THE UNIVERSITY OF MANITOBA

SELF-MONITORING AND SELF-ADMINISTRATION OF TOKEN REINFORCEMENT IN A PRODUCTION TASK WITH RETARDED MALE ADULTS IN A SHELTERED WORKSHOP

by

Frank Hanel

A Thesis

Submitted to the Faculty of Graduate Studies

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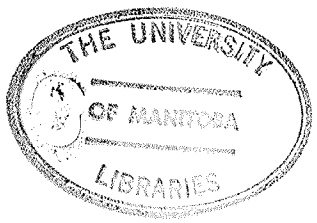

ABSTRACT

Although many studies have demonstrated the effectiveness of self-regulation strategies with non-retarded populations, relatively few studies have examined their value for retarded workers in vocational settings. A Self-Regulation Package (SRP), which incorporated self-monitoring and self-reinforcement procedures, was investigated as a strategy for increasing the productivity of sheltered workshop clients. A combined multiple-baseline, multi-element, reversal-to-baseline design was used to evaluate the SRP. As a function of the presence of the SRP, production of the 8 clients increased by an average of 43% (range: 19 - 60). Social validation procedures revealed that clients preferred to work under SRP conditions versus baseline conditions. Since many workshops for the retarded have client/staff ratios which do not readily permit staff to undertake additional duties, the adoption of self-regulation strategies could represent an effective and acceptable means of assessing and improving individual rates of production.

ACKNOWLEDGEMENTS

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Introduction

Several recent reviews (e.g., Bellamy, 1976; Martin & Pallotta-Cornick, 1979) indicate that researcher activity with the retarded in sheltered-workshop settings has emphasized the examination of variables intended to increase productivity. Some of the types of variables most frequently studied include the effects of antecedent events, consequent events, and general setting characteristics.

When behavioral strategies involving such classes of variables have been applied in sheltered workshops, they were usually administered by researchers or workshop staff. A relatively unexamined possibility is that retarded workers could self-administer such strategies to increase their productivity. When individuals arrange environments in order to change their own behavior, such procedures are called either self-control, self-management, or self-regulation strategies.

Two effective components in self-regulation strategies are self-monitoring and self-reinforcement. These procedures have been frequently used in studies with non-retarded populations. For example, Mahoney (1974) evaluated the effectiveness of self-reinforcement and self-monitoring procedures in obese adults. He found that self-monitoring alone produced small, transient weight reduction. A goal-setting component implemented in conjunction with self-monitoring did not improve weight losses. When self-reinforcement, which permitted participants to retrieve a portion of their money deposit, was added to the above procedures significant weight decrements resulted.

In other circumstances, self-monitoring alone has been shown to be effective. Komaki and Dore-Boyce (1978) illustrated this point in an investigation using undergraduate students who were either highly motivated or lowly motivated, as assessed in questionnaires, to increase their verbal participa-

tion in group discussions. Self-monitoring the frequency of verbalizations produced significant increases in talking for highly motivated students but not for those who were lowly motivated.

Self-regulation procedures have also been demonstrated to be effective in applications with retarded individuals. For example, Shapiro and Klein (in press) taught mildly retarded children to assess and reinforce their own on-task behavior during pre-academic tasks. Teacher-administered instructions and gestural stimuli were faded until children could independently determine on-task behavior, then fading techniques were used to teach them to self-administer token reinforcers. The procedure was found to increase on-task behavior when it was self-reinforced. As well, collateral effects were observed in improved task performance, accuracy of self-assessment, and diminished problem behavior.

Working with mildly retarded adolescents in a classroom setting Nelson, Lipinski, and Boykin (1978) showed that students' rates of appropriate verbalizations could be raised using a self-monitoring procedure. Following training in the use of a counting device, which was either held in the hand or worn on the belt, self-monitoring of classroom comments produced small but reliable increments in their rate of occurrence. In an earlier study in a similar setting Nelson, Lipinski, and Black (1976) trained moderately and mildly retarded adolescents and adults to self-monitor the frequency of either positively-, negatively-, or neutrally-evaluated behavior. During the self-monitoring condition, participants recorded target behaviors on index cards. The results indicated increases in positively-evaluated behavior (talking), significant decreases in neutrally-evaluated behavior (object-touching), and equivocal changes in negatively-evaluated behavior (face-

touching).

Simpson (1978) trained two moderately retarded school children in procedures involving a combination of self-monitoring, self-administration of token reinforcers, self-instructions, goal-setting, and visual feedback. The children were taught to: instruct themselves to cease an undesirable behavior and to praise themselves upon its cessation; record occurrences of the undesirable behavior using wrist-counters; reinforce this behavior by transferring token pegs on a pegboard. At the end of each session, data were posted on a frequency graph and bonus points (pegs) were awarded for a decrease in behavior relative to the level of behavior which occurred on the previous day. In addition, a bonus was available for achieving low-levels in undesirable behaviors, but the author did not specify the minimal level of behavior required to meet this criterion. The pegs were converted to back-up reinforcers at the end of each session. The self-regulation package produced immediate and marked reductions in each of the targeted behaviors. During a 2- to 4-week follow-up period, two of the three undesirable behaviors continued to decrease, while the third behavior gradually returned to its pre-training level. The implications of the follow-up data are unclear, however, since the conditions under which they occurred (for example, whether wrist-counters were available to the children) were not described.

Although self-regulation procedures have been used extensively with non-retarded populations and to a much lesser extent with retarded individuals, very little research has been conducted which examined these procedures in the modification of vocational skills in the retarded. Only three such investigations were located, Two of these studies examined the role of self-administered token or edible reinforcement in vocational tasks, and

the third assessed the effects of self-monitoring supervisory behavior in a sheltered workshop.

Helland, Paluck, and Klein (1976) compared self-administered reinforcement with experimenter-administered reinforcement in two groups of mildly retarded workers engaged in a paper-collating task. The self-administered group was trained to praise themselves and simultaneously select monetary or edible reinforcers (located in a pile in front of them) after each set of 10 that were collated. The second group was trained under identical conditions except that their praise, money, and edible reinforcers were dispensed by the experimenter. The findings showed that self-administered reinforcement was as effective as experimenter-administered reinforcement, each group increasing productivity three-fold over baseline rates.

Horner, Lahren, Schwartz, O'Neill, and Hunter (1977) evaluated the relative efficacy of self-administered tokens versus supervisor-administered tokens upon the duration for task assembly in a severely retarded client. Supervisors delivered tokens and praise for work completion during baseline phases. In experimental phases the client delivered his own tokens. Upon assembly of a 10-part test adapter, the client operated a lever which pushed a token onto his work bench. The self-regulation strategy was assessed in an ABAB reversal design which revealed that assembly time was reduced by approximately 50% during phases in which reinforcement was self-administered. While these data indicate that self-administered tokens were more effective than supervisor-delivered tokens and praise, some qualification of these findings is necessary. Some of the effectiveness of the procedure may be attributed to the sound of a bell which sounded as each token was self-administered.

The only study available which focused upon self-monitoring in a

vocational setting was conducted by Goyos (1978). In this study, one moderately retarded worker and one mildly retarded worker were trained to identify the on-task behaviors of other workshop clients working on three different tasks. The workers were instructed to supervise 11 clients, praising or otherwise interacting with them as much as possible whenever clients were on-task and to record these interactions using wrist-counters. Self-monitoring resulted in large increases in the number of on-task interactions initiated by both workers in each of the tasks performed by clients. The frequency of off-task contacts with clients did not vary substantially when the frequency of on-task interactions increased. Interestingly, clients' productivity did not change as a function of increased attention contingent upon on-task behavior. Several reasons given for this finding were possible ceiling effects occurring across conditions and the brevity of sessions (10 min each) relative to the duration of an entire work day.

These several studies suggest that a combination of self-monitoring and self-administration of reinforcement procedures may have some utility in altering behaviors of retarded workers. In a recent study, for example, Martin, Pallotta-Cornick, Johnstone, and Goyos (1979) combined a number of singly-effective variables into a supervisory production strategy which successfully increased the productivity of severely to mildly retarded workshop clients.

At present, the consistent assessment of productivity levels occurring in an individual workshop client is time consuming but feasible; an assessment of the performance of a number of clients on a consistent basis is difficult and very time consuming; regular assessment of performance and the frequent application of contingent reinforcement by workshop personnel is

a very improbable undertaking, given typical staff/client ratios found in sheltered workshops. A procedure which permits workers to monitor and reinforce their own production behaviors could be a valuable adjunct to vocational settings for the retarded.

Following the strategy adapted by Martin et al. (1979), the present investigation examined the effects of a self-regulation package incorporating both self-monitoring and self-administration of reinforcement techniques upon the productivity of retarded workers. The clients' preference for working under the package contingency relative to baseline conditions was also evaluated, as recommended by Kazdin (1977) and Wolf (1978).

Method

Subjects

Eight retarded adult males, ages 19 - 54 (mean = 28), participated in the study. As a group, they comprised severe to mild levels of retardation. To be included in the study, clients had to be available for daily work in the setting for a period of several months, and be free of serious impairments in vision, hearing, and manual dexterity. All had previous workshop experience and probable exposure to behavioral programs at some time. Several clients worked in institutional placements requiring light housekeeping duties. Individual client characteristics are presented in Table 1.

Insert Table 1 about here

Setting

Procedures were carried out in the Northgrove occupational training center, one of two sheltered workshops located in the basement of a residential complex at the Manitoba School for the Retarded, Portage la Prairie, Manitoba. The

Table 1

Characteristics of Subjects

Client	Chron. Age	Time in Inst.	Test	Test Results	Institutional Diagnosis
1	21 yr	3 yr	WAIS	FSIQ 65	mildly retarded cause unknown
2	38 yr	23 yr	PPVT	SQ .25	severely retarded Down's Syndrome
3	20 yr	9 yr	WAIS	FSIQ 46	moderately retarded
4	54 yr	11 yr	WAIS	FSIQ 50	moderately retarded epilepsy
5	21 yr	8 yr	WAIS	FSIQ 65	moderately retarded cerebral palsy
6	19 yr	8 yr	WAIS	FSIQ 25	moderately retarded cause unknown
7	26 yr	12 yr	S-B	IQ 26	severely retarded Down's Syndrome
8	28 yr	6 yr	-	IQ 42	moderately retarded cause unknown

workshop was a large room containing five production tables, several racks and cupboards, and two office desks. Besides the experimenter, three staff supervised 30 - 35 clients, five days a week. The clients were seated four-to-a-side at a production table which measured 2.4 m by 1.2 m. Wooden bins containing product components were located on the bench in front of subjects. A bin measured 1.1 m by .19 m by .15 m and was divided into four compartments. Each bin was used by two workers. The workshop typically bustled with activity and noise as materials entered and left the shop and were distributed to clients' work tables. Popular music was often played over the workshop sound system and clients frequently sang aloud.

Apparatus

A "Mark Time" mechanical timer was used to clock sessions. A small bell inside the timer sounded when it timed out. In sessions in which the partition (see below) was not in place, the timer was positioned at the end of the work table at the start of each session. When the partition was in use, the timer was placed on the partition cross-piece. The timer was removed from the table at the end of each session.

A marble-dispensing device was used by clients during self-regulation sessions. The device was constructed of two pieces of 1.2 cm plywood. The larger piece was 25.4 cm by 30.5 cm and formed the backboard of the device; the smaller piece measured 10.2 cm by 30.5 cm and formed the base. Four 22 cm clear-plastic tubes (inside diameter = 16 mm) were mounted 3.2 cm apart on the front of the backboard. Facing the front of the device, the tube furthest left was positioned 1 cm from the left edge of the device. Since this tube served a goal-setting function, the surface behind and at the base was yellow (width of yellow surface = 4.3 cm). The remaining frontal surface of the

device was white, except for a heavy black line separating the yellow and white portions. Two numeral "10"s marked the heights of columns of 10 marbles. Fastened to the back of the device was an S-shaped glass tube (inside diameter = 16 mm) which was capable of holding 50 marbles. Blue and orange glass marbles, each 4.3 cm in diameter, were used. They fed by gravity into a cup-shaped depression in the lower end of a wooden lever. The lever, painted green for discriminability, was mounted on a pivot; when the lever was pressed downward, the marble was raised vertically and exited through a 2 cm hole to the front of the device. A dispensed marble was collected in a shallow, cork-lined coaster-receptacle (diameter = 8.6 cm) mounted on the base immediately below the hole. A small 3 cm by 4 cm cloth curtain covered the hole. Cork stoppers prevented marbles from leaving the goal-setting and S-shaped tubes. Two metal J-shaped hooks were fastened to the back of the device. This permitted the device to be easily attached and removed from a client's product bin. A piece of protective foam rubber 12 mm thick covered the back of the device. The device is illustrated in Figure 1.

Insert Figure 1 about here

Experimental Task

Throughout the experiment clients assembled airline coffee packs. Prior to the experiment, all clients had had experience with this task. The task involved folding a dispenser napkin in half lengthwise, then folding the narrowed napkin, making its length approximately 1/3 shorter. The napkin was inserted into a 6.5 cm by 14 cm cellulose bag so that the folded portion was positioned at the top of the bag. A packet of sugar and a plastic stir stick were then placed in the bottom-front of the bag. The front of the

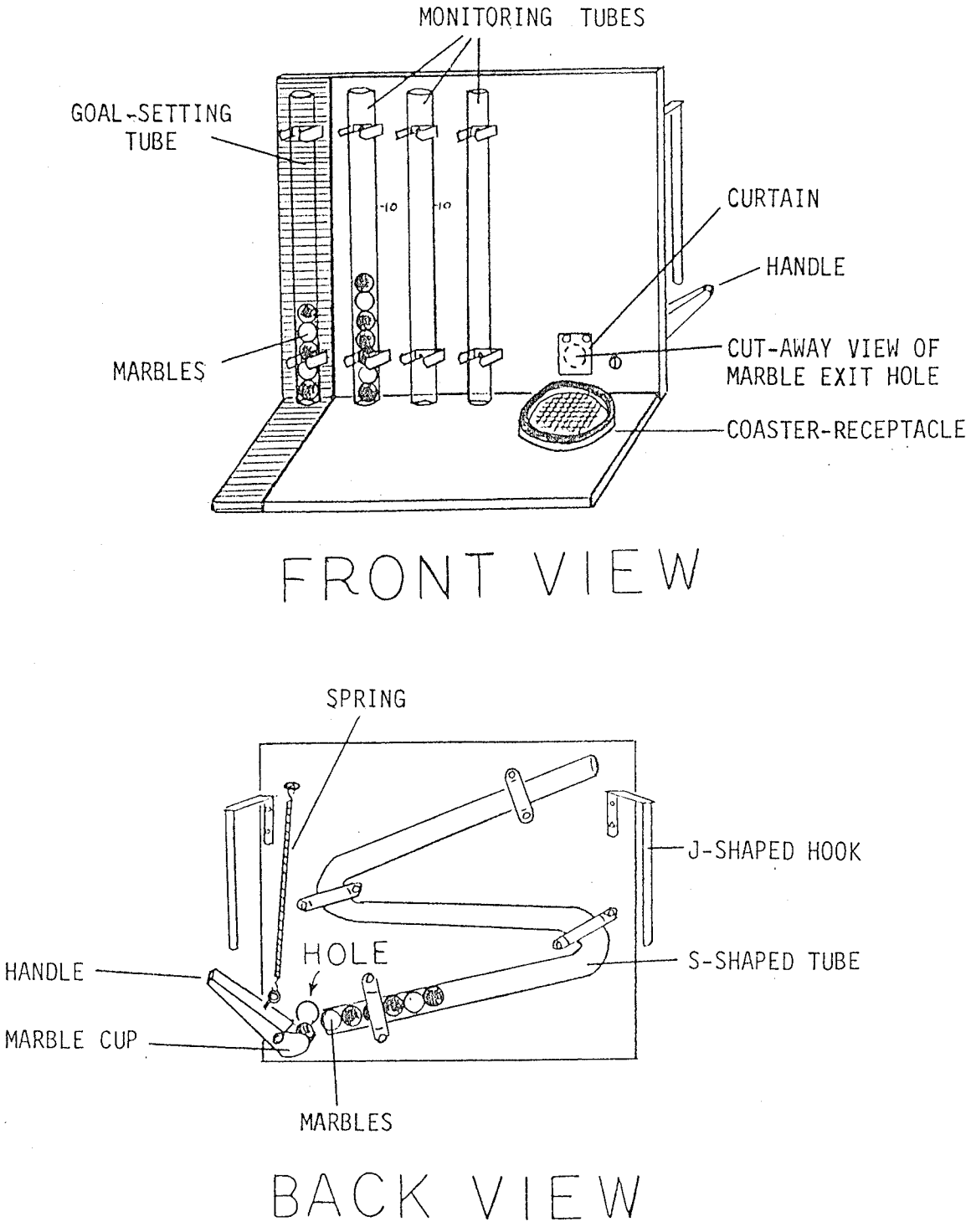


Figure 1. The marble-dispensing device. The upper panel depicts the front view; the lower panel depicts the back view.

bag was lettered and imprinted with a heavy blue mark. Assembled coffee packs were placed into a receiver tray located on the bench in front of the subjects.

Experimental Sessions

Session characteristics. Six sessions were run daily, Monday through Wednesday, over a three-month period. Each session was 20 min long. Clients reverted to the supervision of regular workshop personnel during the two days of the week the experimenter was absent. During sessions 1 - 95, two sessions were held during the morning and four in the afternoon. Thereafter, three sessions were run in the morning and three in the afternoon.

At the beginning of each session, the experimenter announced: "O.K., everybody, I'm going to set the timer to begin a session." As the timer was set, the experimenter continued, "O.K., I've set the timer, now everybody go to work please", and placed the timer in its appropriate position on the production table. When the timer timed out, the experimenter asked: "Did everyone hear the bell? The session's over. Please stop working." The timer was removed and placed out of the clients' view.

At the end of each session, clients' receiver trays were removed and replaced with empty ones. Clients were permitted to continue working during intersession breaks, however, experimenter interactions with them at these times were minimal. Products which were assembled during intersession breaks were removed immediately prior to the start of the next session.

Experimenters. The author conducted all sessions up to and including session 121. Beginning with session 122, a female experimenter was gradually faded into the program over the next five sessions. To accomplish this, she delivered the fourth general prompt and the fourth series of on-task

reinforcements (described below) in session 122, then she delivered the third and fourth of these interactions in session 123, and so on, so that by the end of session 126 and in all subsequent sessions she was in full control of all experimental contingencies. During this fading procedure, she also gradually assumed other necessary functions such as dealing with problem behaviors and giving corrective feedback. The female experimenter was enrolled in a course in introductory behavior modification and was paid for her participation in the study.

Controlled Variables

General prompts. In order to approximate the frequency of staff-client interactions which occurred in workshops in the Manitoba School, general prompts to begin or to continue to work were given four times each session at irregular intervals. For example, the experimenter approached the production table and addressed the entire group of clients as follows: "O.K., fellows, I want everyone to work as hard as you can this morning." These four prompts occurred in every session throughout the duration of the experiment. The first of these prompts immediately followed the setting of the timer.

On-task reinforcement. In every session clients received four individual instances of verbal praise, at irregular intervals, for working on-task. To be on-task a client had to be manipulating components of the assembly task or dispensing device leading to completion of the operation. During this procedure the experimenter moved from client to client, mentioned an individual by name and praised him for working. If an individual was off task, the experimenter ignored him, but returned to give praise when working resumed.

Verbal interactions. Any verbal interaction not required in other experimental procedures was recorded. Verbal interactions were typically

initiated by the experimenter or other staff since clients' non-work related verbalizations were usually ignored. Two types of verbalizations were not recorded: clients' comments to which the experimenter did not respond, and inter-client verbalizations.

Corrective feedback. To maintain or improve the quality of production, clients were given periodic feedback for errors. A client who was observed committing an error, or whose last-completed product was incorrectly assembled, was instructed regarding the nature of the error, the correct task assembly was modeled, and the client was given verbal praise for appropriate assembly behavior.

When the self-regulation device was being used, feedback was given pertaining to improper use of the apparatus, such as depressing the lever with too much force, placing a marble in the wrong tube, lifting the curtain covering the exit hole, failing to move a marble from the coaster-receptacle to the monitoring tube, and neglecting to self-monitor when a pack was assembled. Feedback in the latter case was initiated only if the client had not yet begun to assemble another pack.

Problem behaviors. Because clients sometimes engaged in behaviors which competed with desirable workshop behaviors, a procedure for dealing with undesirable behaviors was in effect. Clients' undesirable behaviors included causing another client to cease working, moving more than 2 ft away from a work station without permission, self-stimulation, swearing, having soiled hands or face, throwing work material on the floor, ripping napkins, being non-productive for several minutes, and so on. The experimenter did not intervene in every instance of problematic behavior, preferring at times to ignore it. When intervention was deemed necessary, the experimenter addressed

the client, described the infraction, suggested more appropriate behavior to engage in, and verbally praised improved behavior if it occurred within 1 min after the termination of the problem behavior. An instance of problematic behavior was recorded immediately, acting as a cue to the experimenter to provide and then record social approval contingent upon appropriate behavior.

Situational structuring. Following the advice of Martin and Pear (1978), a wooden partition was introduced for all sessions beginning in session 36. The partition was .52 m high and was constructed of 1.2 cm plywood. Its cross-shaped structure divided the production table into four sections with two clients seated in each section. The main function of the partition was not to pair subjects but to reduce between-client interaction during experimental phases.

Workshop incentive systems. Prior to and during the study, four clients (Subjects 3, 5, 6, and 7) were included in ward-sponsored programs which provided reinforcement contingencies for appropriate workshop behavior and productivity.

Whether a client's workshop behavior was acceptable was indicated on slips of paper carried by each individual. During the program the experimenter made this judgment, which was not data based. On the days when the program was not conducted, workshop personnel made this judgment. Also, Subject 3 was involved in a ward-sponsored program concerning aggressiveness and swearing and Subject 5 was in a similar program which concerned absences from the workshop. Appropriate behavior was consequated daily with brightly-coloured stars and geometrical shapes which were posted on charts. For all the programs described above, back-up contingencies were supplied on

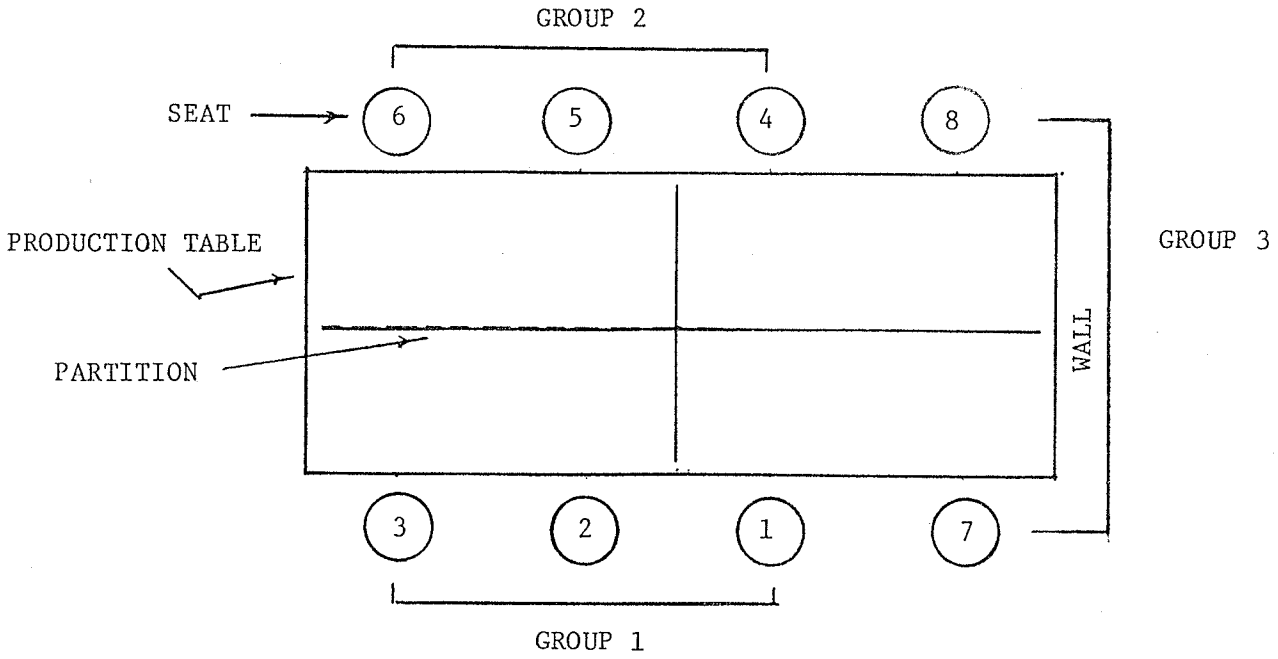
clients' home wards. The extent to which the back-up contingencies were consistently applied could not be determined as wards kept no records of the transactions.

In addition to these contingencies, all clients received a stipend at the end of the week ranging from $1 to $3, depending on a client's rate of pay. This pay system was in effect prior to the program and was in effect up to session 96, at which time seven clients began receiving $2 per week. The eighth client, Subject 1, began receiving $3 per week. Payday was on Fridays, a day of the week in which the program was not run.

Experimental Groups

Clients were included in experimental groups according to production-rate data collected prior to baseline. Clients were observed assembling airline packs during three to five 20 minute periods under pre-experimental workshop conditions. They were not aware they were being observed. The three higher producing clients, Subjects 1, 2, and 3, formed Group 1. Mean rates of productivity per hour were 21, 17, and 14, respectively. Lower producing clients, Subjects 4, 5, and 6, formed Group 2. Mean production rates for these individuals were 3, 12, and 4 per hour, respectively. Group 3 was a delayed-treatment control group, formed by Subjects 7 and 8. Their mean hourly rates were 18 and 10, respectively.

Groups 1 and 2 were seated on opposite sides of the production table. Subject 7 sat on the same side of the table as Group 1 and Subject 8 was seated opposite him, with Group 2 subjects. The seating arrangement is depicted in the following diagram:



Dependent Variables

Rate of production per hour. Productivity was calculated by dividing the total number of packs assembled in a session by the total session time (.33 hr), and rounding to the nearest whole number.

Percentage of correct production. The quality of production was determined by dividing the number of packs correctly assembled in a session by the total number of packs produced in a session, multiplied by 100.

Self-Regulation Training

Each group received eight consecutive 20 minute training sessions. The author trained Groups 1 and 2 and the second experimenter trained Group 3. To begin a session, the self-regulation devices were attached to the bins in front of the clients. The experimenter instructed individual clients with statements such as, "I'm going to teach you how to count the packages you make. O.K., make a package." The experimenter positioned himself behind the clients

and as one of the clients placed an assembled coffee pack in the receiver tray, the experimenter said, "Every time you make a package push this handle down", and pointed to the handle. As a marble dropped into the receptacle, the client was instructed, "Take the blue marble and put it in this tube", as the experimenter indicated the empty tube adjacent to the goal-setting tube. The experimenter said, "This marble means you have made one package; see you've made one package and you've counted one marble. Now make another package."

In the first training session marbles in the dispenser were arranged so that the third marble delivered was an orange, token marble. When this marble was dispensed the experimenter exclaimed, "Wow! You've got an orange marble! Orange marbles are worth a penny! Here's your penny!" The client was then instructed, "Put the orange marble in the same tube as the blue marbles; orange marbles count, too".

As the level of marbles accumulating in the monitoring tube approached the level of those in the goal setting tube, the experimenter drew attention to this fact. "If you get more marbles in your counting tube than in this tube", the experimenter pointed to the corresponding tubes, "I'll give you an extra (so many) pennies". In the first and second training sessions, pennies were awarded as soon as a goal-setting level was exceeded and were exchanged for token marbles as they were earned. In all other sessions, pennies were paid only at the end of the session. Pennies could be exchanged for edibles at the end of each training session.

Typically, the experimenter stood behind the group of clients being trained, prompting and giving feedback as necessary. As training progressed, instructions controlling self-regulation skills were gradually faded out,

according to a standardized procedure. In each of the initial five sessions of training, the experimenter delivered approximately 12 miscellaneous prompts per client. In the sixth training session, each client received six general prompts, six individual on-task reinforcements (verbal praise), and three or four additional prompts. While the number of additional prompts received remained about the same in the last two sessions, general prompts and on-task reinforcements were reduced to five each in the seventh session and to four each in the eighth session. The level of interactions in the final training session approximated those occurring in regular sessions.

During training, tokens for Group 1 and Subject 7 were dispensed according to a VR3 (range: 1 to 5) schedule in all sessions. For Group 2 and Subject 8, the lower-producing clients, a VR2 (range: 1 to 3) schedule was in effect for the first five sessions, then clients were shifted to a VR3 (range: 1 to 5) schedule for remaining sessions.

Training was carried out in the same area of the workshop and at the same production table used throughout the experiment. While a group was receiving training, other clients continued to work at the same table. However, interaction with them was minimal. Because the timer could have served as a discriminative stimulus indicating a session was in progress for other clients at the table, a wristwatch was used to time sessions. General prompts were directed as much as possible to only those individuals undergoing training. Errors in task assembly were not recorded during training.

Independent Variables: A Self-Regulation Package (SRP)

During SRP sessions, the marble-dispensing device was attached to clients' production bins. The device permitted clients to monitor their production while receiving immediate token reinforcement for task completion, and to

gain visual feedback regarding their current performance relative to average baseline productivity.

Self-monitoring. Following the completion of each coffee pack, a client depressed a lever to deliver a marble which was picked up and deposited in the monitoring tube. As a client continued to self-monitor, the individual marbles and the height of the column of marbles in the tube visually represented productivity occurring in the session.

To determine the proportion of session time spent in contact with the device, a stopwatch was used to record the duration of self-monitoring. Timing began when a client's hand touched the lever and ended when the marble was deposited in the monitoring tube. If a marble fell to the table or floor, timing continued until it was placed in the monitoring tube or a client assumed his usual working posture, that is, he was about to resume work because the marble was not retrieved. Other behaviors which were timed included pointing a finger at marbles in the tubes as if counting them, and touching any part of the device. These behaviors were recorded throughout a session. Each client was assessed several times during the experiment.

The percentage of accuracy in self-monitoring sessions was assessed by determining the number of marbles in the monitoring tube(s) and the number of coffee packs contained in the receiver tray, and dividing the smaller of these figures by the larger, times 100.

When accuracy in self-monitoring fell below 90%, clients were given a booster session in which they practiced appropriate self-monitoring behavior. This session occurred just prior to the next SRP session. To start a booster session, the experimenter placed the self-regulation device in front of the client and said, "O.K., (client's name), we're going to practice counting.

Every time you make a package, push the handle. O.K., you can start working now." If a client did not depress the handle of the dispensing device within several seconds of placing an assembled pack in the receiving tray, he was prompted to do so and praised as a marble was deposited in the monitoring tube. Clients were praised following each instance of appropriate self-monitoring.

The device contained only blue monitoring marbles to lessen the probability that a booster session would serve as a reinforcement contingency for inaccurate monitoring. Instructions and corrective feedback were given as required, but no data were kept of their occurrences. A booster session terminated when five consecutive packs were self-monitored.

Self-administration of token reinforcement. Devices were pre-programmed to deliver orange token marbles according to a VR3 (range: 1 to 5) schedule. Thus, on the average, every third marble dispensed by the device was a token marble. Three different VR3 schedules, all having a range of 1 to 5, were constructed using a table of random numbers. During a session, each client worked on a different VR3 schedule. Identical schedules may have led to the predictability of reinforcement by a client who could observe the reinforcers delivered to another client who was more advanced in the schedule. Each type of VR3 schedule was in effect for a block of three self-regulation sessions, after which clients were shifted to a different VR3 schedule.

The level of income derived by the workshop for coffee pack production allowed payment to clients of approximately one cent for every three packs assembled. Therefore, the value of a token marble was set at one cent since clients would self-administer one token marble, on the average, for every three packs produced.

At the end of a session, the experimenter asked each client, "How many

orange marbles did you get?". The experimenter pointed to each token marble in the monitoring tube as they were counted, and when they were tallied he said, for example, "You've got five orange marbles! You get a penny for each orange one so altogether you get five pennies! Here's your money!" The experimenter then counted aloud as each penny was given to the client.

Token marbles were exchanged for pennies at the end of every SRP session. Clients could either keep the pennies they earned or exchange them for edible reinforcers. Cash-in time for back-up reinforcers always took place at the end of the morning and afternoon work periods. The only exception to this occurred in the first self-regulation session following training, when cash-in occurred at the end of the session. At cash-in time, clients were taken to the "store" at one end of the workshop. The "store" consisted of a cupboard containing a variety of edibles including chocolate bars, gumdrops, cookies, chocolate-covered candies, peanuts, etc., from which clients could select back-up reinforcers. Prices were comparable to those found in regular retail outlets.

Goal-setting. The first plastic tube on the left-hand side of the self-regulation device was used in a goal-setting procedure. The quantity of marbles in this tube was based upon each client's average baseline performance. For example, if a client assembled an average of five packs in each 20 min session during baseline, the goal-setting tube contained five marbles. If the average output was nine per session in baseline, the goal-setting tube contained nine marbles, and so on. Several orange marbles were distributed among the blue ones. The number of marbles contained in each goal-setting tube for Subjects 1 - 8 were: 12, 8, 8, 4, 5, 6, 9, and 3, respectively. Sessions 1 - 49 provided this index for Groups 1 and 2. Sessions 1 - 161 were

used for Group 3. Training sessions were not included in computations.

Clients received bonus pennies at the end of the session if the level of marbles in the monitoring tube exceeded the level of marbles in the goal-setting tube. The size of the bonus was a fixed sum, determined by the number of goal-setting marbles, plus one. This amount was divided by three, since clients were paid one cent for every three packs produced. As an example, the client who had five goal-setting marbles must have monitored at least six packs to qualify for the bonus. Since six packs represented the equivalent of two cents in wages, this client's bonus would have been fixed at two cents. The bonuses determined for subjects 1 - 8 were: 4¢, 3¢, 3¢, 2¢, 2¢, 2¢, 3¢, and 1¢, respectively.

Thus, when pennies had been paid for token marbles and a bonus was to be paid, the experimenter directed the client's attention to the tubes with a comment such as, "Look! This tube has more marbles in it than this one. For making more, you get an extra two cents. Here's your two cents.". The goal-setting contingency was in effect during training and all self-regulation sessions, but not in booster sessions.

Experimental Design

A multiple baseline (Martin & Pear, 1978), multi-element baseline (Ulman & Sulzer-Azaroff, 1975), and a reversal (Hersen & Barlow, 1976) were combined to evaluate the effects of the SRP. The incorporation of these design strategies can be seen in Figure 2. Following are the experimental conditions.

Baseline I. Baseline data were gathered in a different workshop during sessions 1 - 30. This workshop was in the same building and was similar in size and many other characteristics.

Baseline II. Due to reorganization within the Vocational Training Department, clients were relocated in the workshop previously detailed. As in Baseline I, all experimental procedures were in effect but without the SRP.

Multi-element baseline. During this phase, baseline sessions were alternated with SRP sessions within days, according to a quasi-random schedule. This schedule, in which the occurrence of one type of session did not reliably predict which type of session followed, was determined using a table of random numbers. The schedule was subject to the provision that there could be no more than three baseline sessions or three SRP sessions in a row.

Consecutive SRP sessions. In this phase, SRP conditions were in effect in every session each day.

Reversal. The conditions prevailing in Baseline II were reinstituted.

Social Validation of the SRP

The purpose of the evaluation was to assess clients' preference for baseline conditions versus SRP conditions. The preference tests took place one week after the experiment ended, and were conducted during a single day. Seven clients were tested at this time. Because Subject 1 was absent that day, he was tested the following day, but under different conditions. The author carried out the preference testing.

On the day of the tests, the seven clients were taken to a room in another part of the building in which a production table had been set up. Clients worked in this room under the supervision of the second experimenter, until preference testing was completed. In this room the clients began working with a task in which battery caps were inserted in a three-gang retainer. Clients worked on the task for about 30 min, then for the remainder of their time in this room they installed rubber gaskets in Porta-Sink caps.

In the workshop area, the production table used by clients during the experiment was relocated in the far end of the shop, on the far side of the room. Whereas in its usual location one end adjoined the wall, the table was now positioned parallel to it. The table was relocated in order to control for the possibility that clients might make their choices by responding to cues present in its typical location. For example, a client may choose a seat closest to a particular client seated at an adjacent table. The table was set up in exactly the same manner as in previous baseline and SRP sessions. Two chairs were positioned at each side of the table.

Two seating arrangements were used during preference tests as a control for clients' preference for their regular seats. In one arrangement, the chairs were positioned near the ends of the table. This was presented to the four clients who were regularly seated closest to the center point of the table. In the second arrangement, the chairs were positioned nearest the center point of the table and presented to the four clients whose regular seats were at the ends of the table.

On the same side of the table, one position was set up for SRP sessions and the other for baseline sessions, i.e, no marble-dispensing device was present. Each client was given four preference tests. In preference tests 1 and 4, the device was set up in the seat on the left; in tests 2 and 3, the device was set up in the seat on the right.

Clients were brought into the workshop in pairs, permitting the testing of two clients at the same time. The side of the table to which a client was directed was alternated in each test. A client was instructed to stand at a point mid-way between the two chairs. The experimenter always stood to the right of a client. In indicating the possibility of working under baseline

or SRP conditions, the experimenter always began by pointing to the left seat and commenting. "You can sit here and work with the marble machine (if it was located there), or you can sit here (pointing to the location on the right)." Usually, clients pointed to the seat they preferred and the experimenter prompted, "Go ahead, sit down.". The procedure was repeated with the other client.

When both clients were seated the experimenter set the session timer and prompted them to work, as in experimental sessions. During the tests, clients worked for five-minute periods and were given one on-task reinforcement. At the end of the interval clients were thanked for their participation and reunited with subjects in the external room. Tokens earned during tests were exchanged as in SRP sessions.

The preference test for Subject 1 was also conducted in the workshop. Throughout most of the day, the client was seated at a workshop production table other than the one at which he usually sat. At this new location the task involved putting plastic tent pegs into boxes. He received one test in the morning and three in the afternoon, spaced about one hour apart. The tests were conducted at a 1 m by 1 m table situated nearby. A production bin occupied the midline of the table and a chair was located at each side. One side of the table was set up for SRP, the other for baseline. In the test the client was instructed to stand at the end of the table, so that the set-ups were located to his left and right. The procedures and contingencies which followed from this point were the same as those described in the tests with the other clients.

Interobserver Reliability

The author and a second observer (either the second experimenter or a

workshop staff) periodically recorded concurrently in order to assess inter-observer reliability (IOR). Observations were always carried out in such a manner that neither could determine what the other had recorded. During the assessments, several different methods of calculating reliabilities were used. These are described below.

Quality of production. In Baseline I, the experimenter examined each pack in clients' receiver trays and determined the proportion which were assembled correctly. The receiver trays were then transfered to a nearby table where a reliability checker also determined the proportion of correct packs. In all other experimental sessions, approximately 9% of clients' total production was collected for reliability purposes. At the end of every session a non-experimental client was instructed to select one pack from each client's receiver tray, and to vary his choices so that selections were made from the front, middle, and back portions of the packs in the receiver trays. These samples were pooled to represent an entire day's production. This was done in each of the remaining 20 days of the study. During reliability assessments, each pool of daily samples was checked separately. The samples were placed into a metal cross-hatched grid, so that each pack occupied a single, numbered space in the grid. The reliability checkers sat on either side of a 1 m by 1 m table. The grid and a small partition were located at the mid-line of the table. The partition prevented one checker from viewing what the other checker had recorded. When one checker had assessed about half of the packs in the grid, the other checker began assessment. In this manner, an agreement or disagreement regarding each pack was obtained.

Two methods of IOR calculations were used to determine agreements on correct production. In Baseline I, reliability was determined by a ratio of

the number of products assessed as correct by each reliability checker. The smaller number was divided by the larger, times 100. In all subsequent sessions, excluding training, reliability of observations was calculated by dividing agreements by agreements plus disagreements, times 100. As an aid to these judgments, a poster displaying examples of correct and incorrect coffee packs was located on a nearby wall.

Total session production. At the end of a session, the experimenter collected clients' receiver trays, placed them on a separate table, and counted and recorded the total number of packs which were produced during the session. This datum was concealed and a checker then tallied the production. Reliability was calculated by dividing the smaller number of packs counted by one checker by the larger number of packs counted by the second checker, times 100.

Accuracy of self-monitoring. At the end of an SRP session, the experimenter removed the marble devices from the production table and placed them either on a separate table or hung them on metal strips attached to a stand of shelves. The experimenter determined the accuracy with which each client had self-monitored by comparing the number of marbles monitored with the number of packs produced, and dividing the smaller figure by the larger, times 100. These data were concealed and a checker performed the same operation. These data were collected every day in which SRP sessions occurred. This entire set of pairs of scores served as the basis for reliability. Each pair of scores was examined singly. An agreement occurred when both scores were identical, a disagreement occurred when they were not. The IOR was calculated by the ratio of agreements over agreements plus disagreements, times 100.

Social validity. A second observer independently assessed clients' preference for either SRP or baseline conditions. Raters recorded every client's choice. Total agreements over agreements plus disagreements, times 100, yielded percent reliability of this measure.

Results

Mean Productivity Per Hour for Group 1

The mean number of coffee packs produced in Baseline I and Baseline II was 27 and 29, respectively. During training sessions with the SRP, mean productivity rose to 44 packs per hour, as shown in Figure 2. Following the

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Insert Figure 2 about here

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brief training phase, SRP sessions were alternated with baseline sessions. Under these conditions, mean SRP performance remained as high as in training, while performance in baseline conditions returned to about the level in the previous baseline conditions. At session 102, SRP conditions were in effect in every session each day. Mean productivity increased slightly to 48 packs per hour during consecutive SRP sessions, the highest performance attained in any condition. When baseline conditions were reinstituted during the final phase, mean productivity remained high, at 47.

Mean Productivity Per Hour for Group 2

Group 2 evidenced lower rates in Baseline I and Baseline II than Group 1, with means of 12 and 18, respectively. Training produced an increase in hourly performance, to a mean of 25. During the intermittent presence of the SRP in the following phase, mean productivity was 29. Mean baseline productivity in this phase, at 23, was greater than in previous baselines, and only slightly lower than in training. Consecutive SRP sessions showed a

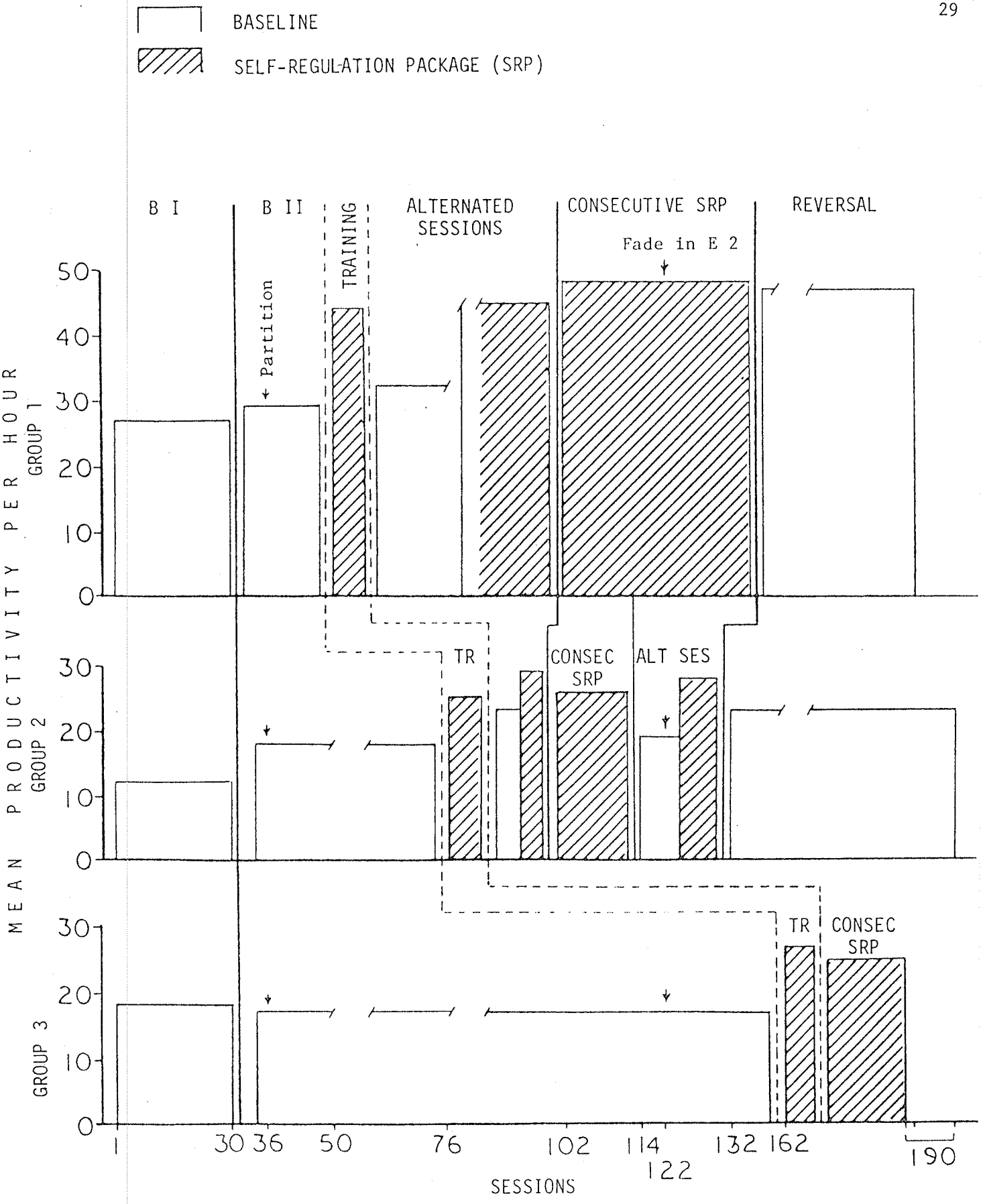

Figure 2. Mean-productivity per hour for Groups 1, 2, and 3. The width of the bars is proportional to the number of sessions in each phase. The broken segments of the bars indicate the cessation of sessions while training occurred in another group.

small decrease relative to immediately previous SRP sessions, to a mean of 26. A return to alternated sessions resulted in a mean baseline performance of 19, approaching Baseline II productivity. In this phase, the mean productivity during SRP sessions was 28. The return to baseline in the final phase showed the mean productivity to be 23 per hour.

Mean Productivity Per Hour for Group 3

The average number of coffee packs produced per hour was 18, in Baseline I. Group 3 was maintained in Baseline II for approximately 105 sessions, substantially longer than Group 1 and 2. Mean productivity was 17. Training in SRP increased average productivity to 27 packs per hour. When the SRP contingency was implemented in consecutive sessions, mean performance changed minimally, to 25 packs per hour.

Mean Productivity of Individual Clients

Two subjects in Group 1 were strongly affected by the SRP. Subject 1 and Subject 3 dramatically increased in mean productivity under SRP conditions, though the effect was not as pronounced in Subject 3. These significant increases persisted when the SRP was withdrawn during final reversal to baseline. Individual data for Subject 2 show that the SRP was a less effective procedure for this client. In fact, his mean performance in the reversal phase was somewhat greater than in any other phase. These data are presented in Figure 3.

Insert Figure 3 about here

Concerning Group 2 clients, results indicate increased performance in the shift from Baseline I to Baseline II. For Subject 4, training did not significantly increase productivity relative to baseline. However, when SRP

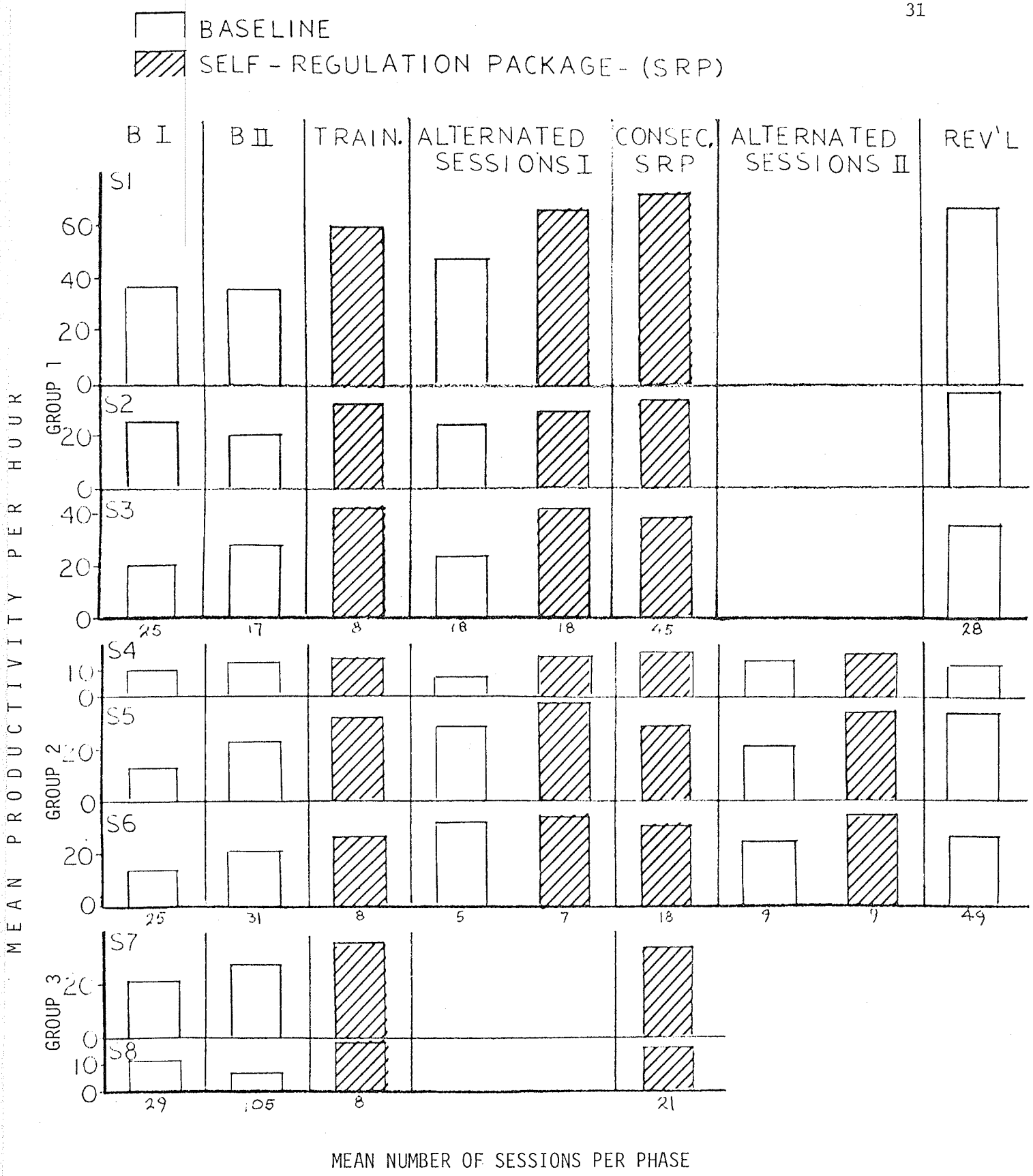

Figure 3. Mean productivity per hour for individual subjects.

and baseline sessions were alternated, rate of responding in SRP sessions was unchanged while corresponding baseline performance decreased below that in Baselines I and II. In the same phase, the productivity of Subject 5 showed further increases in both SRP and baseline conditions. A similar effect was observed in Subject 6. During consecutive SRP sessions, the level of productivity persisted in Subject 4 and Subject 6, while productivity diminished to that of the previous baseline level in Subject 5. In subsequent return to alternated conditions, a replication of increased performance in SRP sessions relative to baseline was evident for Subject 5 and Subject 6, but not in Subject 4. In reversal to baseline, only Subject 4 reverted to original baseline levels.

For Subject 7, average performance showed an increase in Baseline II compared to Baseline I, while a decrease in performance occurred in Subject 8. The impact of the SRP in training was evident in Subject 8, however, more than doubling his productivity. This influence continued throughout consecutive SRP sessions. Training produced a modest increase in the average productivity of Subject 7 relative to Baseline II. A small decrease in performance was observed during consecutive SRP sessions.

Percent Increase in Productivity

Table 2 shows percent increases in mean productivity in combined SRP

Insert Table 2 about here

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sessions relative to the mean productivity in combined baseline phases. With the SRP, all clients showed increased productivity. As a group, the mean increase in prodcutivity was 43% (range: 19 to 60).

Table 2

Percent Increase in Mean Productivity in Combined SRP Phases Relative to Mean Productivity in Combined Baseline Phases

Client	Mean Productivity in Combined Baseline Phases	Mean Productivity in Combined SRP Phases	Percent Increases
	GROUP 1		
1	47	69	47
2	27	32	19
3	26	40	54
Mean	33	47	40
	GROUP 2		
4	11	16	45
5	24	33	38
6	23	33	43
Mean	19	27	42
	GROUP 3		
7	25	34	36
8	10	16	60
Mean	18	25	48

Average mean increase for all clients = 43%

Quality of Production

Mean quality of production was determined separately for all baseline sessions and for all SRP sessions, excluding training. Mean percent correct coffee packs produced in all baseline sessions was 70%; mean percent correct in all SRP sessions was 73%. The percent correct for individual clients, with the first figure representing the mean of all baseline sessions and the second figure representing the mean of all SRP sessions was: Subject 1, 82 and 84; Subject 2, 70 and 59; Subject 3, 66 and 85; Subject 4, 79 and 73; Subject 5, 62 and 63; Subject 6, 76 and 76; Subject 7, 83 and 79; Subject 8, 45 and 14. Thus, relative to the presence of the SRP, two subjects showed small increases in the quality of production (Subjects 1 and 5), and one subject showed a rather large increase (Subject 3). Two subjects revealed slight decreases in the quality of production (Subject 4 and 7), while two subjects evidenced somewhat large decreases (Subjects 2 and 8). Subject 6 showed no change in quality of production.

Accuracy of Self-Monitoring

The accuracy of self-monitoring was determined in all SRP sessions. Mean accuracy of self-monitoring for Group 1 clients was: Subject 1, 97%; Subject 2, 97%; Subject 3, 88%. In Group 1, the mean number of SRP sessions was 63. Mean accuracy of self-monitoring for Group 2 clients was: Subject 4, 98%; Subject 5, 97%; Subject 6, 90%. The mean number of SRP sessions for Group 2 was 34. For Subjects 7 and 8 in Group 3, the mean accuracy of self-monitoring was 97% and 93%, respectively, over an average of 21 SRP sessions. Training sessions were not included in the analysis.

Duration of Self-Monitoring

The amount of time each client spent with the self-regulation device was

recorded. In 17 such observations, clients spent an average of 6.2 sec (range: .68 to 13.8) in each self-monitoring operation or in other behaviors associated with the device.

Social Validation of the SRP

The results of the four preference tests given each client showed that 84% of the choices (out of a total of 32 choices) favoured the SRP conditions. Five clients chose the SRP on all four occasions. Two clients selected the SRP three times, and one client chose it once. Therefore, only one client showed a preference for baseline conditions.

Interobserver Reliability

Mean percentage of interrater agreements was calculated for the following measures.

Quality of production. Twenty reliability checks were made in Baseline I. Mean agreement was 86% (range: 59 to 100). In all other experimental sessions, approximately 9% of each day's production was checked, over a period of twenty days. Mean agreement for this measure was 90% (range: 84 to 96).

Total session production. In a total of 69 checks which were made on total session output, mean agreement was 99.9%.

Accuracy of self-monitoring. Mean agreement for this emasure was 98% in 161 observations.

Social Validity. Both checkers observed all 32 preference tests. Mean agreement was 100%.

Discussion

These findings indicate that self-regulation strategies, as incorporated in the SRP, may considerably influence the productivity of some retarded

workers. The mean productivity of all clients increased as a function of the presence of the SRP. The extent to which alternation of conditions itself produced increases in mean productivity during SRP is unclear, since in consecutive SRP sessions performance increased slightly in Group 1 and decreased somewhat in Group 2.

In the reversal replication phase, previous baseline levels were not recovered for 4 of 6 clients. Group 1's productivity remained high despite the absence of the SRP. There may be several reasons for this. First, the high rate of productivity in Subject 1 contributed heavily to the mean level for the group. An inspection of the data in individual sessions revealed that on two occasions this client's hourly rate of production was 105. Prior to the first of these occasions, a staff member advised him to exhibit exemplary work behavior to ensure imminent community placement. From that point on, a small, but increasing trend in productivity was evident during the phase. Second, the consecutive SRP phase was much lengthier for Group 1 clients, and immediately preceded the reversal-to-baseline condition. Perhaps with these higher-rate clients and this longer exposure, there was an increased liklihood that token reinforcement would contact other procedural variables, such as on-task reinforcement and general prompts, which subsequently strengthened their effectiveness during reversal.

The value of the SRP was not demonstrated in all clients. Although the reasons for this were not examined in the present study, several variables incorporated in the SRP bear future investigation. For example, payment was based on a fixed value: one-third-of-a-cent per pack. For lower-rate producers who contact token reinforcement less frequently, greater magnitudes of reinforcement may prove more effective.

In the goal-setting procedure, the goal to be surpassed was based on an unchanging index of performance: mean baseline productivity. With a fixed-goal contingency, productivity levels minimally exceeding the criterion may be maintained. An improved procedure may be to utilize an adjusting goal-setting criterion. This could be done by setting the goal at the highest mean productivity attained in all previous sessions.

Although a large overall percent increase (43%) in production was obtained using the SRP, the interpretation of percent-increase data may be misleading when lower-rate behaviors are involved. For example, the percent increase obtained with Subject 8 was 60%, however, his productivity was also the lowest in the study. Thus, in lower-rate clients marginal gains produce relatively large percentage increases.

An important question is whether the increase is large enough to be of practical value. From the point of view of the workshop administrator, an overall increase in workshop production of 43% may be very desirable. From the point of view of the lower-rate client, an increase of 43% may not be sufficient to lead to increased opportunities for him, such as admission to more advanced training programs or community workshop placement.

A final point concerns the practicality of the SRP. With this particular self-regulation strategy, considerable percent increases in productivity were obtained in most clients, and they preferred it to standard workshop supervisory conditions. The latter finding may have been due to the relatively greater density of reinforcement which prevailed in the SRP versus typical workshop conditions (Martin et al., 1979). Though the self-regulation procedures employed in this particular strategy may be effective and acceptable, the specific apparatus used is probably not economical, from

a cost-benefit perspective. For example, maintaining the VR schedules of marbles and recording self-monitoring data by hand proved to be a rather time-consuming effort. A better alternative may be to employ electronic or mechanical instruments which could readily streamline self-regulation operations. Since self-administered strategies with retarded workers seem to have much promise, a more efficient means of implementing and managing them needs to be developed.

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