20 days of baseline for Group B.

RESULTS

Group A. Figure 1 shows the per cent of time that the intensity of noise was above the threshold of 76 dB for Group A. The per cent of time that the noise level exceeded the threshold

Fig. 1. The per cent of time that the intensity of noise exceeded the teacher-determined threshold for all four classes.

was greater during the *No Radio* condition than during the *Radio Contingent on Quiet* conditions. Comparatively, the mean per cent of time that the intensity of noise was above the threshold was 22.7% during the *No Radio* condition and 2.4% over all three *Radio Contingent on Quiet* conditions. During the last two *Radio Contingent on Quiet* conditions, the level of noise exceeded the threshold only 0.09% of the time. In contrast, the average per cent of time that the intensity of noise exceeded the threshold during the *Radio Contingent on Noise* condition was 55.63%. If the data from the first three days of the *Radio Contingent on Noise* condition are excluded in computing the mean, because these data had obviously not stabilized, the average per cent of time that noise level was above threshold was 97.3 during the remainder of the *Radio Contingent on Noise* condition.

Groups B, C, and D. Figure 1 also shows the per cent of time that the intensity of noise in classrooms B, C, and D exceeded the threshold of 70 dB. During the *No Radio* condition, the average per cent of time that the intensity of noise in the classroom exceeded the threshold for Groups B, C, and D was 41.9, 35.6, and 43.8% respectively. During the *Radio Contingent on Quiet* condition, the average per cent of time that the noise level was above threshold was 0.33% for Group B, 9.8% for Group C, and 7.6% for Group D.

DISCUSSION

The research and results demonstrate that the use of music contingent on comparative quiet is an effective procedure to reduce the noise level in relatively unstructured classes of junior high school girls. This procedure is perhaps of particular value to teachers because, unlike many published techniques for controlling undesired classroom behaviors (Hall, *et al.*, 1968; Barrish, Saunders, and Wolf, 1969; Schmidt and Ulrich, 1969), the contingencies are automatically applied. The teacher devotes a minimum of time and effort to either use of the procedure or to data collection if it is desired.

According to the teacher's self-recording, she maintained a constant rate of negative directives and positive comments throughout the study. Since estimates of the reliability of her recording were obtained only during the first condition in each classroom, it is not possible to say with certainty that her recording remained accurate. Her impression was that during the periods in which music was contingent upon quiet, the behavior of the students had required less policing and permitted more time for demonstrating and helping the students with their projects. She also stated that the girls probably were more productive when the music was contingent on quiet. However, no data were collected to substantiate her impression of the effects upon productivity.

The results from the *Radio Contingent on Noise* condition demonstrate that the contingency involving the presence of radio music was an important consideration. In addition, this condition provided a control for the amount of time that the radio music was present in the classroom. During the last three days of the *Radio Contingent on Noise* condition, the noise level for Group A remained above the threshold an average of 97% of the time. The radio therefore operated most of the time. However, during the last *Radio-Quiet* condition the radio was again on most of the time, although the noise level rarely exceeded the threshold. Left unanswered is the question of the possible effects of non-contingent music.

No data were collected on the distribution of noise over various sources. It is possible that the changes in data reflect changes of the noise-making behaviors of only one student in each of the classes. However, if noise is a problem in a classroom, it may be inconsequential if the noise is produced by one student or is the product of the behaviors of several students, as long as a practical procedure is available to reduce it to an acceptable level.

Practically, recorded music might be more effective than a radio. The teacher noted that the students seemed more likely to be noisy

during the *Radio-Quiet* conditions whenever popular music was interrupted for commercials and news reports. Practically, it might also be useful to announce the relationship between the presence of the music and the noise level in a classroom. The trend to less noise under the *Radio-Quiet* condition occurred more rapidly with each class in which the contingency was successively introduced. This could have resulted from the students in one class relating the nature of the contingency to students in another class. Terminally, students in all four classes sometimes verbalized the nature of the contingencies. Students frequently expressed appreciation of the presence of the music and those in Groups B and C asked if they could use the radio before the *Radio Contingent on Quiet* condition began in their classes.

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