Sequential Attributional Feedback and Children's Achievement Behaviors

By: Dale H. Schunk

Schunk, D. H. (1984). Sequential attributional feedback and children's achievement behaviors. *Journal of Educational Psychology*, *76*, 1159-1169.

Abstract:
Two experiments investigated how the sequence of attributional feedback influences children's motivation, attributions, self-efficacy, and skillful performance. Children lacking subtraction skills received training and solved problems over four sessions. During the problem solving, one group of children (ability-ability) periodically received ability feedback, a second group (effort-effort) received effort feedback, a third group (ability-effort) was given ability *feedback* during the first two sessions and effort *feedback* during the last two, and for a fourth group this sequence was reversed (effort-ability). . In both studies, children who initially received ability feedback (ability-ability and ability-effort conditions) developed higher ability attributions, self-efficacy, and subtraction skills compared with subjects in the effort-ability and effort-effort conditions. The sequence of attributional feedback did not differentially affect motivation, effort attributions, or perceptions of training successes.

Article:
According to Bandura (1977, 1981, 1982), psychological procedures change behavior in part by creating and strengthening perceived *self-efficacy*, which refers to self-judgments of one's performance capabilities in specific situations that may contain ambiguous, unpredictable, and stressful features. Self-efficacy is hypothesized to influence choice of activities, effort expended, persistence, and task accomplishments. Efficacy information is conveyed through self-performances, socially comparative vicarious means, forms of persuasion, and physiological indexes.

Attributional variables constitute an important influence on self-efficacy (Bandura, 1977; Schunk, 1984). Attributional theories hypothesize that *people* make causal ascriptions for the outcomes of their actions (Heider, 1958; Kelley, 1967; Kelley & Michela, 1980). In achievement contexts, outcomes often are attributed to ability, effort, task difficulty, and luck (Frieze, 1980; Weiner, 1979; Weiner et al., 1971). Future performance expectancies (i.e., self-efficacy) heavily depend on ascriptions for prior outcomes (Weiner, 1977, 1979).

Children often attribute successes to ability and effort (Frieze, 1980; Frieze & Bar-Tal, 1980; Frieze & Snyder, 1980; Hanoi & Covington, 1981). Very young children view effort as the prime cause of outcomes and view ability-related terms as closely associated; but at around 9 years old, a distinct conception of ability begins to emerge (Nicholls, 1978). Third graders use inverse compensation in judging effort from ability information (Kun, 1977; Surber, 1980), that is, they infer less effort as outcomes are presented as resulting from higher ability. Third graders also occasionally use inverse compensation in judging ability from effort information (Surber, 1980). Ability attributions become increasingly important with development, whereas effort attributions decline in importance (Nicholls, 1978, 1979).[1]

The effects of ability and effort information have also been investigated in attributional feedback studies (Andrews & Debus, 1978; Chapin & Dyck, 1976; Dweck, 1975; Medway & Venino, 1982; Miller, Brickman, & Bolen, 1975; Schunk, 1982, 1983). Linking past failures with insufficient effort promotes effort attributions and task persistence (Andrews & Debus, 1978; Dweck, 1975), and effort feedback for prior successes enhances children's motivation, self-efficacy, and skills (Schunk, 1982, 1983). Similarly, positive effects on achievement behaviors have been obtained from providing ability attributional feedback for prior successes (Miller et al., 1975; Schunk, 1983). Once children begin to differentiate ability from effort, ability feedback exerts stronger effects (Schunk, 1983).

An issue that has not been systematically explored is how the sequence of attributional feedback affects children's achievement behaviors. Early task successes constitute a cue used to formulate ability attributions (Frieze & Weiner, 1971; Weiner, 1974). When children work at a task and experience early successes, they are apt to believe that they are becoming competent (i.e., acquiring knowledge and skills) and to develop a sense of efficacy for continued success. Telling them that ability was responsible for their successes ought to substantiate these self-perceptions (Schunk, 1983). Once children develop ability attributions and a sense of efficacy, subsequently providing effort feedback may not alter these perceptions much. Children may interpret the subsequent effort feedback more as an observation of how diligently they have been applying their skills than as an indicator of the level of those skills. Conversely, providing effort feedback for early successes informs children that they can continue to succeed with hard work (Schunk, 1982). Although effort feedback promotes motivation and leads children to feel more able and efficacious, effort feedback may not promote ability attributions or self-efficacy as well as may ability feedback (Schunk, 1983, 1984). Children may question their capabilities because they have to work hard to succeed and may wonder whether they can sustain the necessary high effort level. Even if children subsequently are given ability feedback, they might doubt its credibility because of having been told previously that effort was responsible for their successes.

The purpose of the present two experiments was to determine how the sequence of ability and effort attributional feedback influences children's task motivation, attributions for success, self-efficacy, and skillful performance. Third-grade children participated in a subtraction competency-development program over four sessions and periodically received attributional feedback for their problem-solving progress. One group of children received ability feedback throughout the four sessions (ability-ability), a second group exclusively received effort feedback (effort-effort), a third group was given ability feedback during the first two sessions and effort feedback during the second two sessions (ability-effort), and for a fourth group this sequence was reversed (effort-ability). It was felt that the periodic delivery of attributional feedback (5 times per session or a total of 20 times) would lead children to perceive the attributions as salient causes of their training successes (Schunk, 1981).

The sequence of attributional feedback was not expected to differentially influence children's task motivation during the training program, because both ability and effort feedback exert strong motivational effects on children's performances (Schunk, 1983, 1984). It was predicted that providing ability feedback during the first half of training (i.e., first two sessions) would lead ability-ability and ability-effort children to place greater emphasis on ability as a cause of task success and would result in higher self-efficacy and subtraction skills than would the initial receipt of effort feedback. Children in the latter two conditions (effort-effort and effort-ability) were expected to stress effort as a cause of success. It also was predicted that the achievement behaviors (i.e., motivation, attributions, self-efficacy, skill) of the two conditions receiving ability feedback during the first half of training would not differ nor would those of the two conditions initially receiving effort feedback.

Experiment 1

Method

Subjects. The sample included 40 third-grade children drawn from four classes in one elementary school. Ages ranged from 8 years 3 months to 10 years 5 months (*M* = 9.3 years). The 21 boys and 19 girls were predominantly from middle-class families. Be-cause this study focused on processes whereby skills could be developed when they were lacking initially, children's teachers were shown the subtraction skill test and identified 44 children who they felt could not solve correctly more than about 25% of the problems. These children had encountered some difficulties grasping subtraction operations in their regular classes, but they were not considered low *achievers* nor *were* they receiving remedial instruction. Children were administered the pretest individually by one of two female adult testers drawn from outside the school. Two children were dropped from the experiment because they missed some of the training sessions due to illness. These children were in different experimental conditions; to equalize the cells, one child was randomly dropped from each of the other two conditions.

Pretest. Self-efficacy for correctly solving subtraction problems was measured following procedures of previous research (Bandura & Schunk, 1981; Schunk 1981, 1982, 1983). The efficacy scale ranged from 10 to 100 in 10-unit intervals from *high uncertainty* (10), through intermediate values (50-60), to *complete certainty* (100). Children initially received practice with the efficacy assessment by judging their certainty of successfully jumping progressively longer distances. In this concrete fashion, children learned the meaning of the scale's direction and the different numerical values.

Following this practice, children were shown 25 sample pairs of subtraction problems for about 2 s each. This brief exposure allowed assessment of problem difficulty but not computation of actual solutions. The two problems composing each pair were similar in form and operations required and corresponded to one problem on the ensuing skill test, although they involved different numbers. Children were judging their capability to solve different types of problems and not whether they could solve any particular problem. Children made their judgments privately by circling an efficacy value. They were advised to be honest and to mark how they really felt. Self-efficacy scores were summed across the 2,5 judgments and were averaged.

The subtraction skill test was administered immediately following the efficacy assessment and included 25 problems ranging from two to six columns. Each problem tapped one of the following subtraction operations: no borrowing, borrowing once, borrowing from a one, borrowing twice, borrowing caused by a zero, and borrowing across zeros. Of these 25 problems, 12 were similar to some of the problems that children solved during the subsequent training sessions, whereas the other 13 were more complex. For example, during training children solved problems requiring double borrowing, whereas some skill test problems required triple borrowing. The measure of skill was the number of problems solved correctly.

The tester presented the problems one at a time and verbally instructed children to examine each problem, to decide how long they wanted to spend on it, and to place each page on a completed stack when they finished solving the problem or chose not to work on it any longer. Children were given no performance feed-back.

Training procedure. Following the pretest, children were randomly assigned within sex and classroom to one of four treatment groups (ns = 10) distinguished by the sequence of ability and effort attributional feedback: ability-ability, ability-effort, effort-ability, effort-effort. Children received 40-min training sessions over 4 consecutive school days, during which they worked on a training packet consisting of seven sets of material: These sets were ordered in terms of least-to-most difficult as follows: no borrowing, borrowing once in two-column problems, borrowing once in three-column problems, borrowing once caused by a zero, borrowing twice, borrowing from a one, and borrowing across zeros (Friend & Burton, 1981). The format of each set was identical. The first page contained a written explanation of the subtraction operation and two step-by-step worked examples. The next six pages each contained several problems to solve.

Each child was escorted individually to a large room by one of two *(female)* adult proctors. For any given child, the proctor did not serve as the child's tester. Each proctor was responsible for approximately equal numbers of children in each treatment condition. Children were seated at sufficient distances from others to preclude visual and auditory contact. The proctor reviewed the first explanatory page by pointing to the operations while reading from a narrative that explained the steps. If children indicated a lack of understanding, the proctor reread the relevant narrative but did not supplement it on her own. The proctor explained that whenever children came to a similar page, they were to bring it to her for review. The proctor stressed the importance of careful work and retired to an out-of-sight location. Children solved problems alone and received no performance feedback on the accuracy of their work. They marked their places at the end of each session and resumed there the following day.[2]

Treatment conditions. The proctor monitored the progress of children assigned to the ability-ability feedback treatment 5 times (or about every 8 min) during each of the four training sessions (i.e., a total of 20 times) by walking up to each child and asking, "What page are you working on?" After children replied with the page number, the proctor linked their problem-solving progress to ability by remarking, "You're good at this." This feedback was given in a matter-of-fact tone of voice and without accompanying social reinforcers, such as smiles or pats. The proctor then departed. Children assigned to the ability—effort feed-back condition received this ability feedback during the first two training sessions. During the third and fourth sessions, the proctor instead linked children's progress with effort by remarking "You've been working hard." This remark also was given matter-of-factly and without accompanying social reinforcement, after which the proctor departed.

The proctor monitored effort—ability feedback children in the same fashion as in the preceding conditions. During the first two sessions, children exclusively received effort feedback ("You've been working hard"), whereas during the last two sessions, the proctor only delivered ability feedback ("You're good at this"). The procedures for children assigned to the effort—effort condition were identical with those of the preceding conditions except that children received effort feedback throughout the four training sessions.

Attributions. Children's attributions for their problem-solving progress during training were assessed on the day following the last session. Four scales were shown on a sheet of paper; each scale ranged in intervals of 10 from *not at all* (0), through intermediate values (40-60), to a *whole lot* (100). The four scales were labeled *good at it* (i.e., ability), *worked hard* (effort), *easy problems* (task), and *lucky* (luck). Label order was counterbalanced across subjects.

The tester explained that this paper showed four things that can help children work problems. The tester described the scale and each of the attributions and provided examples of how hypothetical children might mark the scales. Children were advised to think about their work during the training sessions and to mark how much they thought each factor helped them solve problems. The tester explained that children's marks did not have to add to a certain number (e.g., 100). Children privately recorded their ratings.[3]

Posttest. The posttest was administered the day following the attributional assessment. The self-efficacy and skill-test instruments and procedures were identical with those of the pretest except that a parallel form of the skill test was used to eliminate possible problem familiarity. The parallel form was developed in previous research (Bandura & Schunk, 1981); the two forms correlated highly (r = .87) in a reliability assessment conducted in conjunction with that study.

For any given child, the same tester administered all assessments and was blind to the child's treatment condition. Tests and training materials were scored by an adult who was unaware of the children's experimental assignments.

Results

Means and standard deviations of all measures are presented by experimental condition in Table 1. Preliminary analyses revealed no significant differences due to tester, classroom, or sex of child on any measure, nor any significant interactions among these variables or between them and treatment conditions. There also were no significant differences between experimental conditions on the pretest measures.

Self-efficacy/skill. Intragroup changes on each measure were evaluated using the t test for correlated scores (Winer, 1971). Each experimental condition made significant pretest—posttest improvements in both self-efficacy and subtraction skill (ps < .01). Posttest self-efficacy and skill were analyzed with a multivariate analysis of covariance (MANCOVA), using the corresponding pretest measures as covariates. The four experimental conditions constituted the treatment factor. This analysis yielded a significant between-conditions difference, Wilks's $\lambda = .555$, $F(6, 66) = 3.77$, $p < .01$. Multivariate orthogonal contrasts showed that the two conditions that received ability feedback during the first two training sessions significantly outperformed groups initially given effort feedback, Wilks's $\lambda = .692$, $F(2, 33) = 7.36$, $p < .01$. The ability—ability and ability—

effort conditions did not differ significantly nor did the effort—ability and effort—effort conditions. Univariate *F* tests (ANCOVAs) revealed significant between-groups differences in both measures: self-efficacy, $F(3, 35) = 8.40$, $p < .001$; skill, $F(3, 35) = 3.75$, $p < .05$. Separate analyses conducted on the set of 12 problems similar to those covered during training and the set of 13 more complex problems yielded identical patterns of results. Thus, children who initially received ability 'feedback demonstrated significantly higher self-efficacy and subtraction skills compared with subjects initially given effort feedback.

Attributions. The four attributions were analyzed with a multivariate analysis of variance (MANOVA). This analysis yielded a significant difference between the four conditions, Wilks's $\lambda = .537$, $F(12, 87.6) = 1.93$, $p < .05$. Multivariate orthogonal contrasts revealed a significant difference between the two groups initially receiving ability feedback and those initially given effort feedback, Wilks's $\lambda = .755$, $F(4, 33) = 2.70$, $p < .05$; however, the ability—ability and ability—effort conditions did not differ significantly nor did the effort—ability and effort—effort groups. Univariate *F tests* (ANOVAs) yielded a significant between-groups difference on ability attributions, $F(3, 36) = 4.49$, $p < .01$. Compared with subjects initially given effort feedback, children who received ability feedback during the first two training sessions placed significantly greater emphasis on ability as a cause of success.

Table 1
Means and Standard Deviations for Experiment 1

	Experimental condition							
	Ability–ability		Ability–effort		Effort–ability		Effort–effort	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Self-efficacy[a]								
Pretest	36.3	10.2	35.4	10.3	32.9	11.2	35.8	12.1
Posttest	87.6	11.3	87.8	8.3	65.3	16.5	72.4	11.3
Skill[b]								
Pretest	4.1	1.4	3.8	1.8	3.7	2.1	3.5	2.3
Posttest	19.3	4.2	17.4	5.9	12.3	5.9	12.6	6.2
Ability[c]	83.0	19.5	85.0	12.7	59.0	13.7	71.0	23.8
Effort[c]	82.0	16.7	95.0	9.7	89.0	16.6	81.0	15.2
Task ease[c]	68.0	19.3	68.0	23.5	60.0	24.9	72.0	18.7
Luck[c]	30.0	27.9	38.0	27.0	36.0	15.8	37.0	26.7
Training progress[d]	207.8	45.0	186.4	50.0	159.7	64.8	210.2	23.1

Note. $N = 40$; $n = 10$ per condition.
[a] Average judgment per problem; range of scale: 10 (low)–100. [b] Number of correct solutions on 25 problems.
[c] Range of scale: 0 (low)–100. [d] Number of problems completed.

Training progress. To investigate whether experimental treatments differentially affected task motivation as measured by rate of problem solving, an ANOVA was applied to the .number of problems that children completed during the training sessions. This analysis yielded a nonsignificant result, $F(3, 36) = 2.38$. Separate analyses of the number of problems completed during the first and second halves of training also yielded nonsignificant results. A similar pattern of results was obtained using the number of problems that children solved correctly.

Correlational analyses. Correlational analyses were conducted to explore the interrelations between variables. Product-moment correlations were computed among posttest self-efficacy and skill, the four attributions, and training progress (i.e. number of problems completed). Initially, correlations were computed separately within each of the four experimental conditions. Because there were no significant between-conditions differences in correlations of any measures, correlations were averaged using an *r* to *z* transformation (Edwards, 1976). Within-conditions correlations were in the same direction as were those for the entire sample, although some of the former did not attain statistical significance.

The more problems that children completed during training, the more emphasis they placed on ability as a cause of task success $r(38) = .35$, $p < .05$, and the higher were their subsequent self-efficacy judgments, $r(38) = .61$, $p < .01$, and demonstrated skills, $r(38) = .59$, $p < .01$. A similar pattern of results was obtained using the number of problems solved correctly during training. Higher ability attributions were associated with higher self-efficacy, $r(38) = .54$, $p < .01$, and skill, $r(38) = .45$, $p < .01$. Attributions to luck were related negatively to skill, $r(38) = -.39$, $p < .05$, and self-efficacy bore a positive relation to subsequent skillful performance, $r(38) = .67$, $p < .01$.

Discussion

Prior research demonstrated that pro-viding ability or effort attributional feedback for children's past successes during a competency-development program promotes task motivation, self-efficacy, and skills (Schunk, 1982, 1983). The present study expands these findings by showing that the sequence of attributional feedback also is important. Attributing children's early problem-solving progress to ability led to higher ability attributions, self-efficacy, and skills regardless of whether the ability feedback was continued or whether children's later successes were attributed to effort. At the same time, treatments did not differentially influence children's rate of problem solving during training, which is consistent with the idea that ability and effort feedback motivate young children equally well (Schunk, 1983).

Experiment 2 was designed to explore children's attributions and perceptions of the attributional feedback. It seems surprising that treatments did not differentially influence effort attributions because research shows that providing effort feedback enhances effort attributions (Andrews & Debus, 1978; Dweck, 1975). It is possible that among the present type of subjects, the sequence of attributional feedback has a greater impact on ability attributions than on effort attributions because of the emphasis that young children place on effort as a cause of success (Frieze, 1980; Frieze & Snyder, 1980; Harari & Covington, 1981). Medway and Venino (1982) found that pro-viding effort feedback to fourth graders and fifth graders did not enhance effort attributions but that even in the absence of such feedback, children stressed effort as a cause of success. Ability feedback for early successes may promote self-perceptions of ability and self-efficacy more than may effort feedback, but may have little effect on effort attributions. In other words, to the extent that young children generally stress effort more than ability as a cause of success, the sequence of attributional feedback may affect the latter beliefs more than the former. To explore this possibility, Experiment 2 included a pretest measure of attributions.

A related possibility is that the sequence of feedback influences children's perceptions of their training successes, which in turn affect ability attributions and self-efficacy. Early ability feedback may convey that children are performing well, and the perception of early task success is a prominent cue used to formulate ability attributions (Frieze & Weiner, 1971; Weiner, 1974). Conversely, early effort feedback may imply a lower level of success because children may wonder how well they are performing if they have to work hard to succeed. The self-perception of low success is not apt to greatly foster ability attributions or self-efficacy. To investigate this possibility, children's perceptions of their training successes were assessed.

Experiment 2

Method

Subjects. The subjects were 24 boys and 16 girls drawn from three classes in one elementary school. They ranged in age from 8 years 2 months to 10 years 2 months ($M = 9.0$ years). Children were predominantly from middle-class families. Subject-selection procedures were identical with those in Experiment 1. Teachers nominated 46 children; 3 were dropped due to illness, and 3 others were randomly dropped to equalize the cells.

Procedure. The same testing, training, and treatment materials and procedures used in Experiment 1 were employed with the following procedural modifications. First, attributions were assessed before and after the training program. The pretraining assessment was given prior to the self-efficacy and skill pretest. The tester asked children to think about their classroom work in arithmetic and to mark how much they thought each of the four attributional factors helped them to solve problems. The posttraining assessment was identical with that given during Experiment 1.

To determine whether the sequence of attributional feedback led to differential perceptions of training successes, these were assessed at the end of the fourth (last) training session. The proctor asked children to think about their problem solving during the four sessions and to mark how well they felt they had done. The 10-unit (10-100) scale ranged from *not too good (10) to really good* (100). No attributional feedback was given immediately prior to this assessment.

Results

Means and standard deviations are shown in Table 2. Preliminary analyses were conducted as in Experiment 1 and yielded nonsignificant results.

Table 2
Means and Standard Deviations for Experiment 2

Measure	Ability–ability *M*	Ability–ability *SD*	Ability–effort *M*	Ability–effort *SD*	Effort–ability *M*	Effort–ability *SD*	Effort–effort *M*	Effort–effort *SD*
Self-efficacy[a]								
Pretest	33.5	9.6	31.2	9.0	35.2	17.8	31.9	8.1
Posttest	86.7	15.0	86.6	16.4	66.7	19.5	64.6	12.0
Skill[b]								
Pretest	3.0	2.1	2.8	1.9	2.6	1.8	3.0	2.1
Posttest	16.6	3.0	16.4	2.8	9.7	4.5	10.7	5.5
Ability[c]								
Pretraining	40.0	19.4	42.0	29.0	39.0	22.3	38.0	31.1
Posttraining	91.0	12.9	90.0	9.4	61.0	27.3	65.0	28.8
Effort[c]								
Pretraining	84.0	10.8	83.0	14.5	89.0	11.0	87.0	15.7
Posttraining	80.0	9.4	80.0	9.4	86.0	9.7	86.0	5.8
Task ease[c]								
Pretraining	59.0	12.9	55.0	30.6	53.0	20.3	56.0	37.2
Posttraining	71.0	7.4	67.0	25.0	62.0	28.6	63.0	36.8
Luck[c]								
Pretraining	71.0	28.8	68.0	27.5	65.0	33.4	72.0	29.7
Posttraining	40.0	30.9	35.0	22.2	37.0	25.4	35.0	28.0
Training progress[d]	182.9	49.2	208.6	37.9	162.3	63.6	207.5	45.4
Training perceptions[e]	88.0	12.6	82.0	14.2	86.0	9.1	79.0	15.3

Note. $N = 40$; $n = 10$ per condition.
[a] Average judgment per problem; range of scale: 10 (low)–100. [b] Number of correct solutions on 25 problems. [c] Range of scale: 0 (low)–100. [d] Number of problems completed. [e] Range of scale: 10 (low)–100.

Self-efficacy/skill. Intragroup comparisons yielded significant pretest—posttest increases on both measures for each experimental condition (ps < .01). A MANCOVA applied to the posttest measures yielded a significant between-conditions difference, Wilks's λ = .546, F(6, 66) = 3.89, *p* < .01. Multivariate orthogonal contrasts showed that the two conditions that initially received ability feedback scored significantly higher than the other two conditions, Wilks's λ = .726, F(2, 33) = 6.24, *p* < .01; however, the ability—ability and ability—effort conditions did not differ nor did the effort—ability and effort—effort conditions. Univariate Fs (ANCOVAs) yielded significant differences on both measures: self-efficacy, F(3, 35) = 6.15, *p* < .01; skill, F(3, 35) = 7.79, *p* < .01. Separate analyses on the problems similar to those covered during training and those more complex revealed comparable results.

Attributions. Within-conditions changes (pretraining and posttraining) on each attribution revealed for each experimental condition significant increases in ability attributions (ability—ability/ability—effort, ps < .01; effort—ability/effort—effort, ps < .05) and significant decreases in luck attributions (ps < .01). Posttraining attributions were analyzed with a MANCOVA using pretraining attributions as covariates. This result was significant, Wilks's λ = .510, F(12, 77.02) = 1.90, *p* < .05. Multivariate contrasts yielded a significant difference between the ability—ability/ability—effort and the effort—ability/effort—effort conditions, Wilks's λ = .703, F(4, 29) = 3.06, *p* < .05; however, the former two conditions did not differ nor did the latter two conditions. Univariate ANCOVAs revealed a significant difference on ability attributions, F(3, 35) = 5.43, *p* < .01. The ability—ability and ability—effort conditions made higher ability attributions than did the effort—ability and effort—effort groups.

Training progress. Nonsignificant Fs (ANOVAs) were obtained on the number of problems completed ($F < 2$) and on the number solved correctly ($F < 1$). Four separate ANOVAs on the number of problems completed and on those solved correctly during the first and second halves of the training program also yielded nonsignificant results.

Training perceptions. This measure was analyzed with ANOVA and yielded a nonsignificant result ($F < 1$).

General Discussion

Collectively, these results demonstrate that the sequence of attributional feedback can have important effects on children's achievement behaviors. Attributing early problem-solving successes to children's abilities led to higher ability attributions, self-efficacy, and subsequent skillful performance than did initially attributing successes to effort. Experiment 2 showed that these effects were not due to differential self-perceptions of training successes.

An explanation for these effects is as follows. As children solve problems during training, they perceive that they are becoming more competent and begin to develop a sense of efficacy for continued success. Because early successes constitute a prominent cue for forming ability attributions (Frieze & Weiner, 1971; Weiner, 1974), telling them early in the course of skill development that ability is responsible for their successes supports these self-perceptions (Schunk, 1982, 1983). It is likely that ability-ability and ability-effort children formulated ability attributions early in the training program. When ability-effort children subsequently received effort feedback, they might have viewed it more as a reflection of how diligently they were applying their skills than as an indicator of their level of competence. Ability attributions for successful performance result in high expectations for future success (McMahan, 1973), and a strong sense of self-efficacy enhances subsequent skillful performance (Schunk, 1984).

Because effort attributional feedback implies that children can continue to succeed with hard work (Schunk, 1982, 1983), children also should feel more competent and should begin to develop higher self-efficacy. Although the present effort feedback led to significant increases in ability attributions, self-efficacy, and skillful performance, earl) effort feedback did not promote these three achievement outcomes as well as did ability feedback. Children might have wondered how competent they really were if they had to work hard to succeed and whether they could sustain the high effort required for success. Subsequent ability feedback (i.e., the effort—ability condition) might have led children to question its credibility after repeatedly being told that their successes were due to effort. This explanation is consistent with previous research (Schunk, 1983), in which one group of children received only ability feedback, a second group was given only effort feedback, and a third condition received both types of feedback simultaneously. Although children in the latter condition developed equally high self-efficacy and skills as effort-only subjects, the ability-only group demonstrated the highest achievement behaviors. Children in the combined condition apparently discounted the ability feedback in favor of the effort information.

Contrary to prediction, children who received effort feedback during the first half of training did not place greater emphasis on effort as a cause of success compared with subjects initially given ability feedback. This finding conflicts with attribution re-training research, which shows that effort feedback enhances children's effort attributions (Andrews & Debus, 1978; Dweck, 1975), and also conflicts with developmental evidence, which indicates that children use inverse compensation in judging effort from ability information (Kun, 1977; Surber, 1980). Further, Schunk (1983) found that effort-only and ability-plus-effort subjects judged that they expended more effort during training than did ability-only children; however, effort attributions were not measured in this study.

Experiment 2 showed that children emphasized effort as a cause of success prior to the experimental manipulation. Given high initial effort attributions, it is not surprising that effort feedback did not promote them. Attribution retaining studies typically use low achievers or students who initially do not stress effort as a cause of achievement outcomes (Andrews & Debus, 1978; Dweck, 1975; Medway & Venino, 1982). Under these conditions, effort feedback should have a greater effect on effort attributions. Although the present subjects had encountered difficulty during classroom subtraction instruction, they were not viewed as low achievers by their teachers and were not receiving remedial instruction. These subjects exemplify the idea that high effort as a cause of success is valued by children (Frieze, 1980; Frieze & Snyder, 1980; Harari & Covington, 1981), especially when paired with the perception of high ability (Covington & Omelich, 1979b). Children often believe that high effort can enhance ability, al-though with development there is a progressive devaluation of effort in-favor of ability (Harari & Covington, 1981).

It should be noted that in addition to the attributional feedback, children had their actual performances to draw on in forming attributions. Although children received no explicit performance feedback, they derived self-feedback from completing problems and could check answers. The present effort attribution findings may be due in part to this performance context. Because the present subjects initially lacked subtraction skills, they realistically had to expend some effort during training to solve problems, and their actual efforts might have substantiated their initial preference for effort attributions. Conversely, subjects in the Kun (1977) and Surber (1980) studies made attributional judgments of hypothetical persons. In the absence of self-performance cues, children ought to rely more on externally supplied information in forming attributions.

The preceding considerations suggest taking a more in-depth look at how children interpret ability and effort feedback. Attributional feedback is hypothesized to convey information to students about their knowledge and skills, and such information presumably is a cue used to assess self-efficacy (Schunk, 1984). What attributional feedback means to students in terms of their knowledge and skills likely stems in large part from prior interactions with teachers. For example, elementary teachers stress effort and often combine it with praise to encourage students, but praise also can inform students about how the teacher views abilities (Weiner, Graham, Taylor, & Meyer, 1983). Praise can convey that a student's ability is low if it is given for success at an easy task (Weiner et al., 1983) and especially if it is combined with effort information (e.g., "That's good. You're really working hard."). Conversely, teacher praise combined with ability information may be interpreted by children to mean a higher estimation of ability.

As predicted, the sequence of attributional feedback did not differentially influence children's task motivation as measured by rate of problem solving during training. Children's perceptions of their training successes also did not differ as a function of the treatments. Prior research showed that ability and effort feedback enhance motivation equally well (Schunk, 1983). This finding is not surprising because both forms of feedback support children's perceptions of their task progress and help develop self-efficacy (Sehunk, 1984). Experiment 2 suggests that the effects of sequential attributional feedback on other achievement behaviors occur because of how the feedback influences ability attributions.

Consistent with previous similar research, these studies support the idea that self-efficacy is not merely a reflection of prior performances (Schunk, 1981, 1982, 1983). Treatment conditions did not differ in rate or accuracy of problem solving during training, but children who initially received ability feedback judged self-efficacy the highest. Efficacy appraisal is an inferential process that involves weighting the relative contributions of factors such as self-perceptions of ability, effort expended, task difficulty, amount of external aid received, situational circumstances under which the performances occurred, and temporal pattern of successes and failures (Bandura, 1981, 1982). These studies also support the idea that capability self-perceptions bear an important relation to subsequent achievement (Covington & Omelich, 1979a; Schunk, 1981). Personal expectations for success are viewed as important influences on behavior by a variety of theoretical approaches (Bandura, 1981; Covington & Beery, 1976; Kukla, 1972; Moulton, 1974; Schunk, 1984; Weiner, 1979).

The present results must be qualified due to the short-term nature of the studies. Between-conditions differences in motivation would be expected over time due to differential improvements in ability attributions and self-efficacy (Schunk, 1984; Weiner, 1979). It also is possible that ability feedback eventually would result in higher ability attributions and self-efficacy among effort-ability subjects and that continued effort feedback could lead ability-effort subjects to question their competencies. These possibilities, along with the idea that teacher feedback conveys an appraisal of student ability (Weiner et al., 1983), suggest that prolonged effort feedback may not benefit motivation, ability attributions, and self-efficacy. Although effort feedback seems realistic at times (e.g., early stages of skill acquisition, difficult tasks), teachers are advised to not stress effort indiscriminately.

Future research should explore how the sequence of attributional feedback affects achievement behaviors on other types of tasks. The present task was of intermediate difficulty; although it involved cognitive skill learning, children received instruction on the operations necessary to solve problems. Because students initially may have to expend much effort on a more difficult task to experience even limited success, early effort feedback may be perceived as more credible and may promote self-efficacy better than early ability feedback. As students begin to develop some skills and a sense of efficacy, attributing their later successes to ability may better substantiate self-efficacy. Knowing how students interpret forms of attributional feedback as their skills develop on different types of tasks would have important implications for teaching.

Notes:

1 When inverse compensation develops, the factors that influence it merit further investigation. In con-tra.st to Kun's (1977) and Surber's (1980) results, Harari and Covington (1981) found that inverse compensation began in the sixth grade. One important factor may be the achievement context. Harari and Covington used a school task (performance on a math test), whereas Kun and Surber employed nonschool tasks (solving puzzles, lifting weights). It is conceivable that the attributional judgments of Harari and Covington's students were affected by the emphasis that teachers place on effort as a cause of school achievement.

2 For the attributional feedback to be valid, children had to succeed at solving problems. The training packet was designed toward this end. Each explanatory page fully covered the subtraction operations required to solve the problems on the six pages that followed. As a check on children's success at solving problems, each proctor privately reviewed her children's work after they departed each day. Allowing for occasional small computational errors, children solved the problems correctly.

3 This attributional assessment is an example of a structured unidimensional scale (Elig & Frieze, 1979). Such scales assume independence of ratings and allow attributions to be assessed separately. A structured scale was chosen because young children seem to understand it more readily than an unstructured assessment (Diener & Dweck, 1980). Structured unidimensional scales yield attributional dimensions similar to those of structured ipsative scales, in which an individual judgment influences other judgments (Maruyama, 1982).

References

Andrews, G. R., & Debus, R. L. (1978). Persistence and the causal perception of failure: Modifying cognitive attributions. *Journal of Educational Psychology, 70,154-166.*

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

Bandura, A. (1981). Self-referent thought: A developmental analysis of self-efficacy. In J. H. Flavell & L. Ross (Eds.), *Social cognitive development: Frontiers and possible futures* (pp. 200-239). Cambridge: Cambridge University Press.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37,* 122-147.

Bandura, A., & Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology, 41,* 586-598.

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

Covington, M. V., & Beery, R. G. (1976). *Self-worth and school learning.* New York: Holt, Rinehart & Winston.

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

Covington, M. V., & Omelich, C. L. (1979b). It's best to be able and virtuous too: Student and teacher evaluative responses to successful effort. *Journal of Educational Psychology, 71,* 688-700.

Diener, C. I., & Dweck, C. S. (1980). An analysis of learned helplessness; II. The processing of *success. Journal of Personality and Social Psychology, 39,* 940-952.
Dweck, C. S. (1975). The role of expectations and attributions in the alleviation of learned helplessness. *Journal of Personality and Social Psychology, 31,* 674-685.
Edwards, A. L. (1976). *An introduction to linear regression and correlation.* San Francisco: Freeman.
Elig, T. W., & Frieze, I. H. (1979). Measuring causal attributions for success and failure. *Journal of Personality and Social Psychology, 37,* 621-634.
Friend, J., & Burton, R. (1981). *Teacher's guide: Diagnostic testing in arithmetic: Subtraction.* Palo Alto, CA: Xerox Palo Alto Research Center.
Frieze, I. H. (1980). Beliefs about success and failure in the classroom. In J. H. McMillan (Ed.), *The social psychology of school learning* (pp. 39-78). New York: Academic Press.
Frieze, I. H., & Bar-Tal, D. (1980). Developmental trends in cue utilization for attributional judgments. *Journal of Applied Developmental Psychology, 1,* 83-94.
Frieze, I. H., & Snyder, H. N. (1980). Children's beliefs about the causes of success and failure in school settings. *Journal of Educational Psychology,* 72, 186-196.
Frieze, I. H., & Weiner, B. (1971). Cue utilization and attributional judgments for success and failure. *Journal of Personality, 39,* 591-605.
Harari, O., & Covington, M. V. (1981). Reactions to achievement behavior from a teacher and student perspective: A developmental analysis. *American Educational Research Journal, 18,* 15-28.
Heider, F. (1958). *The psychology of interpersonal relations.* New York: Wiley.
Kelley, H. H. (1967). Attribution theory in social psychology. In D. Levine (Ed.), *Nebraska symposium on motivation* (Vol. 15, pp. 192-238). Lincoln: University of Nebraska Press.
Kelley, H. H., & Michela, J. L. (1980). Attribution theory and research. *Annual Review of Psychology, 31*, 457-501.
Kukla, A. (1972). Foundations of an attributional theory of performance. *Psychological Review,* 79, 454-470.
Kun, A. (1977). Development of the magnitude-co-variation and compensation schemata in ability and effort attributions of performance. *Child Development, 48,* 862-873.
Maruyaraa, G. (1982). How should attributions be measured? A reanalysis of data from Elig and Frieze. *American Educational Research Journal, 19,* 552-558.
McMahan, I. D. (1973). Relationships between causal attributions and expectancy of success. *Journal of Personality and Social Psychology,* 28,108-114.
Medway, F. J., & Venino, G. R. (1982). The effects of effort feedback and performance patterns on children's attributions and task persistence. *Contemporary Educational Psychology,-7,* 26-34.
Miller, R. L., Brickman, P., & Bolen, D. (1975). Attribution versus persuasion as a means for modifying behavior. *Journal of Personality and Social Psychology, 31,* 430-441.
Moulton, R. W. (1974). Motivational implications of individual differences in competence. In J. W. Atkinson & J. O. Raynor (Eds.), *Motivation and achievement* (pp. 77-82). Washington, DC: Winston.
Nicholls, J. G. (1978). The *development of* the concepts of effort and ability, perception of academic attainment, and the understanding that difficult tasks require more ability. *Child Development, 49,* 800-814.
Nicholls, J. G. (1979). Development of perception of own attainment and causal attribution for success and failure in reading. *Journal of Educational Psychology, 71,* 94-99.
Schunk, D. H. (1981). Modeling and attributional effects on children's achievement: A self-efficacy analysis. *Journal of Educational Psychology,* 73, 93-105.
Schunk, D. H. (1982). Effects of effort attributional feedback on children's perceived self-efficacy and achievement. *Journal of Educational Psychology,* 74,548-556.
Schunk, D. H. (1983). Ability versus effort attributional feedback: Differential effects on self-efficacy and achievement. *Journal of Educational Psychology,* 75,848-856.
Schunk, 1). H. (1984). Self-efficacy perspective on achievement behavior. *Educational Psychologist, 19,* 48-58.
Surber, C. F. (1980). The development of reversible operations in judgments of ability, effort, and performance. *Child Development, 51,* 1018-1029.
Weiner, B. (1974). An attributional interpretation of expectancy-value theory. In B. Weiner (Ed.), *Cognitive views of human motivation* (pp. 51-69). New York: Academic Press.

Weiner, B. (1977). An attributional approach for educational psychology. In L. Shulman (Ed.), *Re-view of research in education* (Vol. 4, pp. 179-209). Itasca, IL: Peacock.
Weiner, B. (1979). A theory of motivation for some classroom *experiences. Journal of Educational Psychology, 71*, 3-25.
Weiner, B., Frieze, I., Kukla, A., Reed, L., Rest, S., & Rosenbaum, R. M. (1971). Perceiving the causes of success and failure. In E. E. Jones, D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins, & B. Weiner (Eds.), *Attribution: Perceiving the causes of behavior* (pp. 95-120). Morristown, NJ: General Learning Press.
Weiner, B., Graham, S., Taylor, S. E., & Meyer, W. (1983). Social cognition in the classroom. *Educational Psychologist, 18*, 109-124.
Winer, B. J. (1971). *Statistical principles in experimental design* (2nd ed.). New York: McGraw-Hill.