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The Modification of Exercise Behavior of Retarded Adults: Increasing Participation in Exercises Using Games as a Reinforcer

Linda Dawn Allen

Western Michigan University

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THE MODIFICATION OF EXERCISE BEHAVIOR OF RETARDED ADULTS:
INCREASING PARTICIPATION IN EXERCISES USING GAMES AS A REINFORCER

by

Linda Dawn Allen

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

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Linda Dawn Allen
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Research has shown that retarded individuals are often in poor physical condition, that they experience fatigue easily, and that they exhibit poor posture, awkward movements and low endurance (Hayden, 1964; Nunley, 1965). Retarded individuals have also been found to be inferior to normal persons of comparable age and sex on most measures of motor ability and physical fitness.

Howe (1959) compared normal and retarded children on eleven factors that included gross motor and physical fitness skills and found that normal children scored significantly better than retarded children on all factors. Brace (cited in Campbell, 1973) and Parick, Widdop and Broadhead (1970) compared samples of retarded children to national norms on the Youth Fitness Test and found that the retarded children were inferior to the norms on all variables. In another study, Sengstock (1966) compared retarded children to normal children on the Youth Fitness Test and also found that the retarded children scored lower than normal children.

In light of the above data, it appears that retarded children are generally less physically fit than normal children. One reason for this may be a lack of activity by the retarded. Retarded persons often lead inactive, sedentary lives and are not frequently provided an opportunity for vigorous activity (Campbell, 1973; Stein, 1963). Many researchers have noted the lack of physical education programs for the retarded and lack of research in the area (Campbell, 1973; Conover, 1972; Shotick and Thate, 1960; Stein, 1963, 1968, 1977). Until recently, there have been few
provisions made for physical education for the retarded. There may be several reasons for this neglect (Conover, 1972). Few studies have been done that show what retarded persons can do and what potential they may have for physical improvement. Thus, a prevalent assumption may be that the retarded can not substantially improve in physical fitness. In addition, staff training is often minimal, special educators are not prepared to teach physical education and physical educators are not prepared to teach the retarded. Although professionals agree on the need for physical education provisions for the retarded, there is less agreement on specific objectives and little formal research to determine ways to best meet these needs (Shotick and Thate, 1960; Stein, 1963, 1968, 1977).

The formation of the President's Council on Youth Fitness and the President's Council on Physical Fitness in the early 1960's seemed to be a major impetus for the formation of organizations concerned with physical education for the retarded (Stein, 1963). Such organizations as the National Association of Retarded Citizens, American Association for Health, Physical Education and Recreation, the Joseph P. Kennedy, Jr. Foundation and the American Association on Mental Deficiency have become involved in program development, research, professional training, evaluation and publicity information in the areas of recreation and physical education for the retarded (Sengstock and Stein, 1969; Stein, 1977).

With the growing interest and concern by these organizations and by professionals in such fields as physical education, special
education and psychology, physical education programs and research in the area have increased in recent years. This research has shown that when provided with systematic programs of physical education the physical fitness of the retarded children improved significantly.

In an early study, Oliver (1958) put an experimental group through a ten-week physical conditioning program. The measures used were motor educability tests, athletic achievement tests and physical fitness tests, administered as pretests and posttests. The results showed a significant improvement in athletic achievement, physical fitness and strength. Nunley (1965) developed an exercise program that was conducted for 30 minutes each day and ran for 15 months. The program included such exercises as rolls, knee bends, running in place, arm swings, standing broad jumps, pushups, jumping jacks, squat thrusts and bicycles. A motor ability test that evaluated gross motor skills, fine motor skills, coordination and strength, was the pretest-posttest measure. Results showed that a majority of the subjects improved their scores by at least one grade.

Corder (Corder, 1966; Corder and Pridmore, 1966) has conducted a series of similar studies designed to test the effects of physical education on the physical fitness of retarded boys. The experimental groups took part in an exercise program conducted for one hour each day for thirty days, consisting of jumping jacks, pushups, situps, body exercises, broad jumps, wind sprints and dashes. With the Youth Fitness Test as the pretest-posttest
measures, results of the first study showed that the experimental group made significant gains over the control group on all seven items of the test. The results of the second study showed significant improvements on five of the seven items.

Another study showed similar results (Solomon and Fangle, 1967). Their program consisted of an instructional period running 45 minutes daily for eight weeks, divided into three segments that included warmup and calisthenic drills, self testing, dual and relay activities, and stunts and games. Three items from the Youth Fitness Test were used to assess physical fitness, administered as pretest, posttest and followup measures. Posttest results showed substantial improvements over pretest measures. Followup measures conducted six weeks after the termination of the program showed a total stability of the physical fitness gains. Other researchers (Chasey and Wyrick, 1971; Funk, 1971; Giles, 1968; Stephens, et al., 1970) have conducted physical education programs for the retarded and found similar results.

Given that the physical fitness of the retarded will improve when exposed to programs of physical education, ways to better plan more systematic programs, specify objectives and generate improvements are in order. A behavioral approach is one answer to these problems. The field of applied behavior analysis has begun to show interest in the areas of physical education and exercise in the general population. Several researchers have stressed the advantages of employing a behavioral model toward modifying exercise behavior, emphasizing the need for systems analysis.
behavioral objectives (Davis, 1973; Shockley, 1973), and contingency management (Evans, 1974; Presbie and Brown, 1977; Siedentop and Rushall, 1972).

Several studies have been conducted using a behavioral approach with exercise in the general population. Rushall and associates (McKenzie and Rushall, 1974; Rushall, 1972; Rushall and Pettinger, 1969) have conducted experiments focusing on swimming behavior. Self recording by swimmers was used to increase their attendance at training and their work rates (McKenzie and Rushall, 1974). Work rate was increased using reinforcement in the form of candy and money in another group of swimmers (Rushall and Pettinger, 1969).

Contracting was shown to be effective in increasing exercise behavior of college students who earned aerobic points for exercising (Wysocki, Hall and Iwata, unpublished). Epstein, Thompson, and Griffin (unpublished) compared attendance rates of contracting, lottery and control groups who engaged in aerobic exercises. Higher attendance occurred in the contracting and lottery groups. The contracting condition was replicated in a second experiment with similar results. Kau and Fischer (1974) showed that a self modification procedure, a wife contracting with her husband, resulted in an increase in the number of aerobic points earned by the subject.

Geriatric patients who engaged in exercise on a stationary bicycle showed increases in this behavior when tokens were made contingent upon their performance (Libb and Clements, 1969). In another study, feedback was employed to improve the throwing
speed and accuracy of high school students (Malina, 1969). Feedback was also shown to be effective in improving the golf skills of college students (Thompson, 1969). Other studies have included tangible and token reinforcement with pole vaulting behavior (Brock, Brock and Willis, 1972), contingency management with football (Komaki and Barnett, 1972) and weightlifting (Darden and Madsen, 1972).

This behavioral approach has been extended to physical education for the retarded to a limited degree. The advantages of behavior modification in physical education and recreation for the retarded have been stressed and suggestions offered for the development of such programs (Raw and Erickson, 1972; Watson, 1972). A program based on behavior analysis to teach tricycle riding to retarded children was developed, although no experimental data were offered in support of the program (Peterson and McIntosh, 1973). One study employed task specific praise and feedback to improve the swimming behavior of handicapped children (Fueyo, Saudargas and Bushell, 1975). A similar study showed that the swimming skills of retarded children were improved when social reinforcement was used (Bundschuh, et. al., 1972). A third study found that the use of videotaped feedback resulted in improvement in swimming skills of a similar population (Neufeld and Neufeld, 1972). Campbell (1974) used tokens and feedback to increase the number of repetitions of exercises done by retarded boys as compared to a control group who engaged in the same exercises but received only social reinforcement for their performance.
There is a lack of research done by applied behavior analyst in the area of physical education for the retarded, thus the field is open to a variety of research. Because of the generally poor physical condition of most retarded persons, participation in some form of exercise was deemed important. Several studies dealing with the recreation and leisure behavior of the retarded, as well as of other populations, have investigated procedures for increasing participation in these activities. Such studies have shown that by making planned recreational activities available, providing materials, instructions and prompts and giving prizes, participation in these activities increased (Johnson and Bailey, 1977; McClannahan and Risley, 1975; Newkirk, et al., 1976; Quilitch and Gray, 1974). It seems that a similar approach would be applicable to physical education for the retarded.

This study was designed to investigate ways to increase participation in exercises, by initially making organized games and exercises available and then implementing contingencies to increase participation. It was anticipated that participation in games would be higher than participation in exercises and that games could be used to reinforce increased participation in exercises. Previous research has shown that activities may be successfully used as reinforcers. One of the first researchers to suggest this was Premack (1959) who showed that an activity that occurred at a high rate could be used to reinforce a less frequently occurring activity. Play and free time have been used to reinforce classroom behaviors (Hopkins, Schutte and Garton,
In a more directly related study, Pierce and Risley (1974) showed that recreation could be successfully used as a reinforcer to increase membership and decrease disruptions in an urban recreation center.

It was planned that a group contingency was also to be in effect. Previous research has shown that group contingencies were effective in decreasing disruptive behaviors in the classroom (Barrish, Saunders and Wolf, 1968; Drabman, Spitalnik, and Spitalnik, 1974; Hall et al., 1971; Harris and Sherman, 1973; Long and Williams, 1973; Packard, 1970; Schmidt and Ulrich, 1969), decreasing thefts in a classroom (Switzer, Deal and Bailey, 1977), increasing class attendance and decreasing curfew violations (Alexander, Corbett and Smigel, 1976) and improving academic behaviors (Bushell, Wrobel and Michaels, 1968; Maloney and Hopkins, 1973; McCarty, et al., 1977). The "Good Behavior Game", in which teams compete against each other for group reinforcement, has been shown to be effective as a method of utilizing group contingencies (Barrish, Sherman and Wolf, 1969; Harris and Sherman, 1973; Medland and Stachruk, 1972; Warner, Miller and Cohen, 1977). Comparisons of group and individual contingencies have shown that group contingencies are as effective or more effective than individual contingencies (Alexander, Corbett and Smigel, 1976; Drabman, Spitalnik and Spitalnik, 1974; Long and Williams, 1973; Warner, Miller and Cohen, 1977).
The purpose of the present study was to (1) compare different physical education activities to determine which was more reinforcing to the subjects, as measured by participation, (2) determine if manipulating the order of presentation of activities would increase participation, by making the availability of the more reinforcing activity contingent upon participation in the less reinforcing activity and (3) implement group contingencies as an additional method of increasing participation in the activities.
METHOD

Subjects and Setting

The study was conducted at an adult rehabilitation center for the retarded. Clients attended the center five days a week from 9:00 a.m. to 3:00 p.m. and participated in social adjustment, prevocational training and sheltered workshop programs. Staff at the center had expressed interest in developing an exercise class for the clients and time had been scheduled into the program for this purpose. A playground outside the center and an empty classroom were used during this study.

Ten clients (six male, four female) from the Social Adjustment Program served as subjects. All were ambulatory, ranging in age from 28 to 45 years (mean, 35), with I. Q. scores ranging from 20 to 56, with a mean of 42. No subject had a medical condition or was on medication that might have precluded participation in the study. Subjects were selected on the basis of their ability to learn the games and exercises, determined during a pre-experimental instruction phase. Informed consent was obtained from the parent or guardian of each subject and the study was approved by a Human Subjects Review Committee.

Observation

Throughout the study data were collected five days a week for thirty minutes each day on the percent of participation by subjects in exercises and games and frequency counts made on exercise
Participation. A subject was scored as participating in exercises if engaged in one of the following activities:

1. Subject is in the correct exercise position and attempts to perform the exercise.
2. Subject is in the correct exercise position and pauses for no more than three seconds between repetitions of the exercise.

A subject was scored as participating in games if engaged in one of the following activities:

1. Subject is in the correct game formation (line, circle or scattered in play area) and attends to the action.
2. Subject is in the correct formation and interacts appropriately with other subjects (cheers, encourages, etc.).
3. Subject is prepared to play when it is his/her turn without prompts from leader or other players.
4. Subject attempts to perform activity (run, throw, catch, etc.) when it is his/her turn within five seconds.
5. Subject attends to leader instructions between games.
6. Subject begins preparations for the next game within five seconds after instructed to do so.

Observers received detailed definitions which included specific examples of participation and nonparticipation and descriptions of the exercises and games included in the program. Observers were recruited from an undergraduate psychology course and trained prior to the start of the study.

The Planned Activity Check time sampling procedure (Cataldo
and Risley, 1974) was used to obtain the percent of group participation. Two daily fifteen minute sessions were divided into thirty-second intervals. At the start of a session the total number of subjects present was recorded. At the beginning of each thirty-second interval the observer made a sweep of the area, counting the total number of subjects who were participating. The percent of participation during each session was calculated by taking the average ratio of the number participating to the number present. A taped cueing system was developed to assist the observers in determining when to begin each observational sweep. The time allotted for each observation was thirty seconds and if the observation required less time the observer paused until the beginning of the next thirty-second interval. Using this procedure, thirty observations were made during each fifteen minute session, for a total of sixty observations each day.

**Exercise completion.** A frequency count was made of the number of repetitions of each exercise done by each subject. An exercise was counted as completed if the subject attempted to perform the exercise correctly, displaying a close approximation to the correct form. For example, in doing a situp, if the subject sat up and brought arms forward trying to touch the toes, it was counted even though the subject may not have actually touched the toes.

The amount of time required for the subjects to complete the five exercises to criterion was also recorded. This was done by recording the total time that had elapsed during the exercise session as indicated on the data sheet.
Reliability. Independent observations were made on the four dependent variables (exercise participation, game participation, exercise completion and exercise session length) during each phase. Reliability checks were made on participation by having a second observer make simultaneous but independent observations during the fifteen minute sessions. To insure that the two observers were observing the same subject at the same moment, the primary observer indicated which subject was to be observed at a particular moment by calling the subject's number (the subjects wore numbered team markers). Interobserver agreement was calculated for each pair of observations by dividing the smaller by the larger number and these thirty intrasession measures were then averaged to obtain a mean interobserver agreement for the session. Sixteen reliability checks were obtained for exercise participation and twenty-eight for game participation, evenly distributed throughout all phases of the study. Reliability checks yielded a range of 80% to 99.5% and a mean of 93% for exercise participation and a range of 97% to 100%, with a mean of 99% for game participation.

A second observer also made periodic independent frequency counts of the number of repetitions of each exercise done by each subject. Interobserver agreement was calculated for each pair of observations by dividing the smaller by the larger number to obtain the percent of agreement. Reliability checks were made 425 times out of a total of 1520 possible opportunities (ten subjects x five exercises x sixteen sessions during baseline plus nine subjects x five exercises x sixteen sessions during the
treatment phase) or 28% of the time. These checks resulted in a
range of agreement from 72% to 100%, with a mean of 95%.

Reliability checks were made on exercise session length by
having a second observer record the total elapsed time in thirty-
second blocks off the data sheets. Thirty-two reliability checks
were made yielding 100% agreement.

Procedure

An exercise program was conducted five days a week, two sessions
each day, one from 11:25 a.m. to 11:40 a.m. and the other from
11:45 a.m. to 12:00 p.m. The five minute interval between
sessions was used to prepare for and announce the next activity.
Subjects engaged in exercises during one session and played games
during the other session. The activities were conducted on a
playground outside the center or in an empty classroom set aside
for the study.

The exercises were selected to facilitate fitness to different
areas of the body, specifically the legs, arms and abdomen.
Games were selected that provided much the same activity but were
relatively simple to learn. Sources used to select the activities
were textbooks on physical education for the retarded (American
Association for Health, Physical Education and Recreation, 1968a,
1968b; American Association for Health, Physical Education and
Recreation and the Joseph P. Kennedy, Jr. Foundation, 1972; Davis,
1968; Drowatzky, 1971; Hayden, 1964; Milligan, 1975; Voss, 1974).
The exercises selected were toe touches, deep knee bends, situps,
pushups and jumps. The games included running relays, ball passing relays, circle ball passing, circle tags, games of low organization and modified ball games.

The primary criterion in choosing the exercises and games was the subjects' ability to correctly perform the activities. This was determined during a pre-experimental instruction phase, when the games and exercises were taught to the subjects. Any game or exercise that seemed too difficult for the majority of the subjects was eliminated. Specifically, an activity was considered learned when the subject correctly performed the exercise and each component of the game five times unprompted. A major reason for this instructional phase was to insure that any subsequent low levels of participation were not the result of an inability to perform the exercises and games. During this training phase data were also collected on the number of repetitions of each exercise done by each subject and were used to set criteria for the number of exercises to be done by the subjects during the experimental phases.

Baseline. At the start of the session an announcement was made of the activity, either games or exercises, to be conducted during that fifteen minutes. During the games session, the experimenter announced the games to be played, passed out equipment, and assisted in organizing and monitoring the activities if necessary. No other prompts or reinforcers were given (except possible social reinforcement or prompts from other subjects, which were somewhat beyond our control).
At the start of the exercise session the experimenter announced the five exercises to be done and the number in each category. Criteria were established for each exercise that included 20 toe touches, 15 knee bends, 30 jumps, 10 situps and 15 pushups. A chart was constructed to assist the subjects, that listed the five exercises, showed stick figure drawings of the exercises for those subjects who could not read and stated the criterion for each exercise. When subjects considered themselves to be done they left the group and informed the experimenter. If they had not actually completed all five exercises to criteria the experimenter gave the subject a prompt, informing them of the number of exercises still lacking. When the subjects did complete all five exercises to criteria, they left the group and were removed from the time sampling procedure.

**Group Contingency.** Participation in games, the high frequency behavior, noted during baseline, was made contingent upon participation in exercises, the low frequency behavior. In addition, a group contingency was in effect whereby all subjects were required to complete the five exercises before the game session began. At the beginning of the first session of the day the contingency was stated. The subjects were told that they were to complete all the exercises and then they would be allowed to play games. Subjects remained in the exercise condition until all subjects completed all five exercises to criterion or until the end of the allotted time for that day. All other aspects of the exercise and games condition remained the same as during baseline.
Experimental Design

Two types of experimental designs were used. Throughout the study, the program was divided into two fifteen minute daily sessions, each conducted under different conditions. During baseline, one session was conducted under the exercise condition and the other under the games condition, the order of presentation being counterbalanced across days to control for sequence effects. During the treatment phase, each condition was also available daily; however, the games condition followed and was contingent upon the completion of exercises. Thus, a multielement baseline design (Ulman and Sulzer-Azaroff, 1975) was used to compare participation rates in games versus exercises, while an A-E design assessed the effects of games as a reinforcer for exercise completion.
RESULTS

Figure 1 (left ordinate) shows the percent of participation in games and exercises by the subjects across the baseline and treatment phases. The baseline means for both of these measures were 97.5% and 43.1% respectively. An observable increase in participation in exercises was seen as a result of implementing the group contingency, while participation in games remained high. During this phase mean percent of participation in exercises was 84.3% and the mean percent of participation in games was 99.5%.

The exercises and game conditions were counterbalanced across days during baseline in an attempt to control for sequence effects. Data indicated that there were no such effects. On days when exercises were presented first and games second the means were 44.1% and 98.9% respectively. When games were first and exercises second, the means were 96.3% and 42.2% respectively. These means were consistent with the overall means for participation in exercises and games during baseline.

Also shown in Figure 1 (right ordinate) is the length in minutes of the exercise session. During baseline the exercise session averaged 14.5 minutes in duration and was fairly constant. Following the implementation of the contingency, exercise session length became more variable, but with an observable downward trend, and averaged 11 minutes across this phase.

As shown in Figures 2 and 3, during baseline the group mean
Figure 1: Daily mean percent of participation in exercises and games ($N = 10$) and exercise session length during baseline and group contingency phases. Participation is scaled on the left ordinate, and exercise session length on the right ordinate.
Figure 2: Daily mean number of toe touches, knee bends and jumps completed during baseline and group contingency phases. Horizontal broken lines represent mean performance level for each condition.
FIGURE 2

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Figure 3: Daily mean number of situps and pushups completed during baseline and group contingency phases. Horizontal broken lines represent mean performance level for each condition.
Figure 3

Mean number of exercises completed.
number of exercises completed by the subjects was close to but did not reach criterion for the five exercises. The means for each exercise during this phase were: 16.4 toe touches, 13.8 knee bends, 29.8 jumps, 8.4 situps and 11.1 pushups. With the implementation of the group contingency there was an increase in the number of exercises completed. During this phase subjects averaged 23.8 toe touches, 18.9 knee bends, 38.2 jumps, 13.2 situps and 18.8 pushups.

An analysis of the individual data showed that for a majority of the subjects the group means were representative of individual performance. Table 1 shows the mean number of each exercise completed by the ten subjects during the baseline and group contingency phases. During baseline four subjects (4, 6, 7, 8) performed above criterion on most of the exercises. Four other subjects (1, 2, 3, 5) averaged close to, but did not exceed, criterion on the five exercises. The final two subjects (9 and 10) performed consistently below criterion on all five exercises.

Implementation of the group contingency had little effect on the number of exercises completed by those subjects who were already performing above criterion. Subjects who were performing below but close to criteria during baseline showed increases in the number of exercises to a point at or above criterion. A substantial increase was seen in the number of exercises completed by subjects who had been performing considerably below criterion. Subject 2 withdrew from the study at the start of the group contingency phase.
Table 1: Mean number of exercises completed by each subject during baseline and group contingency phases.
TABLE 1

MEAN NUMBER OF EXERCISES COMPLETED BY EACH SUBJECT DURING BASELINE AND PREMACK CONDITIONS

<table>
<thead>
<tr>
<th>Subject</th>
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<tr>
<td></td>
<td>Toe Touches</td>
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<tr>
<td>1 Baseline</td>
<td>18.4</td>
</tr>
<tr>
<td>Premack</td>
<td>22.3</td>
</tr>
<tr>
<td>2 Baseline</td>
<td>18.3</td>
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<tr>
<td>Premack</td>
<td>--</td>
</tr>
<tr>
<td>3 Baseline</td>
<td>17.9</td>
</tr>
<tr>
<td>Premack</td>
<td>20.1</td>
</tr>
<tr>
<td>4 Baseline</td>
<td>24.6</td>
</tr>
<tr>
<td>Premack</td>
<td>29.2</td>
</tr>
<tr>
<td>5 Baseline</td>
<td>17.8</td>
</tr>
<tr>
<td>Premack</td>
<td>22.6</td>
</tr>
<tr>
<td>6 Baseline</td>
<td>23.6</td>
</tr>
<tr>
<td>Premack</td>
<td>26.7</td>
</tr>
<tr>
<td>7 Baseline</td>
<td>21.4</td>
</tr>
<tr>
<td>Premack</td>
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<td>8 Baseline</td>
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<td>9 Baseline</td>
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DISCUSSION

Present results suggest that games were an effective reinforcer in increasing participation in exercises. As indicated by the data, participation in exercises was low during baseline. Participation in games during baseline was quite high, indicating that games may have been more reinforcing to the subjects. When participation in games was made contingent upon participation in exercises, there was an observable increase in participation in exercises.

It should be pointed out that it was not the order of presentation of games and exercises but rather the specific contingency that resulted in changes. This is shown by the data indicating that there were no sequence effects. Although during baseline, on alternate days, the games condition followed the exercise condition (a situation similar to the contingency phase), there was no contingency that restricted the availability of the games. At the conclusion of the fifteen minute exercise session subjects were allowed to play games regardless of whether all subjects had completed the exercises. During baseline participation in exercises and exercise completion were similar whether games preceded or followed the exercises session. Only when the specific contingency was implemented was there an increase in exercise participation and completion.

The number of repetitions per exercise done by the subjects also increased as a result of implementing the premack contingency.
In addition, the length of time required to complete the exercises decreased during the group contingency phase.

An examination of the individual data showed that some of the subjects were performing close to or at criterion in the completion of exercises during baseline. In spite of this, data on participation in exercises during baseline averaged below fifty percent. It was hypothesized that although some subjects were completing the exercises there was much off-task behavior during the exercise session and the entire fifteen minutes was required for a majority of the subjects to complete the exercises. With the implementation of the group contingency, participation in exercises increased to above ninety percent, indicating that off-task behavior was substantially reduced. As a further indication of the reduction of the off-task behavior, the length of time required to complete the exercises decreased. In addition, the number of repetitions of exercises completed increased during the group contingency phase. Thus, subjects performed consistently above criterion on the five exercises, indicating that after implementation of the group contingency, subjects completed more exercises in less time.

There seemed to be slight upward trends in the mean number of exercises completed for all five exercises during baseline. This may have been caused by a practice effect. It is felt that this trend did not confound the results. Data seemed to stabilize during the last several baseline sessions for all the exercises. There were also discernable increases in mean number of exercises completed on the first session of the contingency phase for three
exercises (toe touches, jumps and pushups) and within two sessions for the other two exercises (knee bends and situps).

It might be questioned that, because many subjects were completing the exercises eventually anyway, whether reducing the amount of time required to complete the exercises was warranted. In situations where subjects are performing exercises on their own (e.g., at home alone) this question is legitimate. But in situations where subjects are a part of a class and there are time restrictions, as was the case with this group of subjects, not only in the present study, but in a previously scheduled exercise class at the center, finding ways to reduce off-task behavior and the time required to complete exercises would be beneficial. Using games as a reinforcer was shown to be effective for this purpose.

Equally important, in cases where subjects completed few or no exercises (specifically Subjects 9 and 10), there were substantial increases in the number of exercises completed after the implementation of the contingency. If subjects who were high performers had been removed from the sample, there would have been even more substantial differences between baseline and contingency phases. Also, the mean number of exercises completed by the group of subjects increased after implementing the group contingency. Therefore, games were successfully used as a reinforcer to not only reduce off-task behavior but to increase the number of exercises completed.

There may be several reasons why exercise completion averaged
close to criterion during baseline. It is possible that the criteria established for the five exercises were set too low. That is, the number of exercises required may not have been difficult for the subjects to complete. This problem might have been solved by establishing individual criteria for each subject.

In addition, as part of the procedure subjects were prompted if they failed to complete the exercises. Although a chart was constructed to assist the subjects in determining the number of each exercise to be completed, informal observations indicated that few subjects used the chart and the majority of the subjects required prompts in order to complete the five exercises. It is probable that without the prompts exercise completion and percent of participation in exercises would have been even lower during baseline. Finally, there seemed to be additional prompting by some subjects to other subjects who were not participating. This peer pressure may have had an effect.

Because games were an effective reinforcer for the subjects it would seem that utilizing the premack contingency in this way would have many practical advantages. In many settings there are certain restrictions on the availability of costly reinforcers. There was little cost associated with the present procedure. Tangible or token and backup reinforcers were not necessary. There was an initial cost in purchasing needed equipment for the games, but there were no additional costs. This approach would be particularly valuable in physical education classes for the
retarded or other populations. Most such programs already have the necessary equipment and games are often an integral part of the physical education program. Using games as a reinforcer would merely require rearranging the schedule of activities and making the availability of games contingent upon completion of exercises.

Because there has been so little research done utilizing an applied behavior analysis approach with physical education for the retarded there are many possibilities for future research. Since games were such an effective reinforcer it would be interesting to investigate these activities more closely. One area of investigation would be the reinforcing value of a variety of games. Different types of games may be more reinforcing to subjects than others.

It would be valuable to determine or increase the fitness value of games per se. It has been suggested that specific exercises be integrated into games. For example, relay races may be played that require subjects to actually perform an exercise as one component of the relay. It might also be possible to discover or develop games that have specific fitness value in themselves.

The contingency used in the present study could also be employed to reinforce systematic increases in the number of exercises completed. The exercise completion criteria could be systematically increased in gradual steps, with games used to reinforce this increased performance by subjects.

Finally, future applications of behavioral techniques to the area of physical education should not only employ measures such
as completion rates, participation and time requirements, but should also attempt to objectively assess the long term physiological benefits of improvements in these measures.
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