A Multistage Multidependent Variable Assessment of Children's Self-Regulation of Academic Performance

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Abstract. The utility of Kanfer and Karoly's self-regulation model was assessed in terms of children's academic performance. Since the model's components may be relevant only to motivational aspects of behavior, a self-instructional component was included. One hundred and thirty-eight children (M age = 10.04 years, M IQ = 102.83) were assigned randomly to one of five groups (Control, Control plus feedback, Self-monitoring, Self-determined performance standards and self-reinforcement, or Self-instruction) and their effects were assessed on measures of arithmetic and verbal performance. The significant MANOVA effect was attributable to both measures. Self-determined performance standards and self-reinforcement was significantly more effective than the other conditions for both arithmetic and verbal performance. This finding was consistent with previous research and theorizing. Finally, the child's causal attribution was shown to correlate with the frequency of self-verbalizations on the verbal task.

Kanfer and Karoly (1972a, 1972b) proposed a model to account for the self-regulation of behavior. According to this three-process feedback model, individuals first self-monitor the required behavior. Following this, the adequacy of the behavior is evaluated against some performance standard, and appropriate self-reinforcement

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(positive or negative) would ensue. Subsequent research has validated this process (Kirschenbaum & Karoly, 1977), and demonstrated that operationalizing the model's components can facilitate diverse behavior changes (e.g., Bellack, 1976; Fuchs & Rehm, 1977). This study investigates the predictive value of the model for normal children's academic behavior. More specifically, since academic tasks may vary in difficulty, an assessment of the model's predictive validity regarding diverse tasks is undertaken.

Some research has addressed the issue of the self-regulation of academic (rather than classroom) behavior. In one line of research, single-case designs have assessed the model's components (e.g., Ballard & Glynn, 1975; Glynn & Thomas, 1974), and the external validity of their findings, therefore, cannot be regarded as unequivocal. A second line of research has used between-group designs. Utilizing this approach, Spates and Kanfer (1977) investigated the arithmetic performance of children, while Greiner and Karoly (1976) assessed the academic performance of college students. In both studies, the supremacy of performance standards and reinforcement was indicated. However, the utility of their findings in providing a model of the self-regulation of normal children's academic behavior is questionable for a number of reasons. First, in both studies, the different components were confounded with training effects, which were not assessed independently. Second, Spates and Kanfer (1977) investigated performance on a simple arithmetic task only, although the effects of self-regulation may be task specific (Titchenor, 1977). Third, the nature of Spates and Kanfer's (1977) self-monitoring manipulation is questionable. Their subjects received the following instructions (Spates & Kanfer, 1977, p. 11):

Now let's do something a little differently. As you add each of these problems, say aloud what numbers you are adding, for example, if you are working at this problem (pointing to the first problem on the training sheet) you would say: "Now I am adding these two numbers here; now I am adding these two numbers here; now I am adding these two numbers here."

As Nelson (1977) points out, however, self-monitoring consists of two processes, self-observation and self-recording, neither of which is likely to have resulted directly from these instructions. Rather, this group's experimental manipulation is more likely to have approximated self-instructional behavior.

In examining the research to date, a further problem arises.
Most studies have concentrated on dependent variables which mainly reflect *motivational* aspects of academic performance. Yet effective academic performance would result from a combination of persistence and accuracy. In this respect, dependent variables, such as time-at-task or the number of problems attempted, reflect task persistence. On the other hand, in assessing the number of problems solved correctly—the quality of performance—skill is emphasized. Research has typically concentrated on the first dimension only. However, successful academic performance must be a function of the reciprocal interaction of these two factors. Thus, the present study operationalizes scholastic performance as the ratio of the number of correct responses (skill) to the number of responses made (persistence), and assesses both arithmetic and verbal performance.

In extending the model to assess its effects of accuracy components, the inclusion of a component specific to this dimension may be appropriate. For example, Greiner and Karoly (1976) combined self-determined performance standards *and* cognitive strategies for achieving such standards. Within a behavioral framework, the efficacy of self-instructional techniques has been demonstrated with children (Meichenbaum, 1977), while the frequency of self-verbalizations is important in regulating subsequent behavior (Fry, 1978). Since the content of the self-verbalization can be oriented to eliminate specific deficits, its potential for increasing accuracy is indicated. Consequently, this study also assesses whether a self-instructional component within the children’s self-regulation model would enhance its predictive validity.

Finally, the interaction of personality variables in such research is usually ignored (Achenbach, 1978). In a single study, Kirschbaum and Karoly (1977) investigated whether repression-sensitization accounts for some of the variance in the self-regulation of behavior. Although their results were not significant, the important issue is that the possible effects were investigated in the first instance. In assessing the self-regulation of academic performance, it might be instructive to investigate the influence of the child’s perceived locus of control (LOC) attribution. Research has implicated an internal LOC with the more frequent use of self-verbalizations (Steele & Barling, 1979), and with enhanced academic achievement (Fincham & Barling, 1978). Consequently, the present study assesses also whether the child’s LOC orientation explains some of the variance in the frequency of self-verbalizations.
Method

SUBJECTS AND EXPERIMENTAL DESIGN

One hundred and thirty-eight children ($M$ age = 120.46 months, $SD = 12.79$; 67 boys, 71 girls) took part in this study. All attended the same school, and were in grades three through six. They were of average IQ ($M$ IQ = 102.83) as reflected by their scores on the Peabody Picture Vocabulary Test (PPVT) (Dunn, 1965).

The present study involved a pretest-posttest design. Both testing sessions were conducted in the school hall, where the children were isolated from each other. Pre- and posttest sessions were separated by two months.

MATERIALS

The PPVT, used to assess verbal performance, consists of 150 cards graded according to difficulty, each containing four possible responses (pictures). Two alternate forms (A & B) are available, and the reliability and validity of the PPVT are acceptable (Bochner, 1978; Dunn, 1965).

The Scholastic Achievement Test in Arithmetic (SATA) (Scholastic Achievement Test in Arithmetic, 1974) consists of 60 items, and each grade-appropriate test contains three equal-length subtests. Like the PPVT, two alternate forms of the SATA are available. Both the reliability and validity of the SATA are satisfactory (Scholastic Achievement Test in Arithmetic, 1974). As was the case with the PPVT, a multiple choice format was presented; subjects now chose from five alternatives.

The PPVT and the SATA each yielded two measures. First, a measure of persistence was obtained, comprising the total number of items the child attempted on the entire test, after (s)he had been instructed to answer as many items as (s)he wanted to. The second variable—task accuracy—consisted of the total number of items answered correctly. The dependent variable in each instance was then obtained by dividing the total number of items attempted by the number answered correctly. Children experienced more difficulty with the arithmetic than the verbal task at pretesting (before any intervention had taken place) ($t(137) = 18.55$, $p < 0.001$; $38.48\%$ versus $72.76\%$ answered correctly).

Lunneborg and Lunneborg’s (1964) Social Desirability Scale was administered to all the subjects as this variable may confound the stringency of self-determined performance standards. Nonetheless, social desirability was not related to the relative stringency of arithmetic ($r(25) = 0.26$, $p > 0.05$) or verbal ($r(25) = -0.05$, $p > 0.05$) performance standards.

Finally, all children completed Nowicki and Strickland’s (1973) Children’s Locus of Control Scale at pretesting, before they were assigned randomly to one of the groups. The scale is both reliable and valid (Nowicki & Strickland, 1973), and a high score reflects externality. A principal components factor analysis with varimax rotation was computed, as multidimensional constructs may be more specific pre-

\[A constant of 100 was added to all scores to eliminate potential problems arising from the fact that a number of the pretest-posttest change scores were zero.\]
dictors of behavior. Two factors emerged, and were labeled *Personal Action* (Eigenvalue = 3.78) and *Luck* (Eigenvalue = 1.58), explaining 70.06% and 29.94% of the variance, respectively.

**PROCEDURE**

Subjects were assigned randomly to one of five groups. One tester (a final year, undergraduate psychology student) was assigned randomly to each of these experimental conditions, and served in this capacity for the pre- and posttest sessions. One week prior to the pretest, they were trained in a group regarding the administration of the PPVT and the SATA.1 Again one week prior to the posttest, testers received the same instructions regarding the administration of the tests for their particular group. However, as these instructions now differed for each group, they were trained individually and asked not to discuss the treatment their group would receive so as not to confound the different treatments. Thus, testers remained blind to the aim of the study, thereby facilitating some experimental control.

**Group 1: Control (n = 27).** Subjects in this group (*M* age = 120.7 months, *M* IQ = 100.82, 12 boys, 15 girls) received the same instructions as the other children had in the pretest. Thus, they were told: ‘Your job is to answer as many of the questions as you want. Do you understand?’ (Repeat if necessary.)

**Group 2: Control plus feedback (n = 28).** As was the case with the remaining groups, the subjects (*M* age = 120.64 months, *M* IQ = 105.04; 14 boys, 14 girls) in this group were told that they would be informed if they had answered the item correctly by means of a light being shone. This provided accurate feedback for the subjects regarding the quality of their performance (cf. Kirschbaum & Karoly, 1977). Subjects in this group received the following instructions: ‘Your job is to answer as many questions as you want. Each time you get an answer correct, this light will go on (demonstrate). When the light goes on, it means that you have got the answer correct. Do you understand?’ (Repeat if necessary.) The instructions for the remaining three groups were all preceeded by those received by Group 2.

**Group 3: Self-monitoring (n = 28).** Self-monitoring in this group was based on Nelson’s (1977) two-process definition. Thus, both self-observation and self-recording were included, whereas the Control plus feedback group approximated a self-observation alone condition. In addition, the subjects (*M* age = 119.96 months, *M* IQ = 101.04, 14 boys, 14 girls) were now required to self-monitor their academic performance, and received the following instructions: ‘What you must do is keep count of your score. On the paper in front of you, mark a tick each time you get the answer correct. At the end, we will count your score. Do you understand?’ (Repeat if necessary?)

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1A table detailing the results of this factor analysis may be obtained from the author.
2Copies of these detailed instructions may be obtained from the author.
Group 4: Self-determined performance standards and self-reinforcement (n = 28). As Kanfer (1977) states, it is questionable whether self-reinforcement can be separated from self-determined performance standards. For this reason, subjects in this group (M age = 120.39 months, M IQ = 104.57; 13 boys, 15 girls) self-determined a standard before starting, and then self-reinforced after the posttest on the basis of the comparison between the performance and the standard. In addition, a prompt for the selection of stringent standards was included, as previous research suggests that, when given a choice, children may self-determine the most lenient standard (Felixbrod & O'Leary, 1973). The procedure for this group followed that of Brownell, Colletti, Ersner-Hershfield, Herschfield, and Wilson (1977). Thus, instructions for this group were based directly on those of Brownell et al. (1977, p. 445, points 2 & 3).

In this group, subjects could self-administer any number of stars between one and 10 for each correct answer according to their predetermined standard. Following the completion of both academic tasks, they exchanged the number of stars they had received for a prize, which was worth a specified number of stars. The children chose from a variety of prizes (e.g., sweets, pencils, erasers, crayons). In terms of the number of stars required, the value of the prizes ($0.01 to $1.00) was constant for all subjects across pre- and posttesting. It was important that a choice of reinforcement be available, as the subjective perception of the reinforcement rather than its objective value regulates subsequent behavior (Moore, Mischel, & Zeiss, 1976).

Group 5: Self-instruction (n = 27). To assess the possible utility of self-instruction, the subjects in this group (M age = 120.63 months, M IQ = 102.63; 14 boys, 13 girls) received the following instructions:

Sometimes when people do a difficult job, it helps them to think aloud about how to do the job. Let me show you (pointing to Example 1): I think aloud saying: “Don’t get nervous, don’t rush. Before you guess, try and work out the correct answer from all the choices. Take it a bit slow if you want.” Now let us try this second example together. First, we look at it and then say: “Don’t get nervous, don’t rush. Before you guess, try and work out the correct answer from all the choices. Take it a bit slow if you want.” Try the third by yourself. (Subject self-verbalizes the instructions overtly before attempting the third answer.) Now before you start each item, say this statement: “Don’t get nervous, don’t rush. Before you guess, try and work out the correct answer from all the choices. Take it a bit slow if you want.” Do you understand? (Repeat if necessary.)

Rather than tailoring the self-verbalizations to each child’s idiosyncratic needs and thereby sacrificing some experimental control, the same cues for the self-verbalization were given. In this way, possible within-group differences arising from the self-verbalization’s content were minimized (Kendall, 1977). To prompt the continued use of the same self-instructions, the subjects were provided with cue-cards with the statement on them. The experimenter ascertained the number of overt self-instructions by maintaining a count of the frequency of their occurrence.
Results

Since the two dependent variables were significantly related at pretesting ($p < 0.01$), a MANOVA was necessitated (O’Leary & Turkewitz, 1978). Using the Pillai-Bartlett $F$ approximation, a significant multivariate effect on pretest-posttest change scores (Huck & McClen, 1975) for the two dependent variables was obtained ($F(8,266) = 3.08, p < 0.003$). Before computing univariate ANOVAs to assess this multivariate effect further (Spector, 1977), Bartlett’s Box $F$ statistic showed that in the case of the arithmetic measure, the homogeneity of variance assumption was not satisfied ($F = 4.16, p < 0.005$), and the Kruskal-Wallis one-way ANOVA (corrected for ties) was used in this measure.

Significant between-group differences emerged on both the arithmetic ($X^2(4) = 12.94, p < 0.015$) and verbal ($F(4,134) = 2.7, p < 0.035$) measures. To investigate which groups differed significantly on the verbal measure, Scheffe tests were computed. However, none of the groups differed significantly ($p > 0.05$). It was concluded that the self-determined performance standard and self-reinforcement group was the most effective, and significantly more effective than the control group (Roscoe, 1969). Mann-Whitney U tests showed that the self-determined performance standard and self-reinforcement was significantly more effective than all the other groups regarding arithmetic performance, that the self-monitoring condition was more influential than the self-instruction and control groups, while the self-instructional treatment was more effective than the control group ($p < 0.05$ in all instances). See Table 1.

Finally, separate Pearson correlations were computed between the Personal Action LOC belief and the frequency of overt self-verbalization on the arithmetic ($r(25) = -0.28, p > 0.05$) and verbal ($r(25) = -0.41, p < 0.05$) tasks: an internal Personal Action LOC belief was related to an increased use of self-instructions on the verbal task.

Discussion

The results of this study replicate those of previous findings (cf. Greiner & Karoly, 1976; Spates & Kanfer, 1977). Where significant differences did emerge, positive changes following self-determined
Table 1
Pretest-Posttest Change Scores for the Five Groups on Both Dependent Variables

<table>
<thead>
<tr>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M score:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal performance:</td>
<td>0.96</td>
<td>0.89</td>
<td>1.00</td>
<td>1.05</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>SD:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arithmetic performance:</td>
<td>73.19</td>
<td>88.80</td>
<td>98.11</td>
<td>111.38</td>
<td>84.00</td>
</tr>
</tbody>
</table>

*No information about standard deviations is provided as this data is non-parametric.

standards and self-reinforcement were the most pronounced. These results assume further import for two reasons. First, the components of the self-regulation model were manipulated experimentally. Thus, the possible confound of varying performance levels as a function of training is minimized. Second, research to date has tended to focus on a single dependent variable. The performance of children in this study, however, was assessed in terms of persistence and accuracy on verbal and arithmetic tasks, which differed considerably in difficulty.

The relative efficacy of the different components of the model is a central issue. Of some import is the fact that a significant multivariate effect emerged. Subsequent examination of the univariate results showed that this was attributable to both dependent measures. In terms of arithmetic performance, self-determined performance standards and self-reinforcement were significantly more effective than any of the other groups, although the self-monitoring group was more effective than the self-instruction and control groups, and the self-instruction more effective than the no-feedback control group. With regard to verbal performance, self-determined performance standards and self-reinforcement was the most effective group. The efficacy of this treatment on both tasks is consistent with social learning theory (Bandura, 1977; Kanfer, 1977; Karoly, 1977) and empirical research (Greiner & Karoly, 1976; Spates & Kanfer, 1977). In addition, the results suggest that in certain situations, incorporating self-instruction within a self-regulation model of children's academic performance may be of some value.

It might be expected that self-instruction would be of more im-
portance in terms of skill-relevant variables. Yet the present results demonstrate that self-instruction was only as effective as self-determined performance standards and self-reinforcement regarding arithmetic performance. In accounting for this finding, two options available regarding the content of the self-instruction must be considered (Kendall, 1977). Either the verbalization can be tailored to specific individual deficits, or a generalized self-instruction can be used for all children. The former would typify single-case studies, the latter between-group studies where experimental control is a major consideration. Thus, the content of the self-guiding statements in this study were not task specific, thereby reducing their efficacy somewhat. It is possible that if the nature of the self-verbalization had been oriented more specifically at specific deficits, its efficacy might have been comparable to self-determined standards and self-reinforcement.

That the role of self-verbalizations should be somewhat equivocal is consistent with previous research (Friedling & O'Leary, 1979). Nonetheless, the present findings do not negate the import of self-verbalizations. Rather, a number of factors point to their continued influence. First, only the frequency of overt self-instructions could be assessed, and covert self-verbalizations may be equally important. Second, a significant correlation between an internal Personal Action belief and the frequency of self-verbalizations for the verbal task emerged. Thus, the role of the frequency of self-instruction is supported partially. Third, the potential advantages of orienting the self-verbalization's content specifically remains to be explored. In addition, it should be noted that no inter-rater reliability was obtained for this measure. It is possible, therefore, that the data may not be reliable, which would limit the validity of the results. This possibility is minimized, however, as the tester was required to observe and record the number of overt self-verbalizations only.

Of the three processes in the original self-regulation model, self-monitoring is minimally important. Again, this is consistent with theoretical predictions (Kanfer, 1977). However, for arithmetic performance, self-monitoring was more effective in inducing behavioral change than self-instructions. For self-monitoring to be reactive, individuals should be motivated to change, and some valence should be attached to the target behavior (Nelson, 1977). Since the subjects in this study experienced more difficulty with arithmetic tasks—and, except those in the no-feedback control group, were aware of their success as they received continuous feedback—it is likely that the
valence of behavior change for such performance was greater than that for verbal tasks.

This study was based on the premise that effective performance is a function of both motivation and skill. Explicit acknowledgement of this perspective of academic performance has some implications for research on academic self-regulation. To date, primary emphasis has been placed on motivational aspects. To achieve optimal performance, though, it is essential to enhance both motivation and skill. The explicit incorporation of a task-specific self-verbalization component in the self-regulation model may provide a more comprehensive basis for a social learning theory analysis of children's behavior. Some support for this derives from a study showing that a combination of self-instruction and self-reinforcement was more effective than either component alone (Nelson & Birkimer, 1978).

Four problems remain. First, there is no method of ascertaining whether an individual who is presumed to be self-monitoring only is not also self-determining performance standards and/or self-reinforcing or self-instructing simultaneously. Since significant differences between self-determined standards and self-monitoring emerged, however, this possibility is minimized. Second, it remains essential to separate the effects of self-determined standards and self-reinforcement. On the basis of the present and past studies (e.g., Greiner & Karoly, 1976; Spates & Kanfer, 1977), it is not possible to accomplish this aim. However, it is argued that this is a function of the experimental methodology used: the contribution of performance standards and reinforcement may be assessed separately in a factorial study with each process serving as one of the independent variables. Third, a problem exists as to where in the self-regulation model a self-instruction component might be located. It is suggested that a combination of self-determined standards and self-instruction may overcome this dilemma: it may avail little to set stringent standards if the skill required to achieve the behavioral requirements is deficient. Finally, no information was obtained regarding the reliability of the self-instruction measure, and these results must remain somewhat tenuous.

In conclusion, these results do provide more information regarding a model of the self-regulation of academic performance by normal children. The results of previous studies suggesting the importance of self-determined standards are accepted with one caveat: like behavior in general, self-regulatory strategies may be task specific. Finally, in line with Karoly's (1977) suggestion regarding the
necessity of an expanded analysis of self-regulation, it would seem to be beneficial to view academic performance as a function of both motivation and skill, and structure self-regulatory strategies—both assessment and treatment—accordingly.

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