

MUSICAL REINFORCEMENT OF PRACTICE BEHAVIORS AMONG COMPETITIVE SWIMMERS

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This study determined whether music could be used as a reinforcer for increasing productive and decreasing nonproductive behavior of 6 competitive swimmers during the dry-land portion of a practice session. The swimmers were randomly assigned to either the contingent reinforcement group, who received music for productive behavior, or the noncontingent group, who received music regardless of their training productivity. An ABAB design showed that a large and immediate increase in productive practice behavior and decrease in nonproductive practice behavior occurred during the contingent phase compared to the baseline phase. Subjects rated the musical reinforcement favorably and elected to have the procedure continued.

DESCRIPTORS: athletes, swimmers, athletic performance

Improving the efficiency of practice is important in athletic settings. Research by Crossman (1985b), Hume, Martin, Gonzalez, Cracklen, and Genthon (1985), and McKenzie and Rushall (1974) found that serious time-management problems exist during the practice sessions of various sports. Specifically, athletes engage in a large number of unproductive activities during training that may decrease the potential for improvement.

Research has shown that both individual and group reinforcement contingencies have improved practice efficiency (Heward, 1978; Heward, Heron, Hill, & Trap-Porter, 1984; Hume et al., 1985; Martin & Hrycaiko, 1983). Researchers have suggested that music can be a valuable reinforcer of appropriate training activity when presented in sport settings (Jernberg, 1982; Schubert, 1986). Previous research has both suggested and demonstrated that providing contingent music has effectively improved performance (Dickenson, 1977; Vyatkin & Dorfman, 1980). Kodzhaspirov, Zaitsev, and Ko-

sarev (1988), for example, studied the performance of 65 weightlifters and found that music stimulated their work capacity and raised the effectiveness of training. Furthermore, they found that subjects expended greater effort while listening to preferred music and determined that music need not be played continuously to be effective (in some cases for which concentration is imperative, music can disrupt performance). When asked whether they liked to train to music, 96% of the study group responded favorably, believing that music made training easier, reduced the psychological stress of training, and improved skill mastery.

In another study (Anshel & Marisi, 1978), 32 male and female physical education students performed a bicycle ergometer test under three conditions: a) synchronous movement to music, b) asynchronous movement to music, and c) no music. The major finding from this study was that music had a beneficial effect on the subjects' ability to endure the task, particularly when the music was synchronized to physical movement.

In swimming, nonproductive behaviors are apparent during dry-land training periods, which occur prior to entering the water. This is the most appropriate time to study the effects of music on the practice behavior of swimmers, because when they are swimming (sometimes underwater), hearing becomes difficult. This study evaluated the effects of using contingent music on certain practice behaviors of competitive swimmers.

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METHOD

Subjects and Setting

The subjects were 6 top squad swimmers from the Thunder Bay Thunderbolt Swim Club. The coach, in conjunction with the authors, selected swimmers who did not consistently make effective use of their practice sessions. The athletes ranged in age from 12 to 16 years and had been swimming competitively for 3 years. Swimmers attended at least five practice sessions per week, each lasting approximately 2 hr. One swimmer was eliminated from the study during the first treatment condition due to a lengthy illness. Data were collected at Lakehead University in Thunder Bay, Ontario, in the C. J. Sanders Fieldhouse. This building contains a 50-m eight-lane indoor swimming pool.

Observation System

A partial-interval system was used, wherein the predominant behavior occurring in a given time interval was recorded. The predominant behavior was the behavior that occupied the greatest proportion of time in a predetermined time interval. Three subjects were alternately observed at any one time for 10 s, after which data were recorded on a standardized sheet. While coding, the observers listened to a prerecorded cassette tape that instructed them when to observe and when to record.

The swimmers did not know any of the observers and, as evidenced by baseline observations, the presence of the observers had little effect on the behavior of the subjects. Behaviors were categorized, and then each total was divided by the total number of observed intervals to obtain a percentage for both productive and nonproductive behaviors.

The senior author, who was the primary observer, was assisted in data collection by two trained observers. Training for the observers was conducted in three orientation sessions, during which procedures for accurate data collection were discussed. During the first and second orientation sessions, observers viewed actual swimming practices and gained experience in coding the behaviors of swimmers. During the third session, interobserver reliability checks were made for instances of productive

and nonproductive behaviors. An agreement occurred when both observers simultaneously yet independently recorded the same behavior occurring during the same interval. Occurrence and nonoccurrence reliabilities were calculated by dividing the total number of agreements of occurrence (or nonoccurrence) by the total number of agreements plus disagreements of occurrence (or nonoccurrence) and multiplying by 100. The mean overall occurrence and nonoccurrence percentage was 88% across all swimmers (range, 78% to 100%) and for Swimmers 1 through 6 was 89%, 88%, 89%, 89%, 89%, and 88%, respectively.

Data collection. During each 20-min dry-land training session, the frequency of productive and nonproductive behaviors was recorded. Productive behaviors were defined by the senior author and swimming coach as behaviors that, when exhibited by the athletes during practice, have a high probability of improving subsequent athletic performance. In this study, examples of productive behaviors were doing sit-ups, stretching exercises, and running laps of the pool. Nonproductive behaviors were behaviors that would have no effect or a detrimental effect on subsequent athletic performance (i.e., talking to friends and/or other swimmers, and leaving the pool area).

Dependent variables. Specific definitions of productive and nonproductive behaviors were developed by Crossman (1985a) and are as follows:

1. Productive behaviors: (a) specific practice—the athlete is practicing a skill that he or she had been instructed to do by the coach (i.e., doing sit-ups, running laps of the pool, etc.); (b) related practice—the athlete is performing a physical activity that is directly related to the subject matter (i.e., doing push-ups on the deck, etc.); and (c) demonstrating—the athlete is performing a skill while another athlete or the coach is watching, with the purpose of showing how the skill should be done or pointing out something specific about the skill.

2. Nonproductive behaviors: (a) unrelated activity—the athlete is performing a physical activity unrelated to the subject matter (i.e., doing handstands during warm-up, eating, etc.); (b) inappro-

priate activity—the athlete is behaving in such a way as to interfere with the functioning of other athletes (i.e., stealing goggles); (c) unrelated interaction—the athlete is conversing with other individuals about topics unrelated to the activity (i.e., talking about a date, inquiring about the time); (d) inactive due to injury—the athlete is injured or hurt while in the athletic environment, resulting in inactivity (i.e., spraining a finger on side of the pool); (e) exclusion—the athlete leaves the practice area prematurely and therefore is not in the area when the observation is made; and (f) inactivity—the athlete is waiting for his or her turn to use equipment (i.e., uneven bars, balance beam). Prior to the start of the study, the 6 target swimmers were asked to participate in a study of some new coaching techniques. Any questions the swimmers had were clarified before the initial treatment phase began.

Intervention

The intervention was music, played on a portable cassette player. Prior to the start of the study, questionnaires on musical preference were distributed to each swimmer with the purpose of assisting the experimenters and the coach in the selection of suitable music to be used as reinforcement. The swimmers all preferred similar music, so the choice of six tapes was not difficult.

The 6 target swimmers were unsystematically randomly assigned to either a contingent or noncontingent reinforcement group (3 in each group). During contingent reinforcement, music was played on the first day after an appropriate productivity level was achieved. A 15% improvement in productivity was selected because it was deemed to be a realistic goal that would triple the productivity level achieved during the baseline phase.

Swimmers in the contingent reinforcement group were told that if everyone in the group showed a 15% improvement in productivity over the baseline average of 5%, music would be played in the pool area for all swimmers on the team the following practice day. This contingency continued throughout the treatment phase. If even one of the swimmers in this group failed to achieve the 15% cri-

terion, no music was played on the following day. The swimmers in this group were told that when their dry-land training performance improved to the criterion, the music would be resumed at practices.

Swimmers in the noncontingent reinforcement group were not told how musical reinforcement could be obtained and heard music only at the time the contingent reinforcement group achieved a productivity level high enough to obtain the reinforcer. In other words, the swimmers in the noncontingent group did not have control over the playing of music, and went about their dry-land training as usual.

Experimental Design

A reversal (ABAB) design was used. During the initial baseline period, data on productive and nonproductive behaviors were recorded for the 6 target swimmers until the pattern of performance was stable (13 sessions). Following baseline, the first treatment phase was introduced for the contingent group while the other group received music on a noncontingent basis as previously described. On the first observation day, music was played for 10 min at the end of the dry-land training period so that the reinforcer could be sampled. The first treatment or intervention phase lasted for 12 sessions, after which a return to baseline took place for the 3 swimmers in the contingent group (nine sessions). During this phase, 1 subject from the noncontingent group was eliminated due to a lengthy illness. In the final phase, the treatment was introduced to the 2 swimmers originally in the noncontingent group who had served as a control group throughout the initial AB phase. The study was designed in this fashion to control for the possibility that music might affect performance when presented in a noncontingent manner. The second final treatment phase lasted for six observation sessions.

Social Validation

Following the second treatment phase, 4 of the 5 target swimmers and their coach were asked to complete a social validation questionnaire (Kazdin,

1977; Wolf, 1978). The questionnaire included eight items and asked subjects to rate the clarity, effectiveness, and popularity of the music condition on a 7-point Likert scale in which 1 = not at all and 7 = definitely yes.

RESULTS

The musical reinforcement conditions resulted in large improvements in the percentage of productive behaviors over the baseline conditions of the contingent reinforcement group. For example, Robin showed an average increase of productive behaviors of 34%, whereas Kevin and Lynne showed an increase of 31%. Likewise, the introduction of the musical reinforcement condition resulted in a dramatic drop in the amount of nonproductive behaviors. The return to baseline resulted in large increases in the level of nonproductive behavior. The second treatment phase showed the lowest rates of nonproductive behaviors for all swimmers in the contingent group.

The initial baseline phase for Kendell and Max (noncontingent group) indicated consistently low levels of productive behavior. During the noncontingent treatment phase, Max continued to show low levels of productive behavior, whereas the percentage of productive behavior increased gradually but inconsistently for Kendell. Following the second baseline phase, Kendell and Max were introduced to the contingent reinforcement condition. At this point, immediate large increases in productive behavior were noted and continued throughout the contingent reinforcement phase. Kendell averaged a 70% increase in productive behavior, and Max showed an increase of 35% in productive behavior between the baseline and contingent treatment phase. Kendell and Max showed a decrease in the average percentage of nonproductive behaviors during the noncontingent treatment phase, although a visual inspection reveals inconsistent trends. The most dramatic change in the frequency of nonproductive behavior occurred when the contingent treatment phase was introduced. The decreases in appropriate behavior were immediate after the re-

inforcement condition was introduced and remained consistently low throughout the phase.

All of the swimmers enjoyed having the music played on the pool deck and gave the music condition an average score of 25 out of a possible 28. Three of the 4 swimmers felt the music condition made it easier to warm up and believed they did more exercise when they knew they could obtain music for their efforts. All swimmers wished to have the music condition continue at practices.

On the social validation questionnaire and in an unstructured interview, the coach indicated that the music made it easier for the swimmers to warm up and believed the amount of talking decreased and the amount of productive behavior increased. To date, the coach has continued with music presentation at practice sessions, with a greater variety of music being played.

DISCUSSION

Results of this study can be discussed from the perspective of previous sport performance literature. As Crossman (1985b) indicated, serious problems exist in the productive application of practice sessions. Baseline data from this study supported Crossman's contention.

Our intervention procedure was successful at increasing productive behaviors, as did the intervention by Hume et al. (1985). Specifically, increases in productive behaviors occurred when the intervention package was in effect. Withholding the intervention package led to immediate decreases in productive behavior and increases in nonproductive behavior. The intervention also led to greater practice enjoyment, as reported by the participants.

Throughout this study, Lynne displayed the greatest percentage of nonproductive behaviors when one particular swimmer, who was not a subject in the study, was present. All swimmers, with the exception of Robin, appeared to emit more nonproductive behaviors in the presence of this particular swimmer; hence, this swimmer was a disruptive force at practice. This swimmer was considering quitting swimming and found socializing more re-

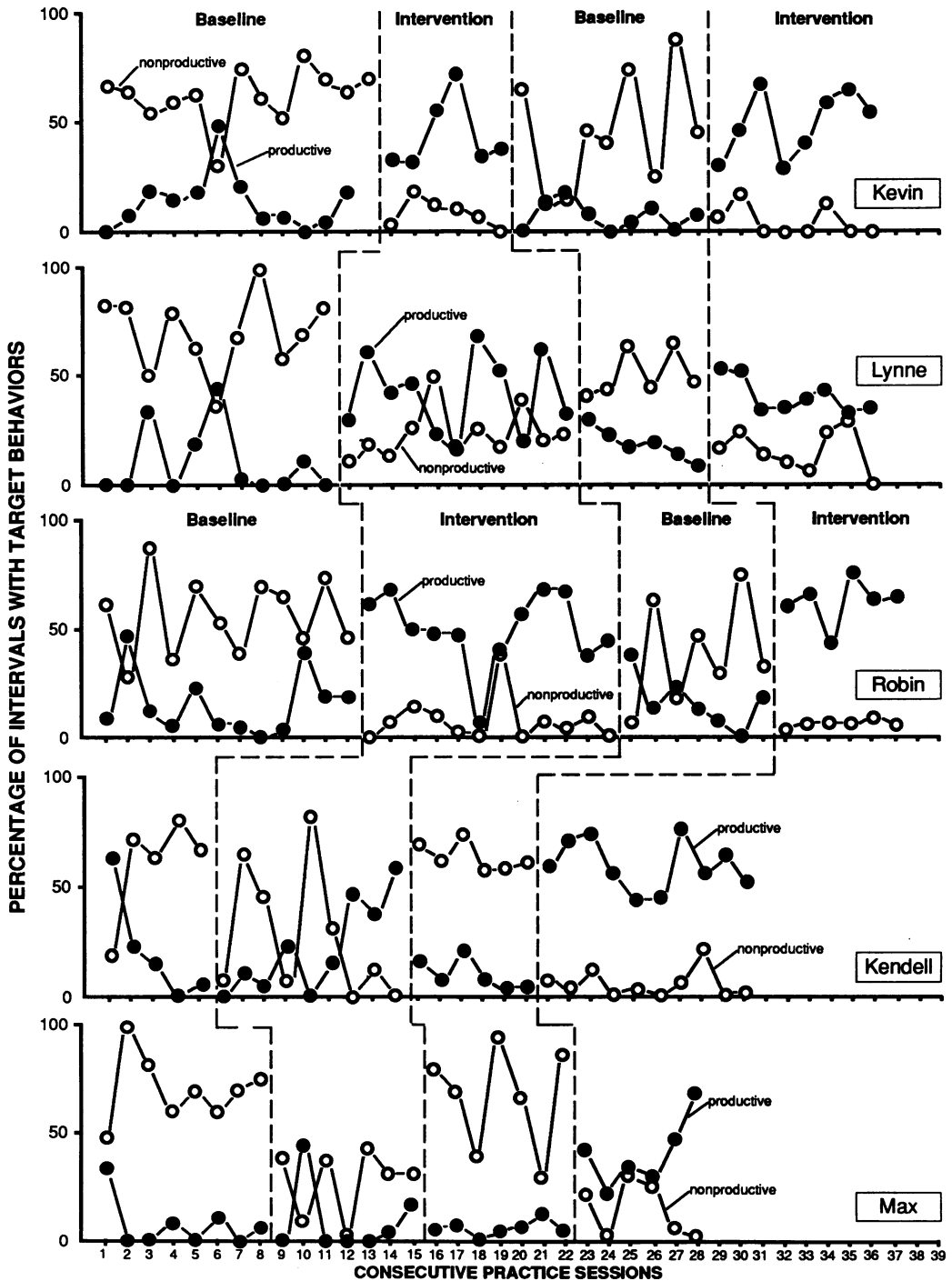


Figure 1. Percentage of productive and nonproductive behaviors during each phase for the contingent and noncontingent reinforcement groups.

inforcing than certain practice behaviors, which may explain why this swimmer was the only swimmer who failed to reach the reinforcement criterion during more than one session.

It would be ideal if musical reinforcement could be presented when swimmers are training in the water. It is difficult, however, to manipulate extrinsic consequences to influence swimming performance once an individual enters the water. Advances in technology may soon enable swimmers to practice in the water with individually chosen music that is clearly audible. This would allow researchers to study the effects of music on the practice behaviors of swimmers while in the water.

The results suggest that music may be used as a successful reinforcer when contingent on the behavior of a small group. In this study, limitations required the musical reinforcement condition to be presented contingent upon the performance of 3 to 5 swimmers. Subjects showed that improvements in performance will result even when reinforcement is not based simply on individual performances. We recommend the study be replicated using swimmers of different age groups and skill levels. The effects of the intervention could also be studied for other sports and in other teaching/performance settings. For example, response-contingent music could be used to control classroom discipline and/or increase desirable on-task behaviors.

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