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# The effects of the timing of self-recording and goal setting on self-efficacy and performance

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# THE EFFECTS OF THE TIMING OF SELF-RECORDING AND GOAL SETTING ON SELF-EFFICACY AND PERFORMANCE

by

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Abstract

THE EFFECTS OF THE TIMING OF SELF-RECORDING AND GOAL SETTING

ON

SELF-EFFICACY AND PERFORMANCE

by

Rosetta Pervan

Adviser: Professor Barry J. Zimmerman

The purpose of this study was to investigate the impact of the timing of self-recording and goal setting on reactivity using Bandura's social learning model of self-regulation as a framework. One hundred ninety two fourth and fifth grade students proficient in long division were randomly assigned to one of twelve treatment groups according to a 4(self-recording) X 3(goal setting) design. The self-recording conditions were immediate, end of session, end of day, and none; the goal setting conditions were positive (3 more problems each day), none and negative(3 less problems each day). The dependent measures were the number of division problems completed and self-efficacy ratings. It was expected that shorter intervals between self-observation and self-recording would be positively associated with number of problems completed and students' self-efficacy perceptions than would longer intervals. A positive correlation between number of problems completed and self-efficacy was predicted.

Results showed that self-recording and goal setting each affected student performance and self-efficacy . There was also a complex interaction between self-recording and goal setting which also affected performance and self-efficacy. The timing of self-recording was not significant as had been predicted. Performance was maximal for students who self-recorded and set positive goals. A significant positive correlation was found between self-efficacy and problems completed. Results were discussed as supporting a cognitive behavioral rather than operant view of reactivity.

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Interest in behavior change methods which are minimally intrusive and self rather than externally controlled has grown because of ethical and practical considerations. Self-observation, self-recording, self-reinforcement, and self-instruction are the components often used in programs for developing behavioral self-control.

Self-recording, which consists of marking the occurrence of each behavior, has been shown to result in behavior change by itself even without the implementation of additional intervention strategies (O'Leary & Dubey,1979; Rosenbaum & Drabman,1979). This phenomenon of behavior change following self-recording is known as reactivity. There is evidence that self-recording is especially useful in fostering behavior change on tasks involving drill and practice but questions regarding its utility in other situations have still to be explored (Snider,1987).

Both operant and cognitive models have been proposed to explain reactivity. Operant models have been advanced by Mace and Kratochwill (1985), Mace and West (1986), Nelson and Hayes (1981; Hayes & Nelson,1983), and Rachlin (1974). The cognitive view has been argued by Kanfer (1970; Spates & Kanfer,1977) and Kazdin (1974). The operant theorists emphasize self-reinforcement and self-recording (as a discriminative stimulus) for behaviors which are ultimately under the control of delayed environmental contingencies. The cognitive view emphasizes the role of self-evaluative processes triggered by the self-recording. There is yet no

conclusive evidence for rejecting or accepting either model since aspects of each theory are supported by existing research.

A number of factors have been identified as influencing the occurrence of reactivity (the nature and valence of the target behavior, the desire to change the behavior, experimenter instructions, training in self-recording, the nature of the self-recording device, the number of behaviors monitored, the schedule of monitoring, goal setting and the timing of the self-recording). A study is proposed to investigate two of these factors: the timing of the self-recording and goal setting.

Bandura's social learning model of self-regulation used as a framework for the design of the study. A major element in Bandura's theory (1986), the construct of self-efficacy, defined as an individual's judgement of task capability, has proven useful in predicting behavior. According to Bandura, the information from self-recording combines with goal setting to determine self-efficacy and motivation which lead to behavior change. The timing of the self-recording, specifically the interval between self-observation and self-recording, is expected to play a critical role in reactivity. Shorter intervals between self-observation and self-recording are expected to be associated with greater reactivity than are longer intervals. Immediate self-recording will provide the most information about ongoing behavior and thus the most opportunity for

self-evaluation to influence the behavior in progress. No research to date has examined the impact of the interval between self-observation and self-recording on reactivity.

Although a positive relationship has been found between goals and performance (Locke, Shaw, Saari & Latham, 1981), there is limited research on how goal combine with other factors to determine performance. The proposed study provides a test of Bandura's theory that goal setting and self-recording combine to determine self-efficacy and performance. The proposed study sought to experimentally demon- strate the critical role of goal setting and of the timing of the self-recording on children's learning in school.

In this proposal the literature on self-recording and goal or criterion setting is reviewed and then Bandura's self-regulation model is presented as a framework for the proposed study.

Self-recording

Self-recording is a relatively simple procedure that requires an individual to self-observe and then record the occurrence of behavior. The recording may be done by placing mark on a sheet or by using counting devices. Self-recording, an important initial component of many behavioral change programs, has been shown to be effective in producing behavior change by itself even without the use of other techniques (O'Leary & Dubey,1979; Rosenbaum & Drabman, 1979). The behavior change following self-recording, known as reactivity, has been documented for various behaviors including smoking (Rozensky,1974), work output (Seymour & Stokes,1976), talking in class (Nelson, Hay, Devany & Koslow Green,1980), disruptive behavior (Bolstad & Johnson,1972), academic achievement (Sagotsky, Patterson & Lepper,1978), on task behavior (Glynn & Thomas,1974) and study skills (Broden Hall & Mitts,1971).

The initial research on reactivity focused on documenting the phenomenon. In an early two-part experiment study, Broden et al. (1971) found that self-recording resulted in an increase in class study behavior and a decrease in talking out in class. In the first experiment, an eighth grade girl who was doing poorly in her history class was given slips on a daily basis on which she was to record "when she thought of it" her study behavior during history class sessions. Study was defined as attending to a teacher assigned task, and when appropriate, facing the

teacher, writing down lecture notes, facing a child responding to a teacher question, or reciting when called upon by the teacher. Non-study behaviors included being out of seat without permission, talking out without being recognized by the teacher, facing the window, fingering non-academic objects or working on assignments for another class. The slips contained three rows of 10 squares on which the student was to record a "+" if she was studying or had been doing so for the last few minutes, and a "-" if she was not studying at the time she thought to record. The slips were returned to the school counselor at the end of the school day and were discussed at the weekly pupil-counselor conference. The self-recording resulted in an increase of study behavior from 30% during baseline to 78% during self-recording.

In the second experiment, an eight grade boy who talked out continually in math class and disturbed both the teacher and other students, was given a slip with a statement on it to "record a mark each time you talk out with- out permission" and a rectangular box on the slip on which to place tally marks. The teacher gave the slip at the beginning of the period and said it would be collected. No other instructions were given to the student. The self-recording resulted in decreased talking out.

Later research identified various factors which could influence the occurrence of reactivity. The nature and valence of the target behavior, experimenter instructions,

the nature of the self-recording device, the schedule of self-monitoring, goal setting and the timing of the self-recording were all investigated (Shapiro,1984).

The valence of the behavior monitored, that is whether the behavior monitored is considered positive (desirable) or negative (undesirable), appears related to the degree of reactivity following self-recording. Kanfer (1970) predicted that positively valenced behavior would have a tendency to increase when self-monitored and negatively valenced behavior would have a tendency decrease when self-monitored. The Broden et al. (1971) results support Kanfer's hypothesis. The self-recording of study behavior (positively valenced) resulted in a significant increase in study behavior while the self-recording of talking out behavior (negatively valenced) resulted in a decrease of talking out behavior.

The specific behavior being monitored was found to play a role in the occurrence of reactivity. Gottman and McFall (1972) found that student's recording instances of speaking in class discussions resulted in an increase in class participation. Student's recording instances of not speaking when wanting to speak resulted in a decrease in class participation.

Glynn and Thomas (1974) found evidence that the type of instructions given to the individual by the experimenter affects the occurrence of reactivity. Using behavioral self-control procedures composed of self-assessment, self-

recording, self-determination and self-administration of reinforcement in a third grade class during an oral and written language lesson resulted in a small and unstable increase in on task behavior for some of the students. Introducing a cueing procedure (chart specifying on task behavior and taped signals for self-recording) resulted in a high and stable increase in on task behavior for all the students.

The nature of the self-recording device, especially its obtrusiveness seems to play a role in reactivity. Nelson, Lipinski and Boykin (1978) found that using hand held counters resulted in more accurate self-recording and a greater increase in appropriate verbalizations than using belt worn counters for self-recording.

Mahoney, Moore, Wade and Moura (1973) investigated the effects of the schedule of self-monitoring (continuous and intermittent) on academic behavior. Subjects reviewing the quantitative and verbal portions of the GRE were randomly assigned to one of four groups: continuos self-monitoring, intermittent self-monitoring (self-recording after 3 correct responses), performance feedback, and control (no self-monitorin and no feedback). Results indicated that the self-monitoring subjects worked longer than performance feedback and control subjects. Continuous monitoring subjects worked longer than the intermittent monitoring subjects.

The timing of the self-recording has been found to be

related to reactivity. The highest degree of reactivity is likely to occur if self-recording occurs before the behavior being monitored occurs. Rozensky (1974) investigated the effect of self-recording cigarette consumption before versus after smoking. Self-recording before smoking was more effective in decreasing cigarette consumption than was self-recording after smoking.

Nelson et al. (1980) considered the timing of self-recording in their study and found that self-recording appropriate and inappropriate verbalizations prior to or after the occurrence of the verbalization did not differentially affect the reactivity of either appropriate or inappropriate verbalizations in elementary school age children The accuracy of the self-recording however was affected. Appropriate verbalizations were self-recorded more accurately after rather than prior to their occurrence and inappropriate verbalizations were self-recorded more accurately prior to rather than after their occurrence. The difference in the accuracy of the self-recording of appropriate and inappropriate verbalizations suggests a self-evaluative component. Children might avoid self-recording after inappropriate verbalizations in order to avoid negative self-evaluations.

The role of the timing in self-recording and self-evaluation clearly needs to be more fully studied and explained. Such research would provide clues to the process involved when an individual physically records behavior and

through such recording effects some behavior change. The interval between self-observation and self-recording would be an ideal way to explore the role of the timing of self-recording in reactivity. No research has specifically examined the degree of contiguity between self-observation and self-recording. It is expected that the longer the delay between self-observation and self-recording, the less reactivity is likely (Shapiro,1984). Shorter intervals between self-observation and self-recording would provide more of an opportunity to alter ongoing behavior and so result in greater reactivity. Immediate self-observation would provide continuous information and so the best opportunity to change behavior while it is still in progress. If self-monitoring is not immediate, it would be possible to experience satisfaction or disappointment with one's performance but these evaluations would not be able to alter past behavior. Immediate rather than delayed self-recording would provide the information needed to change behavior in progress.

Criterion or goal setting

Throughout this paper, the terms goal setting and criterion setting will be used interchangably to refer to a performance standard. Specific operational definitions will be noted in the review of each study.

Although a positive effect of goals on task performance has been found in numerous studies (Locke et al.,1981), mixed results have been obtained regarding the effect of

goal or criterion setting on reactivity. While Kazdin (1974) and Spates and Kanfer (1977) found support for the critical role of criterion setting in reactivity, Sagotsky et al. (1978) and Mace and Kratochwill (1985) did not find such evidence.

Kazdin (1974) found that a performance standard augmented the reactive effects of self-monitoring. Subjects given a sentence construction task and told that the frequent use of "I" and "we" statements was related to high intelligence, creativity, sensitivity and other desirable personality characteristics increased their use of these statements. The increase occurred both when subjects self-recorded their use of "I" and "we" statements and when the experimenter recorded the subjects' use of these statements. For both the self and experimenter monitoring groups, a counter was positioned so that it was directly in front of the subjects and so provided an obtrusive visual display of the monitored behavior.

Spates and Kanfer (1977) examined the relative contribution of self-monitoring, criterion setting, self-evaluation and self-reinforcement in a study with first grade children. They concluded that criterion setting was a critical component in the students' improvement on a simple learning task (adding numbers). In the study (a pretest-posttest design), subjects were assigned to one of four treatment groups or a control group. The self-monitoring subjects were trained to say out loud what numbers they were

adding in the following manner: "Now I am adding these two numbers here; now I am adding these two numbers here; now I am adding these numbers here." The criterion setting group subjects were trained to say out loud as they worked on a problem: "First, I should add the two numbers on the right; then I should add the the two numbers in the middle; next I should add the two numbers on the left." Subjects in the self-monitoring plus criterion setting group were instructed to say out loud as they solved the problems: "First, I should add the two numbers on the right, five plus one equals six; then I should add the two numbers in the middle, five plus two equals seven; next I should add the two numbers on the left, five plus three equals eight." The self-evaluation plus reinforcement group received the same instructions as the self-monitoring plus criterion setting group with the addition of "When you're done with each problem look at your work and see whether you did the right thing and if so, say, I am right, or if you did the wrong thing say, I am wrong." The controlgroup subjects were trained to say the numbers in the problem.

Results indicated that the differences between the control and self-monitoring groups only approached significance but that the self-monitoring plus criterion setting group differed significantly from the other three treatment groups. Spates and Kanfer interpreted these results as suggesting that criterion setting represents a critical component in self-regulation. It is difficult to accept

their results as supporting the critical role of criterion setting in reactivity because of the way in which the variables were operationally defined. The instructions given to the subjects appear to be mainly task facilitating plans giving clear directions for a sequence of behavior. Goal or criterion setting implies a standard or goal and this is not the case in the above study. The results do not appear to be generalizable if other operational definitions of goal or criterion setting are used.

Sagotsky et al. (1978) investigated the impact of self-monitoring and goal setting on math performance in fifth and sixth grade students. During the five week treatment program, students worked through individualized mathematics instruction units. All the subjects were given a math cover sheet to use according to group assignment. The students in the goal setting group were to write the page and problem number where they started each day, the page and problem number up to which they expected to work that day (goal) and the page and problem number where they actually finished that day. The self-monitoring students were told to mark the page and problem number where they stopped working and to mark on a grid of 12 empty boxes "from time to time" whether or not they were actually working. The combined goal setting and self-monitoring subjects were instructed to use both the daily goal sheets and the grid boxes for self-recording. The control subjects only had to record the page and problem number where they stopped working each day.

Results indicated that self-monitoring significantly increased both study behavior and math achievement while goal setting had no effect on either study or achievement. Goal setting also did not enhance the effectiveness of the self-monitoring.

The ineffectiveness of the goal setting in affecting behavior may have been related to the difficulty of setting appropriate goals for the task used in the study. The math units consisted of complex and heterogeneous problems which varied greatly in difficulty making daily goal setting a complicated task. The authors report that on 9.4% of occasions, subjects in the goal setting group failed to set goals. If subjects do not consistently set goals it is not possible to clearly evaluate the impact of goal setting.

Existing research in the self-determination of goals by children suggests that self-set goals result in greater performance changes than externally set goals (Dickerson & Creedon,1981). However, the stringency or leniancy of the goals (Brownell, Colletti, Ersner-Hershfield, Hershfield and Wilson, 1977) and the reinforcement systems in effect also seem to play a role in determing whether self or other set goals lead to the greater performance change.

Mace and Kratochwill (1985) considered the contribution of self-monitoring, goal setting and self-reinforcement to reactivity. Subjects monitored verbal nonfluencies (um, ah, er, uh, you know) while talking on a current topic for nine minutes. The self-monitoring subjects used a mechanical

counter with a visual display. They were instructed to click the counter each time their speech was nonfluent. The self-monitoring plus goal setting subjects were told (in addition to the self-monitoring instructions) to set a goal for reducing their nonfluencies and to write it down. The subjects in the self-monitoring plus goal setting plus self-reinforcement group were given the addition to compare at the end of the nine minutes the number of nonfluencies they had to the goal they had set. If they reached or exceeded the goal, they were to say out loud "I did a really good job of showing self-control." Subjects in the goal setting plus self-reinforcement group were not provided with mechanical counters but were told to set a goal for reducing nonfluencies and to self-reinforce if they met or exceeded the goal. The control subjects were not trained in any of the procedures and only talked for nine minutes. Results indicated that all of the experimental groups showed a decrease in verbal nonfluencies with the largest decrease occurring in the groups using self-reinforcement. The failure of goal setting to influence reactivity may have been due to the difficulty of setting goals for a task when there are no standards identifying levels of performance. This interpretation is supported by the results of the Kazdin (1974) study in which subjects were provided with a performance standard and reactivity was influenced by the goal setting and by the results of the Sagotsky et al. (1978) study in which subjects were not provided with standard and reacti-

vity was not influenced by goal setting.

Mace and Kratochwill interpreted their results as supporting the role of self-reinforcement in reactivity. However, the behavior change in the study may have been due to the subjects in the self-reinforcement groups being told to compare their performance against the goals set. This comparison would lead to positive self-judgments if individuals reached or exceeded goals independent of whether they overtly self-reinforced or not. This interpretation emphasizes the self-evaluative process.

The idea that certain properties of goals influence behavior was investigated by Bandura and Schunk (1981; Schunk,1983a; 1983b; 1983c). They found support for the critical role of goal proximity in developing math competence (Bandura & Schunk,1981). Second to fourth grade students with gross deficits in subtraction were assigned to experimental groups differing in goal conditions while they completed a seven day program of self-directed learning in subtraction.

The children in the proximal goals group were given the suggestion by the experimenter to consider settting a goal of completing at least six pages each day. This suggestion was made at the beginning of the first and second session but not on the other five days. At the start of the first two sessions, the children in the distal goal group were asked to consider setting the goal of completing the entire 42 pages by the end of the seventh session which totaled 258

problems. The students in the no goal group were told that they might try to complete as many pages of problems as they could as they went along. The no treatment children were given pre and post assessments without working on the self-directed instructional material. Results indicated that students in the proximal group exceeded all others in strength of perceived efficacy, surpassed all others in subtraction skill, were most persistent on difficult items, developed intrinsic interest in subtraction problems and progressed rapidly in self-directed learning. Students in the proximal group showed a high congruence between judgements of mathematical self-efficacy and math performance. Self-efficacy was also related to accuracy of math performance.

In a related study, Schunk (1983a) examined the role of goal setting and social comparative information in developing children's self-efficacy and math skills. Fourth and fifth grade students were randomly assigned to one of four treatment groups and on two consecutive school days worked on two division training packets. The children maintained a tally sheet by recording a mark after completing each problem so that a record of their progress was continuously available to them. The students in the comparative information group were told at the start of the first session that half of the children like them were able to finish 25 problems; at the start of the second session they were told that half of the children like them were able to finish 16 prob-

lems. The goals group children were given the suggestion at the start of the first session that they might want to decide to work at least 25 problems; at the start of the second session the suggestion was given to try 16 problems. The students in the combined comparative information and goal group were given both sets of treatment instructions. The training control group was given the two training packets but neither set of treatment instructions. Results indicated that students in the combined comparative information and goal group showed the highest level of division skill after training. Student's perceived self-efficacy was most improved by the goals group instructions.

The role of social comparative information was further elucidated in a study of the impact of goal difficulty and attainment information on student's math skills and self-efficacy (Schunk,1983b). Students deficient in division were assigned to one of four treatment groups and received two 15 minute training sessions involving problems with one digit divisors in the first session and two digit divisors in the second session. The children kept a tally sheet and recorded a mark after completing each problem so that they had a record of their progress continuously available. The students in the high goal difficulty and comparative attainment information group were told to try to finish a certain number of problems (25 on the first day; 15 on the second day) and that other children like them were able to finish this number. The high goal difficulty and direct attainment

information group students were told to try to finish the same number of problems as the students in the first group and that they should be able to work this number of problems The low goal difficulty and comparative attainment information group was given the same instructions as the first group except that a smaller number of problems (15,10) was suggested to be finished in each session. The low goal difficulty and direct attainment information group subjects were given the same instructions as the children in the second group except that a smaller number of problems was suggested for completion (15,10). Results indicated that high goal difficulty subjects completed more problems than low goal difficulty subjects. Highest math skills and self-efficacy was exhibited by subjects in the high goal difficulty and direct attainment group. Providing social comparative information had the least effect on students' perceived self-efficacy.

Although the students in the above studies kept tally sheets, the impact of this procedure was not taken into consideration. In a separate study, Schunk (1983c) investigated the impact of self-monitoring using tally sheets on self efficacy and math achievement. Students deficient in subtraction were assigned to one of three treatment groups and received three 30 minute training sessions in subtraction operations. The students inthe self-monitoring group were instructed at the end of the session to count the number of pages they completed during the period and to record the

number on a sheet. Students in the external monitoring group watched at the end of the session as the proctor counted and recorded the number of pages that had been completed during the session. The no monitoring group subjects worked on the training packets but did not have either type of monitoring. Children in both monitoring groups had higher self-efficacy ratings, more problems completed and greater persistence than the students in the no monitoring group. The self and external monitoring groups did not differ significantly from each other.

The results of the goal setting studies support the idea that goal setting plays an important role in reactivity even when the goals are initially suggested by the experimenter (Bandura & Schunk, 1981). There is evidence (Bandura & Cervone,1983; 1986) that people develop commitment to a goal when it is suggested by an experimenter. It appears that proximal and specific goals serve as a performance standard for self-evaluating one's behavior. Additional research on how self-recording, goal setting, self-efficacy and self-evaluation impact on behavior is needed.

Bandura's self-regulation model

The complementarity of goal setting and self-evaluation processes is emphasized by Bandura (1986; Bandura & Cervone, 1983; 1986) in his view of motivation. Criterion or goal setting provides a clear specification for one's future behavior. Self-recording facilitates a comparison between

one's actual performance and one's performance criteria. This comparison leeads to self-evaluation and self-efficacy judgments. Goal setting, self-efficacy and self-evaluation all operate together to affect motivation and behavior.

Bandura's model of self-regulation (1986) appears useful in explaining reactivity. Self-regulation of human behavior is achieved through a set of subfunctions: self-observation, self-evaluation and self-reaction. For Bandura the self-observation information and goal setting combine to determine self-efficacy and motivation which affects behavior. A summary of Bandura's model of self-regulation based on his discussion in Social foundations of thought and action (1986) follows.

Self-observation

People attend selectively to certain aspects of their behavior and ignore non-relevant aspects. Reliable self-monitoring requires sustained and focused effort. The process of self-monitoring is not simply a mechanical counting of behavior but a process in which self-conceptions influence which aspects of behavior one gives the most attention, how the behavior is perceived and how performance information is organized for memory representation. Mood states can affect how performances are self-monitored and processed

Self-observation functions to provide information for setting performance standards and for evaluating ongoing changes in behavior. Self-monitoring also contributes to behavior change by serving both as a diagnostic device and

as a self-motivating device. As a diagnostic device, self-monitoring allows people to observe patterns of behavior which they can then change. As a self-motivating device, self-monitoring leads to people setting themselves goals of progressive improvement which enlists evaluative self-reactions and efforts toward the goal.

Knowledge of how one is doing changes later behavior by activating self-set goals and self-evaluative reactions. Whether self-observation will result in behavior change is dependent on various factors such as the temporal proximity of the self-observation, performance feedback, motivation, the value of the behavior to the individual and self-evaluation.

Self-evaluation

The self-observation information needs to be interpreted through judgmental processes which leads to goals and behavior change. A performance can be judged positively or negatively depending on the personal standards against which it is evaluated. These internal standards are developed through direct instruction, the reaction of others to one's behavior and observing of the self-evaluative reactions of others. When there are no absolute standards of adequate performance to compare one's performance against in order to make self-evaluations, individuals may rely on social comparison to make self-evaluations.

Self-reaction and self-efficacy

Self-observation, personal goals and self-evaluation

enable people to change behavior in the desired direction. People behave in such a way as to produce positive self-reactions and to avoid negative self-reactions. Judgments of one's capabilities, that is perceived self-efficacy, help determine behaviors that people choose to pursue, how much effort to expend, how long to persist and how they think and feel about their actions.

There is experimental support for the mediating role of the above self-processes in behavior change (Bandura,1986; Bandura & Cervone,1983;1986; Locke,Frederick,Lee & Bobko, 1984). Bandura and Cervone (1983) tested the idea that self-evaluation and self-efficacy jointly regulate performance effort when individuals are able to make comparisons between standards and knowledge of performance. Following a baseline session, subjects performing a strenuous physical activity on an ergometer were randomly assigned to one of four conditions: goals with performance feedback, feedback alone, goals alone, neither goals nor feedback. The goals required a 40% increase in performance; feedback was a 24% increase in performance. Subjects recorded their level of self-satisfaction with their performance and their self-efficacy for goal attainment and then resumed the ergometer task. Results indicated that the combined goals and feedback subjects showed the greatest increase in performance but that neither goals alone nor feedback alone resulted in a significant performance increase. Self-efficacy and self-satisfaction were related to the performance increase in the

combined goals and feedback group. Subjects who performed with either goals alone or feedback alone could not regulate their behavior unless they supplied the missing element. In the feedback alone condition, 70% of the subjects reported that they set their own goals. Setting goals in this group was significantly related to improved performance while self-set goals had no effect on performance for subjects who did not receive performance feedback. In the goal alone condition, the level of self-efficacy was related to degree of performance change. In this group, the stronger the subjects' self-efficacy, the greater was their performance change. In the no goal and no feedback group, self-efficacy and self-satisfaction were unrelated to performance change since subjects had little basis for either judging or regulating their ongoing performance.

In a related study, Bandura and Cervone (1986) investigated the nature of the relationship between self-efficacy, self-evaluation and performance when attainments diverged from goals across a wide range of positive and negative values. Following a baseline ergometer session, subjects picked in a rigged choice procedure a goal of a 50% above baseline levels for the second session. After the second session, preselected feedback independent of actual performance was given to the subjects. There were four feedback groups. Subjects in the large substandard discrepancy group were told that they had achieved a 24% increase over baseline; the moderate substandard discrepancy group subjects

were told they had achieved a 36% increase over baseline; the small substandard discrepancy group were told they had achieved a 46% increase over baseline; the subjects in the small suprastandard discrepancy group were told they had attained a 54% over baseline. Following this feedback, the subjects completed measures of self-satisfgaction, self-efficacy and goals for the next session. Motivational level assessed by effort expenditure on the ergometer, was the dependent measure. Results indicated that perceived self-efficacy contributed to motivation and performance in all discrepancy groups. Self-satisfaction was related to motivation only in the large and moderate discrepancy groups. Self-set goals influenced performance in all groups except the large substandard discrepancy group. These findings suggest a complex relationship between performance and self-efficacy and goal setting.

Rationale of proposed study

The results of the studies reviewed indicate that questions involving the role of the timing of self-recording and goal or criterion setting in reactivity remain unresolved. A study is proposed to provide empirical validation regarding these factors and theoretical clarification on the process of how self-recording leads to behavior change. It is expected that shorter intervals between self-observation and self-recording will be associated with greater reactivity than longer intervals. Such a result would be consistent with Bandura's self-regulation model which emphasizes the

role of self-evaluation in affecting behavior change. The studies reviewed also indicate that goal setting interacts with self-evaluation to determine performance. Bandura and Cervone (1983;1986) found support for the importance of self evaluation in studies which provided subjects with external feedback. No study in this area has been done using self-recording by the subjects. The proposed study used subjects' actual self-recording in order to extend Bandura's findings.

The present study operationalized Bandura's distinction between self-observation and self-judgment sub processes through the assignment of students to self-recording and goal setting groups. The interval between self-observation and self-recording was controlled in the present study in order to affect the focusing of attention on past, present and future behavior. Immediate self-recording provided both evidence of accomplishment and an opportunity to alter ongoing behavior. Increasing intervals between self-observation and self-recording provided evidence of accomplishment but only decreasing opportunity to change behavior in progress. The behavior change associated with immediate self-recording is assumed to occur in order to meet performance standards. Goal difficulty has been found to be positively related to performance (Locke et al.,1981; Schunk,1983b). Varying goal difficulty levels was therefore expected to influence performance. A range of goal difficulty levels was used as well as performance standards

in order to facilitate comparison between ongoing and desired performance. The range of goal difficulty and performance standards was created in the study by simultaneously manipulating both positive and negative goal setting in order to maximize between group differences.

Self-recording and goals were both expected to affect self-efficacy judgments and behavior. The dependent measure was a typical classroom task, completing math computation problems.

Presentation of hypotheses

The purpose of this study was to examine the role of the timing of self-recording and of goal setting on performance. The following hypotheses were tested.

1. Students who self-record immediately will complete more problems than students who do not self-record.

2. Students who self-record immediately will complete more problems than students who self-record at the end of the day.

3. Students who self-record immediately will complete more problems than students who self-record at the end of the session.

4. Students who self-record at the end of the session will complete more problems than students who self-record at the end of the day.

5. Students who self-record immediately and who are provided with a positive criterion will complete more problems than students who self-record immediately and who are

provided with a negative criterion.

6. Students who self-record immediately and who are provided with a positive performance criterion will complete more problems than students who self-record at the end of the day and who are provided with a positive performance criterion.

7. Students who self-record immediately and are not provided with a performance criterion will have higher self-efficacy ratings than students who do not self-record and are not provided with a performance criterion.

8. Students who self-record immediately will have higher self-efficacy ratings than students who self-record at the end of the day.

9. Students who self-record immediately will have higher self-efficacy ratings than students who self-record at the end of the session.

10. Students who self-record immediately and who are provided with a positive performance criterion will have higher self-efficacy ratings than students who self-record immediately and are provided with a negative performance criterion.

11. Student self-efficacy ratings will be positively correlated with the number of problems completed.

12. Day of training will be positively associated with number of problems completed.

13. Day of training will be positively associated with self-efficacy ratings.

## Method

### Subjects

One hundred ninety two fourth and fifth grade students from five New York City schools (104 from three public schools and 88 from two parochial schools) were selected to participate in the study on the basis of their performance on a long division pre-test (Appendix A). Unlike previous studies which focused on populations at risk(students highly deficient in math skills), the present study used a sample of typical elementary school students to find out if self-recording and goal setting would work generally in a school. All the students selected were able to divide using two digit divisors. The ethnic composition of the sample included approximately equal numbers of White, Black, and Hispanic children. Equal numbers of boys and girls were selected. The mean age of the children was 10 years, 6 months; the range was 9 years, 9 months to 10 years, 11 months. Children were randonmly assigned to the treatment conditions within each grade, school and sex. Parental consent was obtained for each child's participation in the study. The students were thoroughly debriefed at the conclusion of the study. A white female graduate student served as the experimenter throughout the study.

### Materials

A handheld manual thumb activated counter with a visual display, manufactured by Sportcraft of Taiwan, was used for self-recording.

Each day, 40 computation problems in a packet with one problem per page was given to the students to solve. Each day the problems spanned a range of difficulty with divisors progressing from 1 to 3 digits and dividends progressing from 2 to 6 digits. Equivalent problem sets were used each day. Eight pairs of computation problems similar to the problems in the packet were used each day for making self-efficacy ratings.

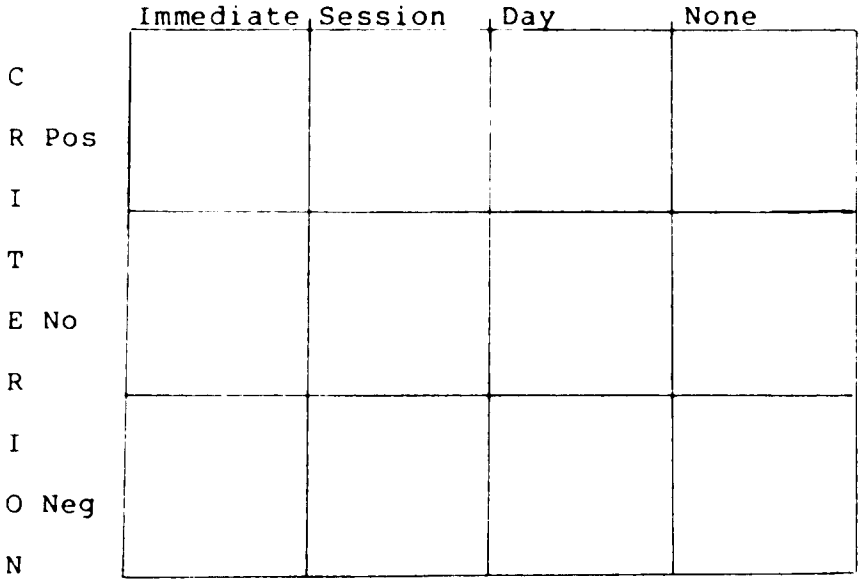
Following Bandura and Schunk (1981; Schunk,1982), self- efficacy ratings were made using a 10 to 100 point scale marked in 10 unit intervals. Four points on the scale were labeled in the following manner: Not Sure at 10; Maybe at 40; Pretty Sure at 70; and Real Sure at 100. The measure of strength of self-efficacy was obtained by dividing the summed magnitude scores by 8.

Procedure

Students were randomly assigned to one of 12 treatment groups (n=16, 8 boys, 8 girls) according to a 4 (recording) X 3 (criterion) factorial design. The research on self-recording has relied on single subject and small group designs. Existing literature provides no information regarding the size of effect for the treatment manipulation in the proposed study. Studies to date have obtained an effect with as few subjects in a group as 6 (Mahoney et al., 1973). To be conservative, 16 subjects were assigned to each treatment group. The recording groups were immediate, end of session, end of day, and no recording. The criterion

or goal setting groups were positive, none and negative. Following Bandura and Schunk(1981; Schunk,1983a), the experimenter encouraged the students to set goals for themselves by providing a performance standard for a "good student". The goal setting procedure was initiated by the experimenter but the students had flexibility in adopting or not the suggested goal. Bandura and Cervone (1983; 1986) found that when goal setting is initiated by the experimenter in such a manner, subjects show a high degree of goal committment to the suggested goal.

SELF-RECORDING




The students in each treatment condition were seen in small groups of three to five children. They were seated at desks far enough apart to prevent them from seeing each other's work. On five consecutive school days they

completed self-efficacy ratings and then worked for 30 minutes on 40 long division problems.

After the students entered the room and were directed to desks with self-efficacy ratings scales and computation packets, all instructions were presented through an audiotape. All of the subjects were told through the tape:

> This is a study to find out how many division problems you are able to do and how sure you feel that you can do different kinds of problems. Put your name on both the packet and the single sheet of paper. Leave the single sheet on top and look at the front of the room at the two problems being held up.

The experimenter then held up two long division problems on a single 9 by 12 piece of paper for 2 seconds allowing enough time to make an efficacy judgment but not enough time to solve the problem.

> Mark how sure you are that you can do this kind of problem. Make a mark at 10 if you think you can't do it, at 40 if you think you may be able to do it, at 70 if you are pretty sure you can do it and at 100 if you are real sure you can do it.

The same instructions were repeated for each of the following 7 pairs of problems. The same format and procedure were followed for the self-efficacy ratings for the duration of the study. Different self-recording and goal setting instructions were provided on the tape according to group assignment.

Treatment conditions

Immediate-Positive. On the first day, the experimenter ollect edthe self-efficacy scales and giae each student a counter with the child's name on it. The experimenter demonstrated the use of the counter and checked that each student was able to hold it comfortably in the non-writing hand, to advance it and to reset it to zero without difficulty. The experimenter asked the students to reset the counter to zero and not to use it in any way except as instructed on the tape:

> You are to work on the problems in your packet and you are to press the counter after you finish each problem. Begin working, remember to click the counter after you finish a problem. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

> Stop working. Look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the packets. Starting on the second day and continuing through the fifth, the students were told after the experimenter collected the self-efficacy scales and gave out the counters

> Look at the number on your counter. Reset it to zero.

The experimenter checked for compliance.

> The problems get harder each day but a good student should be able to do 3 more problems each day. Work on the problems in your packet and push the counter after

you finish each problem. The problems do get harder but a good student should be able to do 3 more problems each day than the day before. Remember to click after you finish each problem.

The students had 30 minutes to work and then the tape was played again.

Stop working. Look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the packets.

Immediate-No goal. On the first day, the experimenter collected the self-efficacy scales and gave each student a counter with the child's name on it. The use of the counter was demonstrated and checked following the procedure described for the immediate-positive group. The students were then instructed by the tape:

You are to work on the problems in your packet and you are to push the counter after you finish each problem. Begin working, remember to click the counter after you finish a problem. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working. Look at the number on your counter and write it on the packet next to your name.

The experimenter collected the counters and the packets. Starting on the second day and continuing through the fifth, the students were told by tape after the experimenter

collected the self-efficacy rating scales and gave out the counters:

Look at the number on your counter and reset it to zero

The experimenter checked for compliance.

Work on the problems in your packet and remember to push the counter after you finish each problem.

The students had 30 minutes to work and then the tape played again.

Stop working. Look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the packets.

Immediate-Negative. On the first day the experimenter collected the self-efficacy scales and gave each student a counter with the child's name on it. The use of the counter was demonstrated and checked following the procedure described for the immediate-positive group. The students were instructed by the tape:

You are to work on the problems in your packet and you are to push the counter after you finish each problem. Begin working, remember to click the counter after you finish a problem. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working. Look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the

packets. Starting on the second day and continuing through the fifth, the students were told by tape after completing the self-efficacy rating scale and being given the counters:

> Look at the number on your counter and reset it to zero

The experimenter checked for compliance.

> Since the problems get harder each day, a good student may not be able to do as many as the day before and may do 3 problems less each day than the day before. Work on the problems in your packet and push the counter after you finish each problem. The problems do get harder each day so that a good student may only be able to do 3 less each day than the day before. Remember to click the counter after you finish each problem.

The students had 30 minutes to work and then the tape was played again.

> Stop working. Look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the counters and the packets.

End of session-Positive. On the first day, after the experimenter collected the self-efficacy rating scales the students were instructed by tape:

> You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was

played again.

Stop working.

The experimenter then handed each student a counter with the child's name on it. The use of the counter was demonsrated and checked following the procedure described for the immediate positive group. The tape was then played.

Go through your packet starting with the first page. Whenever you find a finished problem, press the counter. When you've gone through the whole packet, look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the counters and the packets. Starting on the second day and continuing through the fifth, the students were told after the self-efficacy scales were collected by the experimenter:

The problems get harder each day but a good student should be able to do 3 more problems each day. Work on the problems in your packet. The problems do get harder each day but a good student should be able to do 3 more problems each day than the day before.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter handed each student a counter with the child's name on it.

Look at the number on your counter and reset it to zero.

The experimenter checked for compliance.

> Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet, look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the packets.

End of session-no goal. On the first day after the experimenter collected the self-efficacy rating scales, the subjects were instructed by tape:

> You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

> Stop working.

The experimenter handed each student a counter with the child's name on it. The use of the counter was demonstrated and checked following the procedure described for the immediate positive group. The tape was then played.

> Go through your packet starting with the first page. Whenever you find a finished problem, press the counter. When you've gone through the whole packet, look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the counters and the

packets. Starting on the second day and continuing through the fifth, the students were instructed by tape:

> You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep working until told to stop.

The students had 30 minutes to work and then the tape was played again.

> Stop working.

The experimenter then gave each student a counter with the child's name on it.

> Look at the number on your counter and reset it to zero.

The experimenter checked for compliance.

> Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the packets.

End of session-Negative. On the first day after the experimenter collected the self-efficacy rating scales, the students were instructed by tape:

> You are to work on the problems in your packet and you are to keep going until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was

played again.

Stop working.

The experimenter then handed each student a counter with the child's name on it. The use of the counter was demonstrated and checked following the procedure described for the immediate positive group. The tape was then played.

Go through your packet starting with the first page. Whenever you find a finished problem, press the counter When you've gone through the whole packet, look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the counters and the packets. Starting on the second day and continuing through the fifth, the students were told by tape after the self-efficacy rating scales were collected:

Since the problems get harder each day, a good student may not be able to do as many as the day before and may do 3 problems less each day than the day before. Work on the problems in your packet and remember that since the problems get harder each day a good student may be able to do 3 less each day than the day before.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter then gave each student a counter with the child's name on it.

Look at the number on your counter and reset it to zero

The examiner checked for compliance.

Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and packets.

All of the students in the three end of day recording groups worked on the computation problems during the first morning period and self-recorded during the last afternoon period.

End of day-Positive. On the first day after the experimenter collected the self-efficacy rating scales, the students were instructed by the tape:

You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter collected the packets, the students returned to their homeroom and met again in the afternoon. The experimenter then returned the packets to the students and gave each student a counter with the child's name on it. The use of the counter was demonstrated and checked following the procedure described for the positive-immediate group. The tape was then played.

Go through your packet starting with the first page. Whenever you find a finished product press the counter. When you've gone through the whole packet, look at the number on your counter and write it on your packet next to your name.

The experimenter collected the counters and the packets. Starting on the second day and continuing through the fifth the students were told by tape:

The problems get harder each day but a good student should be able to do 3 more problems each day. Work on the problems in your packet. The problems do get harder each day but a good student should be able to do 3 more problems each day than the day before.

The students had 30 minutes to work to work and then the tape was played again.

Stop working.

The experimenter collected the packets, the students returned to their homeroom and met again in the afternoon. The experimenter returned to each student the packet and the counter with the child's name on it. The tape was played.

Look at the number on your counter and reset it to zero

The experimenter checked for compliance.

Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and the packets.

End of day-No goal. On the first day after the experimenter collected the self-efficacy rating scales, the students were instructed by tape:

> You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

> Stop working.

The experimenter collected the packets, the students returned to their homeroom and met again in the afternoon. The examiner then returned the packets and gave each student a counter with the child's name on it. The use of the counter was demonstrated and checked according to the procedure followed for the immediate positive group. The tape was then played.

> Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet, look at the number on your counter and write it on the packet next to your name.

The experimenter then collected the counters and packets. Starting on the second day and continuing through the fifth, the students were instructed by tape:

> You are to work on the problems in your packet and you

are to keep working until told to stop. Begin working and keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter collected the packets, the students returned to their homeroom and met again in the afternoon. The experimenter then returned the packets and gave each student a counter with the child's name on it. The tape was then played.

Look at the number on your counter and reset it to zero

The experimenter checked for compliance.

Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet, look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the packets and the counters.

End of day-Negative. On the first day after the experimenter collected the self-efficacy scales, the students were instucted by tape:

You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter collected the packets, the students returned to their homeroom and met again in the afternoon. The experimenter then returned the packets and gave each student a counter with the child's name on it. The use of the counter was demonstrated and checked following the procedure for the immediate-positive group. The tape was then played.

> Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet, look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the counters and packets. Starting on the second day and continuing through the fifth, the students were instructed by tape:

> Since the problems get harder each day, a good student may not be able to do as many as the day before and may do 3 problems less each day than the day before. Work on the problems in your packet and remember that since the problems get harder each day a good student may be able to do 3 less each day than the day before.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter collected the packets, the students returned to their homeroom and met again in the afternoon.

The experimenter then returned the packets and gave each student a counter with the child's name on it. The tape was then played again.

Look at the number on your counter and reset it to zero

The experimenter checked for compliance.

Go through your packet starting with the first page. Whenever you find a finished problem press the counter. When you've gone through the whole packet look at the number on your counter and write it on your packet next to your name.

The experimenter then collected the counters and packets.

No recording-Positive. On the first day after the experimenter collected the self-efficacy rating scales, the subjects were instructed by tape:

You are to work on the problems in your packet and you are to keep working until told to stop. Begin working. Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter collected the packets. Starting on the second day and continuing through the fifth, the students were told by tape:

The problems get harder each day but a good student should be able to do 3 more problems each day. Work on the problems in your packet. The problems do get harder each day but a good student should be able to do 3

more problems each day than the day before.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter then collected the packets.

No Recording-No Goal. For the five days of treatment after the experimenter collecteds the self-efficacy ratings, the students were instructed by tape:

You are to work on the problems in your packet and you are to keep working until told to stop. Begin working.

Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter then collected the packets.

No Recording-Negative. On the first day, after the experimenter collected the self-efficacy rating scales the students were instructed by tape:

You are to work on the problems in your packet and you are to keep working until told to stop. Begin working.

Keep going until told to stop.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter then collected the packets. Starting on the second day and continuing through the fifthe the students were told by the tape:

Since the problems get harder each day, a good student may not be able to do as many as the day before and may be do 3 problems less each day than the day before. Work on the problems in your packet and remember that since the problems get harder each day a good student may be able to do 3 less each day than the day before.

The students had 30 minutes to work and then the tape was played again.

Stop working.

The experimenter then collected the packets.

## Results

Two types of analyses were performed on the data. Analyses for the dependent variables of self-efficacy and number of problems completed were performed initially using 4(self-recording) x 3(goal setting) analyses of covariance (ANCOVA) with pretest score indicating performance on a long division pretest (Appendix A) as covariate. A significant correlation between pretest score and number of problems completed ($r = .39$, $p<.0001$) was found. The mean of students' scores for number of problems completed and self-efficacy on the five days of training served as the dependent measures. The mean was selected because it was derived from all five measures and therefore was the most reliable measure of training effect.

In addition, a second one-way repeated measures analysis of covariance was conducted to investigate changes in self-efficacy and number problems completed as a function of day of training. The pretest score served as a covariate in this analysis as well.

Pooled variances were used for the ANCOVAS and error terms adjusted for the covariate were used for the group comparisons. Data for boys and girls were combined since there was no main effect for sex.

### Number Problems Completed

The ANCOVA design assumes homogeneity of variance. To test this assumption, Hartley's $F$ max test (Winer, 1971) was used. At the .05 level of significance, the critical value

for $F$ max (12,15) was 5.9. For number of problems completed, the observed $F$ max value of 2.64 indicated that the homogeneity of variance assumption was met.

Analyses of covariance of number problems completed (See Table 1 ) indicated a main effect for self-recording, $F(3,179)=3.57$, $p<.01$; a main effect for goal setting, $F(2,179)=3.76$, $p<.02$. A self-recording with goal setting interaction, $F(6,179)=2.13$, $p<.05$ attained significance. A priori hypotheses were tested using $t$-test comparisons, however, none achieved significance (ie., hypotheses 1 through 6).

Because the main effects for goal setting and self-recording were qualified by a statistical interaction between these variables, only the results of the interaction will be reported. Simple effects tests were used initially to understand this interaction. (See Figure 1) Self-recording effects emerged only in the positive goal condition, $F(3,179)=5.8$, $p<.05$, but not in the no goals condition, $F(3,179)=.82$, ns, and not in the negative goals condition, $F(3,179)=.17$, ns. There was also a linear trend for self-recording in the positive goal condition, $F(1,179)=12.9$, $p<.01$. Additional simple effects tests showed that goal setting influenced the number of problems students completed during immediate recording, $F(2,179)=4.8$, $p<.05$, and when recording after the session, $F(2,179)=3.8$, $p<.05$ but not when recording at the end of the day, $F(2,179)=1.0$, ns. Goal setting also did not have an impact

Table 1

Adjusted treatment means and standard deviations for number problems completed

| | | SELF-RECORDING | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | A1 | | A2 | | A3 | | A4 | |
| | | Mean | S.D. | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| C | | | | | | | | | |
| R | B1 | 32.1 | 5.6 | 30.9 | 5.5 | 31.0 | 5.5 | 24.8 | 5.5 |
| I | | | | | | | | | |
| T | | | | | | | | | |
| E | B2 | 26.5 | 5.5 | 25.9 | 5.5 | 28.7 | 5.5 | 27.1 | 5.5 |
| R | | | | | | | | | |
| I | | | | | | | | | |
| O | B3 | 30.1 | 5.5 | 26.9 | 5.5 | 28.9 | 5.5 | 27.4 | 5.5 |
| N | | | | | | | | | |

Note. n=16 in each group; range of scores 0 to 40

A1-immediate self-recording

A2-post session self-recording

A3-end of day self-recording

A4-no self-recording

B1-positive goals; B2-no goals; B3-negative goals

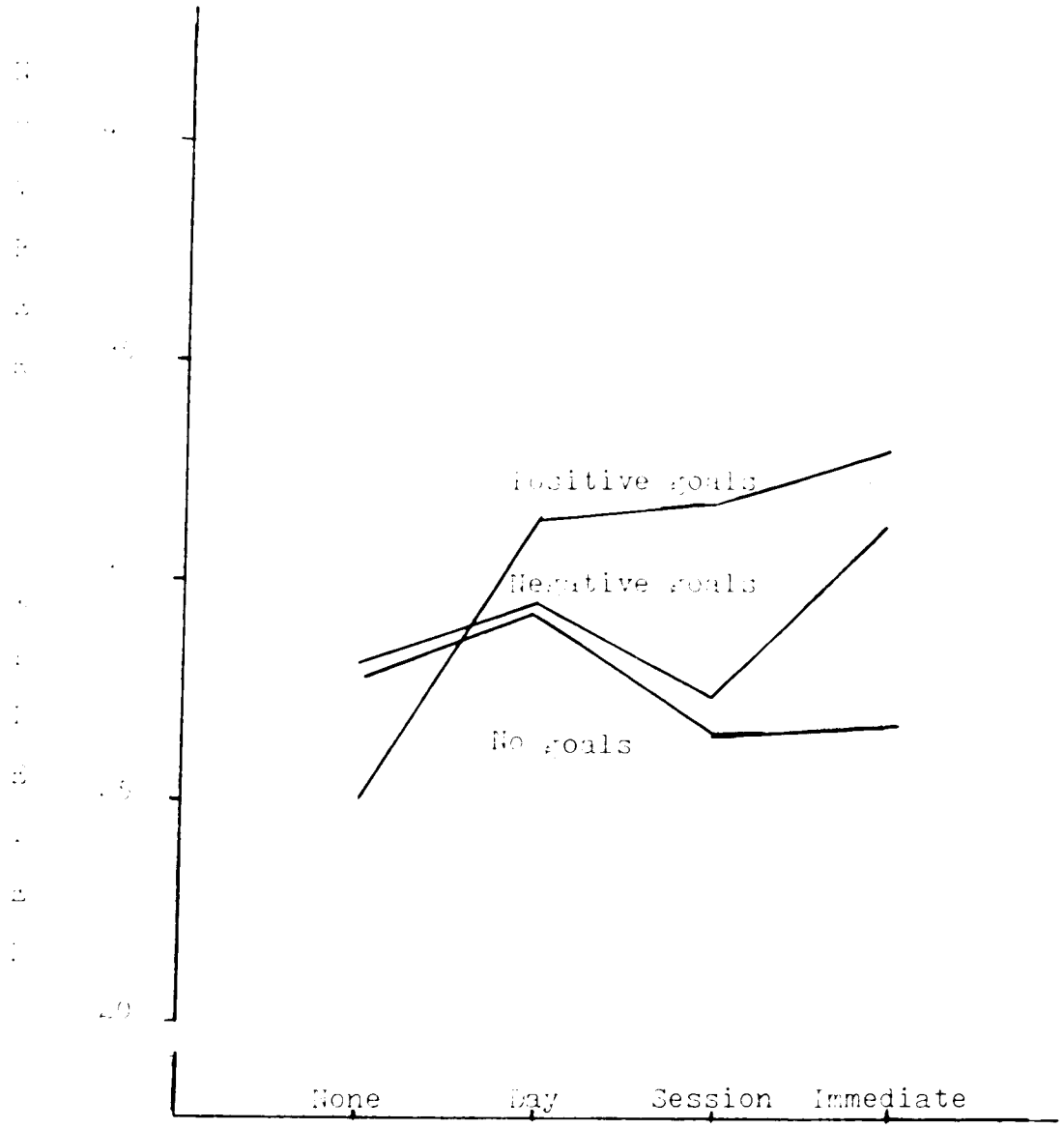



Figure 1. Adjusted means for problems completed

on the number of problems completed by the students in the no recording control group, $F(2,179)=2.34$, ns.

Newman-Keuls tests were used to examine pairwise comparisons involving self-recording and goal setting. In the positive goal or criterion setting condition, students who self-recorded immediately completed significantly more problems ($M=32.1$) than students who did not record ($M=24.8$). None of the other pairwise comparisons reached statistical significance.

The results indicate that both self-recording and goal setting combined to influence the students' problem completion. When students were provided with positive goals, self-recording had an effect. When self-recording closely followed the occurrence of behavior, goal setting had a positive impact on problem completion but goal setting had no impact when self-recording was delayed for several hours.

The second one-way analysis of covariance was applied to day of training data and significant differences were found for number problems completed as a function of day of training, $F(4,720)=178.49$, $p<.01$. Trend analyses were conducted to determine the source of this day of training effect and a linear trend was found which provided the best fit for the data, $F(1,180)=350.62$, $p<.01$ and accounted for 94.2% of the variance.

Self-Efficacy

The ANCOVA design assumes homogeneity of variance. The

Table 2

Adjusted treatment group means and standard deviations for self-efficacy ratings.

| | | SELF-RECORDING | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | A1 | | A2 | | A3 | | A4 | |
| | | Mean | S.D. | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| C | | | | | | | | | |
| R | B1 | 81.1 | 17.5 | 74.1 | 16.8 | 80.7 | 16.7 | 67.8 | 16.6 |
| I | | | | | | | | | |
| T | | | | | | | | | |
| E | B2 | 68.9 | 16.6 | 67.4 | 16.7 | 51.4 | 16.7 | 53.6 | 16.7 |
| R | | | | | | | | | |
| I | | | | | | | | | |
| O | B3 | 69.2 | 16.6 | 69.7 | 16.6 | 69.4 | 16.8 | 71.9 | 16.8 |
| N | | | | | | | | | |

Note. n=16 in each group; range of scores 0 to 100

A1-immediate self-recording

A2-post session self-recording

A3-end of day self-recording

A4-no self-recording

B1-positive goals; B2-no goals; B3-negative goals

F max test (Winer,1971) was used to test this assumption and at the .05 level of significance, the critical value for F max (12,15) was 5.9. The observed F max value for self-efficacy was 5.0 which indicated that the assumption of homogeneity of variance was met.

Analyses of covariance of self-efficacy ratings (See Table 2 ) indicated a main effect for goal setting, $F(2,179)=14.05$, $p<.001$, and an interaction between self-recording and goal setting, $F(6,179)=2.36$, $p<.02$. (See Figure 2) The main effect for self-recording narrowly missed statistical significance, $F(3,179)=2.34$, $p<.07$, however a significant linear trend for self-recording did achieve significance, $F(1,179)=5.52$, $p<.02$.

Simple effects tests revealed that goal setting affected the self-efficacy of students who recorded at the end of the day, $F(2,179)=12.63$, $p<.001$ and of the students in the no recording condition, $F(2,179)=5.33$, $p<.01$. Goal setting did not affect the self-efficacy of students who recorded immediately, $F(1,179)=2.75$, ns, or after the session, $F(1,179)=67$, ns. In the no goal setting condition, there was a simple effect for self-recording, $F(3,179)=4.79$, $p<.005$ and a linear trend for self-recording, $F(1,179)=11.08$, $p<.005$. These results indicate that when students do not give themselves performance feedback (no self-recording) or give themselves delayed feedback (day self-recording), goal setting contributes to ratings of self-efficacy but not when feedback is immediate or close to

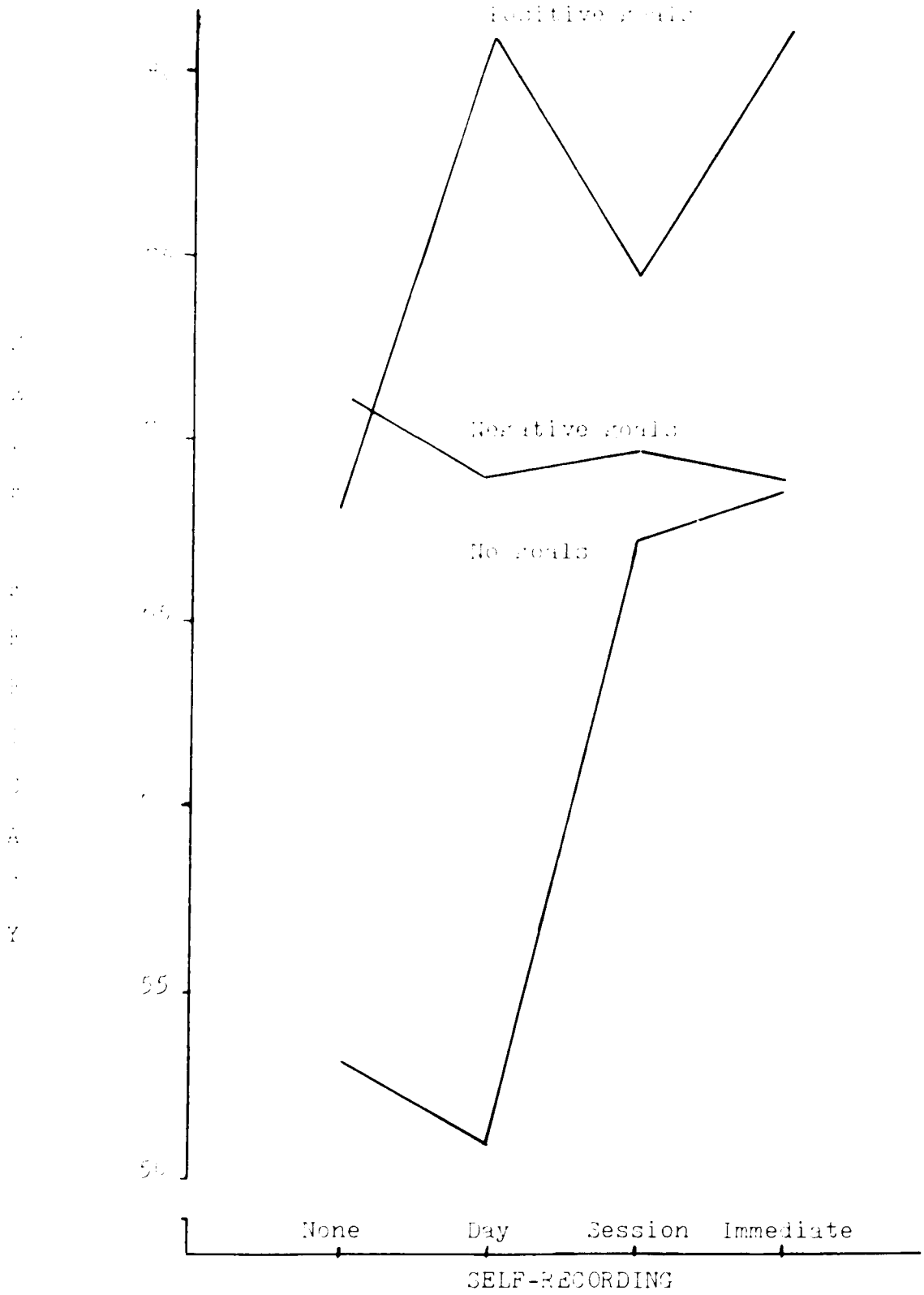



Figure . . Adjusted means for self-efficacy ratings

the occurrence of behavior.

Simple effects tests were also used to to explore the sex with goal setting interaction. It was found that boys' and girls' perceptions of self-efficacy differed when no goals were given, $F(1,167)=9.84$, $p<.01$. Newman-Keuls comparisons indicated that perceptions of self-efficacy for boys ($M=64.3$) and for girls ($M=42.5$) differed significantly in the no recording-no goals group only.

A priori hypotheses were tested using $t$-tests. As predicted, the students who self-recorded immediately but who were not provided with goals had higher self-efficacy ratings ($M = 68.9$) than students who were not provided with goals and did not record ($M = 53.6$), $t(16) = 2.57$, $p<.05$,(confirming hypothesis 7) or recorded at the end of the day ($M = 51.4$), $t(16) = 2.9$, $p<.005$ (confirming hypothesis 8). There was also support for the hypothesis that students who self-recorded immediately and set positive goals had higher self-efficacy ratings ($M = 81.1$) than students who self-recorded immediately but set negative goals ($M = 69.2$), $t(16) = 1.99$, $p<.05$ (confirming hypothesis 10). Hypothesis 9 regarding the significant effects for the timing of self-recording was not supported. The results indicated that when individuals do not have goals, the immediacy of self-recording is more critical on self-efficacy ratings than when individuals do have goals. If the recording is immediate, then positive goals raise self-efficacy ratings more than do negative goals.

The results of Newman-Keuls comparisons supported these conclusions. In the no goal condition, the students who self-recorded at the end of the day ($M$ = 51.4) had significantly lower self-efficacy ratings than the students who self-recorded immediately ($M$ = 68.9) or at the end of the session ($M$ =67.4). The students who did not self-record and did not set goals had significantly lower self-efficacy ratings ($M$ = 53.6) than the students who set positive goals and self-recorded immediately ($M$ =81.1), self-recorded at the end of the session ($M$ = 74.1), and self-recorded at the end of the day ($M$ = 80.7). The students who self-recorded at the end of the day but did not set goals had significantly lower self-efficacy ratings ($M$ = 51.4) than the students who set positive goals and self-recorded immediately ($M$ = 81.1), at the end of the day ($M$ = 80.7), at the end of the session ($M$ = 74.1) or did not self-record ($M$ = 67.8). Students who self-recorded at the end of the day without setting goals for themselves did not differ from the students who set negative goals and self-recorded immediately ($M$ = 69.2), at the end of the day ($M$ = 69.4), or at the end of the session ($M$ = 69.7).

The second one-way repeated measures analysis of covariance was applied to the day of training data. Significant differences were found for self-efficacy ratings as a function of day of training, $F(4,720)=130.47$, $p<.001$. Trend analyses showed that a linear trend provided the best fit for the data, $F(1,180)=242.48$, $p<.001$ and accounted for

96% of the variance due to training day.

As predicted, a significant correlation ($r = .40$, $p<.01$) was found between number of problems completed and self-efficacy ratings (hypothesis 11). This correlation indicates that self-efficacy accounts for approximately 16% of the variance in students' problem completion.

## Discussion

The obtained results provide support for Bandura's model of self-regulation which posits that judgment and self-observation combine to determine self-efficacy and performance. The present study operationalized Bandura's distinction between self-observation and judgment sub processes through the assignment of students to self-recording and goal setting groups. Self-recording enhanced self-observation by providing performance feedback, and goal setting determined the criteria against which self-evaluations were made. The data revealed that self-recording and goal setting variables were key determinants of students' perceptions of efficacy and problem completion. However, the specific pattern of results for self-recording and goal setting relationship did not conform to expectations.

Previous work has shown that performance feedback alone (Schunk,1983c) and goals in combination with feedback (Bandura & Cervone,1983;1986) influenced performance. Therefore, a simple additive statistical model of the relationship was advanced as a starting point for this study. Based on this model, it was predicted that self-recording and goal setting would each separately affect students' performance and together would combine additively to influence self-efficacy and problem completion. The data, however, showed that the self-recording and goal

setting relationship was not additive but instead was interactive and more complex than initially envisioned.

The present study replicated previous research which indicated that self-recording produces student reactivity (Shapiro, 1984). Students who self-recorded completed more division problems than students who did not self-record. This study extends the findings of previous laboratory research with novel tasks through its use of a difficult but familiar task taught in school. Self-recording was found to increase the number of problems that students completed during the course of the study. This suggests that self-recording may be of value in improving completion rate of other school learning tasks. The present study used task completion as the most appropriate measure of motivation. One limitation of this study is that it did not consider the accuracy of the problems completed by the students. This should be addressed in future research.

The students in this study were encouraged to set goals for themselves by the experimenter who provided them with a performance standard or criterion for a "good student". Bandura and Cervone (1983; 1986) found a high degree of goal commitment by subjects when they were encouraged by the experimenter to set goals. The obtained results provide support for the contention that goal setting plays a central role in reactivity (Bandura, 1986). Having positive goals influenced students' completion of long division problems in the present study.

Performance was maximal for students who self-recorded and were provided with positive goals. When the students set positive goals, the timing of the self-recording was not as crucial for improving performance. The students who self-recorded immediately and set positive goals completed significantly more problems than the students who set positive goals but did not self-record. The students who self-recorded immediately and set positive goals did not complete significantly more problems than students who set positive goals and recorded either at the end of the session or at the end of the day. These results show that in the absence of performance feedback, positive goals do not have an impact on future performance but when combined with self-recording positive goals lead to improved performance regardless of the timing of self-recording. This suggests that setting positive goals may make an individual less dependent on immediate performance feedback. This lack of environmental dependence may indicate a greater degree of self-regulation.

The timing of the self-recording was found to be associated with the effectiveness of goal or criterion setting because goal setting affected the number of problems completed in the immediate and post session recording groups. This suggests that having performance standards against which to compare one's performance affects performance only when performance is ongoing or just completed. When making the comparison several hours later

or not making it at all, performance standards do not affect susequent performance.

The importance of the timing of the self-recording was also supported by the group comparisons involving perceptions of self-efficacy. When students were not provided with goals, they had higher self-efficacy ratings if they recorded immediately or at the end of the session than if they self-recorded at the end of the day or did not self-record at all. The timing of the self-recording may be important when no goals are provided because the immediacy of the self-recording may lead individuals to personally set goals. It appears that immediate performance feedback may compensate for students' lack of goals, but it does not appear that goals can compensate for lack of feedback. Having goals without knowing how one is doing seems to undermine their effect on future behavior.

In contrast, Bandura and Cervone (1983) found that 70% of their subjects who were provided with performance feedback but no goals reported setting their own goals. If students are not provided with goals, the monitoring of behavior immediately or close to its occurrence could more easily result in the setting of goals against which to make self-evaluations than could delayed monitoring or no monitoring. This suggests that both feedback and goals are required in order to optimize self-efficacy and performance. Both are necessary and neither is sufficient alone. This conclusion is in accord with that of Bandura and Cervone

(1983). The present study extends their laboratory findings by using subjects' self-recordings rather than machine given feedback and by setting progressive goals dependent on the subjects' actual performance rather than goals selected beforehand. Future research needs to investigate the occurrence of self-set goals in different self-recording conditions in order to verify whether the timing of the self-recording does in fact play a role in the formation of self-set goals

The prediction of an overall effect for the timing of self-recording was not supported. It was hypothesized that shorter intervals between self-observation and self-recording would be associated with greater reactivity than longer intervals because immediate self-recording would provide the most information about ongoing behavior and thus the most opportunity for self-evaluation to influence the behavior in progress. It is possible that the operational definitions of shorter and longer time intervals were not appropriate. The range of the timing of the self-recording from immediate to 5 hours may have been too narrow so that the effects due to the timing of the self-recording were not found. It is also possible that the students in the study were able to remember their good performance from day to day as well as during the performance-recording interval. The ability to remember one's behavior might decrease the effect of the timing of self-recording on self-efficacy and performance.

The lack of an overall effect for the timing of the self-recording in this study may be analogous to the lack of effect for the timing of feedback in programmed instruction. McKeachie (1974) cites evidence which shows that there is little support for the operant position that immediate feedback is essential for superior learning during programmed instruction. Research suggests that immediate knowledge of results made little difference in learning or in some cases was detrimental to learning.

The data provide support for the cognitive behavioral rather than operant interpretation of reactivity. The self-recording and goal setting interaction strongly suggests that a self-evaluative process involving a comparison between one's performance and goals is a key factor in improving self-efficacy and performance. The operant position gives little emphasis to goal setting, particularly in the absence of direct reinforcement. However,the data showed that environmental feedback in the form of self-recording was not useful without goals; the data also indicated that the timing of the self-recording by itself did not affect either problem completion or self-efficacy. These findings conform with a social learning model of reactivity. The results strongly suggest that self-recording is more than a mechanical counting response but also involves active cognitive processing.

Evidence that having specific goals influences the effectiveness of students' self-recording as well as their

self-efficacy and performance is also concordant with a cognitive behavioral model of reactivity. Bandura and Schunk (1981; Schunk,1983a; 1983b; 1983c) found that proximal and difficult goals in combination with a performance standard had the greatest impact on reactivity. The present study found that a performance standard involving proximal and progressive goals strongly affected students' task completion. Having a positive goal lead to higher self-efficacy ratings than having a negative goal. The students' self-efficacy ratings did not decrease during the course of the study. Future research should examine under what self-recording and goal setting conditions does students' self-efficacy and performance actually deteriorate. Knowledge of this could prevent such occurrences in students'lives.

## Educational Implications

The present study showed that self-recording by students positively influenced their completion of the schoolwork. This result suggests that teachers may find it useful to teach students to self-record classroom outcomes. The procedures used in this study could be easily adapted to the classroom without adversely affecting normal class routines. The students who participated in the study were able to master the self-recording procedure without difficulty. During the course of the study, many students

spontaneously reported feelings of pride and accomplishment about their self-recordings. There were no reports of feeling self-conscious and uncomfortable about recording one's behavior. However self-recording in the present study involved a familiar task. Whether self-recording would engender self-consciousness during the learning of a new task needs to be adressed in future studies.

The finding of a significant interaction between self-recording and goal setting has important educational implications. The present study suggests that it would be unwise to teach self-recording without also helping students to set appropriate goals. Schunk (1983a; 1983b) found that difficult proximal goals resulted in the greatest math improvement. The results of the present study suggest that teachers could help students use their own performance as a starting point for setting their future goals. This would also be consistent with the idea that self-regulated learners should set their goals independent of other children's accomplishments. The goals the teacher would try to have the students set should be progressive and predicated on a student's past performance levels.

Being able to self-record behavior and to set appropriate goals would have the effect of not just increasing self-efficacy and improving performance in school but would also provide students with an important self-regulation skill which could be applied to many other aspects of their life.

Appendix A Pretest problems

1. 48/2
2. 619/3
3. 58/29
4. 756/36
5. 210/35
6. 1531/23
7. 6192/72
8. 8662/721
9. 35,215/627
10. 369,000/123

Appendix A Day one problems

1. 13/2
2. 18/3
3. 13/4
4. 30/5
5. 48/5
6. 49/6
7. 28/7
8. 154/7
9. 152/8
10. 208/8
11. 324/9
12. 136/2
13. 582/2
14. 219/3
15. 825/3
16. 144/4
17. 994/4
18. 152/5
19. 62/18
20. 135/15
21. 768/24
22. 162/27
23. 108/30
24. 155/31
25. 290/32
26. 423/47
27. 456/52
28. 250/62
29. 404/65
30. 485/80
31. 1980/22
32. 3610/38
33. 2340/46
34. 5212/51
35. 2944/64
36. 9360/72
37. 2400/300
38. 4498/642
39. 68,634/757
40. 560,979/789

Appendix A  Day two problems

1. 45/9
2. 27/3
3. 75/3
4. 28/4
5. 76/4
6. 52/8
7. 79/8
8. 936/3
9. 995/9
10. 387/9
11. 924/4
12. 211/2
13. 261/3
14. 807/3
15. 280/4
16. 880/4
17. 274/5
18. 244/6
19. 84/21
20. 210/29
21. 275/30
22. 768/32
23. 390/55
24. 348/58
25. 882/63
26. 586/71
27. 295/74
28. 423/76
29. 496/81
30. 826/94
31. 2340/12
32. 4144/16
33. 1066/26
34. 1470/35
35. 4085/43
36. 6848/64
37. 4498/642
38. 4823/689
39. 36,462/256
40. 147,852/333

Appendix A  Day three problems

1. 15/3
2. 20/4
3. 26/4
4. 19/5
5. 37/6
6. 96/6
7. 66/7
8. 121/3
9. 280/3
10. 159/4
11. 302/4
12. 120/6
13. 423/7
14. 518/7
15. 700/7
16. 272/8
17. 424/8
18. 207/9
19. 43/12
20. 112/16
21. 630/18
22. 130/20
23. 984/23
24. 224/28
25. 240/30
26. 152/38
27. 360/40
28. 126/42
29. 946/43
30. 436/50
31. 5428/23
32. 1224/24
33. 1984/32
34. 2958/34
35. 4028/53
36. 2745/61
37. 5285/201
38. 6240/416
39. 15,512/621
40. 312,457/913

Appendix A Day four problems

1. 18/2
2. 20/3
3. 75/3
4. 23/4
5. 28/5
6. 35/6
7. 59/7
8. 174/2
9. 616/2
10. 267/3
11. 836/4
12. 635/5
13. 186/6
14. 312/6
15. 841/6
16. 168/7
17. 301/7
18. 791/7
19. 90/10
20. 738/18
21. 126/21
22. 442/26
23. 182/34
24. 945/35
25. 259/37
26. 376/47
27. 530/68
28. 336/79
29. 405/81
30. 258/86
31. 2250/18
32. 6091/19
33. 1886/21
34. 2805/35
35. 1530/39
36. 2224/52
37. 8448/384
38. 4789/431
39. 12,763/222
40. 281,536/708

Appendix A Day five problems

1. 60/3
2. 52/4
3. 20/5
4. 38/5
5. 35/7
6. 51/8
7. 59/9
8. 192/2
9. 826/2
10. 329/3
11. 439/4
12. 754/5
13. 134/6
14. 437/7
15. 636/7
16. 352/8
17. 901/8
18. 369/9
19. 84/12
20. 140/15
21. 95/19
22. 882/21
23. 792/24
24. 125/25
25. 744/31
26. 782/34
27. 294/35
28. 200/38
29. 117/39
30. 283/40
31. 3066/43
32. 1680/48
33. 1378/53
34. 3420/54
35. 5696/64
36. 5137/77
37. 8901/989
38. 2635/412
39. 14,916/452
40. 123,456/192

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