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Cultivating Competence, Self-Efficacy, and Intrinsic Interest Through Proximal Self-Motivation

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The present experiment tested the hypothesis that self-motivation through proximal goal setting serves as an effective mechanism for cultivating competencies, self-percepts of efficacy, and intrinsic interest. Children who exhibited gross deficits and disinterest in mathematical tasks pursued a program of self-directed learning under conditions involving either proximal subgoals, distal goals, or no goals. Results of the multifaceted assessment provide support for the superiority of proximal self-influence. Under proximal subgoals, children progressed rapidly in self-directed learning, achieved substantial mastery of mathematical operations, and developed a sense of personal efficacy and intrinsic interest in arithmetic activities that initially held little attraction for them. Distal goals had no demonstrable effects. In addition to its other benefits, goal proximity fostered veridical self-knowledge of capabilities as reflected in high congruence between judgments of mathematical self-efficacy and subsequent mathematical performance. Perceived self-efficacy was positively related to accuracy of mathematical performance and to intrinsic interest in arithmetic activities.

Much human behavior is directed and sustained over long periods, even though the external inducements for it may be few and far between. Under conditions in which external imperatives are minimal and discontinuous, people must partly serve as agents of their own motivation and action. In social learning theory (Bandura, 1977b, in press), self-directedness operates through a self system that comprises cognitive structures and subfunctions for perceiving, evaluating, motivating, and regulating behavior.

An important, cognitively based source of self-motivation relies on the intervening processes of goal setting and self-evaluative reactions to one's own behavior. This form of self-motivation, which operates largely through internal comparison processes, requires personal standards against which to evaluate ongoing performance. By making self-satisfaction conditional on a certain level of performance, individuals create self-inducements to persist in their efforts until their performances match internal standards. Both the anticipated satisfactions for matching attainments and the dissatisfactions with insufficient ones provide incentives for self-directed actions.

Personal goals or standards do not automatically activate the evaluative processes that affect the level and course of one's behavior. Certain properties of goals, such as their specificity and level, help to provide clear standards of adequacy (Latham & Yukl, 1975; Locke, 1968; Steers & Porter, 1974). Hence, explicit goals are more likely than vague intentions to engage self-reactive influences in any given activity. Goal proximity, a third property, is especially critical because the more closely referential standards are related to ongoing behavior, the greater the likelihood that self-influences will be activated during the process. Some

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suggestive evidence exists that the impact of goals on behavior is indeed determined by how far into the future they are projected (Bandura & Simon, 1977; Jeffery, 1977).

In the social learning view, adopting proximal subgoals for one's own behavior can have at least three major psychological effects. As already alluded to, such goals have motivational effects. One of the propositions tested in the present experiment is that self-motivation can be best created and sustained by attainable subgoals that lead to larger future ones. Proximal subgoals provide immediate incentives and guides for performance, whereas distal goals are too far removed in time to effectively mobilize effort or to direct what one does in the here and now. Focus on the distant future makes it easy to temporize and to slacken efforts in the present.

Proximal subgoals can also serve as an important vehicle in the development of self-percepts of efficacy. Competence in dealing with one's environment is not a fixed act or simply knowing what to do. Rather, it involves a generative capability in which component skills must be selected and organized into integrated courses of action to manage changing task demands. Operative competence thus requires flexible orchestration of multiple subskills. Self-efficacy is concerned with judgments about how well one can organize and execute courses of action required to deal with prospective situations containing many ambiguous, unpredictable, and often stressful elements. Self-percepts of efficacy can affect people's choice of activities, how much effort they expend, and how long they will persist in the face of difficulties (Bandura, 1977a; Brown & Inouye, 1978; Schunk, 1981).

Without standards against which to measure their performances, people have little basis for judging how they are doing or for gauging their capabilities. Subgoal attainments provide indicants of mastery for enhancing self-efficacy. By contrast, distal goals are too far removed in time to provide sufficiently clear markers of progress along the way to ensure a growing sense of self-efficacy.

The processes underlying the development of intrinsic interest may similarly be governed, at least in part, by goal proximity. Most of the activities that people enjoy doing for their own sake originally had little or no interest for them. Young children are not innately interested in singing operatic arias, playing tubas, deriving mathematical equations, writing sonnets, or propelling heavy shotput balls through the air. However, through favorable continued involvement, almost any activity can become imbued with consuming significance.

One can posit at least two ways in which proximal goals might contribute to enhancement of interest in activities. When people aim for, and master, desired levels of performance, they experience a sense of satisfaction (Locke, Cartledge, & Knerr, 1970). The satisfactions derived from subgoal attainments can build intrinsic interest. When performances are gauged against lofty, distal goals, the large negative disparities between standards and attainments are likely to attenuate the level of self-satisfaction experienced along the way.

Conceptual analyses of intrinsic interest within the framework of both self-efficacy theory (Bandura, 1981) and intrinsic motivation theory (Deci, 1975; Lepper & Greene, 1979) assign perceived competence a mediating role. A sense of personal efficacy in mastering challenges is apt to generate greater interest in the activity than is self-perceived inefficacy in producing competent performances. To the extent that proximal subgoals promote and authenticate a sense of causal agency, they can heighten interest through their effects on perception of personal causation.

Investigations of intrinsic interest have been concerned almost exclusively with the effects of extrinsic rewards on interest when it is already highly developed. Although results are somewhat variable, the usual finding is that rewards given regardless of quality of performance tend to reduce interest, whereas rewards for performances signifying competence sustain high interest (Boggiano & Ruble, 1979; Enzle & Ross, 1978; Lepper & Greene, 1979; Ross, 1976). The controversy over the effects of extrinsic rewards on preexisting high interest has led to a neglect of the issue of how intrinsic interest is developed when it is lacking. One of the present study's aims was to test the notion that proximal subgoals enlist the type of sustained involvement in activities that build self-efficacy and interest when they are absent.

Children who displayed gross deficits in mathematical skills and strong disinterest in such activities engaged in self-directed learning over a series of sessions. They pursued the self-paced learning under conditions involving either proximal subgoals, distal goals, or bids to work actively without any reference to goals. It was predicted that self-motivation through proximal subgoals would prove most effective in cultivating mathematical competencies, self-percepts of efficacy, and intrinsic interest in mathematical activities. For reasons given earlier, distal goals were not expected to exceed bids to work actively in promoting changes. It was hypothesized further that strength of self-efficacy would predict subsequent accuracy on mathematical tasks and level of intrinsic interest.

Method

Subjects

The subjects were 40 children of predominantly middle-class backgrounds, ranging in age from 7.3 to 10.1 years, with a mean age of 8.4 years. There were 21 males and 19 females distributed equally by age and sex across conditions.

Children were drawn from six elementary schools. As an initial screening procedure, teachers identified children in their classes who displayed gross deficits in arithmetic skills and low interest in such activities. The pretreatment procedures were administered to each of the identified children by one of two testers (a male and a female) to determine whether the children's arithmetic skills were sufficiently deficient to qualify for the experiment.

Pretreatment Measures

The study was presented to the children as a project aimed at gaining understanding of how arithmetic skills are acquired. To reduce further any evaluative concerns, they were informed that the project was being conducted in several schools and that their work would be treated in full confidence.

Mathematical performance test. The performance pretest consisted of 25 subtraction problems graded by level of difficulty. The test problems, which ranged from two to six columns, were specifically designed so as to tap each of seven subtraction operations that were included in the treatment phase of the study.

Of the 25 pretest problems, 8 were similar in form and difficulty to some of the types of items used in the subsequent treatment phase. To test for generalization effects, 17 problems required application of the various subtraction operations to problem forms that were more complex than those children would encounter in the self-instructional phase. For example, in treatment they learned how to borrow once or twice from zero in, at most, four-column problems, whereas a generalization item would require borrowing from three consecutive zeros in a six-column set. To add a further element of complexity, all the test problems were cast in a form in which the minuend and the difference between the minuend and the subtrahend were provided so that children had to solve the subtrahend.

Children were presented the set of 25 subtraction problems one at a time on separate pages and were instructed to turn each page over after they had solved the problem or had chosen not to work at it any longer. The tester recorded the time spent on each problem. The measure of competence in subtraction was the number of problems in which the children applied the correct subtraction operation.

Pilot work in the development of the test procedures revealed that children who do not fully comprehend subtraction operations fail to grasp the nature of their deficiency because they faithfully apply an erroneous algorithm. When presented with a subtraction problem, they simply subtract the smaller number from the larger one in each column regardless of whether the smaller number is the minuend or the subtrahend. To address this problem at the outset of the experiment proper, after children completed the arithmetic pretest they compared their solutions to the correct answers. However, children performed the posttest without feedback of accuracy.

Since this study centered on motivational processes by which competencies, perceived efficacy, and interest can be developed when they are lacking, children who solved more than four problems were excluded. The selected sample of children indeed exhibited gross deficits; one third could not solve a single problem, and another third could only solve one.

The children's substantial quantitative deficiencies were further confirmed by standardized measures of their mathematical ability obtained from the school district on three subtests of the Metropolitan Achievement Test (Durost, Bixler, Wrightstone, Prescott, & Balow, 1970). They occupied the bottom percentile ranks in computation (22), concepts (27), and problem solving (22). Children in the various treatment conditions did not differ in this respect.

Self-efficacy judgment. Before measuring perceived mathematical efficacy, children performed a practice task to familiarize them with the efficacy assessment format. The tester stood at varying distances from the children and asked them to judge whether they could jump selected distances and to rate on a 100-point scale the degree of certainty of their perceived capability. In this concrete way, children learned how to use numerical scale values to convey the strength of their self-judged efficacy.

In measuring strength of mathematical self-efficacy, children were shown, for 2 sec each, 25 cards containing pairs of subtraction problems of varying difficulty. This brief exposure was sufficient to portray the nature of the tasks but much too short to even attempt any solutions. After each sample exposure, children judged their capability to solve the type of problem depicted and rated privately the strength of their perceived efficacy on a 100-point scale, ranging in 10-unit intervals from high uncertainty through intermediate values of certainty to complete certitude. The higher the scale value, the stronger the perceived self-efficacy. The measure of strength of self-efficacy was obtained by dividing the summed magnitude scores by the total number of problems.

Self-Instructional Material

Research conducted at the Stanford Institute of Mathematical Studies has shown that competence in subtraction requires several subskills (Friend & Burton, 1981). These include subtracting a number from a larger one, subtracting zero, subtracting a number from itself, borrowing once, borrowing caused by zero, borrowing twice, borrowing from 1, and borrowing from zero. Seven sets of instructional material were designed, which incorporated the various subtraction operations. The material was organized in such a way that children could work independently at their own pace over a series of sessions.

The format of each instructional set was identical. The first page of each set contained a full explanation of the relevant subtraction operation, along with two examples illustrating how the solution strategies are applied. The following six pages contained sets of problems to be solved using the designated operation. Pretesting showed that if children worked at a steady pace, they could complete each self-instructional set in about 25 min.

Procedure for Self-Directed Learning

One of three experimenters (one male and two females) brought the children individually, at slightly staggered times, into the study room, where they were seated in different locations, facing away from each other to preclude any visual contact. Both the experimenter and the schools from which the children were drawn were the same across treatment conditions. The entire set of instructional materials was placed face down on the table. The children were informed that they could work on these subtraction problems for seven 30-min. sessions.

In describing the procedure for self-directed learning, the experimenter turned over the first page, which explained the subtraction operation for the first six-page set. Children were told that whenever they came to a page of instructions, they should bring it to the experimenter who would read it to them. Then they should solve, on their own, the subtraction problems contained on the succeeding pages. If children asked for further assistance with the instructions, the experimenter simply reread the relevant sections of the instructions but never supplemented them in any way. Since the instructions were self-explanatory and the importance of children working on their own was underscored, they rarely sought the experimenter's attention during the sessions.

The self-directed study was conducted on consecutive school days. At the end of each session, children marked where they had stopped and simply resumed work at that point in the subsequent session.

The situational arrangement for the instructional phase of the study was designed to leave the initiative to the children, thus allowing leeway for self-directedness and self-motivation to exert their effects. By working independently but in a group setting, none of the children was the focus of attention. The seating arrangement and sequential entry precluded communication between the children. After delivering the instructions, the experimenter retired to a table away from the children and remained as unobtrusive as possible throughout the sessions. By having children in different treatments pursue separately the self-directed learning in the same setting at the same time, social and situational factors that might otherwise vary were comparable across treatment conditions.

Treatment Conditions

Children were assigned randomly to one of three treatment conditions or to a nontreated control group. The instructions, format, and materials for the self-directed study were identical across treatment conditions except for variations in goal setting.

Proximal goals. For children in the proximal-goal treatment, the experimenter suggested that they might consider setting themselves a goal of completing at least six pages of instructional items each session. To give some salience to a continuing goal orientation, the suggestion of proximal goals was made at the beginning of the second session as well. There was no further mention of goals thereafter.

Distal goals. For children assigned to the distal-goal treatment, the experimenter suggested that they might consider setting themselves the goal of completing the entire 42 pages of instructional items by the end of the seventh session, which comprised a total of 258 problems.

In both treatment conditions, the goals were mentioned suggestively rather than prescriptively so as to leave the goal-setting decision to the children. This mode of goal structuring was used for two reasons. First, it was designed to increase children's self-involvement in the instructional task. Second, choice increases the level of personal responsibility and commitment to goals.

No goals. A third group of children pursued the self-directed learning without any reference to goals. However, they were told to try to complete as many pages of instructional items as possible as they went along. The reasons for including this particular condition were twofold: to provide a control for the effects of self-directed instruction alone and to equate the groups for the social suggestion that they work productively.

No treatment. A fourth group of children was administered the full set of assessment procedures without any intervening exposure to the instructional material. This group provided a control for any possible effects of testing and concomitant classroom instruction.

Posttreatment Assessment

The procedures used in the pretreatment phase of the study were readministered on the day following completion of the fourth session. This intermediate point was selected to gauge the effects of goal proximity on the development of skill, self-efficacy, and intrinsic interest within an identical length of time. Had children been tested after completing the entire program of study, the posttreatment changes would have been confounded by variations in the amount of time different children required to complete the self-instruction.

Children's mathematical self-efficacy was measured at the end of treatment and after the posttest of subtraction performance. The self-efficacy scores obtained at the end of treatment were used to gauge the value of self-efficacy judgment in predicting subsequent arithmetic performance. Since posttest performance can affect perceived efficacy, the measure of self-efficacy obtained following the arithmetic posttest was related to the subsequent measure of intrinsic interest.

Each of the 25 pairs of efficacy assessment items, which were the same as those used in the pretreatment assessment, corresponded in form and difficulty level to a subtraction problem in the performance test but involved different sets of numbers. As noted previously, most of the test problems were more complex than the ones included in the treatment phase of the study. Because the test of self-efficacy tapped new applications of cognitive operations, children had to rely on generalizable perceptions of their mathematical capabilities in making their efficacy judgments.

A parallel form of the performance test used in the pretest was devised for the posttreatment assessment of mathematical competence. This eliminated any possible effects due to familiarity with problems. Both forms were administered in a counterbalanced order to a sample of 17 children who were not participants in the formal study. The alternate forms yielded highly comparable scores ($r = .87$).

Children's intrinsic interest in subtraction problems was measured in a separate session scheduled the day after the posttreatment assessment. The tester explained that she/he had another task the children could do. Their attention was then drawn to two stacks of 10 pages each. One stack contained 60 subtraction problems of varying levels of difficulty; the other stack contained rows of digit-symbol problems adapted from the Wechsler Intelligence Scale for Children (Wechsler, 1974). The latter task involved filling in rows of empty squares with symbols corresponding to the digits appearing above each square.

The tester stressed that the children should feel free to decide whether they wanted to work on one, or the other, or both tasks. It was further emphasized that it was up to them to decide how much time they wanted to spend on each activity. The children worked alone until 25 min. had elapsed. The number of subtraction problems the children solved under these permissive choice conditions constituted the measure of intrinsic interest.

All of the assessment procedures were administered individually by the same tester in both phases of the study. To control for any possible bias, the testers had no knowledge of the conditions to which the children had been assigned.

After the experiment was concluded, all children, including the controls, pursued self-directed instruction to completion under proximal subgoals to provide maximal benefits for all participants.

Results

No significant sex differences were found on any of the measures at either the pretest or posttest assessments, since the sample was confined to children with gross arithmetic deficits. In the posttest assessment, children showed comparable gains in self-efficacy and arithmetic performance on generalization problems and on the types of items used in the treatment phase. Having mastered particular subtractive operations on simpler exemplars, children applied them accurately to more complex forms. The data were therefore pooled across sex and class of item for the primary analyses.

Analyses of variance were computed on the different sets of data, with phases of the experiment and treatment conditions representing the main factors. At the pretest phase, the groups did not differ on any of the measures. Significant intergroup differences obtained in the posttreatment phase were analyzed further, using the Newman-Keuls multiple-comparison method. Table 1 shows the significance levels of the treatment effects, the changes achieved by children within each condition, and comparisons between treatment conditions.

Perceived Self-Efficacy

The strength of children's perceived mathematical efficacy at different phases of the experiment is presented graphically in Figure 1.

Analysis of these data shows the main effect of treatment, $F(3, 36) = 10.13$, $p < .001$, and the interaction between treatment and experimental phases, $F(6, 72) = 5.96$, $p < .001$, to be highly significant.

Intragroup comparisons of changes in strength of self-efficacy, evaluated by the t test for correlated means, yielded no significant differences for children in the control group (Table 1). Those who had the benefit of proximal subgoals substantially increased

Table 1
Significance of Intergroup Differences and Intragroup Changes

Measure	Proximal vs. distal	Proximal vs. no goals	Proximal vs. control	Distal vs. no goals	Distal vs. control	No goals vs. control
			Intergroup comparisons (Newman-Keuls comparisons)			
Strength of Self-efficacy						
$Post_1$	<.05	<.05	<.01	*ns*	<.05	*ns*
$Post_2$	<.01	<.05	<.01	*ns*	<.05	<.01
Arithmetic performance	<.01	<.01	<.01	*ns*	<.01	<.01
Persistence						
Easy problems	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Difficult problems	*ns*	*ns*	<.05	*ns*	<.05	<.05
Intrinsic interest	<.05	<.05	<.05	*ns*	*ns*	*ns*
Accuracy of Self-Appraisal of Efficacy	<.05	<.05	<.05	*ns*	*ns*	*ns*

Intragroup changes (*t* tests)

	Proximal	Distal	No goals	Control
Strength of Self-efficacy				
Pre vs. $Post_1$	4.69***	2.93**	2.16*	0.01
Pre vs. $Post_2$	5.90****	2.15*	3.70***	0.78
$Post_1$ vs. $Post_2$	3.55***	2.75**	1.18	1.12
Arithmetic Performance	12.62****	3.17***	4.27***	1.01
Persistence				
Easy problems	0.72	0.26	0.32	4.12***
Difficult problems	4.57***	1.41	1.76	3.34***

* $p < .10$. ** $p < .05$. *** $p < .01$. **** $p < .001$.

their perceived self-efficacy and exhibited even further gains following the performance posttest. Children oriented toward distal goals displayed a moderate increase in self-efficacy but a small decline after the posttest. Self-directed learning without goals produced a modest increase at a borderline level of significance.

In separate comparisons between treatments, the proximal group exceeded all others in strength of perceived self-efficacy, as measured both before and after the behavioral posttest (Table 1). Children in the distal condition also exceeded the controls in self-efficacy, but they did not differ significantly from those who set no goals for themselves. Children in the latter condition judged their mathematical efficacy more highly than did the controls after but not before the performance posttest.

Mathematical Performance

Figure 1 presents the mean scores obtained on the subtraction performance test