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REDUCTION OF CLASSROOM NOISE LEVELS USING GROUP CONTINGENCIES

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Abstract

The therapeutic workplace is an employment-based abstinence reinforcement intervention for unemployed drug users where trainees receive on-the-job employment skills training in a classroom setting. The study is an extension of prior therapeutic workplace research, which suggested that trainees frequently violated noise standards. Participants received real-time graphed feedback of noise levels and had the opportunity to earn monetary group reinforcement for maintaining a low number of noise violations. Results suggested that feedback and monetary reinforcement reduced the number of noise violations.

Keywords

group contingency; monetary reinforcement; noise reduction; real-time feedback; therapeutic workplace

The therapeutic workplace is an employment-based contingency-management intervention designed to promote drug abstinence and establish job skills that chronically unemployed drug users may need to obtain and maintain employment (Silverman et al., 2005). In the workplace, trainees earn monetary vouchers that are exchangeable for goods and services for attendance in the training program, for working on training programs, and for maintaining professional demeanor (Silverman et al., 2005).

Previous descriptive research in the therapeutic workplace has indicated that trainees frequently exhibit unprofessional interpersonal behaviors that would not be considered acceptable in community workplaces (Carpenedo et al., 2007), including elevated noise levels or library mode violations. *Library mode violations* have been defined as “talking loud

enough that someone 10 ft from you could hear the conversation” (Carpenedo et al., 2007, p. 1146) and as “1 s in which the noise level is recorded at or above 55 dB” (Sigurdsson et al., 2011, p. 49). Results from these studies indicated that library mode violations were frequent, were generated by classroom participants engaging in non-work-related conversations (Sigurdsson et al., 2011), and may have reduced productivity (Carpenedo et al., 2007).

Because it is difficult to determine which individual trainees are responsible for noise violations in the workplace setting, interdependent group contingencies were used in the current study. In interdependent contingencies, all members of the group must adhere to the goal in order for the entire group to earn the incentive (Cooper, Heron, & Heward, 2007). Previous studies using group contingencies to reduce noise levels have not utilized technology to provide real-time graphed feedback on noise levels, nor have they been conducted in therapeutic or job training settings (e.g., Greene, Bailey, & Barber, 1981; Meyers, Artz, & Craighead, 1976; Schmidt & Ulrich, 1969). The settings of previous studies that have attempted to reduce group noise levels have included an elementary classroom (Schmidt & Ulrich, 1969), a school bus for elementary school children (Greene et al., 1981), and a college dormitory (Meyers et al., 1976).

The purpose of the current study was to assess the effectiveness of real-time graphed feedback combined with group monetary reinforcement to reduce noise levels in the workplace classroom, as suggested by Sigurdsson et al. (2011). This study also represents the first use of group-level monetary reinforcement in the therapeutic workplace.

METHOD

Setting and Participants

The study was conducted at the Center for Learning and Health in Baltimore, MD (for a description, see Silverman et al., 2007). Participants were 26 trainees who were enrolled in one of three different studies between January and June, 2010. All participants could attend the workplace to learn job skills for approximately 6 months, up to 4 hr per day (2 hr in the morning and 2 hr in the afternoon) for 5 days per week. Participants were enrolled in one of three randomized controlled clinical trials that were being conducted at the Center for Learning and Health (DeFulio et al., 2012; Dunn et al., 2013; Holtyn et al., 2014).

Apparatus

Two RS232-supported digital sound meters were used to record and measure decibel levels in the classroom. Meters were placed in the ceiling of the classroom with the sensor pointing to the floor. They were calibrated three times during the study: before the baseline and information condition and before and during the feedback and monetary reinforcement (two meters) condition.

Data Collection

Classroom noise levels were recorded and stored in a dedicated database each second during each morning and afternoon session (i.e., 4 hr per day). Frequency weighting of Type A was used to measure noise levels per Occupational Safety and Health Administration regulations

(OSHA, 2008). A *library mode violation* was defined as 1 s in which the noise level in the classroom was recorded by a sound meter at or exceeding 55 dB. The threshold of 55 dB was set according to OSHA requirements (OSHA, 2008). To illustrate, 55 dB is the sound level of a normal conversation. The ambient noise level in the classroom was approximately 43 dB (Sigurdsson et al., 2011).

To control for participants' varied work schedules (trainees are free to come and leave as they please), total library mode violations recorded per session were divided by the total number of minutes worked by all participants in the workplace during a given session. Minutes worked per participant were readily available because they are used to determine participant pay (Silverman et al., 2007). Data are reported as whole-day bins (i.e., violations per minute worked from the morning and afternoon sessions were averaged).

Design

The current study utilized an A-B-B'-A reversal design.

Baseline and information (A)—Before the baseline and information phase, the first author conducted an in-service meeting with all participants. The meeting consisted of the first author reading a handout to the group, playing two sample noises (one sample above and one below 55 dB), a question-and-answer session, and a comprehension quiz about study procedures. The handout included information on the new operational definition of a library mode violation (i.e., 1 s of noise at or above 55 dB) and alerted participants of the existence of noise meters and that the consequences of violations would be corrective verbal feedback.

Real-time feedback and monetary reinforcement: two meters (B)—A second in-service meeting was conducted before the onset of this phase. A handout that contained the same materials as the previous handout was distributed to participants, with additional information on new noise-level contingencies, delivery of real-time feedback graphs, and group monetary reinforcement contingencies.

Graphs were located on each participant's computer screen and displayed the decibel levels as recorded by the noise meter closest to the participant in real time. Graphs displayed the decibel level (on a scale from 20 to 100) vertically and a moving 10-s window horizontally. A red line depicted the real-time decibel level, and a fixed blue line depicted the decibel-level criterion (i.e., 55 dB). The top panel of the graph depicted the total number of violations that occurred in the session and the total number of violations allowed. The top panel changed from green to yellow to red as the number of total violations increased, were met, and then exceeded the maximum number of violations allowed, respectively (if applicable). The maximum number of violations allowed per session was set at 350, which was derived by calculating a 10% reduction of the lowest number of violations recorded in the baseline and information phase. The 10% reduction was used because the researchers believed it was an attainable goal.

Each participant had the opportunity to earn up to \$2.00 total per workday (\$1.00 in the morning session and \$1.00 in the afternoon session) in which the average total violations

recorded by the two noise meters were at or below 350. Monetary reinforcement earned was based on the amount of time each individual participant worked that session. To determine the value of the monetary reinforcer, the total minutes a participant was signed in to the classroom for that session was divided by 120 (total possible number of minutes in a session), and the quotient was converted to a dollar amount.

Real-time feedback and monetary reinforcement: one meter (B')—During the previous phase, participants suggested that the sound meters could have been recording violations from an air conditioning window unit. We determined that the meter closest to the air conditioner (Meter 2) was recording violations from the air unit. The noise meter furthest from the air conditioner (Meter 1) was not affected by the air conditioner and was used for all subsequent decibel recordings for the remainder of the study. Therefore, the new measurement system used Meter 1 only to determine if the total number of violations per session exceeded 350, and all feedback graphs on participants' computer screens depicted the decibel level as recorded by this meter. Each participant received back pay for sessions in which he or she would have received incentive pay under the new measurement system.

Return to baseline and information (A)—The first author met with each participant and reviewed a handout explaining that feedback and monetary reinforcement would no longer be available. Consequences for library mode violations were again corrective verbal feedback from a staff member.

RESULTS AND DISCUSSION

All data depicted in Figure 1 are from the meter that was not affected by noise from the classroom's air conditioning unit. That is, although the second phase (B) is termed feedback and monetary reinforcement (two meters), the data depicted are only those recorded by the unaffected meter. Figure 1 shows the number of violations per minute worked and the average number of participants working, depicted in 1-day bins. Noise levels decreased during the initial feedback and reinforcement intervention phase. These reductions were maintained in the B' intervention condition. The return to baseline and information phase resulted in a slight immediate increase in violations, followed by a considerable increase in violations. Violations were variable throughout the return to baseline, which had the highest average level of violations recorded of all phases of the study. Twenty-four participants earned a total of \$175.95 in pay during both feedback and reinforcement phases. Pay ranged from \$0.74 to \$ 25.92, including back pay, and the median pay was \$5.27. Seven participants received back pay, ranging from \$0.17 to \$ 4.44, with an average of \$3.15.

It may be a concern that one or two participants could have caused noise violations and a lack of violations was due to their absence. This concern is somewhat alleviated considering that the same individuals were present during the end of Phase A and the beginning of Phase B, when the number of violations per minute worked decreased. Thus, although it is possible that one or two individuals may have caused the violations, the results suggest that the intervention nevertheless decreased the volume of their vocalizations.

Several limitations should be noted. One limitation is the air conditioner interference and the lack of precise information about when the interference began. This should not affect the interpretation of the results, however, because all data depicted are from the unaffected meter. Other limitations include inconsistent and unreliable participant attendance throughout the study and the lack of an intervention component analysis (e.g., feedback vs. monetary reinforcement). It would have also been ideal to end with an intervention phase to replicate the effects of the intervention.

This study expands on prior therapeutic workplace research (Carpenedo et al., 2007; Sigurdsson et al., 2011) and on research on group contingencies to reduce noise levels (Greene et al., 1981; Meyers et al., 1976; Schmidt & Ulrich, 1969). The study demonstrates a novel intervention to reduce elevated noise levels in a workplace where elevated noise levels have been previously attributed to non-work-related conversations (Sigurdsson et al., 2011). Although a reduction in noise levels demonstrated in the study may not be considered clinically significant (Wolf, 1978), Carpenedo et al. (2007) identified library mode violations as a precursor for a physical altercation between workplace trainees.

This intervention could be viable in other settings. The intervention could be part of a treatment package designed to prepare individuals with histories of unemployment and drug use for community employment or with other populations in which elevated noise levels may hinder productivity, academic achievement, or safety (e.g., Greene et al., 1981; Schmidt & Ulrich, 1969).

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Figure 1. Violations per minute worked and average number of participants across experimental phases. All data are from the unaffected meter.