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ABSTRACT

The purpose of this study was to test several hypotheses from self-efficacy theory in the area of children's arithmetic achievement. Fifty-six elementary school children showing low arithmetic achievement were assigned to one of four treatment groups of 12 subjects each (modeling-attribution, modeling-no attribution, didactic-attribution, didactic-no attribution) or to a nontreated control group of 8 subjects. In the cognitive-modeling treatment, children observed as an adult verbalized aloud the solution strategies to division problems contained in the explanatory pages of their packet. In the didactic treatment, children studied the same explanatory pages on their own, after which they worked the practice problems. For children assigned to the modeling-attribution and didactic-attribution conditions, the trainer attributed their successes to high effort and their difficulties to low effort on the average of once every 5 minutes during the practice phase of each of the training sessions. Results showed that both instructional treatments enhanced division persistence, accuracy, and perceived efficacy, but cognitive modeling was more effective in promoting skill development. In the context of competency development, effort attribution had no significant effect either on perceived efficacy or on arithmetic performance. Perceived efficacy was an accurate predictor of arithmetic performance across levels of task difficulty and modes of treatment. The treatment combining modeling with effort attribution produced the highest agreement between efficacy judgment and performance. (Author/JMB)

Self-Efficacy in Achievement Behavior

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Abstract

Children showing low arithmetic achievement received either modeling of division operations or didactic instruction, followed by a practice period. During practice, half of the children in each instructional treatment received effort attribution for success and difficulty. Both instructional treatments enhanced division persistence, accuracy, and perceived efficacy, but cognitive modeling produced greater gains in accuracy. In the context of competency development, effort attribution had no significant effect either on perceived efficacy or on arithmetic performance. Perceived efficacy was an accurate predictor of arithmetic performance across levels of task difficulty and modes of treatment. The treatment combining modeling with effort attribution produced the highest agreement between efficacy judgment and performance.

Self-Efficacy in Achievement Behavior

The theory of self-efficacy postulates that different modes of influence change behavior in part by creating and strengthening self-percepts of efficacy (Bandura, 1977, in press). Perceived self-efficacy is concerned with judgments of one's capability to perform given activities. In this view, self-efficacy affects behavioral functioning by influencing people's choice of activities, effort expenditure, and persistence in the face of difficulties. The higher the perceived efficacy, the greater is the sustained involvement in the activities and subsequent achievement.

The purpose of this study was to test hypotheses from self-efficacy theory in the area of children's arithmetic achievement. First, the theory predicts that providing subjects with modeling, guided performance, corrective feedback, and self-directed mastery will foster development of skills and self-efficacy (Bandura, 1977). One group of children therefore received cognitive modeling of problem-solving strategies with guided participation (Bandura, 1976; Meichenbaum, 1977). The comparison approach involved didactic instruction. Children received the same explanatory material, the same amount of practice applying the knowledge they had gained, and the same feedback of accuracy, but did not receive any modeling of cognitive operations. Although it was predicted that both treatments would raise skills and self-efficacy, evidence suggests that providing explanatory principles with exemplary modeling is more effective in developing children's cognitive skills than is providing explanatory principles alone (Rosenthal & Zimmerman, 1978).

The second set of hypotheses concerned the effects of effort attribution for success and difficulty provided during the process of competency development. According to attribution theory, ascribing past achievement outcomes to effort is hypothesized to have motivational effects. To the extent that children come to believe that increased effort produces success they should persist longer in the face of difficulties and thereby increase the level of their performance (Weiner, 1977, 1979; Weiner, Frieze, Kukla, Reed, Rest, & Rosenbaum, 1971). Results of attribution training programs generally show that attributing failure to a lack of effort, as opposed to a lack of ability, increases persistence (Andrews & Debus, 1978; Chapin & Dyck, 1976; Dweck, 1975).

Self-efficacy theory predicts that active engagement in activities promotes development of skills and self-efficacy (Bandura, in press). Thus, effort attribution can affect self-efficacy and skill development to the extent that it results in more active efforts. But such efforts require minimal skills to start with. If children can apply operations more readily through modeling, then effort attribution could lead to more active engagement with further skill and self-efficacy gains. On the other hand, if skills develop slower with didactic instruction, the validity of effort attribution--especially for difficulty--may be mitigated in favor of other factors, such as task difficulty.

A third set of hypotheses concerned the relationship of self-efficacy to subsequent achievement. In a series of studies with adult phobics, Bandura and his colleagues (Bandura & Adams, 1977; Bandura, Adams & Beyer, 1977) found that subjects accurately appraise their capabilities to perform given activities, as revealed by high agreement between self-efficacy judgment and subsequent performance at the level of individual tasks. Accurate appraisal is important since misjudgments in either direction can have negative consequences. Persons who overestimate their capabilities are apt to become demoralized through repeated task failure, while those who underestimate may shun achievement contexts, thereby precluding opportunities for skill development.

Accuracy of self-percepts is affected by the validity of information on which they are based. Modeling seems ideally suited for this purpose because it focuses children's attention on problem-solving strategies and corrective operations. To the extent that the benefits of modeling are augmented by boosts in performance arising from effort attribution, then attribution should also lead to more accurate appraisal. Conversely, with the less-explicit information provided by a didactic mode of treatment, effort attribution might offer no significant advantage in appraisal compared with no attribution.

It was hypothesized that compared with didactic instruction, cognitive modeling would result in higher arithmetic achievement, persistence, self-efficacy, and accuracy of self-appraisal. Effort attribution was expected to increase these outcomes in the modeling treatment but not in the didactic treatment.

Method

Subjects were 56 children (M = 9 years 10 months) drawn from five elementary schools. The 33 males and 23 females were predominantly middle-class. Teachers initially identified children who displayed low arithmetic achievement, persistence, and self-confidence. Those children were administered the pretest individually by an adult tester. The pretest consisted of measures of division skill, persistence, and self-efficacy.

The division skill test contained 18 problems that had from one to four digits in the divisors. There were 12 problems with 1- or 2-digit divisors; these training problems were similar to those subsequently presented to children during training. The remaining six generalization problems contained 3- or 4-digit divisors; these problems were conceptually more difficult than those presented during training and were included to test the generalized effects of treatment. Problems were also graded in difficulty within common divisor level by having progressively more digits in the dividends. The tester presented the problems to children one at a time with instructions to examine each problem and to place the problem on a completed stack when they were through solving it or had chosen not to work it any longer. The tester recorded the time children spent with each problem.

Self-efficacy was measured after the skill test to insure familiarity with the different problem types. The efficacy scaled ranged from 10 to 100 in intervals of 10 with the following verbal descriptors: 10--not sure, 40--maybe, 70--pretty sure, 100--real sure. Following practice on the scale children were briefly shown pairs of problems that corresponded in form and difficulty to those on the preceding division test. For each of the samples children privately judged on separate efficacy scales their capability to solve that type of problem.

Following the pretest children were randomly assigned to one of four treatments of 12 subjects each (modeling-attribution, modeling-no attribution, didactic-attribution, didactic-no attribution) or to a nontreated control group of 8 subjects. On separate days, treatment children received three, 55-minute training sessions, each of which contained three phases. The first phase (10 minutes) provided instruction on division strategies. The second phase (35 minutes) provided opportunities to practice applying the strategies. During the third self-directed mastery phase (10 minutes) children solved problems alone. Training was administered individually with trainer and child seated side-by-side during the instruction and practice phases.

Although different packets were used for each session, their format was identical. The first two pages explained the solution strategies and provided examplars showing step-by-step application. On each of the next several pages was one division problem; children worked these pages one at a time during the practice phase. Children were informed of the correctness of their solutions; for computational errors trainers asked children to check their work. Several self-directed mastery problems appeared on the last two pages.

In the cognitive-modeling treatment, children first observed an adult model solve division problems contained in the explanatory pages of the packet and verbalize aloud the solution strategies used to arrive at the correct solutions. During the practice phase corrective modeling was provided when children encountered conceptual difficulty. On these occasions, the trainer modeled the relevant strategy while referring to the appropriate explanatory page.

In the didactic treatment, children initially studied the same explanatory pages on their own, after which they worked the practice problems. When children experienced conceptual difficulty during practice the trainer referred them to the relevant section of the explanatory pages and told them to review it. The explanatory pages were pilot-tested to insure that the vocabulary was understandable by children low in arithmetic achievement.

For children assigned to the modeling- and didactic-attribution conditions the trainer attributed their successes to high effort and their difficulties to low effort on the average of once every 5 minutes during the practice phase of each of the three training sessions. Children received each type of attribution about 20 times during training to make the effort attributions salient. For example, success was attributed to high effort when children succeeded on a task after expending a great deal of effort ("You worked really hard on that one"), while difficulty was attributed to insufficient effort when children seemed less diligent in their efforts or after they had performed some operation carelessly ("You need to work harder").

The posttest was given about a week after training. The procedures were identical to those used during the pretest except that a parallel form of the skill test was used and self-efficacy was measured before the skill test. The self-efficacy scores obtained prior to the skill test were used to test the predictive value of self-efficacy judgment.

Results

Division problems were scored as correct if children correctly applied operations at each solution stage or made a small computational error but otherwise used the correct operations. A self-efficacy judgment of 40 or higher was scored as indicating efficacy for that type of problem, while a judgment less than 40 was scored as indicating inefficacy. The scale value 40 was accompanied by the descriptor maybe, which indicated moderate assurance. Persistence was defined as the number of seconds children spent with each problem.

There were no reliable differences due to sex or experimenter on any of the pre- or posttest measures; the data were therefore pooled for subsequent analyses. There also were no reliable differences between experimental groups on any pretest measure. The posttest measures (division skill, persistence, self-efficacy) were analyzed using multiple-regression procedures (Kerlinger & Pedhazur, 1973). Separate analyses were run for training and generalization problems for each posttest measure. Three categorical variables were introduced as predictors to check for reliable differences between treatment groups (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). These three variables were instructional treatment (modeling-didactic), attribution within modeling (yes-no), and attribution within didactic (yes-no).

Pre- and posttest means are shown by condition in Table 1. Scores were pooled across the four treatments and compared using the t test for correlated scores (Winer, 1971) to assess the overall effects of treatment. All differences were positive and reliable ($df = 47$, $p < .01$); the t values for training and generalization problems were, respectively, 11.64 and 3.67 for division skill; 5.95 and 3.48 for persistence; and 7.56 and 7.33 for self-efficacy. In contrast, the controls showed no reliable differences except for less persistence on training problems, $t(7) = -2.98$, $p < .03$.

Insert Table 1 about here

Intergroup comparisons revealed no reliable results for the posttest self-efficacy or persistence measures. However, a reliable effect on division skill due to the modeling-didactic variable was found for both training and generalization problems. Modeling children were significantly more accurate than didactic children on both training, $F\ (1,\ 44) = 6.16$, $p < .05$, and generalization tasks, $F\ (1,\ 44) = 7.35$, $p < .01$.

To assess accuracy of self-appraisal, each posttest efficacy judgment was compared to the subsequent division skill score on the problem of comparable form and difficulty. An accurate self-appraisal was defined as children judging themselves capable of solving a given type of problem and then solving the problem of this type, or judging themselves incapable of solving that type of problem and subsequently failing the exemplar. As before, judgments of 40 or higher were defined as indicating efficacy. Two measures of inaccuracy were also computed. The first was overestimation, defined as children judging they could solve a certain class of problem but subsequently failing to solve the exemplar, while the second was underestimation, defined as the opposite. These scores were summed within problem classes and divided by the number of problems in the class to arrive at percentages. These are shown by treatment in Table 2.

Insert Table 2 about here

Multiple-regression procedures using the three categorical variables as predictors revealed that modeling children showed significantly more accurate self-appraisal than didactic children on training, $F\ (1,\ 44) = 15.02$, $p < .01$, and generalization problems, $F\ (1,\ 44) = 4.44$, $p < .05$. Within the context of modeling, children receiving attribution showed more accurate appraisals on training problems than children not receiving attribution, $F(1, 44) = 4.28$, $p < .05$. With regard to mismatches, didactic subjects overestimated significantly more than modeling children on both training, $F(1, 44) = 9.07$, $p < .05$, and generalization problems, $F(1, 44) = 4.37$, $p < .05$.

Discussion

The present study demonstrates that treatments providing problem-solving principles, practice in applying the principles, corrective feedback, and self-directed mastery were effective in developing skills and enhancing a sense of efficacy in children who were low achievers in arithmetic. In contrast, control children who did not have the benefit of the instructional treatment showed no significant changes in self-efficacy, remained unskilled at solving division problems, and became less persistent.

As hypothesized, cognitive modeling was more effective than didactic instruction in promoting skill development. This difference was found despite the many similarities between the two treatments noted above. The only difference between the two treatments was that modeling children observed division strategies modeled with different exemplars during periods of instruction and feedback.

The hypotheses of greater gains in self-efficacy and persistence as a result of modeling were not supported. This may have been due to the many intertreatment similarities. Providing children with instruction and opportunities to practice, both of which produce success experiences, should lead to heightened self-efficacy and persistence.

Attributing modeling children's successes and difficulties to effort did not influence their self-efficacy, persistence, or skill accomplishment, as hypothesized. Since the modeling treatment provided children with valid information concerning their arithmetic competence, any effects of persuasive effort attribution may have been overridden. It is also possible that effort attribution altered perceptions of capabilities among both modeling and didactic children but that the effects dissipated quickly due to the difficulty of many of the problems. If expending more effort were often followed by difficulty, the causal ascriptions may have rapidly lost their impact.

The expected differences in accuracy of self-appraisal favoring the modeling over the didactic treatment cannot stem from differential behavior sources of efficacy because children in both treatments performed the same problems and had ample opportunities to observe their successes and difficulties. The self-appraisal differences may have been due to a combination of benefits associated with modeling that provide valid performance information: Modeling focuses attention on processes being taught, provides a concrete set of observable operations tied to abstract principles, and provides specific information on the source and remedy for deficiencies. Without such valid indicators, didactic children may have been swayed by their modest training successes while remaining largely uninformed of the extent of their deficiencies.

But these considerations do not explain why modeling and effort attribution benefited self-appraisal more than modeling alone. Children in these groups received the same amount of behavioral information during training and they did not differ in accuracy of division solutions.

It is possible that modeling children benefited from the attribution by gaining a better understanding of how effort can affect performance. Belief that heightened effort leads to success would occasionally be disconfirmed by failure on difficult tasks despite the children's more concerted effort. As a result, these children may have formed a more realistic picture of the limitations of effort in solving difficult problems than did modeling-no attribution children for whom the limits of effort alone might have been less salient.

One issue not addressed in this study concerns the status of self-efficacy as a performance mediator. According to Bandura (1977), psychological procedures influence behavior change in part through the intervening influence of changes in self-efficacy. It is of interest that research on the mediational status of causal attribution using path-analytic techniques showed that people's expectation of successful performance was one of the best predictors of how well they performed (Covington & Omelich, 1979).

References

Andrews, G. R., & Debus, R. L. Persistence and the causal perception of failure: Modifying cognitive attributions. Journal of Educational Psychology, 1978, 79, 154-166.

Bandura, A. Social learning perspective on behavior change. In A. Burton (Ed.), What makes behavior change possible? New York: Brunner/Mazel, 1976.

Bandura, A. Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 1977, 84, 191-215.

Bandura, A. Self-referent thought: The development of self-efficacy. In J. H. Flavell & L. D. Ross (Eds.), Cognitive social development: Frontiers and possible futures. New York: Cambridge Press, in press.

Bandura, A. & Adams, N. E. Analysis of self-efficacy theory of behavioral change. Cognitive Therapy and Research, 1977, 1, 287-310.

Bandura, A., Adams, N. E., & Beyer, J. Cognitive processes mediating behavioral change. Journal of Personality and Social Psychology, 1977, 35, 125-139.

Chapin, M. & Dyck, D. G. Persistence in children's reading behavior as a function of N length and attribution retraining. Journal of Abnormal Psychology, 1976, 85, 511-515.

Covington, M. V. & Omelich, C. L. Are causal attributions causal? A path analysis of the cognitive model of achievement motivation. Journal of Personality and Social Psychology, 1979, 37, 1487-1504.

Dweck, C. S. The role of expectations and attributions in the alleviation of learned helplessness. Journal of Personality and Social Psychology, 1975, 31, 674-685.

Kerlinger, F. N. & Pedhazur, E. J. Multiple regression in behavioral research. New York: Holt, Rinehart and Winston, Inc., 1973.

Meichenbaum, D. Cognitive-behavior modification: An integrative approach. New York: Plenum, 1977.

Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent, D. H. Statistical package for the social sciences (2nd ed.). New York: Mc-Graw-Hill, 1975.

Rosenthal, T. L., & Zimmerman, B. J. Social learning and cognition. New York: Academic Press, 1978.

Weiner, B. An attributional approach for educational psychology. In L. Shulman (Ed.), Review of research in education (Vol. 4). Itasca, Il.: Peacock, 1977.

Weiner, B. A theory of motivation for some classroom experiences. Journal of Educational Psychology, 1979, 71, 3-25.

Weiner, B., Frieze, I., Kukla, A., Reed, L., Rest, S., & Rosenbaum, R. M. Perceiving the causes of success and failure. Morristown, N.J.: General Learning Press, 1971.

Winer, B. J. Statistical principles in experimental design (2nd ed.). New York: McGraw-Hill, 1971.

Pre- and Posttest Achievement Outcome Means

by Problem Class and Experimental Condition

Measure	Problem Class	Experimental Condition: Modeling-Attribution	Modeling-No Attribution	Didactic-Attribution	Didactic-No Attribution	Control
Skill[a]	Training					
	Pretest	2.2	2.7	2.4	2.3	1.6
	Posttest	8.3	7.8	6.3	7.0	1.8
	Generalization					
	Pretest	0.0	0.3	0.2	0.2	0.0
	Posttest	1.6	1.2	0.3	0.5	0.0
Persistence[b]	Training					
	Pretest	36.0	53.3	45.9	65.0	28.9
	Posttest	99.7	79.5	100.1	97.0	13.6
	Generalization					
	Pretest	35.1	27.5	27.0	36.7	19.6
	Posttest	102.2	59.9	47.8	73.3	5.0
Self-Efficacy[c]	Training					
	Pretest	3.3	4.8	4.3	6.2	3.6
	Posttest	8.9	9.3	9.4	8.7	4.8
	Generalization					
	Pretest	0.2	0.3	0.3	0.4	0.6
	Posttest	2.1	2.2	1.8	2.2	0.0

[a] Number of accurate solutions; maximum of 12 training, 6 generalization.

[b] Average number of seconds per problem.

[c] Number of efficacious judgments; maximum of 12 training, 6 generalization.