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The effects of anchoring biases on teachers' self-efficacy and performance: A test of the causality of self-efficacy

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The Effects of Anchoring Biases on Teachers' Self-Efficacy and Performance: A Test of the Causality of Self-Efficacy

by

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Abstract

THE EFFECTS OF ANCHORING
BIASES ON TEACHERS' SELF-EFFICACY
AND PERFORMANCE: A TEST OF THE CAUSALITY
OF SELF-EFFICACY

by

Judith A. DiStefano

Advisor: Professor Marian Fish

The study explored teachers' self-efficacy in a situation-specific seriation of length teaching task. Levels of self-efficacy were manipulated by use of adjustment and anchoring. Three levels of anchoring (high, low, control) were embedded in an informational questionnaire.

Fifty-one teachers and a like number of preschoolers served as subjects. Teachers were offered a monetary stipend ($5 - $7) for taking part in the study. A criteria was established for children's inclusion in the study and all preschoolers were pretested as to their knowledge of seriation of length. Prior to the teaching session, teachers completed two questionnaires: (1) informational including the anchoring manipulation, (2) 11-part self-efficacy. The one-to-one teaching session was observed by a doctoral student. Dependent

teacher measures assessed were: (1) persistence, (2) number of items seriated, and (3) teacher-student behavior. Teacher and student outcome measures were evaluated at the termination of the session.

Results of the study did not support the hypothesis that anchoring would be directly related to pretest self-efficacy. However, anchoring was related to intermediate and global self-efficacy measures which, in turn, were related to pretest self-efficacy. The number of items seriated was the one variable related to most dependent measures. Persistence also proved to be a variable related to teachers' level of attainment, students' outcome measures, and teacher-student positive behavior. An additional finding was that anchoring had a significant effect on the global self-efficacy measure and there were significant differences between the high and low groups.

Praise, encouragement, and teachers' ability to "stick" with the child were positive behaviors exhibited by more than half the teachers in the study.

As a result of the above research, a conceptual model was formulated to describe anchoring biases on teachers' self-efficacy judgments and performance.

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Without question my family has provided me with my greatest inspiration and strength. Over the years

their love, faith, and belief enabled me to attain a lifetime goal. To my beloved mother, "Yes, I am finally finished!" To my wonderful, loving, and caring daughter and son, "Thank you for your faith and gentle prodding over the years. There seemed to be a role reversal at some point in time." And last, but never least, to my sensitive, devoted husband, "You always encouraged, supported, and believed in my goals, despite some of my own misgivings. The end is actually in sight!"

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Chapter I

Introduction

Motivation is of major importance in the study of behavior. Why does one individual persist on a task while another exerts little effort? Based on a social learning analysis, behavior choice and effort expenditure are governed in part by percepts of self-efficacy. This construct has been demonstrated to be an effective motivator of behavior (Bandura, 1977). Self-efficacy refers to one's judgments of performance capabilities in a specific domain of activity. Human behavior is influenced by mediating factors and Bandura (1977) conceptualizes self-efficacy as the cognitive mechanism contributing to behavioral change. As a mediating variable, self-efficacy is influential in a person's choice of activities, effort expended, persistence, and task accomplishments.

The self-efficacy literature has focused on methods of enhancing perceptions of self-efficacy. For example, studies employing modeling as an intervention mode (Bandura & Adams, 1977; Bandura, Adams & Beyer, 1977; Schunk, 1981, 1984) have demonstrated the positive effects of this technique in altering perceptions of self-efficacy and affecting behavioral change. Results of the above

studies demonstrate self-efficacy to be an accurate predictor of performance. Subjects' perceptions of self-efficacy predicted how well they performed in specific behavioral situations. However modeling techniques may, in fact, have strengthened the subjects' competencies by teaching various strategies which improved performance. Perhaps these altered competencies were responsible for improvement in approach behavior or skill development. Even when non-enactive treatment modeling strategies were observed (Bandura, Reese & Adams, 1982), subjects may have learned various coping methods to be employed when faced with the feared object.

In most instances self-efficacy judgments can be conceptualized as judgments made under circumstances of uncertainty. Tversky and Kahneman (1974) posit three heuristics influential in the judgmental process. These heuristics reduce complex tasks to more simplified judgmental operations and although they are quite useful, at times they may lead to severe and systematic errors. According to these researchers (1) representativeness, (2) availability, and (3) adjustment and anchoring are utilized to assess probability and predict values. The latter heuristic, <u>adjustment and anchoring</u> is a process whereby persons make judgments after first considering some "anchoring" information. Thus, people

make estimates by considering an initial value and adjusting it upward or downward to arrive at their final decision. Judgments are often biased in the direction of the initial "anchor" value.

Although Tversky and Kahneman (1974) applied the adjustment and anchoring principle to factual judgments, Cervone and Peake (1986, 1987) examined the effect of anchoring on self judgments. They explored the impact of anchoring on the formation of self-efficacy judgments. In addition, these researchers studied the relationship between personal estimates and subsequent behavior. Results of Cervone and Peake's studies (1986, 1987) provide support for the hypothesis that self-efficacy judgments causally influence performance.

Research into the self-efficacy construct has demonstrated its effectiveness in clinical interventions (Bandura, Adams & Beyer, 1977) and in the development of academic skills (Bandura & Schunk, 1981). Although empirical research on teachers' self-efficacy has been negligible, teachers' self-efficacy has been reported to be an important factor in reading achievement (Armor, Conry-Oseguera, Cox, King, McDonnell, Pascal, Pauly & Zellman, 1976) and maintenance of innovations, percent of project goals achieved, improved student performance, and the extent of teacher change (Berman, McLaughlin,

Bass, Pauly & Zellman, 1977). Ashton and Webb (1982) developed a conceptual framework and multidimensional model of self-efficacy. Findings from their research support the conception that teachers' self-efficacy is related to student achievement.

Problems conceptualizing and measuring the construct of teacher efficacy have been discussed (Ashton, Olejnik, Crocker, & McAuliffe, 1982; Buhr, Crocker & Ashton, 1983; Denham & Michael, 1981; Gibson & Dembo, 1984). Much of the research on teachers' self-efficacy has been conducted using questionnaires, interviews, and classroom observations (Ashton & Webb, 1982; Doda, 1982; Gibson & Dembo, 1984; Soar & Soar, 1982). Teacher behaviors associated with a high sense of efficacy have been documented.

Since self-efficacy is posited to be situation-specific (Bandura 1977, 1982, 1986), it follows that an empirical investigation using a specific teaching experience could further our understanding of characteristics associated with teachers' self-efficacy.

Bandura (1982) states that efficacy appraisals occur more often when a person encounters new task demands. Based on this premise, it would appear that a teacher faced with a novel teaching assignment would exhibit specific behaviors based on his/her feelings of efficacy

in that situation. Uncertainty regarding performance would be manifest in this situation.

Seriation, a complex, developmental, conceptual skill has been shown to be difficult for young children (Siegel, 1972). For this reason, seriation has been chosen as the teaching assignment in the present study.

The present study is an initial attempt to investigate teachers' self-efficacy in a situation-specific episode. The impact of the adjustment and anchoring heuristic on teachers' self-efficacy judgments will be explored. Relationships between these self-efficacy estimates and subsequent behavior in the teaching situation will be studied.

In this manner a stringent test of self-efficacy can be effected independent of teacher competency, and a causal link between self-efficacy judgments and performance will be investigated.

Purpose of the Study

This study will explore teachers' self-efficacy in a situation-specific episode. Prior research into teachers' self-efficacy have failed to employ an experimental paradigm to study this construct. In the present study levels of self-efficacy will be manipulated by use of adjustment and anchoring. Although this heuristic

has been shown to impact on the formation of self-efficacy judgments among high school and college students, its effect on teachers in a teaching situation has not been tested.

The adjustment and anchoring manipulation will allow for a direct measure of the effect of self-efficacy judgments on teacher behavior. By employing this manipulation, self-efficacy judgments will be studied independent of teachers' prior competencies and skills.

Based upon the existing literature, it is anticipated that teachers in a high anchor condition will exhibit higher self-efficacy judgments and demonstrate more persistence in their teaching assignment than teachers in the low anchor and control conditions. Teachers' behavior in this experimental context will be explored to determine the effects of anchoring and self-efficacy judgments on subsequent behavior. Additionally, the child's success rate and its relationship on teachers' self-efficacy judgments will be studied.

Rationale

Although an extensive literature is available on teachers' effectiveness, empirical research on teachers' self-efficacy is negligible. This will be an initial attempt to investigate teachers' self-efficacy in a

situation-specific experimental context.

Teachers' self-efficacy will be explored independent of skill level. Positive findings will support the hypothesis that self-efficacy judgments causally influence teachers' performance. An analysis into relevant behaviors associated with highly efficacious teachers can provide important information in teacher-training preparation. Research has demonstrated teachers do matter in students' education (Good, 1979). If self-efficacy proves to be causally linked to performance, then methods to enhance self-efficacy can be implemented in a consistent manner.

Chapter II

A Review of the Literature

The present chapter will delineate the relevant research pertaining to (1) the self-efficacy construct, (2) judgmental heuristics, (3) teacher effectiveness, and (4) teachers' self-efficacy.

Self-Efficacy

According to social learning theory, self-efficacy plays a prominent role in the acquisition and retention of behavior patterns (Bandura, 1977, 1982, 1986). Bandura (1982) writes, "Perceived self-efficacy is concerned with judgments of how well one can execute courses of action required to deal with prospective situations" (p. 122). Self-efficacy serves as a cognitive mediator and central processor of information. Knowledge related to one's sense of efficacy is conveyed to an individual through actual performances in situations, vicarious experiences, verbal persuasion, and physiological indices (Bandura, 1977, 1982, 1986).

Perceptions of self-efficacy affect an individual's motivation and behavior. Choice of activity, effort expended, persistence in the face of obstacles, or aversive experiences and task accomplishments are influenced

by one's sense of efficacy. High efficacy perceptions allow people to undertake and perform activities they judge themselves capable of handling. Vigorous and persistent efforts are demonstrated by an individual with a strong sense of efficacy (Bandura, 1977). In Bandura's view, ". . . persons who have a strong sense of efficacy deploy their attention and effort to the demands of the situation and are spurred to greater effort by obstacles" (1982, p. 123). Low efficacy results in avoidance behavior or limited effort (Bandura & Schunk, 1981; Brown & Inouye, 1978; Schunk, 1981).

Bandura (1977) perceives self-efficacy as dynamic, multidimensional, and situation specific. He differentiates between efficacy expectations, or the belief that one can successfully execute behavior required to produce outcomes; and outcome expectations, or a person's estimate that a specific behavior will lead to certain outcomes.

Clinical Intervention Studies

Research on this construct has provided support for self-efficacy theory. Much of the early work on self-efficacy was in the area of clinical interventions and focused on techniques to rid subjects of their fears. In a series of studies on adult snake phobics, different

modes of treatment were analyzed to determine their effect on self-efficacy and behavior change.

In one study, Bandura, Adams, and Beyer (1977) compared performance mastery (participant modeling) to vicarious experience (modeling) in an effort to alter efficacy expectations and avoidance behavior of adult snake phobics.

In participant modeling, operated through direct mastery experiences, subjects were assisted to engage in progressively more threatening interactions with a snake. In the modeling treatment subjects observed the experimenter perform the same activities as the participant modeling condition for an equivalent period of time, but they themselves did not engage in any behavior. Subjects in the control participated in the assessment procedures without receiving any intervening treatment. Level, strength, and generality of the subjects' efficacy expectation were measured (1) prior to treatment, (2) following treatment but before the posttest, and (3) after completing the behavioral posttest. Subjects ranked in order of increasing threat those tasks they considered themselves capable of executing. They rated the strength of their expectations for each task on a 100-point probability scale ranging in 10-unit intervals from great uncertainty through intermediate values of

certainty to complete certainty. Following the completion of the posttest those subjects in the control and modeling condition who did not achieve appropriate performance levels received participant modeling treatment. Results of the study indicated experiences based on participant modeling produced the highest, more generalized, and stronger efficacy expectations than either the vicarious or control condition. This result supports Bandura's (1977) postulate that information from enactive attainments is the most powerful determinant of efficacy expectations. In addition to this finding, perceptions of efficacy were shown to be more accurate predictors of future performance than past performance accomplishments.

A related study by Bandura and Adams (1977) investigated another intervention strategy. The effects of desensitization on self-efficacy and behavior avoidance were examined among adult snake phobics. Consistent with the initial study, Bandura and Adams (1977) found that performance corresponded closely to the level of self-efficacy. The higher the subjects' level of perceived self-efficacy, the more approach behavior they initiated in the posttest. Self-efficacy proved to be an accurate predictor of subsequent performance on 85% of the tasks.

Behavioral change during participant modeling was

also investigated in a second study by Bandura and Adams (1977). Level of efficacy predicted the rate of behavior change during treatment, while performance attainments were of less value in predicting future performance.

Non-performance modes of treatment provide no behavioral information for judging changes in percepts of self-efficacy. Inferences regarding capabilities are assessed from symbolic sources of efficacy information. Positive findings in this non-enactive treatment mode strengthens the case for a causal link between self-efficacy and performance.

In a study undertaken by Bandura, Adams, Hardy, and Howells (1980), the self-efficacy theory was tested in yet another treatment modality, namely cognitive modeling. The effect of efficacy probes was evaluated in order to determine their influence on subsequent performance. Generality of self-efficacy was measured toward a dissimilar threat. Results of this study demonstrated that the cognitive modeling treatment substantially reduced fear arousal. Both strength and level of self-efficacy were enhanced in the cognitive modeling treatment and self-efficacy proved to be a highly accurate predictor on tasks varying in difficulty. The congruence rate between self-efficacy and performance was eighty-one percent. Efficacy probes had no effect on subsequent

avoidance behavior or fear arousal.

Another non-enactive treatment modality was designed by Bandura, Reese, and Adams (1982) in which differential levels of self-efficacy were induced vicariously. Subjects observed coping strategies modeled, but did not execute any actions. Predictability and controllability were emphasized in the modeling condition. Subjects' perceived self-efficacy was raised to predetermined low or medium levels. Results demonstrated the higher the level of perceived self-efficacy, the higher the produced performance attainments. This finding lends further support to the hypothesis that individuals are more influenced by their interpretations of performance outcome than by the actual outcome itself.

In order to test the generality of the efficacy theory across behavioral domains, Bandura, Adams, Hardy, and Howells (1980) studied enactive mastery experiences with agoraphobics. Treatment lasted ten days and included group sessions and field mastery experiences. Seven different field therapists were employed to assist the agoraphobics gain mastery over their fears. Findings demonstrated that improvements in coping behavior corresponded to efficacy changes. The higher the level of self-efficacy, the greater the stress tolerance and venturesome behavior. Bandura, et al. (1980) state

that their studies demonstrate that both emotional arousal and behavior are affected by one's perception of coping capabilities.

Achievement Motivation

One of the first attempts to focus on students' motivation to achieve was Brown and Inouye's study (1978). These researchers examined vicariously induced helplessness in forty male college students and their findings demonstrated the importance of perceived similarity to the model. Efficacy expectations were either undermined or increased dependent upon perceptions of relative competence to the model. Observers who perceived themselves as superior to a failing model maintained high efficacy expectations and continued working despite failure. When perceived to be of comparable ability, modeled failure had an adverse effect on subjects' self-judged efficacy. A low sense of personal efficacy was expressed by these subjects and they gave up quickly upon encountering difficulties.

Academic Skill Development

One study that explored achievement was undertaken by Schunk (1981). This research was an initial attempt to apply self-efficacy theory to enhancement of cognitive

skills by investigating the effects of modeling and attributions on children's achievement. Fifty-six children who exhibited deficit arithmetic achievement were assigned to one of three conditions: cognitive modeling, didactic instruction, or non-treatment control. Within each treatment condition, half of the children received effort attribution for success or failure. During the cognitive modeling treatment, subjects observed an adult model solve division problems and verbalize aloud the strategies employed in the solutions. Children in the didactic condition studied explanatory pages of the training packet that had been both verbalized aloud and demonstrated during the cognitive modeling treatment. For those students who were assigned to attribution conditions approximately twenty times during the treatment condition, the trainer attributed their success to high effort and difficulties to low effort. Results of Schunk's (1981) study demonstrated that although both treatments enhanced persistence, accuracy, and perceived efficacy, ". . . cognitive modeling was more effective than didactic instruction in promoting skill development" (p. 102). Effort attribution had no effect on math performance nor on perceived efficacy.

Research on self-efficacy has proliferated. Many experiments have been devised to study the mediating

effects of self-efficacy in developing academic skills (Schunk, 1985a). Mathematics (Bandura & Schunk, 1981; Schunk, 1981, 1982, 1983a, 1983b, 1983c), listening comprehension (Schunk & Rice, 1984), and reading comprehension (Schunk & Rice, 1985) have been areas of interest. The groups studied have included remedial students (Bandura & Schunk, 1981; Schunk, 1981, 1982, 1983a, 1983b, 1983c), high and low achievement level students (Collins, 1985), conduct disorders (Lyman, Prentice-Dunn, Wilson & Bonfilio, 1984), and learning disabled subjects (Omizo, Cubberly & Cubberly, 1984; Schunk, 1985b; Schunk & Cox, 1986). Interventions such as goal setting (Bandura & Schunk, 1981; Locke, Frederick, Lee & Bobko, 1984; Schunk, 1983b, 1983c, 1985b); attributional feedback (Schunk, 1982, 1983a; Schunk & Rice, 1986), rewards (Schunk, 1983d, 1984), self verbalizations (Schunk & Rice, 1984), and modeling (Schunk, 1981; Schunk & Hanson, 1985) have been investigated.

In addition to these studies, Schunk and Lilly (1984) investigated sex differences in self-efficacy and attributions among students. Results of the research were consistent with Bandura's theoretical formulation. Self-efficacy was demonstrated to be an accurate predictor of performance and not merely a reflection of past performance. Self-efficacy proved effective in cognitive

skill development across subject areas and populations.

As illustrated by the vast body of research cited, links between self-efficacy and behavior have been established.

Judgmental Processes

However, research on the processes associated with the formation of self-efficacy judgments is lacking. Bandura (1977, 1982, 1986) posits that potential sources of efficacy information are: (1) actual performances in situations, (2) vicarious experiences, (3) verbal persuasion, and (4) physiological indices.

Cervone and Peake (1986) addressed the issue of processes employed when forming self-efficacy judgments by drawing upon research from Tversky and Kahneman (1974). Based upon the premise that judgments of self-efficacy are formed under circumstances of uncertainty, these researchers applied one of the three principles Tversky and Kahneman (1974) state guide judgments made under circumstances of uncertainty.

For Tversky and Kahneman (1974) representativeness, availability, and anchoring and adjustment are the three principles responsible for reducing complex tasks into simpler judgmental operations. Tversky and Kahneman state, ". . . these heuristics are quite useful, but

sometimes they lead to severe and systematic errors" (p. 1124).

The representativeness heuristic relates to the probability an object, event, or process belongs to a specific class or process. In employing representativeness, an individual relies on the degree to which a specific event A resembles B. "When A is highly representative of B, the probability that A originates from B is judged to be high" (Tversky & Kahneman, 1974, p. 1124). Conversely, if A has little similarity to B, the probability A derives from B is considered to be low.

Availability refers to situations whereby individuals assess the probability of an event or the frequency of a class by the ease in which instances or occurrences can be brought to mind. Examples of large classes are usually recalled better than examples of less frequent classes.

The third heuristic influencing judgments made under situations of uncertainty is adjustment and anchoring. This principle specifies that people make estimates by starting at an initial point that is adjusted to arrive at a final answer. In many instances these adjustments are insufficient. Anchoring refers to the fact that different starting points will yield varying esti-

mates which are biased toward the initial value. The anchoring effect was studied by Tversky and Kahneman (1974) when subjects were asked to estimate the percentage of African countries in the United Nations. Subjects were asked to indicate whether the correct value was higher or lower than random numbers which had been presented to them. Subjects who first judged whether the value was more or less than sixty-five gave higher estimates than those subjects who first judged it more or less than ten.

Although Tversky and Kahneman (1974) applied the three judgmental heuristics to factual information, Cervone and Peake (1986) extended the above research to investigate the effect the adjustment and anchoring heuristic played in forming self judgments, specifically judgments of self-efficacy. In their initial study of sixty-two college undergraduates, subjects were assigned to one of six conditions in a design with anchor conditions (high, low, none), tasks (anagrams, cyclical graphs), and gender as independent variables. Subjects were told they had a total of fifteen minutes to work on a maximum of forty items (twenty anagrams and twenty cyclical graphs). Subjects in the anagrams condition would work on the anagrams first; subjects in the cyclical graphs condition would work on the graphs first. During

each trial, subjects were to attempt to solve one item of a particular type of task. After the trial, subjects had a set of choices regarding the next trial. If they had not been successful, they could continue working on the same item, switch to the next item, or switch to an alternate task. Once a subject stopped working on a particular item, he/she could not return to that item. Subjects were told items of both tasks would be arranged in order of increasing difficulty. Prior to beginning work, subjects received a questionnaire in which the anchor value was embedded. Thus, the instructions varied according to the assigned condition (high, low, none). Subjects in the high- and low-anchor condition were told one of the questions involved relative and absolute judgments of capabilities on the tasks. Relative judgments involved judging abilities in comparison with a random ability level. Prior to receiving the questionnaire subjects in the high- and low-anchor condition received an anchor value pertinent to the question concerning relative judgments. The anchor values were selected so that they appeared to be random numbers. The experimenter showed the subject 20 small cards numbered 1 to 20, placed them in a cloth bag attached to a wooden rim and handle, shook the bag, and presented it to the subject, who selected a number. However,

the number was not random and the subjects actually selected from a preloaded set of 20 cards all of which read either 4 (low-anchor condition) or 18 (high-anchor condition). That number was then entered into the designated item of the questionnaire. Four items relating to the task were contained on the questionnaire. The first two items served as filler items; the third question provided the anchor value, and in the fourth question subjects were asked to judge how many items of the initial task they thought they were capable of solving. This latter judgment provided the measure of perceived self-efficacy. In the no-anchor condition, no anchor value was presented and the question pertaining to relative judgments was omitted.

For both tasks (anagrams and cyclical graphs) items were arranged so that the first eight items were solvable while the remainder were unsolvable. The session began when the experimenter handed the subject the first item of the initial task. If the subject did not solve the item within 15 seconds, the experimenter said, "Time." The subject made the choice of repeating the item, selecting the next item of the same task, or switching to the alternate task. The study ended when the subjects switched to the alternate task.

Results of the study demonstrated that anchoring

biases significantly influenced judgments of self-efficacy. Differences in task persistence paralleled differences in self-efficacy judgments. High-anchor subjects also persisted longer than no-anchor subjects. When the experimenters controlled for the anchoring condition, self-efficacy was predictive of persistence; but when self-efficacy was controlled, anchoring was not.

In a second experiment, Cervone and Peake (1986) studied the generality of the above findings with a different population. Two changes were made in the study: cyclical graphs were used as the initial task and the low anchor condition was reduced to a value of two. Twenty-three junior year high school students served as subjects. Procedures and materials were identical to the first study with the exception of the two changes mentioned above. Results demonstrated that anchoring biases significantly affected the level of self-efficacy. Differences in perceived self-efficacy were accompanied by corresponding differences in task persistence.

Both studies demonstrated self-efficacy to be predictive of both between group differences and variations in performance within the anchoring condition.

In order to control for both experience with the target task and information made available for processing

in forming efficacy judgments, Cervone and Peake (1987) employed a manipulation referred to as "sequence anchoring." In this manipulation subjects rate their confidence at attaining five different levels of performance, ranging from very low to very high. In one condition subjects provided the ratings in an ascending order; in another condition subjects provided the same ratings but in a descending order. In a control condition subjects provided efficacy estimates without rating their confidence at the five different levels. Results demonstrated subjects making ratings in an ascending sequence yielded self-efficacy ratings significantly lower than those making ratings in a descending order. Control subjects provided efficacy estimates midway between the two anchored groups. In the above paradigm, self-efficacy proved to be the controlling variable.

Cervone and Palmer, as reported by Cervone and Peake (1987), conducted a study where self-efficacy judgments were reassessed as subjects worked on thirty geometric tasks. Anchoring was used to affect initial efficacy judgments. After attempting the tenth and twentieth item, subjects reassessed their level of self-efficacy by completing a questionnaire. Results demonstrated anchoring biases strongly affected initial efficacy judgments. The differences persisted despite con-

trolled, repeated performance feedback.

Teachers' Effectiveness

While much attention has focused on students' self-efficacy and its relationship to achievement, little research has examined the role of teachers' self-efficacy on student achievement. Achievement outcomes have been of concern to educators. Criticism of the schools has focused on declining achievement scores (Gallup, 1984). Numerous strategies have been proposed to improve the educational system (Boyer, 1983; Goodlad, 1984; The National Commission on Excellence in Education, 1983).

Despite the innovation, sophistication, and strength of many of the proposed programs, the classroom teacher is ultimately responsible for the successful delivery of instruction. Research has provided support for the importance of teacher over method (Good, 1979). Good (1979) further reported a 1978 study by Rakow, Airasian, and Madaus in which data from the International Education study were reanalyzed at a teacher rather than school level and findings demonstrated ". . . individual teachers appear to make important contributions to student achievement" (p. 53).

An extensive literature exists on teacher effectiveness (e.g., Brophy & Evertson, 1981; Brophy & Good,

1974; Dunkin & Biddle, 1974; Good, 1979; Rosenshine, 1971), yet research attempting to link specific teacher behaviors to student achievement has been discouraging (Dunkin & Biddle, 1974).

Teachers' managerial abilities have been found to be a strong determinant of student learning, as has direct and active teaching (Good, 1979). Students' ability level appears to be the single most significant student characteristic affecting teachers' interactions (Cooper & Good, 1983; Prawat & Jarvis, 1980). Differential teacher behavior towards low and high ability students has been demonstrated (Ames & Ames, 1984; Brophy & Good, 1970; Cooper, 1979; Good, 1981).

Although many studies have examined teachers' effectiveness, research on teachers' self-efficacy and its relationship to student achievement has been scant.

Teachers' Self-Efficacy

One of the first attempts to investigate teachers' self-efficacy and its relationship to student achievement was undertaken by the Rand Corporation studies (Armor, Conry-Osequera, Cox, King, McDonnell, Pascal, Pauly & Zellman, 1976; Berman, McLaughlin, Bass, Pauly & Zellman, 1977). Self-efficacy was defined as ". . . the extent to which the teacher believed he or she had the capacity

to affect student performance" (p. 137). In the initial evaluation of the Los Angeles School Preferred Reading Program, Armor, et al., (1976) found that teachers' self-efficacy was related to increases in reading achievement. In a second study of one hundred Title III projects of the 1965 Elementary and Secondary Education Act, teachers' use of innovations was examined. Berman, McLaughlin, Bass, Pauly, and Zellman (1977) reported a positive relationship between teachers' self-efficacy and the percent of project goals achieved, the extent of teacher change, improved student performance, and teachers' maintenance of the innovations. Student performance was not measured by standardized tests but by teachers' responses to two Likert items dealing with the project's impact on student achievement, as well as its impact on attitudes and behavior. Self-efficacy in the two studies was measured by the total score on two five choice (ranging from strongly agree to strongly disagree) Likert scale items:

1. When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment.
2. If I really try hard, I can get through to even the most difficult or unmotivated students (Berman,

et al., pp. 136-137).

The researchers in the Rand studies used Rotter's locus of control as the theoretical foundation for teachers' self-efficacy.

Another attempt to investigate the effects of teachers' self-efficacy was undertaken by Ashton and Webb (1982). Their exploratory research was developed to provide a conceptual framework for further research in this area. An alternate theoretical formulation was proposed to explain their multidimensional model of teachers' sense of efficacy, and social learning theory, specifically Bandura's construct of self-efficacy (1977, 1982, 1986), was influential in the conceptualization of teachers' self-efficacy in their model.

Ashton and Webb (1986) view the construct of teachers' self-efficacy as a ". . . situation-specific expectation that they can help students learn" (p. 3). This conception of specificity parallels Bandura's (1977, 1982, 1986) contention that perceptions of self-efficacy are situation specific.

The four dimensions represented in Ashton and Webb's (1982) model "include, first, a general causal belief in action-outcome contingencies; second, a generalized sense of self-efficacy; third, a general belief in teachers' ability to motivate students; and fourth, a specific

belief in their own perceived competence in motivating students" (p. 5). A general belief in teachers' ability to motivate students or a sense of teaching efficacy refers to teachers' beliefs about the general relationship betw en teaching and learning. Expectations for specific students in specific situations would be reflected in this belief. A specific belief in their own perceived competence in motivating students or personal teaching efficacy is viewed as the best predictor of teacher behavior. This dimension refers to a teacher's specific belief about his/her personal competence in motivating students. Personal teaching efficacy is an integration of teaching efficacy and personal efficacy. Sense of teaching efficacy and sense of personal teaching efficacy are seen as two independent dimensions.

Based on Bandura's self-efficacy construct (1977, 1982, 1986), teaching efficacy is comparable to cutcome expectations, while personal teaching efficacy is analogous to efficacy expectations.

Ashton and Webb (1982) used an ecological model suggested by Bronfenbrenner (1976) to conduct their research on teachers' self-efficacy. This approach posits four systems:

1. The microsystem consisted of the teachers' immediate setting (e.g., classroom or school).

2. The mesosystem consisted of interrelations among teachers' major settings (e.g., principal, colleagues, or school norms).
3. The exosystem referred to the formal and informal social structures (e.g., socioeconomic level).
4. The macrosystem consisted of predominant cultural beliefs and ideologies.

In an ethnographic study as reported by Doda (1982), two middle schools differing on three organizational dimensions were selected. One school had a modern middle school organization (interdisciplinary team, multi-age grouping, adviser-advisee program) while the other was a traditional junior high school (department organization, single-age grouping, and homeroom). The schools were similar in all other dimensions (size, racial, and socio-economic distribution and school community). Based on responses to a questionnaire, high and low efficacy teachers were identified. As in the Rand Corporation studies, teachers' self-efficacy was measured by scores on the two-item, five-choice Likert scale. Based on their self-efficacy model, the first item in the scale was analogous to teachers' self-efficacy; while the second item measured personal teaching efficacy. Two high efficacy and two low efficacy teachers from each of the different middle schools were observed over a

six week period. At the completion of six weeks, these teachers were interviewed at length regarding their attitudes toward teaching. The following year, a micro-ethnographic study was conducted in which two teachers from each school were observed as they taught classes and interacted with staff and parents. Ashton and Webb (1986) sum up this qualitative research, "The findings lead to the hypothesis that school organization, leadership, and ethos contribute to the establishment and maintenance of teachers' sense of efficacy" (p. 120). Team teaching, adviser-advisee programs, multi-aged grouping, clear and shared education aims diminished low efficacy perceptions. Regarding interactions with students, high efficacy teachers minimized negative affect, promoted an expectation of achievement, and provided a warm, interpersonal relationship in the class. Conversely, teacher stratification, conflictual classroom situations, and emphasis on academic achievement for the more able students were demonstrated in low efficacy classrooms.

Based on the findings in the initial phase of their investigation, a process-product study of forty-eight high school remedial mathematics and language teachers was explored (Soar & Soar, 1982). Student achievement was measured by the math, reading, and language sub-tests

of the Metropolitan Achievement Test. Measures of teacher attitudes included a questionnaire with the two-item Rand efficacy questions, an eight-item forced-choice measure of teaching efficacy (Webb efficacy measures), and fifteen Efficacy Vignettes (measure of personal teaching efficacy). The three instruments used to collect classroom data were (1) the Climate and Control System measuring classroom climate; (2) the Teacher Practices Observation Record used to gather information about teachers' instructional styles, and (3) the Engagement Rate Form measuring students' attentiveness (Soar & Soar, 1982). Findings supported the hypothesis that teachers' self-efficacy was related to student achievement. The assumption of the specificity of teachers' efficacy was also supported. Teaching efficacy was significantly related to math achievement; while personal teaching efficacy was related to language test scores. Although no significant relationships were found between teacher attitudes and behaviors in class, some trends were evident. Low efficacy teachers were more likely to have disorderly classes and used harsh methods in controlling students. Warmer classroom climates were evident in the classes of teachers who were confident in their ability, and praise, nodding, and smiling were evident in their behaviors. Small group instruction

and assigned seatwork were also more evident in these classes. One of the strongest trends was that high efficacy teachers tended to give individual attention to all students. Maintenance of high academic standards, concentration on academic instruction, and monitoring of students' on-task behavior were found in high efficacy classrooms.

In an effort to increase teachers' self-efficacy, a small-scale pilot effort (N = 48) was undertaken by Ashton, Webb, and Doda (1983). Three approaches to change teacher behavior were compared:

1. a process-product approach;
2. an attitude change approach;
3. a combination of process-product and attitude change.

The forty-eight mathematics and communication basic skills teachers from the process-product study served as subjects. A different treatment consisting of a two-hour workshop based on the above approaches was presented in three different schools. A fourth school served as control. Criterion measures, assessed six weeks after the workshop, were ratings on the Classroom Climate and Control Observation System (Soar & Soar, 1982). No significant differences were found among the four groups of teachers.

Denham and Michael (1981) also proposed a model

of teacher efficacy. Components of their model are teachers' efficacy, its antecedents and consequent conditions. Similar to Ashton and Webb (1982), teachers' self-efficacy is viewed as an intervening variable. The difference between the models lies in the two components comprising this dimension, a cognitive and affective component. The cognitive element consists of two parts: (1) the likelihood that the ideal or normative teacher can bring about changes in the student; and (2) an assessment of the teacher's own ability to implement change. The cognitive component is similar to Ashton and Webb's (1982) teaching efficacy and personal teaching efficacy. The affective element is the pride or shame associated with the sense of efficacy. Antecedent conditions consist of teacher training and experiences, system and personal variables, and casual attribution. Teacher and student behavior are the measurable consequences. Formulation of this model was based on literature reviews, consultations with specialists, and a pilot study of twenty teachers.

In discussing their model, Denham and Michael (1981) state, "Probably the variable most difficult to measure is sense of efficacy itself" (p. 44).

Measurement of Teacher Self-Efficacy

Ashton, Olejnik, Crocker, and McAuliffe (1982) attempted to develop more useful measures of teachers' self-efficacy. A seven-item, forced-choice scale (Webb Efficacy Scale) served as an expanded Rand measure. The scale's increased length was meant to increase its reliability. Unfortunately, assessment of the measure indicated that psychometrically the scale lacked internal consistency. The KR-20 reliability estimate ranged from .33 to .51.

To broaden the concept of efficacy, self-report measures of personal teaching efficacy were also constructed. A fifty-item questionnaire was developed in which each question contained a situational teaching vignette followed by a 7-point rating of the teachers' perceived effectiveness. The vignettes were descriptions of problem situations concerning various dimensions of teaching. The questionnaire was eventually reduced to fifteen of the original fifty vignettes.

Internal consistency was demonstrated in three administrations of the instrument. Seven of the fifteen vignettes were significantly correlated to the Rand Efficacy two item (personal teaching efficacy in the Ashton & Webb model), and the Efficacy Vignettes were viewed as representative of the dimension of personal

teaching efficacy.

Recognizing the response bias inherent in requesting teachers to assess their effectiveness, a stress measure was employed as a proxy for efficacy. It was hypothesized that an admission of stress would be less threatening than an admission of ineffectiveness. For each of the fifty Efficacy Vignettes a 7-choice stress measure was added. Correlations between the vignettes and the stress items ranged from -.05 to -.82 with an average correlation of -.39. The investigators concluded that while the stress items had a moderate relationship to the efficacy items, the use of a stress measure as a proxy for efficacy was not warranted.

Buhr, Crocker, and Ashton (1983) investigated teachers' self-efficacy as a self- or norm-referenced construct. They attempted to evaluate whether a teacher measured his/her effectiveness in terms of "How effective am I?", or whether he/she measured effectiveness compared to the performance of others, "Am I more or less effective than other teachers?"

Ratings on the Efficacy Vignettes (Ashton, et al., 1982) were self-referenced and social desirability bias was of concern to these researchers. In a pilot study using the self-referenced response with the vignette, as reported by Buhr, et al., (1983), a correlation of

.46 between vignette score and a measure of social desirability (Marlowe-Crowne) was obtained. In order to reduce influence of social desirability, the use of a norm approach to efficacy was studied. Buhr, et al., (1983) collected data from sixty-five graduate students. From the original fifty-item measure of personal teaching efficacy, twenty-five items were chosen. The self-referenced approach was used on one form of the questionnaire and norm-referenced approach on a second form. The Rand items and Marlowe-Crowne Scale of Social Desirability were also administered. Internal consistency was high for both the self- and norm-referenced measures. Norm-referenced approach and total efficacy scale were significantly correlated; however, findings of significance were not apparent with the self-referenced vignettes. A significant correlation was demonstrated on the social desirability scale (Marlowe-Crowne) and self-referenced vignettes, but significance was not attained for the norm-referenced vignettes.

Based on these findings, Buhr, et al., (1983) state, "This study suggests that teachers evaluate their effectiveness in terms of their performance in comparison to the performance of other teachers" (p. 8).

Dembo and Gibson (1985) describe the construct of teacher self-efficacy as an integration of teaching

efficacy and personal teaching efficacy and Bandura's theory (1977, 1982, 1986) was applied to their construct of teachers' self-efficacy. Outcome expectations reflected the degree the teachers believed the environment could be controlled and efficacy expectations were viewed as teachers' evaluations of their ability to bring about positive change.

Gibson and Dembo (1984) developed an instrument to measure teacher efficacy and provided validity for this construct. The pilot study of their instrument was administered to ninety teachers and consisted of fifty-three items based on teacher interviews and analysis of the literature. Thirty items were extracted which were presented in Likert form.

In Phase I, Gibson and Dembo (1984) administered the thirty-item Teacher Efficacy Scale to 208 elementary school teachers selected from thirteen elementary schools (kindergarten to sixth grade). Teaching experience ranged from one to thirty-nine years and approximately seventy-five percent of the sample was female. Factor solution of the Statistical Package of the Social Sciences was used to analyze the underlying factor structure. Two factors were extracted and both oblique and orthogonal rotations were used to compare item loadings. Results of the analysis demonstrated two substantial factors:

Factor 1 accounted for 18.2% of the total variance and Factor 2 accounted for 10.6%. Factor 1 represented a teacher's sense of personal teaching efficacy and all items reflected teacher's sense of personal responsibility. Factor 2 represented a sense of teaching efficacy or a belief that any teacher's ability to bring about change is limited by the environment. Internal consistency reliability yielded high alpha coefficients (.78 Factor 1, .75 Factor 2, and .78 Total items). Reliability coefficients resulted from sixteen of the thirty items. Based on their findings, Gibson and Dembo (1984) state, "Results indicate that teacher efficacy, as measured by the Teacher Efficacy Scale, is multidimensional and comprises at least two clearly distinguishable factors" (p. 574).

A multitrait-multimethod analysis was undertaken in the second phase of Gibson and Dembo's study (1984). Fifty-five teachers completed two teacher efficacy, verbal ability, and flexibility measures. Using multitrait, multimethod matrix of analysis, data from the three traits were analyzed across closed-ended and open-ended measurements. Results supported the convergence of teacher efficacy when measured by the different approaches and discriminability from other constructs in use (verbal ability and flexibility).

In the third phase of the study, a pilot investigation of the relationship between self-efficacy and teacher classroom behavior was explored. Eight teachers (four high efficacy and four low efficacy) were selected from the original 208 teachers who participated in the first phase of the study. Seven observers were trained in data collection, and three observers viewed each of the eight teachers for approximately 7.5 hours of the academic portion of the day. Due to limited sample size raw data were reported. Results of this study demonstrated low efficacy teachers spent significantly more time in small group instruction, while high efficacy teachers spent more time in whole group instruction. Teachers' use of criticism and teacher lack of persistence in failure situations differentiated high and low efficacy teachers. High efficacy teachers were more effective in leading students to correct responses.

Based on the exploratory research of Ashton, Webb, and Doda (1983) and Gibson and Dembo (1984) differential behaviors were found associated with high and low efficacy teachers. A question of interest is whether related teacher behaviors would be evident in a situation specific teaching episode between one teacher and one student.

Through the use of workshops, Ashton, Webb, and Doda (1983) unsuccessfully attempted to increase teacher

efficacy using either (1) a process-product approach, (2) an attitude change approach, or (3) an integrated process-product, attitude change approach.

Modeling has been demonstrated to be one effective source of efficacy information. Although they did not evaluate self-efficacy, Zimmerman and Kleefeld (1977) investigated whether teachers' spontaneous use of modeling, and systematic training in this technique would enhance teachers' effectiveness. Twenty-four advanced students majoring in education and a like number of day care children were the subjects. A seriation of length task was developed in which four sets of stimuli each having five members differed in equal units. Children were pretested and those who could recognize seriated stimuli or correctly order scrambled arrays were eliminated from the study. An instrument was created to assess teacher-student interactions and was composed of a behavioral record of teacher and student responses and an instructional content rating form. Three experimental conditions were investigated. In the untrained condition, teachers were given twenty-five minutes to study instructions and prepare themselves for the teaching task. Prior to the episode the experimenter met for a brief five minute period with the teacher to make certain he/she understood the task. In the trained

condition, teachers received written instructions concerning the use of modeling procedures, as well as the general instructions given to the untrained teachers. The modeling instruction stressed teaching by explanation and demonstration, and the use of mnemonics. The experimenter also met with teachers in this condition for a five minute period and briefly modeled the techniques to be imitated. Children in the control group were only posttested. Results of the study demonstrated trained teachers used more explanation and demonstration and this method improved learning. Untrained teachers took approximately 60% longer during instruction and modeling procedures were not widely used among the untrained teachers. Explanations alone interfered with acquisition of learning the task.

The seriation of length tasks used in the Zimmerman and Kleefeld (1977) study will be used in the current study.

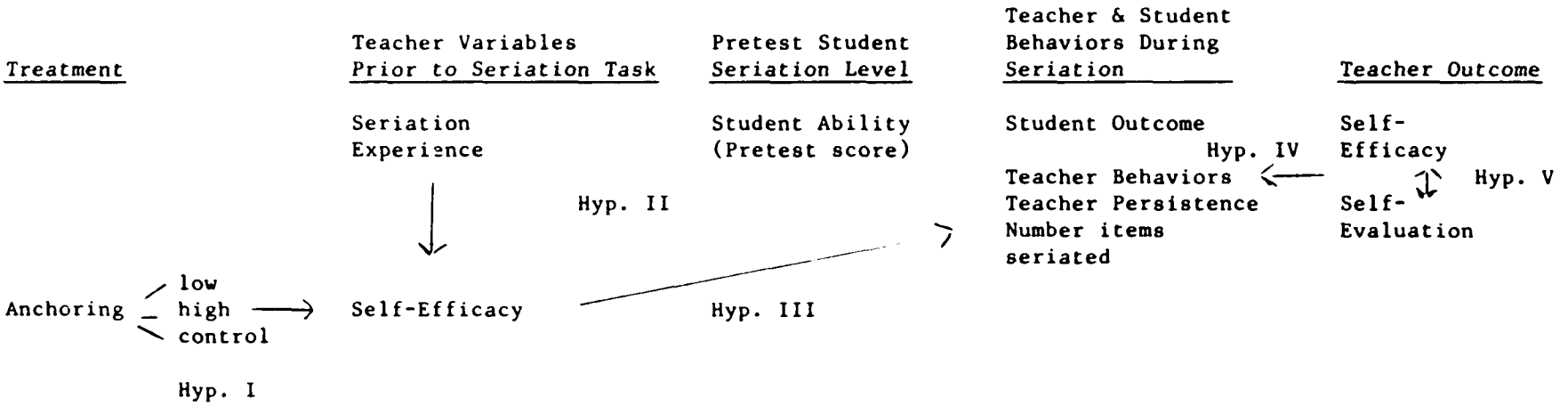
To date research on teacher self-efficacy has been scant and empirical studies lacking. Perhaps the behaviors associated with high and low efficacious teachers are associated with their skills as teachers. In order to study teachers' self-efficacy independent of performance competencies, anchoring biases will be employed to manipulate self-efficacy judgments. This paradigm

has proved effective in influencing self-efficacy judgments in various studies (e.g., Cervone & Peake, 1986, 1987).

The current study will investigate the effects of anchoring biases on teachers' self-efficacy for seriation of length. Four dependent measures will be studied: (1) teacher behavior, (2) teacher persistence, (3) number of items seriated, and (4) student outcomes. Two teacher post-test measures will be obtained: (1) self-efficacy for seriation of length with a future student, (2) self evaluation for teaching seriation of length.

A model of the above study follows:

Figure 1. Model of Anchoring Biases on Teachers' Self-Efficacy for Seriation of Length



Hyp. I & II: 2 x 3 Anova
Hyp. III: Simple correlations
Hyp. IV: Multiple regression
Hyp. V: Simple correlation

Based upon the above model the following hypotheses will be tested in the present study:

HYPOTHESIS I: The high anchor group will exhibit significantly higher self-efficacy judgments than either the low anchor or control groups.

HYPOTHESIS II: Teachers with experience in seriation of length tasks will exhibit significantly higher levels of self-efficacy than will teachers with no previous experience.

HYPOTHESIS III: A significant positive relationship between teachers' self-efficacy and teacher-student behavior will be exhibited during seriation of length tasks. Higher levels of self-efficacy will result in higher student seriation levels, and number of items seriated, greater teachers' persistence, and more positive teacher-student interactions.

HYPOTHESIS IV: Of all variables identified in the study teacher and student behaviors

will be found to be the best predictors of teacher outcome measures of self evaluation and self-efficacy.

(a) Higher levels of student and teacher behaviors will result in higher levels of teacher self-efficacy.

(b) Higher levels of student and teacher behaviors will result in higher levels of teacher self-evaluation.

HYPOTHESIS V: There will be a significant positive relationship between teacher outcome variables of self-evaluation and self-efficacy.

In sum, the present study will be an initial attempt to study teachers' self-efficacy, independent of performance capabilities, in a situation specific teaching episode.

Chapter III

Methodology

Sample

Teachers

Fifty-one teachers were selected from four teacher-training programs. As an incentive to take part in the study, all teachers were offered a small monetary stipend ($5 - $7).

Of the fifty-one teachers in the sample, 44 (86.3%) were enrolled in a City University teacher-training program. Seven teachers (13.7%) were enrolled at private universities. The majority of the teachers were elementary education majors (N = 45, 88.2%). The remaining teachers were early childhood (N = 3, 5.9%), special education (N = 2, 3.9%), or school psychology (N = 1, 2%) majors.

Forty-five teachers (88.2%) had no experience teaching seriation, while six teachers (11.8%) had experience teaching seriation.

Teachers' age ranged from 20 to 39 years with a mean of 25.07 years and standard deviation of 5.27. Teachers' college education ranged from 1 to 7 years with a mean of 3.76 years and standard deviation of 1.08.

Children

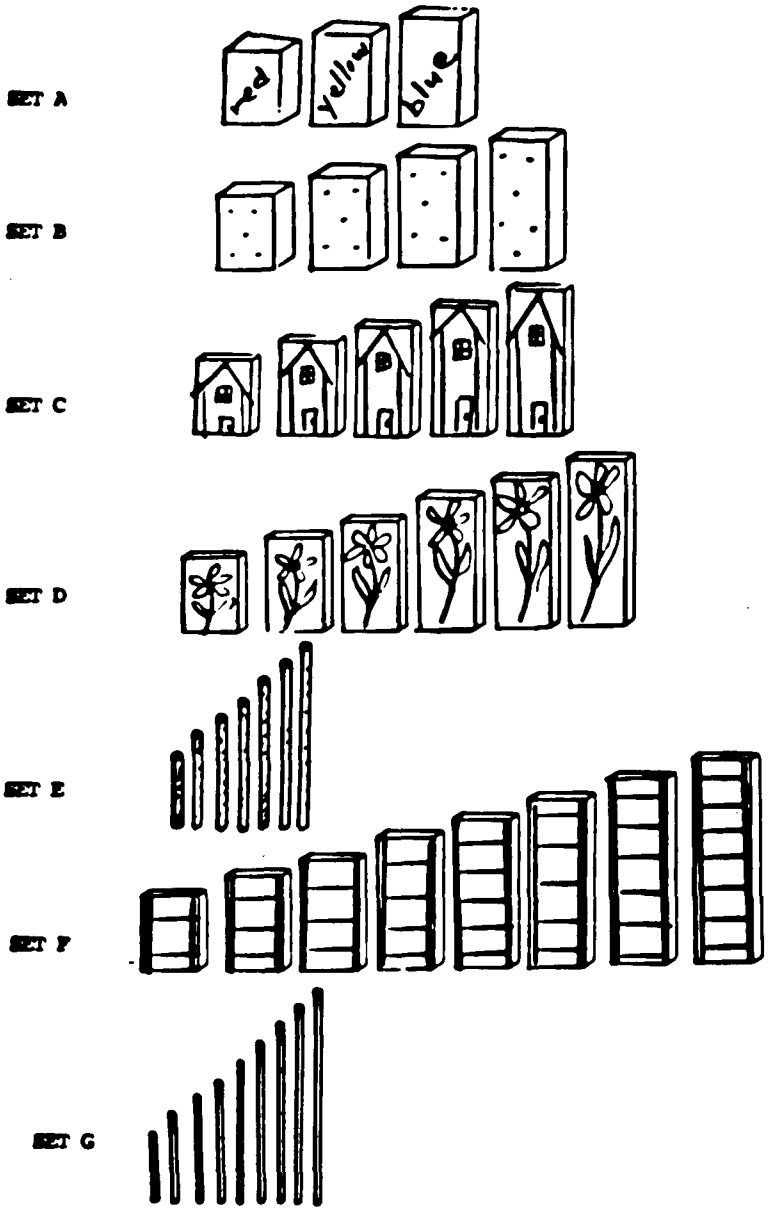
Fifty-one preschool children from nursery school programs in the general vicinity of the college took part in the study. Children's age ranged from 42 to 71 months, with a mean of 55.16 months and standard deviation of 6.03. Students were of lower socioeconomic income. Thirty-five children were males (69%); sixteen were females (31%). Thirty children (59%) were black; seventeen (33%) white, three (6%) Hispanic, and one (2%) Asian. Prior to the testing, written permission was obtained from the parents of the children to participate in the study (see Appendix A).

Materials

Task Stimuli

Seven sets of stimuli were created ranging in size from three to nine members. The stimuli differed in equal units of length (see Figure 2). Set A stimuli was composed of three members. Each member was a wooden block painted either red, blue, or yellow. Set B stimuli was composed of four members and made out of blocks colored white with black dots. Set C stimuli consisted of five flat pieces of wood painted to resemble houses. Set D had six members and were painted to resemble flowers. Set E stimuli was composed of seven rounded wooden members

Figure 2. Seriation of Length Task Stimuli



and were painted black with white dots. Set F had eight members and were painted to resemble ladders. The final Set G consisted of nine rounded members and were painted red, blue, black, green, purple, orange, grey, white, and brown.

Teacher Initial Questionnaire

This questionnaire (see Appendix B) consisted of (1) instructions describing the seriation of length task, (2) teachers' demographic information, (3) the anchoring manipulation, (4) teachers' perception of the number of objects they could seriate (an intermediate self-efficacy measure), and (5) a global estimate of self-efficacy related to the teachers' assuredness regarding their ability to teach seriation of length.

The anchoring manipulation was capitalized and printed in heavy, bold type at the top of the last page of the questionnaire. Teachers in the high anchor condition were told, **"From past experience with the teaching of seriation of length of objects, it has been found that it is not difficult to teach this concept. The average teacher can teach a preschool youngster to seriate eight objects in a single session."** In the low anchor condition subjects were told, **"From past experience with the teaching of seriation of length of objects,**

it has been found that it is quite difficult to teach this concept. The average teacher can teach a preschool youngster to seriate a set of four objects in a single session." Teachers in the "no anchor" condition had the particular question pertaining to the anchor value omitted.

Teacher Self-Efficacy Questionnaire

Teachers' self-efficacy for teaching seriation was measured from data obtained from the 11-part self-efficacy questionnaire (see Appendix C). The efficacy scale ranged from 10 to 100 in 10-unit intervals from high uncertainty (10), through intermediate values (50-60), to complete certitude (100). The higher the scale value, the stronger the perceived self-efficacy. Strength of self-efficacy was obtained by dividing the summed magnitude scores by 11 (total number of self-efficacy questions). The self-efficacy scale was administered both prior to the teaching episode and at the termination of the session.

Teacher Behavior Observation Form

Teacher behavior was assessed on a 14-item observation form (see Appendix D). Behaviors were scored on a 4-point Likert Scale ranging from 0 to 3. A higher

score reflected more positive teacher behaviors. A maximum score of 36 could be attained. Two questions were not directly related to the teacher's behavior. Behaviors demonstrated in prior research to be associated with teacher effectiveness and high efficacy were assessed. Some of the behaviors measured were: praise, encouragement, smiling, and ability to "stick" with the child. Table 1 presents behavioral descriptions of the teachers' actions assessed on the observation form. A doctoral student in Educational Psychology observed all teacher-student sessions.

Teacher Self-Evaluation Questionnaire

Teachers' self-evaluation for the seriation of length task was measured from data obtained from the self-evaluation questionnaire (see Appendix E). A self-evaluation score was obtained from questions 1-5 on the questionnaire. Self-evaluation scores ranged from 10 to 100 in 10-unit intervals. Higher scores reflected stronger self-evaluation. Strength of self-evaluation was obtained by dividing the magnitude scores by 5.

Independent Variable

Anchoring, the independent variable, was the number of seriation of length objects teachers were told the

Table 1

Descriptions of Teachers' Behavior Assessed on the Observation Form

Behaviors	Cue	Description
Establishes rapport	Verbal	Asks child's name, age, etc.
Explains task	Verbal	We are going to find the longest/shortest. Put them in order, etc.
Responds to child's questions pertaning to task	Verbal	That was the longest. Put that block next, etc.
Praises child	Verbal	Good job; That's right; Terrific, etc.
Smiles	Non-verbal	Smiles or laughs while working with child.
Nods approval	Non-verbal	Nodding of head.
Makes physical contact	Non-verbal	Touches child's arm; pats hand, shoulder, etc.
Encourages	Verbal	Let's try again, keep working, etc.
Allows child more than one opportunity to seriate	Non-verbal	Child successfully seriates the set more than once.
"Sticks" with child	Non-verbal	Teacher tries task again despite child's difficulty. Teacher does not stop task once child experiences problems.
Frustrates	Non-verbal	Sighs, makes faces.
Makes negative comments	Verbal	That's not good. You're not watching; listening.

average teacher could teach to a preschool youngster in a single session. The high anchor value was eight objects and the low anchor value was four objects. The anchoring manipulation was embedded in the initial teacher questionnaire (see Appendix B).

Dependent Variables

1. Teachers' Self-Efficacy Judgments

   The score obtained on the 11-part teacher self-efficacy questionnaire (see Appendix C) measured this variable.

2. Teacher-Student Behavior

   This variable was measured during the teaching session by a doctoral student in Educational Psychology. The teacher behavior observation form (see Appendix D) was employed to measure behaviors during the seriation of length task.

3. Task Persistence

   Teacher persistence was assessed in terms of the total number of minutes the teacher spent on the seriation of length task. This measure was recorded by the observer during the teaching session.

4. Number of Seriation of Length Objects Taught

   The actual number of seriation of length objects

(e.g., 3-9) taught to the preschool youngster served as the teacher's level of attainment. This number was recorded by the observer on the teacher behavior form.

5. Student Outcome Measures

The actual posttest seriation of length judgment score and posttest seriation of length ordering score served as student outcome measures. A replication of the 12-item pre-test for seriation of length judgments and orderings determined posttest scores.

6. Teacher Outcome Measures

(1) Teacher posttest self-efficacy was the score obtained on the 11-part self-efficacy questionnaire (see Appendix C).

(2) Teacher self-evaluation was the score obtained on the teacher self-evaluation questionnaire (see Appendix E).

Teacher Grade

Teachers' final grade in the respective class in which they were recruited for the study served as another performance measure. The grade was utilized in order to ascertain whether high or low efficacious teachers actually differed in their overall teaching ability.

Grades ranged from 6 (C+) to 12 (A+). Each digit increased the grade one increment. Plus and minus grades were employed. A mean of 9.67 and standard deviation of 1.18 was demonstrated. Therefore, the average grade for the 51 teachers approached A-.

Procedures

Permission to test the children was obtained from the parents prior to the testing. Children whose parents agreed to the testing were pretested on seriation of length sets.

Seriation of Length Tests

A twelve-item pretest was employed to eliminate children who recognized seriated stimuli or correctly ordered scrambled arrays. Items from Sets C, D, and E were utilized. Six items were correctly seriated by length when presented to the child and six were scrambled. Three of the correctly seriated items were ordered shortest to longest from left to right and three were ordered from right to left. The difficulty of items was varied by employing four items having three stimulus members (the shortest three), four items having four stimulus members (the shortest four), and four items having five stimulus members (the shortest five).

Pretest items were scored according to two measures: (1) seriation of length judgments, and (2) seriation of length ordering. On each item children were asked for their seriation judgment (e.g., "are the (stimuli name) in order from the longest to shortest?"). On the scrambled arrays, regardless of their response, children were asked to order the arrays from longest to shortest. A total of twelve judgments was possible, whereas six ordering responses were possible. Judgment and ordering responses were scored correct or incorrect. Nine or more correct judgments and three or more correct orderings were considered evidence of seriation of length skills. Those youngsters who met this criteria were eliminated from the study.

The teaching sessions were held in a private room in each school setting and all sessions were observed by a doctoral student in Educational Psychology. Upon arrival for the teaching episode, a packet containing two questionnaires: (1) the initial instructional questionnaire containing the anchoring manipulation (see Appendix B), and (2) the self-efficacy questionnaire (see Appendix C) were distributed to teachers. Both teachers and preschool children were randomly assigned to experimental condition (high anchor, low anchor, or control). To assure anonymity regarding the anchoring

condition, packets containing the above material were presorted and randomly distributed to each teacher.

Following the completion of the two questionnaires, the teaching session began. The observer used a stop watch to record task persistence, recorded the number of objects seriated, and scored specific behaviors described on the teacher behavior form (see Appendix D).

At the termination of the teaching session, the teacher completed the teacher outcome measures: (1) the 11-part self-efficacy questionnaire for teaching another preschool child (see Appendix C), and (2) the self-evaluation questionnaire (see Appendix E).

Children's posttest measures of seriation of length judgments and orderings were assessed by the observer.

Pilot Test

A pilot test of twelve teachers and a like number of three and four year old children was undertaken prior to the initiation of the study. The purpose of the pilot testing was to assess the measurement instruments, and to refine any methodological problems inherent in the paradigm.

Teachers and children were randomly assigned to one of three experimental conditions: low anchor, high anchor, and control. The pilot study was conducted

in the following manner:

Initial Step: Consent for pre-kindergarten children's inclusion in the study was secured from parents.

Second Step: Children were prescreened as to their ability to seriate objects by length.

Third Step: Demographic information was gathered from the teacher questionnaire. The anchoring manipulation was embedded in the questionnaire. A low anchor value of "4" and a high anchor value of "8" was implemented. Four was used as the low value due to its proximity to the lower limit of the seven seriated sets. Eight was chosen due to its proximity to the upper limit of the seven seriation sets. Control condition subjects had the question pertaining to the anchoring manipulation deleted from the questionnaire.

Fourth Step: The eleven item self-efficacy questionnaire was administered to all teachers.

Fifth Step: Teaching sessions began. Teaching behaviors elicited during the session were recorded by the observer. Teaching per-

sistence was measured by stop watch and was the total number of minutes spent on the seriation of length tasks. Termination of the session by the child was recorded on the observation form.

Sixth Step: Directly following the teaching session, the eleven item self-efficacy questionnaire was readministered as a posttest measure. The self-efficacy questionnaire assessed the teacher's judgment of teaching seriation of length to another pre-kindergarten child.

Seventh Step: Follow-up questionnaire was administered, to assess teacher's self-appraisal of both his/her performance and child's performance during the teaching session.

Eighth Step: Pre-kindergarten children were posttested on seriation of length skill.

Pilot Study Results

The twelve children's pretest seriation of length judgments ranged from 4 to 10 with a mean of 6.08 and standard deviation of 1.55. Seriation of length orderings ranged from 0-3 with a mean of 1.42 and standard deviation of .95. A mean of 56.36 and standard deviation of 15.18

was demonstrated on the teachers' pretest self-efficacy measure. Pretest self-efficacy scores ranged from 19.09 to 82.73.

The dependent teacher measures of: (1) teacher persistence, (2) number of items taught, and (3) teacher-student behavior are presented in Table 2. Teacher persistence was the number of minutes on task. Number of items taught was the actual number of seriated objects attempted. The minimum number of objects that could be taught in the teaching session was 3; the maximum number was 9. Total teacher behavior was the score on the teacher behavior observation form. A maximum score of 36 could be achieved on this measure.

Teachers persisted on the seriation task from a low of 9 minutes to a high of 31 minutes. The mean number of minutes teachers persisted on teaching seriation was 23.17 minutes.

Table 2 demonstrates that the number of seriation objects taught ranged from a low of 5 objects to a high of 9 objects. The mean number of objects taught was 7.5. No teacher taught to the lowest level (3 objects).

On the teacher behavior measure scores ranged from 10 to 29 with a mean of 22.08.

Students' dependent outcome measure of posttest seriation of length judgment indicated scores ranged

Table 2

Pilot Study

Means, Standard Deviations, and Ranges for Dependent Teacher Measures

	N	M	SD	Range
Teacher persistence	12	23.17[a]	5.76	9-31
Number of items taught	12	7.5[b]	1.44	5-9
Total teacher behavior	12	22.08[c]	4.91	10-29

[a] Number of minutes

[b] Actual objects seriated

[c] Score on Teacher Behavior Form

from 6 to 10 with a mean of 7.17, and standard deviation of 1.52. Posttest seriation of length orderings ranged from 0 to 5 with a mean of 2.08 and standard deviation of 1.71.

Teachers' posttest self-efficacy judgments ranged from 37.27 to 95.45 with a mean of 68.64 and standard deviation of 19.75. Posttest teacher self-evaluation scores ranged from 45 to 81.67 with a mean of 66.11 and standard deviation of 14.46.

Based upon the pilot testing, it was decided to eliminate younger-aged children from the study. Any child in the nursery program who, based upon the pretest seriation of length screening, did not possess the seriation concept, was included in the study.

Due to difficulties securing a subject population of teachers, the criteria for inclusion in the study was expanded beyond student-teachers to include students matriculated in an education program.

As a result of the pilot study, packets of questionnaires were presorted prior to the initial session. This was done to assure that the observer remained "blind" to treatment condition.

All materials and procedures outlined in the pilot were utilized in the study.

The teachers' pretest self-efficacy mean and stan-

dard deviation were utilized to calculate power and sample size for the study. It was determined that a sample size between 45 and 60 subjects would provide the needed power for the study.

Data Analysis

A 2 x 3 ANOVA, simple correlations, and multiple regression were employed to analyze data for the present study.

Hypotheses I and II were tested using a 2 x 3 ANOVA.

Simple Correlations were the measurement instrument for Hypothesis III.

Hypothesis IV was tested using multiple regression.

Simple correlations were used to assess differences between teacher outcome measures in Hypothesis V.

Chapter IV

Results

The present chapter reviews results of the study. Results are divided into two sections: section one is descriptive; section two contains results of the hypotheses testing.

Descriptive

Dependent measures studied in the model were (1) teacher behavior, (2) teacher persistence, (3) number of items seriated, and (4) student outcome measure of posttest seriation judgments and posttest seriation orderings. Table 3 presents means, standard deviations, and ranges for the dependent measures.

The teacher behavior measure was derived from the teacher behavior observation form. A maximum score of 36 could be achieved, and high scores reflected more positive teacher behaviors. The mean score of 19.25 was slightly more than half the maximum score. No teacher achieved the maximum score of 36. Scores appeared to be close to a normal distribution.

The teacher persistence measure was the actual number of minutes spent on the seriation teaching task. Scores ranged from a low of 7 minutes to a high of 53

Table 3

Means, Standard Deviations, and Ranges for Teachers' Behavior, Teachers' Persistence, Number of Items Seriated, and Student Outcome Measures

	N	M	SD	Range
Teacher				
Behavior	51	19.25[a]	5.01	10-29
Persistence	51	22.33[b]	9.24	7-53
Number of Items Seriated	51	6.67[c]	1.72	4-9
Student				
Posttest Seriation Judgments	51	7.05[d]	1.74	4-12
Posttest Seriation Orderings	51	1.58[e]	1.68	0-6

[a]Score of teacher behavior form

[b]Number of minutes

[c]Items seriated (e.g., 3-9)

[d]Judgments (e.g., 0-12)

[e]Orderings (e.g., 0-6)

minutes. The mean number of minutes for the 51 teachers was 22.33.

A mean of 6.67 objects were seriated. Six teachers taught 4 objects, 12 teachers taught 5 objects, 5 teachers taught 6 objects, 8 teachers taught 7 objects, and 10 teachers taught 8 and 9 objects respectively.

The student outcome measures of seriation judgments and seriation orderings were the achieved scores on the students' post-test. The seriation judgment mean was 7.05 and scores ranged from 4 to 12. The seriation ordering mean was 1.58 and scores ranged from 0-6.

Teacher behaviors elicited during the seriation teaching task were measured on the observation form. Table 4 presents the observable teacher behaviors, and the number and percent of teachers exhibiting these actions.

Praise (68.6%) and encouragement (60.8%) were the strongest positive behaviors exhibited during the teaching session. Teachers' ability to "stick" with the child when he/she was experiencing difficulty (58.9%) was also a behavior manifested by more than half of the teachers ($N = 30$). Nodding approval (5.9%) and physical contact (15.77%) were the least likely actions exhibited. The frequencies of negative comments (0%) and frustration (3.9%) were negligible. However, the fact that these

Table 4

Teachers' Behavior Associated With Seriation of Length Teaching Task

Behaviors	N	Percent
Establishes rapport	25	49.1%
Explains task	24	47%
Responds to child's questions	19	37.3%
Praises child	35	68.7%
Smiles	26	51%
Nods approval	3	5.9%
Makes physical contact	8	15.7%
Encourages	31	60.8%
Allows child more than one opportunity to seriate	24	47.1%
"Sticks" with child	30	58.9%
Frustrates	2	3.9%
Makes negative comments	0	0%

teachers were being observed in a situation-specific teaching session might have contributed to the absence of these "negative" behaviors.

Posttest Measures

Changes in (1) the children's seriation judgments and seriation orderings, and (2) the teachers' self-efficacy judgments were evident when comparing pretest and posttest scores on the seriation length task. The mean and range of scores increased. These scores are presented in Table 5. Two children had maximum seriation judgment scores (e.g., 12 judgments) in the posttest, whereas there was no maximum judgment score in the pretest. Two children scored maximum seriation ordering scores on the posttest (e.g., 6 orderings), and no children scored maximum orderings in the pretest. Although low seriation scores (4 judgments, 0 orderings) occurred in the posttest, the number of children scoring at these lower levels decreased. On pretest seriation judgments, five children scored 4, whereas two children scored 4 on the posttest. Twenty children scored 0 on the pretest seriation ordering while 12 children scored 0 on the post-test seriation ordering.

Teachers' posttest self-efficacy judgments increased from pretest self-efficacy judgments. One teacher scored

Table 5

Means, Standard Deviations, and Ranges of Children's Pre and Posttest Seriation Judgments and Orderings and Teachers' Pre and Posttest Self-Efficacy Judgments

	N	M	SD	Range
Children				
Pretest Judgments	51	6.07	1.35	4-10
Posttest Judgments	51	7.05	1.74	4-12
Pretest Orderings	51	.90	.93	0-4
Posttest Orderings	51	1.58	1.68	0-6
Teachers				
Pretest Self-Efficacy Judgments	51	62.23	16.11	18.18-84.55
Posttest Self-Efficacy Judgments	51	66.57	18.79	24.55-100

at the maximum level of 100 on the posttest. A maximum score of 100 did not occur during the pretest. Teachers' pretest self-efficacy scores ranged from 18.18 to 84.55 with a mean of 62.23 and standard deviation of 16.11. Posttest self-efficacy scores ranged from 24.55 to 100 with a mean of 66.57 and standard deviation of 18.79.

Teachers' overall self-evaluation regarding the seriation of length task ranged from a low score of 26 to a high score of 80, a mean of 61.22 and standard deviation of 12.07. Table 6 presents means and standard deviations of teachers' self-evaluations on the seriation of length teaching task.

Other Measures of Self-Efficacy

Teachers' assuredness regarding their ability to teach seriation of length was conceptualized as a global self-efficacy measure. On a 100-point scale, scores ranged from a low of 30 to a high of 90 with a mean of 71.96 and standard deviation of 18.15.

Teachers' average pretest (M = 62.23) and posttest self-efficacy scores (M = 66.57) were lower than the teachers' global evaluation of their ability to teach seriation (M = 71.96).

Teachers' assessment regarding the actual number of seriation items they could teach to a preschool child

Table 6

Means and Standard Deviations of Teachers' Evaluation of the Seriation of Length Task

Teacher Assessment	N	M	SD
Difficulty of session	51	45.49[a]	22.26
Difficulty for another teacher	51	49.41[a]	17.20
Effort expended	51	67.06[a]	24.36
Teach task again	51	81.96[a]	17.60
Adeptness of teaching ability	51	62.16[a]	19.44
Capability of child	51	65.10[a]	18.51
Level of child's understanding	51	5.29[b]	1.94
Total teacher evaluation	51	61.22[a]	12.08

[a]Scale 10-100 in 10 unit intervals

[b]Number of objects (e.g., 3-9)

in a single session was conceptualized as an intermediate measure of self-efficacy. Scores ranged from a low of 3 objects to a high of 9 objects. The mean number of objects teachers perceived they could teach was 5.20. This assessment was below the actual achieved mean of 6.67, which was the actual number of objects seriated.

Hypotheses Testing

A 2 x 3 ANOVA was performed on Hypothesis I and II. The analysis assessed group differences in self-efficacy judgments. Seriation experience (experience, no experience) and anchoring (high, low, none) were the factors in the analysis.

Hypothesis I posited that the high anchor group would exhibit significantly higher self-efficacy judgments than either the low anchor or control groups. Results of pretest self-efficacy scores by anchoring and seriation experience are presented in Table 7. The mean anchoring pretest self-efficacy scores are in the expected direction as reported in previous studies (Cervone & Peake, 1986, 1987). However, no significant differences were found between the three anchoring groups (F (2,45) = .04 p >.05).

Hypothesis II stated that teachers with experience in seriation of length tasks would exhibit significantly

Table 7

Means and Standard Deviations of Pretest Self-Efficacy by Anchoring and Experience

	Anchor											
	Low			Control			High			Total		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
No Seriation Experience	15	54.6	18.36	16	60.57	16.97	14	66.88	11.62	43	60.55	16.43
Seriation Experience	2	81.82	3.86	1	71.82		3	71.21	7.40	6	74.85	7.36
Total	17	57.81	19.43	17	61.23	16.65	17	67.65	10.93	51	62.23	16.27

higher levels of self-efficacy than teachers with no previous experience. A marginal effect was found (F (1,45) = 3.71 p <.06). Pretest self-efficacy mean for teachers with no experience teaching seriation was 60.55 while pretest self-efficacy mean of 74.85 was calculated for teachers with seriation experience. No interaction was found between the anchoring condition and teachers with experience in seriation of length (F (2,45) = .8376, p >.05). Results of the 2 x 3 ANOVA are presented in Table 8.

Hypothesis III posited a significant positive relationship between teachers' self-efficacy and teacher-student behaviors. It was hypothesized that higher levels of self-efficacy would result in higher student seriation levels and number of items seriated, greater teacher persistence, and and more positive teacher-student positive interactions. Simple correlations were used to test this hypothesis. The Pearson coefficients between pretest self-efficacy and teachers' persistence (r = .07, p >.05), teacher student behavior (r = -.05, p >.05), and student outcome measures of posttest judgments (r = .26, p >.05), and posttest orderings (r = .14, p >.05), failed to reach significance. However, a significant relationship was found between teachers' self-efficacy and the number of items seriated (r = .37,

Table 8

ANOVA Summary of Anchoring on Average Pretest Self-Efficacy and Seriation of Length Experience

Source	DF	SS	MS	F
Anchor	2	25.4106	12.7053	.0524
Seriation Experience	1	900.4857	900.4857	3.7127*
Anchor/Experience Interaction	2	406.3295	203.1648	.8376
Residual	45	10914.5282	242.5451	

*$p < .06$

$t = 2.57$, $p < .01$). As hypothesized, higher levels of self-efficacy judgments resulted in a greater number of items seriated. Higher levels of self-efficacy did not produce greater teacher persistence, higher student outcome, or more positive teacher student behavior.

Hypothesis IV stated that teacher and student behaviors would be the best predictors of teacher outcome measures of self-efficacy, and self-evaluation. A stepwise multiple regression was conducted for each outcome measure. The following ten variables were available for the analysis: (1) anchoring, (2) teachers' perception of number of items seriated, (3) teachers' assuredness regarding seriation ability, (4) average pretest self-efficacy, (5) average teacher behavior, (6) total teacher behavior, (7) teacher persistence, (8) number of items taught, (9) posttest judgment, and (10) posttest ordering. These variables were entered into the program and a default level below .99 was utilized wherein only variables attaining a $p < .99$ remained in the equation. In all, four variables met the criterion for posttest self-efficacy and their ordering of entry into the equation were: (1) number of items, (2) average self-efficacy pretest, (3) posttest order, and (4) teacher persistence. All four variables achieved significance, and results of the multiple regression analysis are presented

in Table 9.

There was a significant multiple correlation (R = .84) using these four variables (F (4,46) - 27.17, p <.001), and 70% of the variance in posttest self-efficacy was explained by these four variables.

A stepwise multiple regression for teachers' self-evaluation utilized the same ten variables that were available for posttest self-efficacy. A default level of .99 was also employed. Two variables met this criterion and their order of entry into the regression equation was: (1) number of items seriated, and (2) average pretest self-efficacy. Table 10 summarizes results of the multiple regression analysis.

There was a significant multiple correlation (R = .61) using these two variables (F (2,48) = 14.38, p <.001). Number of items seriated and average pretest self-efficacy explained 37% of the variance in teachers' self-evaluation. Results of the analyses demonstrated number of items seriated and pretest self-efficacy were the most powerful predictors of teachers' posttest self-efficacy and teachers' self-evaluation. Hypothesis IV was partially supported. Number of items seriated, posttest order, and persistence predicted the teacher outcome measure of posttest self-efficacy. Number of items seriated predicted the teacher outcome measure of self-evaluation. Pretest self-efficacy

Table 9

Predictors of Average Teacher Posttest Self-Efficacy Using Multiple Regression Analysis

Predictor Variable	r	Coeff.	Beta	F-ratio	Prob-ability
Pretest Self-Efficacy	.60	.48	.41	22.39	.000
Teacher Persistence	-.10	-.49	-.24	6.87	.011
# Objects Taught	.66	4.60	.42	12.98	.001
Posttest Order	.58	4.05	.34	11.39	.002
Constant		10.3764			

Table 10

Predictors of Average Teacher Self-Evaluation Using Multiple Regression Analysis

Predictor Variable	r	Coeff.	Beta	F-ratio	Prob-ability
# Objects Taught	.62	.21	.28	5.477	.022
Pretest Self-Efficacy	.41	3.09	.44	13.20	.002
Constant		27.3237			

was a predictor in both teacher outcome measures.

Hypothesis V stated that there would be a significant positive relationship between teacher outcome variables of self-evaluation and self-efficacy. A simple correlation revealed there was a strong positive relationship between teacher outcome variables (r = .72, t = 7.33, p <.001).

Additional Findings

Although a relationship between anchoring and self-efficacy (r = .25, p >.05) was not confirmed, anchoring was strongly related (r = 76, t = 8.16, p <.0001) to teachers' perception of the number of objects they believed they could teach (an intermediate self-efficacy measure). These perceptions were positively related to the actual number of objects taught (r = .45, t = 3.48, p <.001). There was a significant relationship between anchoring and teachers' assuredness regarding their ability to teach seriation of length (a global self-efficacy measure) (r = .36, t = 2.68, p <.01).

A positive relationship between teachers' pretest self-efficacy scores and teacher persistence was not found (r = .07, p >.05); however, there were significant relationships between persistence and teacher-student behaviors (r = .55, t = 4.60, p <.001), number of items

seriated (r = .48, t = 3.80, p <.001), and student posttest judgments (r = .53, t = 4.43, p <.001), and posttest orderings (r = .32, t = 2.41, p <.02). Table 11 presents intercorrelations among the independent and dependent variables. All correlations were not significant and the relationship of pretest self-efficacy and posttest self-efficacy is not presented.

An analysis used in prior research by Cervone and Peake (1986, 1987) was run to determine anchoring effects on teachers' assuredness regarding their ability to teach seriation of length (global estimate of self-efficacy). In the Cervone and Peake (1986, 1987) studies, a measure similar to this global self-efficacy measure was regarded as the self-efficacy dimension. A significant overall effect was found (F (2,48) = 3.57, p <.05). Results of the analysis are presented in Table 12.

A follow-up two-tailed t test assessed group differences. The high anchor group was found to be significantly higher in their assuredness regarding their ability to teach seriation than the low anchor group (t = 2.65, p <.01). No differences were found between the high anchor and control groups nor the low anchor and control groups. Table 13 presents the means and standard deviations for the respective groups.

Table 11

Intercorrelation Matrix of Independent and Dependent Variables

Variables	1	2	3	4	5	6	7	8
(1) Anchoring								
(2) Pretest Self-Efficacy	.25							
(3) Assuredness	.36**	.81***						
(4) Perceptions of # Objects Taught	.76***	.31*	.32*					
(5) Teacher-Student Behavior	.18	-.05	.08	.15				
(6) Persistence	.19	.07	.14	.24	.55***			
(7) # Objects Seriated	.35**	.37**	.27	.45**	.20	.48***		
(8) Posttest Judgments	.12	.26	.20	.32*	.19	.53***	.57***	
(9) Posttest Ordering	.15	.14	.03	.25	.03	.32*	.60***	.77***

*p <.05
**p <.01
***p <.001

Table 12

ANOVA Summary of Anchoring on Teachers' Assuredness Regarding Their Ability to Teach Seriation

Source	DF	SS	MS	F
Anchor	2	2145.098	1072.549	3.512*
Residual	48	14658.824	305.392	
Total	50	16803.922		

*$p < .05$

Table 13

Means and Standard Deviations by Anchoring Condition on Teachers' Assuredness Regarding Seriation Ability

Group	N	Mean	SD
Low	17	64.118	20.328
High	17	80.000	10.000
Control	17	71.765	20.073

Teacher Grade

Relationships between teacher grade and pretest self-efficacy were not significant (r = -.06, p >.05), as were relationships with teacher-student behavior (r = .04, p >.05), teacher persistence (r = .03, p >.05), and student posttest seriation judgments (r = -.10, p >.05). Significant relationships found were: (1) teacher grade and the number of items seriated (r = -.31, t = 2.23, p <.05), (2) teacher grade and posttest self-efficacy (r = -.30, t = 2.21, p <.05), and (3) teacher grade and posttest self-evaluation (r = -.27, t = 2.00, p <.05).

Summary Statement

The present research was undertaken to examine the effect of anchoring biases on teachers' self-efficacy and performance. A model was developed to explain the effects of the independent variable (anchoring) on various dependent measures.

A 2 x 3 ANOVA was calculated to analyze Hypothesis I and Hypothesis II. Hypothesis I was unsupported: The high anchor group did not exhibit significantly higher self-efficacy judgments than the low anchor or control groups. A marginal effect was found with Hypothesis II which predicted teachers with seriation expe-

rience would exhibit significantly higher levels of self-efficacy than teachers with no experience. Hypothesis III posited a significant positive relationship between teachers' self-efficacy and teacher-student behavior. Simple correlations examined the various relationships. Number of items seriated was the one variable that Hypothesis III supported. Higher levels of self-efficacy did not result in higher students' seriation levels, greater teacher persistence, nor more teacher-student positive interactions.

Hypothesis IV was partially supported. Not all teacher-student behaviors were the best predictors of teacher outcome measures of self-evaluation and self-efficacy. Using a multiple regression analysis, number of items seriated and pretest self-efficacy were found to be the best predictors of the two teacher outcome measures. To a lesser degree, posttest order and teacher persistence accounted for variance in posttest self-efficacy.

As predicted in Hypothesis V, a significant positive relationship was found between self-evaluation and self-efficacy.

In addition, although not hypothesized, anchoring proved to be strongly related to teachers' perceptions of the number of items they believed they could teach.

This variable was conceptualized as an intermediate self-efficacy judgment. These perceptions were positively related to the actual number of objects taught. Correlations were also noted between anchoring and teachers' assuredness regarding their ability to teach seriation, a global self-efficacy measure. Additional relationships were demonstrated between teachers' persistence and teacher-student behavior, number of items seriated, and student outcome measures.

Anchoring had a significant effect on a global estimate of self-efficacy (e.g., teachers' assuredness regarding their ability to teach seriation) and the high anchor group was found to be significantly greater than the low anchor group.

Teacher's behaviors most evident during the teaching session were praise (69%), encouragement (61%), and ability to "stick" with the child (59%). Few negative behaviors were manifested and frustration was evident by 4% of the teachers.

Chapter V

Discussion

The purpose of this study was to explore the role of teachers' self-efficacy in an experimental context. Levels of self-efficacy were manipulated through the use of adjustment and anchoring. A direct measure of the effect of self-efficacy judgments on teacher behavior was sought.

It was hypothesized that teachers in a high anchor condition would exhibit higher self-efficacy judgments and demonstrate more persistence in their teaching assignment than teachers in a low anchor or a control condition. Teachers' behavior in the experimental context was explored to determine the effects of anchoring and self-efficacy judgments on behavior.

Hypothesis I stated that the high anchor group would exhibit significantly higher self-efficacy judgments than either the low anchor or control groups. This hypothesis was unsupported. Due to the lack of support for Hypothesis I, a direct measure of the effect of self-efficacy judgments on teacher performance was not found. The causal link between self-efficacy judgments and performance was not substantiated. Factors which might have accounted for lack of support for this hypothe-

sis, may have been the self-efficacy measure itself.

The behavioral domain in which the subjects in prior research (Cervone & Peake, 1986, 1987) made judgments was different from the behavioral domain in the present study. In Cervone and Peake's research (1986, 1987) college and high school students judged their capability on anagrams and cyclical graphs; whereas in the present study, teachers judged their certainty to teach a preschool youngster a specific level of seriation of length. Each self-efficacy measure was assessing very different judgments.

Cervone and Peake (1986, 1987) employed a one-item measure of self efficacy, while the present study employed an 11-part questionnaire which encompassed various situation-specific aspects of the seriation of length task. The difference in the measurement technique may have contributed to the non-significant findings. The anchoring manipulation was shown to be effective when an additional analysis employing a one-item response similar to the Cervone and Peake studies (1986, 1987) proved significant. The high anchor and low anchor groups were significantly different. Possibly the one-item self-efficacy judgment was more sensitive to the anchoring manipulation. The 11-part self-efficacy measure covered various levels of seriation of length judgments and may have been too

encompassing for the anchoring manipulation to be effective. Anchoring biases may have dissipated by the time the teachers completed the 11-part questionnaire.

Hypothesis II predicted teachers with seriation of length experience would exhibit significantly higher levels of self-efficacy. Marginal results were found and the low number of teachers having experience teaching seriation of length (N = 6) may have been responsible for the marginal effects demonstrated. A larger sample of teachers having seriation experience might have led to significant findings. The larger sample size would have provided a more accurate estimate of mean differences between the two groups of teachers. The sensitivity of the study would also be increased with a larger sample of teachers having seriation experience.

Higher levels of self-efficacy were hypothesized to result in higher student seriation levels, number of items seriated, greater teacher persistence, and more teacher-student positive interactions.

Hypothesis III was partially supported and the number of items seriated was the one variable related to higher levels of self-efficacy. The three other variables (teacher persistence, student outcome, and teacher-student positive behavior) were unrelated to self-efficacy. Although a causal link between self-

efficacy and performance was unsupported by Hypothesis I, a relationship between self-efficacy judgments and teachers' performance (e.g., level of attainment on the seriation of length task) was found.

Hypothesis IV which stated teacher and student behaviors would be the best predictors of teacher outcome measures of self-efficacy and self-evaluation was partially supported. Results demonstrated that the number of items seriated and pretest self-efficacy were the best predictors of posttest self-efficacy and self-evaluation. Teacher persistence and posttest ordering were also predictors of the teacher outcome measure of posttest self-efficacy.

Hypothesis V was supported and a significant positive relationship was demonstrated between the teacher outcome measures of self-efficacy and self-evaluation.

Results of the present study suggested a different model than outlined above (see Figure 1) to describe the anchoring effect on teachers' self-efficacy and performance. Anchoring was hypothesized to effect the self-efficacy judgments obtained from the 11-part situationspecific self-efficacy questionnaire. In turn, higher levels of self-efficacy were hypothesized to result in higher student seriation levels, number of

items seriated, greater teacher persistence, and more teacher-student positive interactions.

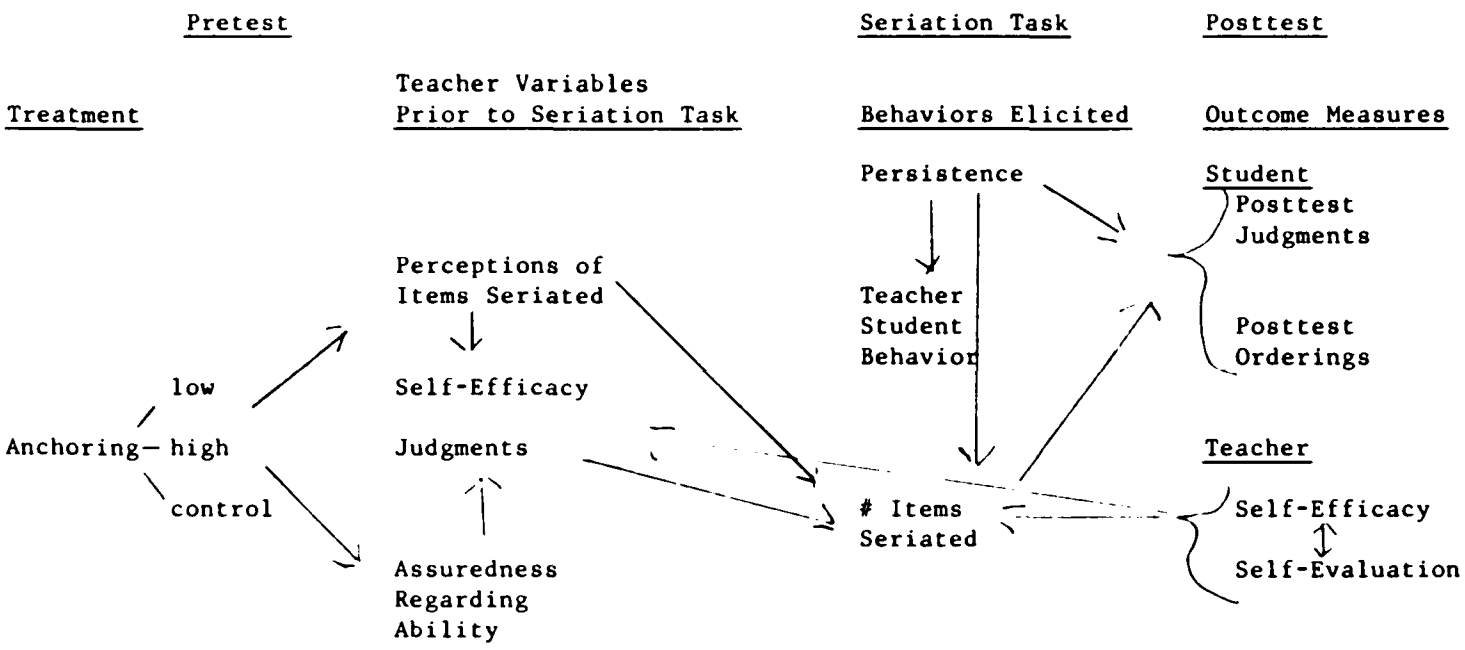
Based upon results of the present research, a model emerged in which three different levels of self-efficacy were evident: (1) items of the 11-part self-efficacy questionnaire focused on situation-specific issues (e.g., How certain are you that you can teach a pre-kindergarten youngster to successfully recognize a set of three objects seriated by length?), (2) an intermediate level of situational specificity was required by the self-efficacy question on the initial informational questionnaire (e.g., How many objects do you think you can teach to a preschool child in a single session?), and (3) a global estimate of self-efficacy assessed on the informational questionnaire (e.g., How assured are you regarding your ability to teach seriation of length?). Anchoring was related to teachers' perceptions of the number of objects they could teach to a youngster, as well as their assuredness regarding their ability to teach seriation of length. These two levels of self-efficacy (intermediate and global) were related to the situation-specific self-efficacy measure. Teachers' perceptions of the number of items they could seriate and the pretest self-efficacy measure were related to the actual number of items that the teachers seriated.

The number of items seriated was related to the student outcome measures of posttest judgments and posttest ordering. The initial pretest self-efficacy judgment, along with the actual number of objects seriated, predicted teacher outcome measures of self-efficacy and self-evaluation. Teachers' persistence, although not related to teachers' self-efficacy judgments, was related to teacher-student positive behavior, number of items seriated, and students' outcome measures (seriation judgments and seriation orderings). Figure 3 presents the revised model.

Anchoring was shown to have an indirect effect on pretest self-efficacy judgments, and as in prior studies with college and high school students (Cervone & Peake, 1986, 1987), the anchoring manipulation proved to be effective. Rather than affecting teachers' pretest self-efficacy judgments directly, anchoring impacted (1) teachers' assuredness (global self-efficacy) and (2) teachers' perceptions of their ability to teach seriation (intermediate self-efficacy measure) which, in turn, affected their pretest self-efficacy judgments.

The lack of evidence that self-efficacy judgments affected teachers' persistence within the teaching session could be related to the nature of the present study. Prior research on self-efficacy had focused on subjects

Figure 3. Revised Model of Anchoring Biases on Teachers' Self-Efficacy for Seriation of Length



and their fears (Bandura, Adams & Beyer, 1977), students and academic skill development (Bandura & Schunk, 1981), or the impact of anchoring on self-efficacy judgments (Cervone & Peake, 1986, 1987). This aforementioned research investigated individual enhancement of perceptions of self-efficacy. The individual subject was solely responsible for improvement of their self-efficacy judgments and persistence was related to the increased judgments. Teachers' persistence in this study depended not only upon him or herself, but also upon the preschool youngster. Although a relationship between self-efficacy and persistence was not confirmed, teachers' persistence was an important component of children's skill development. Teachers' persistence was also related to teacher-student positive behaviors and the number of items seriated.

Bandura's (1977, 1982, 1986) hypothesis regarding the effect of self-efficacy judgments on behavior was partially supported in the present study. Teachers' self-efficacy judgments were related to the actual number of objects seriated and the number of objects seriated was related to the student outcome measures. Although relationships between self-efficacy judgments and teacher persistence, student outcome measures and teacher-student positive behavior were not evident in this study, further research into this area is needed to investigate self-

efficacy and its relationships to teaching. Pretest self-efficacy, along with the number of objects seriated, proved to be the best predictors of the teacher outcome measures. Although not necessarily the best predictor of future performance, as posited by Bandura (1977, 1982, 1986), self-efficacy proved to be one predictor of future performance.

Limitations of Study

A limitation of the study was the self-selection process of the teacher sample. The low response rate among contacted student-teachers make it difficult to draw general conclusions from these results. This problem could be remedied in future studies by making the teaching task part of a class assignment. In this way a more representative sample of educational students could be studied. In addition, a larger sample size would be drawn which should increase the power of the study.

Another limitation of the present study was the use of only one observer during the teaching session. Subjectivity may have entered into the reporting of teacher behaviors. The reliability of these observations may have been strengthened by assigning another observer to each teaching session and assessing the percentage of agreement regarding the observable behaviors.

Educational Implications and Future Research

Teachers' persistence in the teaching session was positively related to all teacher-student behaviors. Based upon these findings, the importance of teacher persistence to actuate achievement gains should be further investigated.

Praise, encouragement, and ability to "stick" with the child were positive behaviors most noted during the teaching session. Investigation to ascertain whether these behaviors are pervasive in other experimental paradigms needs further study.

Elicited behaviors during the teaching session are important components to examine. Since a behavioral observer appears to be somewhat inhibitory to the spontaneity of the teaching session, a situation whereby the observer is unobtrusive (e.g., room with a one-way mirror) allows for a more naturalistic setting in which other behavior patterns may be demonstrated.

This study was an initial attempt to study teachers' self-efficacy in an experimental context. More experimental studies are needed to examine teachers' self-efficacy and its relationship to performance in a variety of teaching situations. As previously noted, the teaching task should be prescribed as part of a class assignment in order to realize a larger and more representative

teacher sample.

Teachers expressed positive feelings regarding teaching another student seriation of length (M = 81.96). The above study could be expanded so that the teacher had an opportunity to reteach the seriation of length task to another preschool child. Differences between the sessions could be assessed in order to determine whether self-efficacy judgments become stronger and more powerful during the second teaching task. Bandura (1977, 1982, 1986) posits that information from enactive attainments is the most powerful determinant of efficacy expectations. The stability of self-efficacy judgments across teaching tasks could be assessed.

Student behavior and its relationship to teacher outcome measures were not evaluated in the present research. An interesting topic for future study would be to investigate the effect of student behaviors on teacher self-evaluation. To what extent does student behavior (i.e., resistant, impulsive, cooperative, friendly, etc.) effect teachers' self-evaluative processes?

Negative behaviors concerning the present-day educational system need to be dispelled and confidence in the educational process needs strengthening. Further research into self-efficacy as a motivator of teacher behavior needs to be undertaken. If we can begin to

unravel the variables related to teachers' effectiveness and achievement gains, we are one step closer to providing teachers with the ammunition they sorely need.

Appendix A

Dear Parents:

Re:_____

Let me introduce myself to you. My name is Judith DiStefano and I have been a practicing school psychologist on Long Island for the past twelve years. I am presently completing my studies at the Graduate Center of City University and am working on my doctoral dissertation. My research deals with teaching.

I would very much like your assistance at this time and I ask that you allow your child to take part in my study. Your child will be learning pre-mathematical concepts. These concepts are an important part of basic math skills. The teaching session will be of approximately twenty minutes duration and carried out at your child's school.

Please check the appropriate box, sign, and return to the school:

/ / I will allow my child to take part in the training.

/ / I will not allow my child to take part in the training.

_____
Your signature

Thank you in advance.

Sincerely,

Judith A. DiStefano

Appendix B

Instructions for Teaching Seriation of Objects by Length

Seriation of length is a pre-mathematical skill related to the ordering of objects from longest to shortest. Seriation of length is a developmental skill which generally emerges around six years of age. Research has demonstrated seriation of length can be taught to pre-kindergarten children.

For this teaching assignment you will teach one pre-school child (3-4 year old) seriation of length of various objects (e.g., painted blocks, round cylinders, etc.). There are seven sets of seriation objects of varying lengths and each set consists of a different number of objects ranging from three to nine members. There is no time limit for the teaching session. You may determine when the session is over. You must begin teaching with the first seriation set (3 objects). It is most important that when you change to a different set, you make certain the set with which you were working is put back in the appropriate container.

Once you switch to another set, you cannot return to the terminated one.

In order to assess retention of the skill, all children will be tested by another person at the termination of the teaching assignment.

In order to obtain some background information regarding your teaching experience, please take a few minutes to complete this questionnaire. Please answer every question.

NAME:_____

AGE:_____

SCHOOL:_____

MAJOR:_____

YEAR IN PROGRAM:_____

1. Have you had experience in teaching a child any skill (e.g. reading, math, music)?

   YES_____ NO_____

   If yes, what subject area have you taught:_____

   _____

   If yes, what age children have you taught:

   Pre-school____ K____ Elementary 1-6____

   Jr. High 7-8____ Sr. High 9-12____ Other_____
   (please specify)

2. Have you had any experience in teaching seriation of length (ordering objects by length)?

   YES_____ NO_____

   If yes, how many teaching episodes have you had?_____

   _____

FROM PAST EXPERIENCE WITH THE TEACHING OF SERIATION OF LENGTH OF OBJECTS, IT HAS BEEN FOUND THAT IT IS QUITE DIFFICULT TO TEACH THIS CONCEPT. THE AVERAGE TEACHER CAN TEACH A PRESCHOOL YOUNGSTER TO SERIATE FOUR OBJECTS IN A SINGLE SESSION.

3. How many objects do you think you can teach to a pre-school child in a single session?_____

Use the following scale to answer the next question.

10	20	30	40	50	60	70	80	90	100
Cannot Accomplish				Average Assuredness				Very Assured	

If you were asked a question regarding your ability to teach a swimming class and you were a non-swimmer, you would put 10 after the question. However, if you believed you could do a very good job, you might put 90 after the question.

4. How assured are you regarding your ability to teach seriation of length?

_____
fill in value from scale

Thank you for your cooperation.

If you would like a copy of the results of the study, please print your name and address below.

Appendix B

Instructions for Teaching Seriation of Objects by Length

Seriation of length is a pre-mathematical skill related to the ordering of objects from longest to shortest. Seriation of length is a developmental skill which generally emerges around six years of age. Research has demonstrated seriation of length can be taught to pre-kindergarten children.

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Once you switch to another set, you cannot return to the terminated one.

In order to assess retention of the skill, all children will be tested by another person at the termination of the teaching assignment.

In order to obtain some background information regarding your teaching experience, please take a few minutes to complete this questionnaire. Please answer every question.

NAME: _____

AGE: _____

SCHOOL: _____

MAJOR: _____

YEAR IN PROGRAM: _____

1. Have you had experience in teaching a child any skill (e.g. reading, math, music)?

   YES_____ NO_____

   If yes, what subject area have you taught: _____

   _____

   If yes, what age children have you taught:

   Pre-school____ K____ Elementary 1-6____

   Jr. High 7-8____ Sr. High 9-12____ Other_____
   (please specify)

2. Have you had any experience in teaching seriation of length (ordering objects by length)?

   YES_____ NO_____

   If yes, how many teaching episodes have you had?_____

   _____

FROM PAST EXPERIENCE WITH THE TEACHING OF SERIATION OF LENGTH OF OBJECTS, IT HAS BEEN FOUND THAT IT IS NOT DIFFICULT TO TEACH THIS CONCEPT. THE AVERAGE TEACHER CAN TEACH A PRESCHOOL YOUNGSTER TO SERIATE EIGHT OBJECTS IN A SINGLE SESSION.

3. How many objects do you think you can teach to a pre-school child in a single session?_____

Use the following scale to answer the next question.

10	20	30	40	50	60	70	80	90	100
Cannot Accomplish				Average Assuredness					Very Assured

If you were asked a question regarding your ability to teach a swimming class and you were a non-swimmer, you would put 10 after the question. However, if you believed you could do a very good job, you might put 90 after the question.

4. How assured are you regarding your ability to teach seriation of length?

_____
fill in value from scale

Thank you for your cooperation.

If you would like a copy of the results of the study, please print your name and address below.

Appendix B

Instructions for Teaching Seriation of Objects by Length

Seriation of length is a pre-mathematical skill related to the ordering of objects from longest to shortest. Seriation of length is a developmental skill which generally emerges around six years of age. Research has demonstrated seriation of length can be taught to pre-kindergarten children.

For this teaching assignment you will teach one pre-school child (3-4 year old) seriation of length of various objects (e.g., painted blocks, round cylinders, etc.). There are seven sets of seriation objects of varying lengths and each set consists of a different number of objects ranging from three to nine members. There is no time limit for the teaching session. You may determine when the session is over. You must begin teaching with the first seriation set (3 objects). It is most important that when you change to a different set, you make certain the set with which you were working is put back in the appropriate container.

Once you switch to another set, you cannot return to the terminated one.

In order to assess retention of the skill, all children will be tested by another person at the termination of the teaching assignment.

In order to obtain some background information regarding your teaching experience, please take a few minutes to complete this questionnaire. Please answer every question.

NAME: _____

AGE: _____

SCHOOL: _____

MAJOR: _____

YEAR IN PROGRAM: _____

1. Have you had experience in teaching a child any skill (e.g. reading, math, music)?

   YES_____ NO_____

   If yes, what subject area have you taught:_____

   _____

   If yes, what age children have you taught:

   Pre-school____ K____ Elementary 1-6____

   Jr. High 7-8____ Sr. High 9-12____ Other_____
   (please specify)

2. Have you had any experience in teaching seriation of length (ordering objects by length)?

   YES_____ NO_____

   If yes, how many teaching episodes have you had?_____

   _____

3. How many objects do you think you can teach to a pre-school child in a single session?_____

Use the following scale to answer the next question.

10	20	30	40	50	60	70	80	90	100
Cannot Accomplish				Average Assuredness					Very Assured

If you were asked a question regarding your ability to teach a swimming class and you were a non-swimmer, you would put 10 after the question. However, if you believed you could do a very good job, you might put 90 after the question.

4. How assured are you regarding your ability to teach seriation of length?

_____
fill in value from scale

Thank you for your cooperation.

If you would like a copy of the results of the study, please print your name and address below.

Appendix C

NAME: _____

SCHOOL: _____

Self-Efficacy for Seriation

Using the scale 10 to 100 in 10-unit intervals, rate the following questions as to your certainty that you would be able to teach a pre-kindergarten child (e.g. 3-4 year old).

10	20	30	40	50	60	70	80	90	100
Uncertain			Moderately Certain					Very Certain	

For example, if you were not quite certain you could teach a pre-kindergarten youngster to count to ten, you might put 20 after the question. However, if you very definitely knew you could teach the child, you might put 100 after the question.

Please answer every question using the above scale.

1. How certain are you that you can teach a pre-kindergarten youngster the concept of longest?

   _____
   fill in value from scale

2. How certain are you that you can teach a pre-kindergarten youngster the concept of shortest?

   _____
   fill in value from scale

3. How certain are you that you can teach a pre-kindergarten youngster the concept of middle?

   _____
   fill in value from scale

10 20 30 40 50 60 70 80 90 100
Uncertain Moderately Certain Very Certain

4. How certain are you that you can teach a pre-kindergarten youngster to successfully recognize a set of <u>three</u> objects seriated by length?

fill in value from scale

5. How certain are you that you can teach a pre-kindergarten youngster to successfully reorder a set of <u>three</u> objects by length?

fill in value from scale

6. How certain are you that you can teach a pre-kindergarten youngster to successfully recognize a set of <u>five</u> objects seriated by length?

fill in value from scale

7. How certain are you that you can teach a pre-kindergarten youngster to successfully reorder a set of <u>five</u> objects by length?

fill in value from scale

8. How certain are you that you can teach a pre-kindergarten youngster to successfully recognize a set of <u>seven</u> objects seriated by length?

fill in value from scale

9. How certain are you that you can teach a pre-kindergarten youngster to successfully reorder a set of, <u>seven</u> objects by length?

fill in value from scale

10	20	30	40	50	60	70	80	90	100
Uncertain			Moderately Certain					Very Certain	

10. How certain are you that you can teach a pre-kindergarten youngster to successfully recognize a set of nine objects seriated by length?

fill in value from scale

11. How certain are you that you can teach a pre-kindergarten youngster to successfully reorder a set of nine objects by length?

fill in value from scale

Appendix D

Teacher Behavior Observation Form

Observer Name:_____ Time Began:_____

Teacher Observed:_____ Time Terminated:_____

Student Name:_____ Age:_____

1. Upon beginning the session does the teacher engage in conversation to establish rapport with the child (e.g., ask the child's name, age, etc.)?

   _____ _____ _____ _____
   Never Very seldom Most of the time Continually

2. Does the teacher explain the task before beginning (e.g., We are going to find the longest, the shortest)?

   _____ _____ _____ _____
   Never Very seldom Most of the time Continually

3. Does the child ask questions pertaining to the task (e.g., Is this the longest? What goes next?)?

   _____ _____ _____ _____
   Never Very seldom Most of the time Continually

4. Does the teacher respond to the child's questions appropriately (e.g., That was the longest. Put this block next, etc.)?

   _____ _____ _____ _____
   Never Very seldom Most of the time Continually

5. Does the teacher employ praise while teaching seriation (e.g., Good job; that's right)?

   _____ _____ _____ _____
   Never Very seldom Most of the time Continually

6. Does the teacher smile at the youngster?

Never	Very seldom	Most of the time	Continually

7. Does the teacher nod approval?

Never	Very seldom	Most of the time	Continually

8. Does the teacher make physical contact with the child in a warm, supportive manner (e.g., touch child's arm, pat his/her shoulder)?

Never	Very seldom	Most of the time	Continually

9. Does the teacher encourage the child to continue working (e.g., let's try again; keep working)?

Never	Somewhat	Pretty much	Continually

10. Does the teacher give the child an opportunity to successfully seriate each set more than once?

Never	Very seldom	Most of the time	Continually

11. When the child experiences difficulty, does the teacher "stick" with the child (e.g., teacher doesn't give up: tries task again)?

Never	Somewhat	Pretty much	Continually

12. Does the teacher appear frustrated when the child experiences difficulty (e.g., sighs, makes faces)?

Never	Somewhat	Pretty much	Continually

13. Are criticisms or negative comments directed at the child (e.g., That's not good. You're not watching, listening)?

Never	Some	Often	Continually

14. Is the teaching session terminated due to the child's inattention, frustration, etc.?

YES_____ NO_____

Appendix E

NAME: _____

SCHOOL: _____

Please circle the value after each question. Answer every question. Use whatever numerical value in the scale that applies to you.

1. How difficult did you find this teaching session?

10	20	30	40	50	60	70	80	90	100
Very easy		Easy		Average			Difficult		Could not accomplish

2. How difficult do you believe this task would be for other teachers?

10	20	30	40	50	60	70	80	90	100
Very easy		Easy		Average			Difficult		Could not accomplish

3. How much effort do you feel you exerted on this teaching assignment?

10	20	30	40	50	60	70	80	90	100
Very little				Average					As much as possible

4. Would you teach seriation to another pre-kindergarten child?

10	20	30	40	50	60	70	80	90	100
Never				Perhaps					Without a doubt

5. How adept do you feel in your teaching ability of seriation?

10	20	30	40	50	60	70	80	90	100
Inept				Adept					Extremely adept

6. How capable was the youngster of learning the task?

10	20	30	40	50	60	70	80	90	100
Unable to learn				Average					Extremely capable

7. What level of understanding of the concept of seriation of length (the number of objects) do you believe the youngster attained? _____ / # objects in set

8. How many objects can an "average" teacher teach a pre-kindergarten youngster to seriate in a single session? _____ objects

9. What do you believe was the purpose of this study?

_____

_____

_____

_____

_____

Thank you for your time.

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