PROMOTING THE POSITIVE ACHIEVEMENT MOTIVATION OF YOUNG CHILDREN IN A REGULAR GRADE 2 CLASSROOM

By

Cindy Maria Bell

P.D.P., Simon Fraser University, 1976
B.Ed., Simon Fraser University, 1991
Burnaby, British Columbia

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NAME Cindy Maria Bell

DEGREE Master of Arts

TITLE Promoting the Positive Achievement Motivation of Young Children in a Regular Grade 2 Classroom

EXAMINING COMMITTEE:

Chair Philip H. Winne

_____ _____

Lannie Kanevsky
Senior Supervisor

_____ _____

Lucy LeMare
Assistant Professor
Member

_____ _____

Dr. Deborah L. Butler, Assistant Professor
Dept. Educational Psychology and Special Education, Faculty of Education
University British Columbia
External Examiner

Date: 1995.07.27

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Promoting the Positive Achievement Motivation of Young Children in a Regular Grade 2 Classroom

Author:

(Signature)

Cindy Maria Bell

(Name)

July 27/95

(Date)

ABSTRACT

This study compared the influence of math instruction minus motivation instruction (-M) and math instruction plus motivation instruction (+M) on children's motivational orientation and learning.

Participants were 38 public school students from 3 Grade 2 classrooms in the same school. Students ranged in age from 86 to 97 months (average age was 91.34 months). Nineteen students were assigned to each of the treatment conditions with 9 girls and 10 boys in the math instruction group and 8 girls and 11 boys in the math instruction plus motivation group.

Both groups were involved in identical pre- and post-treatment sessions in which math pattern recognition ability, preference for an easy or hard task (behavioural component of motivational orientation) and combined affective and cognitive components of motivational orientation (motivational orientation questionnaire) were assessed. Both groups also received 7 math pattern strategy lessons. In addition to the math instruction, the +M group received information about the nature of learning and attribution training within a context that explicitly valued learning.

The results indicate a statistically detectable group by time interaction $F(5,32) = 2.43$, $p = .056$ for motivational orientation. A significant number of students in this group changed from preference for an easy task to preference for a hard task, $\chi^2 = 5.8$, $df = 1$, $p = .01$. Also, students in this group experienced a significant increase in their motivational orientation questionnaire scores, $t\ (18) = -2.82$, $p = .01$ and in their pattern recognition ability scores, $t\ (18) = -2.78$, $p = .01$, pre- to post-treatment. The -M group did not demonstrate significant changes on any of these measures.

Based on the results of this study, supplementing regular instruction with Motivation Instruction (providing information about the nature of learning, endorsing a classroom learning goal, and providing instruction about how to apply effort appropriately in the pursuit of learning) appears to have positive effects on students' achievement motivation and math pattern learning in a regular Grade 2 classroom. Children taught without the Motivation instruction did not experience similar improvements in their MOQ scores or Pattern Recognition scores. This study has implications for the role of regular classroom teachers in promoting positive achievement motivation and effective learning.

DEDICATION

To Jeremy and Nolan...

Follow your dreams!

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

"For students to become active, independent learners they must see their own efforts as the determinants of their success" (Groteluschen, Borkowski, & Hale, 1990, p. 83).

Educational research contributes to knowledge which leads to the improvement of educational practice (Borg & Gall, 1989). According to Borg and Gall (1989), one type of educational research concerns interventions and the development of teaching methods for the purpose of improving student learning or other valued outcomes. Insight into the key role of motivation has surfaced in the extensive research into how best to promote self-regulated learning. The accumulated body of knowledge suggests that teaching practice should include attention to content instruction and strategy instruction as well as motivation.

It is generally acknowledged that motivation plays an integral role in learning (Bandura, 1993; Borkowski, Carr, Rellinger & Pressley, 1990; Lepper, 1988; Paris & Byrnes, 1989; Zimmerman, 1989). Positive motivational orientation correlates positively with constructs indicative of effective learning: metacognition (Borkowski et al., 1990); self-regulated learning (Groteluschen et al., 1990; Pintrich & DeGroot, 1990; Zimmerman, 1989); and acquisition, transfer and maintenance of skills, strategies, and knowledge (Dweck, 1975; Salomon, 1989; Salomon & Globerson, 1987; Salomon & Perkins, 1989). The purpose of the present study was to investigate the effectiveness of an instructional intervention designed to promote positive motivational orientation and thus influence effective learning.

Several models of achievement motivation exist in current educational literature. Each of these models includes a dichotomy of positive and negative

motivational orientation: intrinsic motivation versus extrinsic motivation (Harter, 1981; Lepper, 1988); task orientation versus ego orientation (Nicholls, Patashnick, & Nolen, 1985); mastery goal versus performance goal (Ames, 1992a); learning goal versus performance goal orientation (Dweck, 1975; Dweck & Leggett, 1988; Dweck, 1989; Dweck, 1991; Elliot & Dweck, 1988). Although the different models label the constructs differently, there is considerable overlap in the characteristics that distinguish positive and negative motivational orientations and the consequences of each (Lepper, 1988). Following Lepper's example then, one particular model will be used to discuss the characteristics and consequences of positive and negative motivational orientations. The terms learning goal (positive achievement motivation) and performance goal (negative achievement motiviation) "are used in a generic sense here to refer to the common elements of the several models" (Lepper, 1988, p. 294).

The common elements of the different models based on goal theory of achievement motivation include how different goals, learning and performance, mediate different motivational orientations and differences in the nature and quality of children's investment in learning (Ames, 1992a; Dweck, 1989; Dweck & Leggett, 1988; Nicholls, 1984). A learning goal of "improving" one's competence mediates positive motivational orientation and an achievement response conducive to effective learning (Dweck, 1989; 1991; Dweck & Leggett, 1988). A performance goal of "proving" one's competence mediates negative motivational orientation and an achievement response that undermines effective learning (Dweck, 1989; 1991; Dweck & Leggett, 1988). The responses associated with the different motivational orientations become most apparent in situations of failure, failure being defined and operationalized as challenge, difficulty, or uncertain success (Diener & Dweck, 1978).

When a learning goal or positively oriented individual is confronted with challenge, her response involves applying previous knowledge and strategies to the task at hand (Dweck, 1989; 1991; Salomon, 1989; Salomon & Perkins, 1989). She persists, maintains positive affect, and believes her success depends on her own efforts (Borkowski et al., 1990; Groteluschen et al., 1990; Meece, 1994; Pintrich & DeGroot, 1990; Zimmerman, 1989).

On the other hand, the typical response of a performance goal or negatively motivated individual confronted with challenge is to act maladaptively (Diener & Dweck, 1978,1980; Dweck, 1979; Elliot & Dweck, 1988). That is, she becomes unable to apply previously demonstrated skills to the task at hand. This maladaptive response arises because the goal of proving competence is threatened when a task requires effort. The need to exert effort, when confronted by challenge, difficulty, or uncertain success, is interpreted as evidence of one's inability (Diener & Dweck, 1978). It connotes incompetence and elicits negative affect which may include avoidance behaviours expressed as derogatory comments about the activity or one's own abilities. Furthermore, this individual believes her success depends on conditions external to herself such as luck or teacher bias, yet she attributes difficulties (failures) to her own lack of ability. Consequently she typically exerts minimal effort and persistence.

The consequences of the different motivational orientations are emphasized if learning is considered to be "a problem solving process in which the learner attempts to overcome obstacles or contradictions that arise as he or she engages in purposeful activity" (Cobb, 1986, p. 302). Challenge is inherent in learning and challenge activates the different achievement responses associated with different motivational orientations. Negative motivational orientation is undesirable, as it is not conducive to "active, independent" learning (Groteluschen et al., 1990, p. 83). Conversely, the response associated with positive motivational orientation,

characterized by persistence, belief in self-efficacy, expenditure of effort, positive affect, and effective application of previous knowledge, definitely underlies effective learning (Pintrich & De Groot, 1990; Zimmerman, 1989). The learning goal orientation response epitomizes what educators hope to foster in their students (B. C. Ministry of Education, 1990).

Classroom conditions conspire against this though. Children enter school with different motivational orientations (Cain, 1990; Dweck & Smiley, 1994). Each child is confronted with academic achievement situations that are fraught with challenge and difficulty. For instance, the introduction of new concepts in class is generally accompanied by some activity to test students' understanding and application of the concepts. And, throughout the day students are assigned tasks to reinforce and monitor their learning. Usually these activities are designed to encourage learning. That is, they involve more than rote learning. They push students to go beyond what they have done before. The degree of difficulty that one experiences is dependent on each individual's level of learning with respect to the activity. And, each individual's experience of the difficulty in turn has an impact on their learning response to the activity. Consequently, by their nature, certain conditions in academic achievement situations threaten to exacerbate negative motivational orientation and maladaptive achievement responses. This occurs because difficulty and the need to exert effort is interpreted by the negatively motivated individual as evidence of their inability. Since the goal of the negatively motivated individual is to prove their competence, situations that appear to provide evidence of incompetence elicit negative affect, avoidance tendencies, and interfere with academic performance.

To make matters worse, evidence suggests that it is not only individuals with extreme performance goal orientation who are at risk for a maladaptive response when confronted with difficulty (Stipeck & Kowalski, 1989). Individuals who are

relatively more performance goal oriented than learning goal oriented tend to be vulnerable to the performance goal motivational response when confronted with failure (Stipeck & Kowalski, 1989). This is particularly true in evaluative situations (Ames, 1992b; Diener & Dweck, 1978; Salomon, 1989), that is, in situations where one's performance is deemed to be judged.

Certainly this includes academic achievement situations. Tests are written, work is marked and graded, wrong answers must be corrected, report cards are issued. Stipeck and Kowalski (1989) suggest that classrooms may well be perceived by most children as highly evaluative contexts. Students must prove their competence to their teachers, peers, and parents. By nature, the academic achievement situation is performance goal oriented. This spawns grave implications particularly since performance goal conditions have been shown to undermine the achievement response of learning goal oriented children (Dweck, 1975; Dweck & Leggett, 1988; Elliot & Dweck, 1988).

Considering the nature and consequences of different motivational orientations, and the nature of classroom conditions, it might be expected that without due care and attention, academic achievement situations could quite easily promote negative motivation rather than positive motivation. In fact, research has shown traditional schooling to be antithetical to fostering positive motivation to learn (Anderman & Maehr, 1994; Eccles, Wigfield, Midgley, Reuman, MacIver, & Feldlaufer 1993; Elliot & Dweck, 1988). Certainly this contradicts educators' intent. However, research by Ames (1992b) indicates that classrooms with a learning goal orientation can promote positive motivation to learn. Unfortunately, Ames (1992b) feels her treatment is too complex to be readily implemented in regular classrooms. It becomes prudent then, to investigate ways of fostering positive motivational orientation in regular classrooms.

The present study tested an instructional intervention developed to address this need. Previous research informed the development of this intervention. Recognizing the relationship between motivation and learning, various studies have been conducted to investigate the promotion of the adaptive learning response. It has been found that goal orientation can be influenced by external factors (Ames, 1992b; Elliot & Dweck, 1988; Salomon, 1989; Stipeck & Kowalski, 1989). The right conditions can reduce the maladaptive responses of individuals assessed as negatively motivated and reinforce the adaptive responses of positively motivated students (Ames, 1992a; Borkowski et al., 1990; Stipeck & Kowalski, 1989).

Much energy has been expended in attempting to change maladaptive achievement responses (Borkowski, Estrada, Milstead, & Hale, 1989; Dweck, 1975; Dweck & Leggett, 1988, Fowler & Peterson, 1981; Groteluschen et al., 1990; Licht & Kistner, 1986; Marsh, 1986; Wong 1991a). These attempts have met with limited success. But, long term effects have resulted from context specific attribution training embedded in instruction (Borkowski, Weyhing, & Carr, 1988). Borkowski et al. (1988) suggest that promoting positive attributional beliefs requires ongoing attention across contexts because it is general antecedent attributions rather than context specific attributions that tend to distinguish individuals' motivational orientation and influence achievement responses. Thus, developing an approach for promoting positive motivational beliefs that can be interjected across content areas is particularly important. The present study sought to investigate the effects of instruction intended to do this in a regular classroom.

The potential for promoting positive motivational beliefs in the classroom is bolstered by the student-teacher relationship. Dweck and Smiley (1994) cite extensive research that indicates early motivational goal development is mediated by adult-child interactions. The quality of these interactions directly influences

children's responses to challenge. Children's tendencies to encourage themselves or to judge themselves (i.e. tendencies to adopt goals to improve or prove competence) arise through interactions with adults in various contexts. These include parent-child interactions in the home, and teacher-student interactions in school. If these tendencies are developed in the home, that means some children enter school disadvantaged with respect to their inclination to learn. If they do, perhaps they can be influenced by experiences in school, to develop adaptive beliefs. Teachers encouraging children by explicitly valuing learning and conscientiously heightening children's awareness of what improving competence (learning) entails, may influence tendencies fundamental to positive achievement motivation. Considering the impact of positive achievement motivation on learning, the inclusion of motivation instruction in the regular classroom routine, may be an important step toward accomplishing the goals of developing life-long learners, and promoting effective learning (B. C. Ministry of Education, 1990).

The motivation instruction developed for the present study is a theoretically based approach founded on goal theory of achievement motivation (Lepper, 1988). The intervention derives from previous research investigating the remediation of negative achievement motivation (Dweck, 1975; Fowler & Peterson, 1981; Marsh, 1986; Licht & Kistner, 1986), and promotion of positive achievement motivation (Ames, 1992a; Elliot & Dweck 1988; Salomon, 1989; Stipeck & Kowalski, 1989), metacognition, and self-regulated learning (Borkowski et al., 1988; Borkowski et al., 1989; Groteluschen et al., 1990; Reid & Borkowski, 1987; Wong, 1991a). The purpose of the present study was to test an intervention intended to promote the adaptive learning response associated with positive achievement in a regular classroom of young children. There are apparent advantages to starting to nurture learning goal orientation early in children's school

careers. Previous literature and research provides details about why this is so, and how it can be accomplished.

These details will be enumerated to establish how previous work influenced the development of this study. Adult-child relationships influence the development of positive and negative motivational orientations (Dweck & Smiley, 1994). Positive achievement motivation underlies effective learning (Dweck & Leggett, 1978; Groteluschen et al., 1990; Zimmerman, 1989). By their nature, regular classrooms influence negative motivation (Alderman & Maehr, 1994; Eccles et al., 1993). It is very difficult to remediate students who have developed well-established negative achievement motivation (Licht & Kistner, 1986) although it appears positive influences across a wide range of experiences are most useful (Borkowski et al., 1988). Remediation research informs of us of a plethora of positive intervention influences, many of which could easily be imbedded into sound teaching practice (Dweck, 1975; Borkowski et al., 1988; Stipeck & Kowalski, 1989).

It seems appropriate to conscientiously apply sound instructional methods conducive to promoting the development of positive achievement motivation early in children's school careers for four reasons. The first, and most obvious reason is the beneficial relationship between positive motivation and learning. Secondly, it is desirable to develop a strong foundation of positive motivation resilient to the undermining forces of evaluation and difficulties, inherent in academic achievement situations. Thirdly, if the development of positive motivation can be influenced in young children, in school, this potentially prevents the development of negative achievement motivation. And, fourth, this is important because of the limited success in remediating well-established negative motivation.

Considering these reasons, the author sought to develop an intervention for influencing positive achievement motivation in young children. Other criteria that had an impact on the development of this intervention include, 1) that it be

appropriate for imbedding into regular school curricula and class routine, and 2) that it be manageable by classroom teachers, so that they could learn how to do it in their classrooms by reading a description of it. The present study investigated the influence of the resulting Motivation Instruction intervention.

CHAPTER 2

LITERATURE REVIEW

This literature review is divided into six sections. First, to reveal the theoretical framework for the approach taken in this study, the Social-Cognitive Model of Motivation is reviewed. Second, to provide insight into the origins of the approach taken in this study, research relevant to promoting positive motivation is reviewed. The third section reviews evidence of motivational patterns in young children. In the fourth section, the research review is synthesized. The fifth section outlines the rationale for the present study The hypotheses for this study are presented in the sixth section.

Research Based Social-Cognitive Model Of Motivation

The purpose of this section is to explain why and how different knowledge and beliefs undermine or promote learning. To do this, the profiles of negatively motivated individuals who demonstrate a maladaptive learning response and positively motivated individuals who demonstrate an adaptive learning response are revealed through a description of the Social-Cognitive Model of Motivation and Personality (Dweck & Leggett, 1988).

In the domain of achievement motivation, two different learning responses, adaptive (positive) and maladaptive (negative), have long been identified (Battle, 1965; Tyler, 1958). Moreover, research has identified constellations of different cognitive, affective, and behavioural components that characterize each response (Butterfield, 1964; Cain, 1990; Dweck, 1975; Dweck & Leggett, 1988; Dweck & Smiley, 1994; Kistner, Osborne, LaVerrier, 1988). On the basis of this research a comprehensive model that accounts for these responses in terms of underlying psychological processes has been proposed (Dweck & Leggett, 1988).

In their Social-Cognitive Model of Motivation and Personality, Dweck and Leggett (1988) suggest that individuals hold different theories of intelligence which elicit different achievement goals. The different achievement goals create different contexts within which different cognitions, affect, and behaviours emerge. It is this constellation of cognitions, affect, and behaviors that forms the final product: the learning response. Each part of the model will now be described: 1) implicit theories of intelligence, 2) achievement goals, and 3) learning response. The learning response will be further divided to describe its cognitive, affective and behavioural components.

1) Implicit Theories of Intelligence

The two theories of intelligence identified in Dweck and Leggett's model (1988) are incremental and entity. These implicit theories represent beliefs individual's hold about themselves as learners. Individuals with an incremental theory of intelligence believe "intelligence is a malleable, increasable, controllable quality" (Dweck & Leggett, 1988, p. 262). Consequently, they believe they are capable of learning. Individuals with an entity theory of intelligence believe "intelligence is a fixed or uncontrollable trait" (Dweck & Leggett, 1988, p. 262). These individuals believe that if they encounter a situation that is beyond their capabilities, there is nothing they can do about it. These different theories elicit different achievement goals.

2) Achievement Goals

The entity theory of intelligence is typically associated with a performance goal of affirming the adequacy of one's ability. The incremental theory of intelligence is typically associated with the learning goal of extending one's abilities. It is suggested that the different goals create different frameworks for interpreting and responding to challenge. They do this by evoking different concerns, different questions and attention to different information. "Within a performance goal,

individuals are concerned with measuring their ability and with answering the question, 'Is my ability adequate or inadequate?' In contrast, learning goals create a concern with increasing one's ability and...lead[s] individuals to pose the question, 'What is the best way to increase my ability?'" (Dweck & Leggett, 1988, p. 260). Consequently, "the same event may have an entirely different meaning and impact if it occurs within the context of a learning versus a performance goal" (Dweck & Leggett, 1988, p.260). This is particularly true with respect to situations involving failure outcomes and in situations demanding effort expenditure.

3) Learning Responses

Different achievement goals mediate different responses to challenge which in turn result in the nature and quality of individual's investment in learning as evidenced in different cognitions, affect, and behaviour. The responses are distinctly different for positively and negatively motivated individuals.

i) cognitions

For instance, negatively motivated individuals, intent on documenting their competence, interpret difficulty as evidence of their insufficient ability. Additionally, because they believe that ability is fixed, they have low expectations for future success. And when asked, these individuals typically attribute their difficulties to their lack of ability.

To positively motivated individuals who are intent on improving their competence, difficulty signals the extent of their learning. Because they believe ability is malleable, this situation is seen as temporary and overcome via one's own effort. Consequently these individuals maintain high self-assessments of ability and expectations for future success. When asked, these individuals typically attribute their difficulty to their own lack of effort.

ii) affect

For the performance goal oriented individual, self-assessments of low ability result in depression, anxiety, boredom, and defiance (Diener & Dweck, 1978). Feigning boredom is one defense mechanism to disguise or de-emphasize lack of ability. Showing disdain for or devaluing a task also permits an individual of low perceived ability to divert attention away from oneself.

Difficulty simply challenges the learning goal oriented individual to formulate a solution. Dweck and Leggett (1988) report children responding gleefully to challenge. Also, because these individuals value effort for its role in mediating learning, the need to exert effort "in the service of...learning...can be a source of pride" (Dweck and Leggett, 1988, p.261).

iii) behaviours

Affective reactions prompted by cognitive interpretations of failure and difficulty, result in specific behaviours with respect to task choice and response to difficulty. The ideal task within a performance goal orientation is one that results in a positive judgements of ability. Individuals who adopt performance goals show preference for non-challenging tasks in order to minimize the risk of failure or expenditure of effort. In contrast, positively motivated children demonstrate preference for challenging tasks in order to maximize opportunities for increasing competence.

Positively and negatively motivated children also display different behaviours when confronted with difficulty. For negatively motivated individuals who interpret difficulty as due to lack of fixed ability, expending effort is futile and consequently they lack persistence (Licht & Kistner, 1986). When effort is most needed, negatively motivated children withhold it to avoid demonstrating their inability. Preserving self-esteem takes priority over mastery of the challenge. Anxiety over failure often interferes with concentration and effective strategy deployment (Dweck, 1975; Stipeck & Kowalski, 1989; Wine, 1971). Consequently, individuals

who adopt performance goals are unlikely to experience the intrinsic reward increased self-efficacy that can develop as a result of success achieved through effort (Borkowski et al., 1989; Fowler & Peterson, 1981; Groteluschen et al., 1990).

Within a learning goal, "failure, rather than signaling low ability, provides a cue to escalate effort" (Dweck & Leggett, 1988, p. 257). This in turn prompts renewed attention and concentrated effort which results in the application of previous skills and knowledge to resolve the difficulty. Success accomplished through such effort is likely to provide intrinsic reward and heightened self-efficacy which will provide impetus for future endeavors (Borkowski et al., 1989; Butler, 1993; Fowler & Peterson, 1981; Groteluschen et al., 1990).

Promoting Positive Achievement Motivation and Effective Learning

The critical underlying importance of motivational orientation to effective learning is well established (Ames, 1992a; Borkowski et al., 1988; Lepper, 1988; Paris & Byrnes, 1989; Pintrich & De Groot, 1990; Reid & Borkowski, 1987; Salomon, 1989; Zimmerman, 1989). Acknowledging this relationship, researchers have investigated ways of *externally influencing* motivational orientation. The goal has been for students to willingly confront challenge, and when confronted with challenge, to maintain positive affect, to believe they can overcome the challenge through their own effort, and to persist and apply previous skills and knowledge to resolve the challenge (Ames, 1992a; Borkowski et al., 1988; Lepper, 1988; Paris & Byrnes, 1989; Pintrich & De Groot, 1990; Reid & Borkowski et al., 1987; Salomon, 1989; Zimmerman, 1989). Three main types of intervention have been undertaken to accomplish these ends. These include: 1) attribution training (Dweck, 1975; Fowler & Peterson, 1981; Licht & Kistner, 1986; Marsh 1986); 2) attribution plus strategy training (Borkowski et al., 1988; Reid & Borkowski, 1987); and

3) manipulating goal orientation (Elliot & Dweck, 1988; Salomon, 1989; Stipeck & Kowalski, 1989). Research involving these interventions have contributed to our understanding of potential ways of promoting positive motivation and effective learning and will now be discussed.

Attribution Training

According to pervious research, attributional beliefs predict motivational orientation (Cain, 1990; Chapman, 1988; Dweck & Smiley, 1994; Kistner et al., 1988). More specifically, the extent to which an individual believes that effort can overcome failure predicts how he will respond to challenge. Positively motivated individuals attribute failure to lack of effort (a controllable factor) while negatively motivated individuals attribute failure to their own lack of ability (Chapman, 1988; Dweck, 1975; Dweck & Leggett, 1988; Kistner et al., 1988). Attribution training has been used in an attempt to alter the maladaptive achievement responses associated with negative achievement motivation (Dweck, 1975; Fowler & Peterson, 1981). In early attribution training interventions, children were merely told to try harder when they made mistakes.

For example, Dweck (1975) investigated the influence of attribution retraining on children's responses to failure in an experimental problem-solving situation. The subjects were 12 children between the ages of 8 and 13. They had been identified by their teachers, principals and school psychologists as having extreme reactions to failure. This assessment was based on observations of the students' in-class behaviour and a rating scale, completed by teachers, of students' reactions to an academic situation in which failure was possible or present. Dweck (1975, p.676) does not define 'extreme response to failure' beyond, "expectation of failure and deterioration of performance in the face of failure." She mentions that

six of the children attended a class for children performing below grade level but does not elaborate.

The children were paired according to ability (based on their teachers' assessments) and randomly assigned to two treatment conditions. Both conditions involved 25 training sessions in which the children did 15 one minute math drills. Banks of problems were created for each subject based on math questions they previously successfully completed. In addition to a 1 minute time limit, a criterion number of correct answers was set for each trial. The criterion was indicated by a row of green lights. With each completed correct answer a corresponding red light was illuminated. When the criterion number was met that trial ended. Students in the Success Only (SO) group were only given math questions that assured success in meeting the criterion. For students in the Attribution Retraining (AR) group the criterion was set high enough to guarantee failure on two to three trials each session. Following the trials that the students failed, the researcher said, "That means you should have tried harder" (Dweck, 1975, p. 679).

Math tests developed to assess the effect of failure on students' rate and accuracy of performance interrupted the training sessions and were administered pre-training, mid-training, and post-training. At pre-training the students did the test for 10 consecutive days before experiencing the failure test. At mid-treatment and at post-treatment, the subjects did the test for three consecutive days before the failure test and then for three days after the failure test. The tests consisted of three to four sheets of 25 to 30 questions sectioned into groups of five. If four of the five were completed correctly the student got a token redeemable for a prize later. Each child's questions were derived from their own school workbooks and ranged in difficulty from moderately easy to moderately difficult. After doing the same pages but in different order, for several days, the pages were changed to include questions beyond the students ability in the second and fourth groups of five

questions. When students in the AR group completed these groups of five questions, the researcher corrected the wrong answer(s) and said, "You got too many wrong that time. You don't get a token" (Dweck, 1975). During all sessions, completion of each group of five was timed and the number of correct answers recorded in order to compare pre- and post-failure performance.

The number of correct answers per minute, or rate of performance, was calculated for each students' pre-failure and post-failure test at pre-training, mid-training, and post-training. Change in performance was calculated as the percentage decrease in correct problems per minute, between pre-failure and post-failure at pre-training, mid-training, and post-training. Percentage decrease represented deterioration in performance. Graphs of each students percentage decrease from pre-training to mid-training to post-training clearly show marked deterioration in the performance of students in the SO group while the performance of students in the AR group generally increased. Graphs of the mean scores of the two groups further emphasized the effects of the different treatments. I tests comparing the SO and AR students' change scores from pre-training to post-training indicated the AR group experienced a significantly greater improvement than did the SO group. Success alone was not enough to counteract the debilitating effect of failure on the response of negatively motivated children. On the other hand hearing the researcher attribute two to three wrong answers in each of 25 sessions to the student's not trying hard enough in the AR treatment was effective in positively altering the subjects' response to failure. AR promoted adaptive response to challenge.

The generalizability of this study is limited by the number of students involved and their extreme negative motivation orientation. At the same time, Dweck's findings provide a critical contribution to our understanding of the effects of negative motivation on student's achievement behaviour. This study provides

evidence of the tendency of negatively motivated children to demonstrate deterioration on previously displayed abilities when confronted with failure. In this study each students' math questions were ones they had demonstrated ability with. They had repeated opportunities to practice the same moderately easy to moderately difficult math questions and experience success with them for approximately 50 days. Nonetheless, for students in the SO group, failure on two of 25 questions in a particular session was sufficient to result in significant deterioration of performance. It should also be noted that students were punished by not receiving a token, and they were also admonished by the researcher saying "You got too many wrong that time. You don't get a token." Perhaps the combination of these negative variables prompted bad feelings and thus deterioration of performance. On the other hand, despite the fact that students in the AR group were subjected to the same experience, their performance did not deteriorate. Simply being told that getting wrong answers meant that they needed to try harder sustained these students demonstrated level of ability. In fact, the performance of five of these six children with extreme negative motivation improved.

Three important implications for designing interventions for promoting positive motivation learning responses in the regular classroom arise from these findings. First, creating a situation in which students predominantly experience success does not alter negatively motivated individuals' responses to failure. At any rate, attempting to create a context in which children predominantly experienced success would not be practical in the context of the regular classroom. Secondly, children experience 'negative variables' in regular classrooms not unlike those experienced in this experimental situation. Their work is marked, they are told how many they got wrong, and until their work is corrected (all their answers are right) they are often denied rewards or excluded from privileges enjoyed by children with

right answers. Third, if merely telling children their mistakes are due to their lack of effort counteracts these negative variables, this is well worth incorporating into daily classroom routine. Dweck suggests, "errors should be capitalized upon as vehicles for teaching the child how to handle failure" (1975, p.684). This suggestion is certainly applicable to the classroom where failure, mistakes, and difficulty are encountered in the process of learning.

Positive results achieved in other attribution training studies include increased incidence of attributing failure to lack of effort, greater expenditure of effort (Licht & Kistner, 1986) and more persistence on academic tasks (Fowler & Peterson, 1981) in experimental conditions. However, the results did not persist beyond the experimental situation in these studies. Such results provide evidence that attributional beliefs about effort are perhaps necessary, but not sufficient, to promote adaptive achievement response toward effective learning. Attributional beliefs about effort are not sufficient in two respects. One, positive effort attributions are just one aspect of a constellation of components that contribute to effective learning (Leggett, & Dweck, 1988). Second, and related, is the fact that many children expend tremendous effort without experiencing success (Licht & Kistner, 1986). For such individuals, attributing failure to lack of effort (when they are exerting effort) is confusing and defeating. The effort required is not simply effort for effort's sake. The effort needs to be purposeful and appropriate to the task at hand to lead to success (Borkowski et al., 1988; Borkowski et al., 1989; Groteluschen et al., 1990; Reid & Borkowski, 1987). Effort expended to employ a specific strategy to solve a problem qualifies. This is the goal of attribution training combined with strategy training.

Attribution Training Plus Strategy Training

Research investigating attribution training combined with strategy training has yielded impressive results including long term strategy maintenance, generalization and transfer, and increased and maintained belief in effort as important to academic success (Borkowski et al., 1988; Reid & Borkowski, 1987).

In one study (Reid & Borkowski, 1987), 77 underachieving, hyperactive children from Grades 2, 3 and 4, were distributed equally into three treatment groups. The three treatments consisted of: memory strategy training plus self-control training *and* attribution training; memory strategy training plus self-control training; and memory strategy training only. Children met individually with a researcher for four training sessions. During the first two sessions children in all groups did "psychoeducational tasks taken from the Barnell Loft series" (Reid & Borkowski, 1987, p. 298). Children in two of the groups also received training to use five self-statements to assist them to do the tasks. This training involved the researcher demonstrating the statements: (i) "Find out what I am supposed to do," (ii) "consider all answers" (iii) "stop and think" (iv) "mark my answer" (v) "check my answer." Over the course of the first two sessions the researcher said the statements outloud several times while doing the tasks. Other times, the researcher demonstrated thinking them while doing the tasks. The students also said the statements outloud several times while doing tasks as well as practiced saying them to themselves while doing the tasks.

Finally, during these first two sessions, one of the groups received attribution training. This training emphasized the need to use the self-control steps. This was accomplished by the researcher proceeding too quickly on one of the tasks, so as not to use the self-control strategy, and fail at the task as a result. The researcher then said "I need to use the self-control steps", and using them, proceeded to successfully complete the task. The researcher also engaged students in

discussions about the causes of failure in school and used a poster to assure children in the attribution training group that failure was due to controllable factors such as lack of effort, not uncontrollable factors such as teacher bias or bad luck. By providing difficult tasks, the researcher ensured that these children experienced an error so that the attribution training could be reiterated.

Memory strategy training was introduced in the third session and continued in session four. At this time, children in all three groups were taught two different memory strategies for recalling several items. The first involved associating two items so that recall of one would prompt recall of the other. The second taught students to sort the items into categories. Training of both strategies did not merely involve the researcher telling the students what to do. Rather, once the students understood the basic strategy, they were given opportunities to practice and the researcher probed for their reasons for making particular associations and forming particular categories, thereby promoting concerted involvement with the strategy and greater depth of understanding of the strategies. The groups differed though, in that the researcher coached students in the memory training plus self-control training group to recite the memory strategies outloud and then to themselves, while undertaking the memory tasks. This was also the procedure followed with the memory training plus self-control training *and* attribution training group. But, with this latter group the researcher interjected attribution training (modeling, poster, dialogue format) throughout these sessions. The attribution training occurred after the introduction of strategies, and after students trials. The researcher commended student successes as resulting from the use of the memory strategies and condoned mistakes as resulting from not using the strategies.

The treatment that included attribution training significantly surpassed the other treatments with respect to its influence on generalization and long-term maintenance of the memory strategy behaviour. Additionally, analysis revealed a

significant treatment effect toward positive attributional beliefs about the role of effort in success, school work generally, and specifically related to the research tasks. This first set of post treatment measures was administered three weeks after training. At 10 months after treatment these results persisted. Subjects from the attribution training group were significantly more strategic on the maintenance task, had more complete memory knowledge, and held more positive attributional beliefs about the role of effort in success. Interestingly, this group also demonstrated significantly greater understanding of "metacognitive awareness about the overall importance of strategic-based performance" (Reid & Borkowski, 1987, p.305) than subjects in the other two conditions. No differences were found between the other two groups eliminating the possibility that the findings were influenced by the self-control training rather than the attribution training.

Despite the positive results of this study, a couple of concerns arise. First, the generalizability of the study is confined to the interview-based experimental condition, and the memory strategy training which has little relevance to regular classroom content. Second, the claims of generalizability, transfer, and maintenance are somewhat suspect and warrant further scrutiny and investigation. For instance, would other researchers concur that the dependent variables used to purportedly measure generalizability, transfer, and maintenance, in fact appropriate for those purposes?

Nonetheless, the positive impact of the attribution training plus strategy training on the achievement responses of children with extreme negative motivation is particularly impressive. Strategy skills training has met with limited success in influencing self-initiation and use of learned strategies beyond the experimental condition (Englert, 1990; Mastropieri & Fulk, 1990; Swanson, 1990). Despite intervention, maintenance, transfer, and generalization of learned strategies has been poor (Gelzheiser, 1984). Groteluschen et al. (1990) conclude, "The

extensiveness of specific strategy knowledge does not appear to be a major determinant of generalization." Rather, motivation has been identified as a key variable in strategy training studies, successful in promoting effective self-regulated learning (Borkowski et al., 1988; Pintrich & De Groot, 1990). As already indicated, effort attributions (an index of motivational orientation), as well a metacognitive awareness were significantly positively influenced in Reid and Borkowski's (1987) study. The apparent positive impact that the attribution training plus strategy training had on promoting positive motivation and metacognitive awareness informs the development and potential benefit of future interventions. The importance of motivation to learning has been covered quite extensively thus far in this paper. Metacognition will now be briefly outlined to provide a possible explanation for the apparent superiority of attribution training plus strategy training over attribution training only interventions.

Efficient, independent use of strategies (behaviour identified in positively motivated individuals) is dependent on metacognition (Borkowski et al., 1989; Groteluschen et al., 1990). Metacognition is knowledge about cognition and regulation of cognition. "Knowledge about cognition concerns an individual's knowledge about his own cognitive resources and the compatibility between himself as a learner and the learning situation" (Wong, 1991a, p. 233). "The regulation of cognition concerns the self-regulatory mechanisms used by an active learner during an ongoing attempt to solve problems" (Wong, 1991a, p. 234). Groteluschen et al. (1990) contend that regulation of cognition, such as, choosing, applying, monitoring, assessing, and modifying strategies to match the situation at hand, is dependent upon general strategy knowledge. General strategy knowledge is "the understanding that effort is required to apply strategies and that well-chosen strategies improve performance" (Groteluschen et al., 1990, p. 83). General strategy knowledge is intimately related to the type of attributional beliefs

characteristic of positively motivated individuals (Butler, 1993; Dweck & Leggett, 1988).

And as described earlier, attributional beliefs influence how one feels about and deals with challenge (Dweck & Leggett, 1988). The Social-Cognitive Model of Motivation associates different attributional beliefs with different affect and behaviours. Descriptions of metacognition (Borkowski it al., 1990; Groteluschen et al., 1989) provide more indepth explanations of the relationship between effort attributions and the transfer, generalizability and maintenance of strategic behaviour. These descriptions propose that attributional beliefs influence how one feels about and deals with challenge because these feelings and experiences in turn feed back to cognitions and result in self-efficacy beliefs or the degree to which people believe they are capable of exercising control over events in their lives (Borkowski et al., 1989; Butler, 1993; Groteluschen et al., 1989). Self-efficacy beliefs are an aspect of self-concept (Damon & Hart, 1982). And, Damon and Hart (1982) suggest that self-concept, the beliefs a person has about their abilities and attractiveness, all form the foundation for self-esteem. Self-esteem, or the liking of one's self, in turn, has a direct impact on affect (Damon & Hart, 1982). It becomes apparent then that beliefs and understandings influence affect and actions, which in turn influence beliefs, affect, and actions and so on.

How does this all relate to motivation, strategic learning behaviour, and the effectiveness of interventions that combine strategy training and attribution training? Butler (1993, p. 14) provides a succinct explanation in her statement that "motivational beliefs, including perceptions of self-efficacy and attributions, both influence the cognitive activities engaged in during self-regulation and evolve through engagement in academic tasks." Based on this statement it becomes apparent that the combination of appropriate attributional beliefs and tasks engaged in enhance effective strategic learning behaviour. It follows then that

interventions that attend to both would potentially be more effective than interventions that attend to each separately. Attribution training plus strategy training interventions attend to both simultaneously. Furthermore, the intervention described (Reid & Borkowski, 1987) addresses previous expressed concerns that children be provided real opportunities to learn how to handle failure (Dweck 1975) and the opportunity to experience success as a result of strategic behaviour (Groteluschen et al., 1990).

Manipulating Goal Orientation

It is hypothesized, and research validates, that achievement goals are critical determinants of motivational orientations and their attendant achievement responses (Elliot & Dweck, 1988). Goal achievement theory suggests that goals influence motivational orientations and achievement responses because they create different frameworks for interpreting and responding to situations. Different goals evoke different concerns, different questions and attention to different information, which in turn influence individuals' cognitions, affect, and behaviors in achievement situations (Ames, 1992b; Dweck, 1975; Dweck, 1990; Elliot & Dweck, 1988).

In previous research, achievement goals have been described and manipulated in various ways (Lepper, 1988). In this paper, to maintain coherence, terms consistent with the Social-Cognitive Model of Motivation (Dweck & Leggett, 1988) will be used to discuss the goals associated with positive and negative achievement motivation. The terms positive motivation and learning goal will be used interchangeably, and *improving competence* will be used to describe a learning goal. Negative motivation and performance goal will be used interchangeably, and *proving competence* will be used to describe a performance goal.

Research manipulations of learning goal include focusing students' attention on the task (Salomon, 1989; Stipeck & Kowalski, 1989) and "making the value of increasing competence high" (Elliot & Dweck, 1988, p. 7). Manipulations of performance goal focus attention on the performance of the individual (Salomon, 1989; Stipeck & Kowalski, 1989) and make "the value of displaying competence high" (Elliot & Dweck, 1988, p. 7).

Benefits of promoting learning goals include promoting positive affect and application of effective strategies (Elliot & Dweck, 1988; Stipeck & Kowalski, 1989), expenditure of mental effort, and high quality task solutions (Salomon, 1989). For the cases cited, the goal orientations were manipulated merely by altering the instructions for assigned tasks.

For example, Elliot and Dweck (1988) conducted a study involving 101 grade 5 students from regular classrooms. Initially, all students received training on a pattern recognition task. The training continued until it was determined that all students had comparable competence with the task. Next, students were subjected to a series of test trials with the experimental task. These tests confirmed that all students performed the task equivalently.

Subjects were then distributed equally among four treatment conditions. "Feedback that the child's current skill level on the experimental task was either low or high was crossed with task instructions that highlighted the value of either a performance (look competent) or a learning (increase competence) goal" (Elliot & Dweck, 1988, p. 6). Students' perceptions about their ability on the experimental task were manipulated by predetermined feedback given by the tester. Students were randomly assigned to receive low or high ability feedback for three test trials. The purpose of the ability feedback which was randomly assigned, was to simulate either a success or failure experience. After providing the feedback, the first experimenter introduced the second experimenter and left the room.

The second experimenter (blind to children's ability conditions) was responsible for the goal manipulations. First, this experimenter presented the students with two boxes both containing the same experimental task but described differently. For the performance task, students were told that they would not learn new things but it would show the experimenter what children can do. In contrast, for the learning task it was suggested that students would probably learn lots of new things but confusion and mistakes might occur previous to that learning.

While all students were presented with the two boxes they were randomly assigned to the different goal manipulation conditions. The experimenter delivered the goal manipulations to the respective groups before allowing students to choose one of the boxes, just described to them. Students in the performance goal condition were told that their performance would be filmed for scrutiny by experts later. No filming was mentioned in the learning goal condition. Instead, children were told, "that the learning task might be a big help in school, because it 'sharpens the mind' and learning to do it well could help their studies" (Elliot & Dweck, 1988, p. 7). The performance goal condition was expected to make the value of displaying competence high. The learning goal condition was expected to make the value of increasing competence high.

Three dependent variables were measured, including task choice (learning or performance task box), effective application of trained strategies, and spontaneous verbalizations (attributions and affect) during the experimental task. As hypothesized, ability feedback did not predict task choice, but goal condition did. In the learning goal condition, 82% of subjects chose the learning box, while in the performance goal condition, 66% of subjects picked the performance box.

Through the training sessions and test of the experimental task, there were no significant differences in subjects' strategy effectiveness. Subsequent tests measured strategy effectiveness after ability feedback. In the learning goal

condition, both high and low ability feedback subjects showed improved strategy effectiveness over the course of the experimental trials. In the performance goal condition, however, low ability feedback subjects deteriorated in their strategy effectiveness.

Spontaneous verbalizations of students were content analyzed for attribution statements and statements of negative affect. In the performance goal condition, low ability feedback subjects made statements attributing difficulties to uncontrollable factors and expressed negative affect. Both of these responses are considered maladaptive (Battle, 1965; Dweck, 1975; Dweck & Leggett, 1988) and have been shown to interfere with learning (Borkowski et al., 1988; Dweck 1975; Fowler & Peterson, 1981; Licht & Kistner, 1986; Stipeck & Kowalski, 1989). In the learning goal condition, neither high or low ability feedback students made maladaptive attributions for failure or expressed negative affect. In other words, simulated failure in a performance goal condition negatively influenced students, whereas, simulated failure in a learning goal situation did not negatively effect students.

The strength of this research resides in its validation of goal theory of achievement of motivation, and more specifically of achievement goals as critical mediators of cognitive and affective achievement responses. Previous research has provided evidence that effort attributions are useful for predicting achievement motivation responses (Borkowski et al., 1988; Cain, 1990; Dweck & Smiley, 1994; Reid & Borkowski, 1987; Stipeck & Kowalski, 1989). Informed by these research findings, subsequent research has been conducted to effect changes in individuals' effort attributions in order to positively influence their achievement responses (Diener & Dweck, 1978; Dweck, 1975; Fowler & Peterson, 1981). If achievement goals, and not effort attributions are the critical mediators of cognitive and affective achievement responses, as indicated by the findings in Elliot &

Dweck's (1988) work, then it would appear that perhaps manipulating goals is an appropriate means for externally influencing positive achievement motivation and its attendant achievement responses in regular classrooms.

Salomon (1989) describes another goal manipulation study. This study involved 146 college students. Initially, all students were presented with two stories and asked to describe in writing, the moral they read in each. Two days later each student received a story problem under one of three experimental conditions. One condition was the control in which students were merely instructed to solve the problem as well as they could. There were also two conditions intended to induce different motivational orientations. The different orientation manipulations were accomplished by pairing the story problem with instructions embedded in one of two scenarios. One scenario appealed to the individual's sense of pride in a job well done (learning goal). The other scenario emphasized avoiding poor judgements on one's performance by one's peers (performance goal). Written samples of subjects' morals for the stories, and story problem solutions were collected and analyzed. Students also answered a questionnaire regarding their expenditure of mental effort and how they arrived at a solution, as well as what specifically motivated them toward that solution.

Subjects were similar across all three groups with respect to the morals they extracted from the initial two stories. However, differences emerged in other areas. In the learning goal condition 73% of the subjects solved the story problem correctly as compared to 16% in the performance goal condition, and 14% in the control group. The learning goal subjects also overwhelmingly indicated engaging in transfer to solve the experimental problem correctly. That is, comments regarding how the subjects arrived at problem solutions included statements of using previous experiences, including the moral stories encountered two days earlier. Such statements were negligible in the other two conditions. Subjects in

the learning goal condition also reported exerting significantly more mental effort than subjects in the performance goal condition or in the control group.

Finally, findings included significant positive correlations between mindfulness scores (how one arrived at the answer) and the quality of solution scores in the control and performance goal conditions but not in the learning goal group. The evidence suggests that certain individuals (positively motivated) may independently exert effort and be mindful in their problem solving approach. On the other hand, others (negatively motivated) will not necessarily do this independently, but are more likely to when conditions support such behaviour, for example when learning goals are endorsed. Salomon (1989) concludes, "under normal conditions, when no motivation to be particularly mindful in the search for a solution [exist], it is mainly the more mindfully inclined individuals who spontaneously engage in high road transfer. The others, it appears, go through the motions to satisfice the task requirements" (p. 8). He claims to have successfully induced different types of motivation (as indicated by the manipulations check built into the student questionnaire) and claims that it was "this difference in motivation that made a crucial difference" (Salomon, 1989, p.8) with respect to transfer. He goes on to say that the findings strongly suggest "a certain kind of motivation is crucial for high road transfer" (Salomon, 1989, p.8). Salomon induced motivational orientation conducive to transfer simply by the use of particular task instructions. This particular finding speaks to the value of explicitly articulating learning goals in regular classrooms.

Unfortunately the specific methodology used in the research described by Salomon (1989) is not appropriate for regular classrooms. While the instruction scenarios were appropriate for the contrived experimental situation, it is not realistic to consider developing similar instruction scenarios to accompany assignments students receive throughout their day in a regular classroom. At the

same time, it is conceivable that task instructions appropriate to regular classrooms could be designed. And, investigations into such appropriate instructions appear warranted considering the findings in this research.

Stipeck and Kowalski (1989) investigated whether instructions similar to those used to alleviate test anxiety could also relieve the typically maladaptive cognitions, affect and strategic behaviour of negatively motivated children confronted by difficulty. The study involved 110 fifth and sixth grade students from regular classes. Pre-treatment, students' effort orientations were assessed via a 10-item subset of questions from the Intellectual Achievement Responsibility (IAR) Questionnaire (Crandall, Katkovsky, & Crandall, 1965) which measures attributions for failure and has been used extensively as an indicator of motivational orientation (e.g., Diener & Dweck, 1978, 1980; Licht & Dweck, 1984). Answers are forced choice with one of the choices relating to effort and the other choice relating to aspects beyond the student's control (i.e. teacher bias, task difficulty or luck). This resulted in the assignment of 65 students to a high effort (positive motivation) group and 45 students to a low effort (negative motivation) group. Half of each of the high and low effort groups was randomly assigned to one of two treatments which offered either task oriented (learning goal) or performance oriented (performance goal) instructions for a computerized discrimination task.

All students did the same discrimination problems on the computer. The first three problems provided training in an effective problem-solving strategy. These were followed by four test problems that could not be solved and for which all subjects received only failure feedback. Before commencing the fourth computer task, students were given either task- or performance-oriented instructions. The instructions derived from the achievement goals of positively and negatively motivated children (Dweck & Leggett, 1988). For instance, the negative motivation goal of proving competence promotes concern about performance. Consequently,

task-orienting instructions were designed "to relieve anxiety about performance and to focus attention on the task." The instructions included such phrases as, "it doesn't matter how many you get right...these problems are kind of hard" (p. 387). The authors did not describe the exact nature of the performance-oriented instructions. It was also explained that the researcher was interested in what fifth and sixth graders think about when they work on problems, so both groups were asked to say out loud, whatever they were thinking while they worked. These comments were later content analyzed to compare affective and cognitive responses of high and low effort children to the task-orienting and performance-orienting instructions. The computer task was programmed to record and analyze students' moves on the test tasks thus facilitating comparison of their strategic behaviour.

Results indicated that low effort students used significantly more effective strategies in their attempts to solve the discrimination problems in the task-orientation condition than they did in the performance-orientation condition. Low effort students in the performance-orientation condition "expressed more negative affect or made more negative comments about their performance than other children" (Stipeck & Kowalski, 1989, p. 388). An interaction occurred between individuals' motivational orientations (inferred by their effort attributions) and the situational goal orientations. For negatively motivated (low effort) children, the learning goal situation, which focused students' attention on the task rather than their performance, influenced a more adaptive strategic learning response than did the performance-oriented situation. Negative affect and concerns about ability were also elicited in the performance-oriented condition.

Stipeck and Kowalski's findings (1989) are encouraging with respect to the potential for promoting positive achievement responses, specifically strategic problem solving. But, the specific instructions employed to promote this strategic

behaviour were unrealistic for a regular classroom. Students were told it didn't matter how many they got right and warned that the problems were likely too difficult for them. In a real classroom situation, it is unlikely that students would be purposefully assigned material way beyond their current level of competency. And, correct answers do matter. In school, correct answers are one measure by which teachers assess whether or not students are understanding the material being presented and judge when to increase difficulty levels. Realistically, the correctness of student responses is ultimately the basis for assessing students' development and reporting progress. This, however, does not negate the potential for designing classroom appropriate instructions that de-emphasize evaluation and focus attention away from student performance.

The computer task used for this study had no direct link with regular school content or curriculum. In exploring ways and means of fostering positive achievement motivation in school it is important to work with content relevant to everyday school experiences.

Stipeck and Kowalski's (1989) findings emphasize the importance of undertaking investigations into promoting positive achievement motivation in regular classrooms. The students in this study were not extreme in their beliefs about the role of effort in overcoming difficulty. They were designated high or low depending on their score out of 10 on the IAR. Those students scoring five or less were designated low, and those scoring six or greater were designated high. Those students with relatively less belief in effort than their classmates responded maladaptively to failure in the performance goal condition. Their previously demonstrated strategic problem-solving ability deteriorated and they experienced negative affect and expressed negative thoughts. This occurred under conditions similar in many ways to those of a regular classroom. These findings suggest that regular classroom conditions potentially influence maladaptive learning responses

in some students. Stipeck and Kowalski (1989) conclude that, "children who are not extreme in their beliefs but who put relatively less emphasis on effort can be debilitated in...some task contexts" (p. 389). Other research supports this contention (Anderman & Maehr, 1994; Maehr & Parker, 1993). These findings are disturbing as it is certainly not the intent of educators to undermine the learning of their students. On the other hand, the positive influences engendered by a learning goal manipulation emphasize the potential benefits of structuring regular classrooms as learning goal environments (Ames, 1992a).

What the goal manipulation research cited herein highlights, is the sensitive quality of the interactive nature between student characteristics and instructional methods, and the consequent impact on student's learning responses. For instance, negative motivational orientation does not have to be extreme in individuals to influence debilitating consequences when performance goals prevail (Elliot & Dweck, 1988; Salomon, 1989). On a positive note, relatively simple treatments appear effective in inducing adaptive learning responses associated with positive motivational orientation (Elliot & Dweck, 1988; Salomon, 1989; Stipeck & Kowalski, 1989). Simple alterations in instructional methods (i.e. framing instructions differently to emphasize learning goals) have been shown to influence higher quality problem solutions and greater expenditure of effort (Salomon, 1989) as well as effective strategic behaviour (Elliot & Dweck, 1988; Stipeck & Kowalski, 1989).

Might classrooms that explicitly endorse learning goals result in the development of positively motivated children? If so, this speaks to exposing children to learning goal classrooms early in their school careers and embedding learning goals across children's academic experiences to nurture positive achievement responses. With these goals in mind, further research was investigated to determine the potential for promoting positive achievement

motivation in a regular classroom, and locating appropriate measures for assessing motivation in young children.

Motivational Patterns in Young Children

Controversy exists as to whether or not the motivational patterns that have long been identified in children 10 and older are evident in young children. Recent research has found evidence of these patterns in children as young as 47 months (Dweck & Smiley, 1994).

In her study of the developmental relationship between motivation and cognition, Cain (1990) found evidence of the motivational orientations and concomitant responses in six year old children. The study involved 45 first grade children, 47 third grade children, and 47 fifth grade children. Two interview sessions were conducted with each child. During the first session, questions were asked about the child's conceptions of intelligence, and to tap into his or her understanding of ability and achievement. A baseline measure of children's picture puzzle ability was also established. During the second session, children worked on four puzzles. The first three were fixed so they could not be solved. All children solved the fourth. To assess children's preferences for easy or challenging tasks, they were asked which of the four puzzles they would like to work on again later. Next, they were asked a number of questions intended to assess their feelings both during their attempt to do the difficult puzzles and after successfully completing the fourth puzzle. Two attribution items assessed whether the children believed they could solve the difficult puzzles, given more time. The children first answered yes or no to whether they thought they could to this by trying hard. The second question asked whether they believed they could solve the difficult puzzles or whether they believed they could not solve the difficult puzzles

because they were just not good enough at puzzles. They were also asked about their expectations for successfully completing four more puzzles.

Initially, children were categorized according to whether they chose to work on a difficult puzzle (one they had not yet solved) or an easy puzzle (the one they had successfully completed). A difficult puzzle choice was interpreted as preference for challenging tasks and as such was considered to infer positive achievement motivation. An easy puzzle choice was interpreted as avoidance of challenge and as such was considered to infer negative achievement motivation. The responses on the interview questions and the hedonic ratings of children who chose easy puzzles were compared to those who chose hard puzzles. Children at all three grade levels displayed the cognitive, affective, and behaviour patterns typically associated with positive and negative achievement motivation. These findings indicate that these orientations do exist in young children. Furthermore, preference for a challenging or non-challenging task (the behavioural component of motivational orientation) reliably correlated with associated cognitive and affective components of positive and negative achievement motivation.

Dweck and Smiley (1994) conducted a study to enhance confidence in task preference as an indicator of motivational orientation. They did this to establish an index of motivational orientation applicable to young children. Traditionally, researchers investigating aspects of the Social-Cognitive Model of Motivation have relied on cognitive effort attributions as an indicator of motivational orientation. The measure most often used is a 10-item subset of the IAR. This measure has been used because the extent to which individuals believe they can overcome difficulty through effort reliably indicates motivational orientation. But, this questionnaire is inappropriate for young children because the questionnaire items refer to academic situations outside of the experience of young children and also because the readability is too advanced. Preference for challenging or non-challenging

tasks is another characteristic that distinguishes individuals with different motivational orientations (Cain, 1990). Establishing its reliability, potentially advances investigations of motivational orientation in young children.

Dweck and Smiley's (1994) study involved 78 children between the ages of 47 - 74 months. The format was very similar to Cain's (1990) study described above. It differed in three respects. First, it excluded the interview questions related to conceptions of intelligence and understandings of ability. Second, it involved two trials with the four puzzles and two opportunities for choosing to work on easy or difficult puzzles. Third, it incorporated an additional task to test the generality of subjects' tendency to seek or avoid challenge. Findings indicated a strong association between the two task preference measures. Furthermore, preference for easy or challenging tasks was a good predictor of both cognitive and affective components of achievement motivation (Dweck & Smiley, 1994).

Synthesis of Previous Research

Achievement goals are critical mediators of positive and negative motivational orientation (Elliot & Dweck 1988). Two types of motivation are distinguished by different achievement responses which in turn differentially influence learning (Dweck & Leggett, 1988). Children in regular classrooms range in their motivational orientations and corresponding predispositions toward more or less effective learning (Stipeck & Kowalski, 1989). But, motivational orientation and achievement situation conditions interact to influence achievement responses (Elliot & Dweck 1988; Salomon, 1989; Stipeck & Kowalski, 1989). One condition that exerts a powerful influence is the achievement goal suggested by the situation (Elliot & Dweck 1988; Salomon, 1989; Stipeck & Kowalski, 1989). Learning goals emphasizing improving competence are clearly more favourable in promoting effective learning than are performance goals emphasizing proving competence

(Elliot & Dweck 1988; Salomon, 1989; Stipeck & Kowalski, 1989). Meanwhile, schools are predominately performance goal oriented by nature (Anderman, & Maehr, 1994). Performance goal conditions are especially debilitating for performance goal oriented individuals (Elliot & Dweck, 1988; Stipeck & Kowalski, 1989) but also threaten to undermine the progress of learning goal oriented individuals (Elliot & Dweck, 1988). One other positive influence promoting effective learning is explicit information to the learner that effort appropriately applied promotes success (Borkowski et al., 1988; Reid & Borkowski, 1987). This condition is most influential when combined with the opportunity to experience success as a result of strategically based effort (Borkowski et al., 1988; Reid & Borkowski, 1987).

Four guiding findings emerge from the research: 1) achievement goals are critical mediators of motivational orientation, achievement responses and effective learning; 2) learning goal conditions bolster the propensity for positive achievement response; 3) a belief in effort as a contributor to improving competence underlies positive motivational orientation; and 4) providing strategies in well designed content lessons supports learning goal orientation.

Rationale for the Present Study

It was the intent of the present study to combine and apply the findings and practices from the research reviewed in order to develop a Motivation Instruction treatment and investigate the influence of this treatment on the achievement responses of primary aged children in a regular classroom. Furthermore, a goal of the present study was to design an intervention that could be easily and manageably interjected into regular class routine across content areas. An underlying assumption of that goal is that intervention of this type will not only promote the development of positive achievement motivation, but will also prevent

the development of negative achievement motivation in regular classes. The Motivation Instruction was tested in a regular classroom and compared to traditional instruction.

Research Hypotheses

Students' motivation orientation and learning were evaluated before, during, and after they participated in a series of math lessons with or without Motivation Instruction. Students in both conditions received seven scripted math lessons. The experimental group received the math lessons with the Motivation Instruction embedded in them (+M). The comparison group received the math lessons only (-M). Three dependent variables were used to test effects of the Motivation Instruction on students' achievement motivation orientation and learning. These included: 1) a behavioural measure of motivational orientation (Task Choice); 2) a combined cognitive, affective measure of motivational orientation (Motivational Orientation Questionnaire); and 3) an assessment of learning (Pattern Recognition Measure).

1. When comparing the behavioural component of achievement motivation, of children in the +M group with children in the -M group, as measured by Task Choice, the following results were expected: a) children in the +M group who chose a non-challenging task pre-treatment would change to a challenging task post-treatment; b) children in the +M group who chose a challenging task pre-treatment would again choose a challenging task post-treatment; and c) children in the -M group would duplicate their pre-treatment task choice post-treatment.

2. When comparing affective and cognitive components of achievement motivation, of children in the +M group with children in the -M group, across a series of math lessons, as measured by six questionnaire items regarding affect, attributions for failure, self-assessment of ability and expectations for future

success, it was expected that regardless of their pre-treatment assessed motivation: a) children in the +M group would become more positively motivated; and b) children in the -M group would maintain their pre-treatment assessed motivational orientation.

3. When comparing learning, pre- to post-treatment, as measured by changes in Pattern Recognition Scores, it was expected that, children taught in the +M group would demonstrate greater improvement in their Pattern Recognition Scores than children taught in the -M condition.

CHAPTER 3

METHOD

Participants

The participants were 38 public school students from three Grade 2 classrooms in the same suburban school. Students ranged in age from 86 to 97 months with a mean age of 91.34 months. Information describing the study and parental consent forms were sent home with all students in the Grade 2 classrooms (Appendix A). The school was situated in a predominantly white, middle class suburban neighbourhood. All of the children's first language was English. Those students who returned signed consent forms were included in the study. Students who did not return consent forms left with the regular classroom teacher when the experimenter arrived to conduct the sessions. Nineteen students were assigned to each of two treatment conditions: 1) math instruction minus motivation group (-M), and 2) math instruction plus motivation group (+M). Nine girls and 10 boys comprised the -M group and 8 girls and 11 boys comprised the +M group.

The researcher was a female teacher with 12 years elementary school experience. She has a Bachelor's of Education with a Major in Psychology as well as a B.C. professional teaching credential. She conducted all of the research sessions. The research was in partial fulfillment of a Master's of Arts degree in Curriculum and Instruction.

Materials

Math Lesson Instructional Materials

The math lessons used a hundreds chart to explore, identify, and extend patterns. During the whole group instruction for each lesson, the researcher used

the overhead projector extensively. Blank 10 X 10 grids and hundreds charts were projected to help students grasp the concepts being conveyed in the lessons. The procedure for the individual Math Lessons describes the specific materials for each lesson more fully.

Math Lesson Seatwork

Each session of math instruction included an individual seatwork activity. The math seatwork was designed to be challenging. This was done because it is in instances of challenge that the different learning response patterns of negatively and positively motivated children become most evident. And, the purpose of this study was to investigate the influence of the motivation instruction on children's learning responses. The seatwork related to the concepts and demonstrations covered in the math lesson instruction but in a slightly different way. In other words, it was not mere practice of what had been demonstrated, but rather, application to a related, but slightly different type of problem. All seatwork activities were developed by the experimenter using various mathematics resources. Descriptions of the seatwork for each lesson follow:

Lesson 1 Seatwork

A cut-up hundreds chart and a piece of construction paper with a blank 10 X 10 grid photocopied onto it was provided to each student (Appendix B). The student's task was to reconstruct and glue the cut-up hundreds chart on the construction paper grid. The purpose of this activity was to test student's familiarity with the hundreds chart and understanding of its nature.

Lesson 2 Seatwork

Each student was provided a folder of hundreds charts upon which to colour their observations of patterns (Appendix C). The purpose of this task was for

students to explore the hundreds chart and discover more and different patterns than were discovered during the whole group activity.

Lesson 3 Seatwork

Each student received a worksheet picturing a total of 40, two to five square, horizontal and vertical strips cut from a hundreds chart (Appendix D). These shapes were blank except for one numeral printed in one of the squares of each on the strips. The student's task was to supply the missing numerals that belonged in the other squares of the strips. The purpose of this activity was to reinforce and test students' understanding of the arrangement of numbers on a hundreds chart. Filling in the blanks on the horizontal strips required students to understand the counting concepts of minus and plus 1, and filling in the blanks on the vertical strips required students to understand the counting concepts of plus and minus 10.

Lesson 4 Seatwork

A worksheet picturing 20 complex puzzle pieces cut from a hundreds chart was provided to further reinforce and test students' understanding of the arrangement of numbers in a hundreds chart (Appendix E). These shapes required students to consider both vertical and horizontal counting patterns to complete each shape.

Lesson 5 Seatwork

A folder of hundreds charts and a list of tasks to complete was provided to each student (Appendix F). The first task involved colouring name patterns and supplying their respective corresponding skip counting patterns. This was accomplished by repeatedly printing a name, putting each of the letters of the name in the next square of the hundreds chart. Then each square on the hundreds chart containing the last letter of the name was coloured. Students then identified the counting pattern. The next task consisted of five incomplete number patterns. The first two to three numbers of the patterns were presented followed by a series of blanks and numbers. The student's task was to supply the numbers belonging

in the blanks and determine the counting pattern for each. These tasks tested students' ability to move beyond recognition of spatial patterns on the hundreds chart to their corresponding numerical skip counting patterns.

Lesson 6 Seatwork

Students were once again provided with folders of hundreds charts and task instructions (Appendix G). On the first four charts, their task was to colour skip counting patterns and record the numerical equivalent of the coloured pattern, as demonstrated in the lesson. The next five hundreds charts were each accompanied by specific instructions directing the children what to count by, and where to start. For instance, "Start at 4. Count by 7's", which was a departure from the lesson. The purpose of this seatwork was to test students' capability to extend the math lesson instruction.

Lesson 7 Seatwork

The purpose of the Lesson 7 worksheet was to test and extend students' understanding of the math pattern concepts encountered in the previous six lessons (Appendix H). The first three sections of the worksheet involved review. The first section required students to determine the counting patterns depicted on different coloured hundreds charts. Next, students were asked to colour and state the counting pattern corresponding to their name, and provide the first nine terms for that pattern. The third section of the worksheet depicted an array of 10 shapes similar to those encountered in the tasks for Lessons 3 and 4.

The next two sections involved numerical patterns. Six seven-term number patterns were presented. For each pattern students were asked to identify the counting pattern. The final task presented five incomplete numerical patterns. The children were advised what to count by, and asked to fill in the blanks to complete the patterns.

Dependent Measures

Three measures were administered pre- and post-treatment: 1) a behavioral measure of motivational orientation (Task Choice), 2) a math pattern recognition assessment (Pattern Recognition Measure), and 3) a combined cognitive and affective measure of motivational orientation (Motivational Orientation Questionnaire). The Motivational Orientation Questionnaire was also administered in Math Lessons 1, 3, 5, and 7

Task Choice

According to previous research, preference for a challenging or non-challenging task (a behavioral component of motivational orientation) indicates positive and negative motivational orientation in young children, aged four to eleven (Cain, 1990; Dweck & Smiley, 1994). The children in the present study were between 7 and 8 years old so Task Choice was determined to be an appropriate measure of motivational orientation.

In previous research children worked on four picture puzzles (Cain, 1990; Dweck & Smiley, 1994). The children were not aware that three of the puzzles were unsolvable. After success with the one, and failure on the remaining three, children were given opportunities to indicate which puzzles they would like to work on another time. Choice of a solved puzzle was interpreted as preference for non-challenging tasks and choice of an unsolved puzzle was interpreted as preference for challenging tasks. These sessions were conducted in individual interview sessions, one child to one researcher.

The whole class setting of the present study precluded using interview-based methods of measuring Task Choice. Consequently, a method applicable to a whole class situation was devised. This dependent measure was piloted first with six Grade 2 students, then altered, and piloted with an additional eight Grade 2

students. Originally, the researcher presented the students with a choice between working on a package of 'easy' or 'tricky' math pattern tasks. The students interpreted 'tricky' as playful, causing them not to treat the tasks seriously. For the second pilot the 'tricky' label was changed to 'hard'. This worked well and the change was retained for the study.

Pre- and post-treatment, students were given the opportunity to indicate their preference for working on easy or hard number pattern tasks by picking up an 'easy' or 'hard' package of tasks from piles set out in the classroom. All of the packages contained pattern recognition tasks of the same difficulty regardless of the label. The inferred motivational orientations derived with this measure were used to test the hypothesis that the two treatment conditions influenced individuals differently.

Reasons for the task choice were also collected. In a space provided on the outside of all Task Choice package, students wrote an open-ended explanation of why they chose an easy or hard package. This was included in the present study to monitor whether peer pressure or perceptions of what the researcher expected of them influenced students' choices, as opposed to reasons typical of differently motivated children: reasons that express preference for or avoidance of challenge. It was also thought that these responses might potentially serve the same purpose as the open-ended interview question about reason for task choice used in interview-based situations.

Questionnaires

Three different questionnaires were used in this study. All had the same item format and administration procedure. A modification of a five-point Likert scale was used for all three questionnaires. For each questionnaire item, a row of five circles of increasing size was pictured. The experimenter read a first person statement

followed by a range of responses. The size of the circle represented the extent to which a particular stem applied to an individual. The children were asked, "How much is this like you?" Response options ranged from 'not at all', for the smallest circle, to 'a lot" for the largest circle. Children responded to the item stem by colouring the circle corresponding to their response choice. Concern for the reading level of Grade 2 students led to the use of this format. It ensured that all students had equal opportunity to hear and understand each item.

Because these materials were developed for the present study they were piloted before commencement of the research. The first pilot involved six Grade 2 students. For this pilot, the questionnaires had the statements, expressed in the first person, printed above the response circles. This was problematic for two reasons: 1) the statements were beyond the reading ability of most of the students, and 2) students focused their attention on attempting to read rather than listening to the experimenter and became confused. The questionnaires were changed by removing the printed statements and only providing the response circles. This change was piloted with a second group of eight Grade 2 students. Students listened carefully which facilitated questionnaire completion. The changes were retained for the study.

Familiarization Questionnaire

This questionnaire consisted of two items designed to familiarize the children with the questionnaire format used throughout the study (Appendix I). The first item stem was, "When I get a special treat I feel...". The researcher elicited student responses by directing them to "Please mark the circle that tells how happy you feel when you get a special treat: not at all happy, a little bit happy, happy, quite happy or very happy." The other item stem on this questionnaire was "Doing number patterns I am...". The researcher directed students to "Please mark the circle that tells how good you think you are at number patterns: not at all good, a

little bit good, good, quite good, very good." The responses corresponded to circles of increasing size which students marked to indicate their choice.

Reason for Task Choice Questionnaire

The present study sought to develop a way to assess students' reasons for preference for challenge or avoidance of challenge that could be applied to whole class situations, as opposed to an interview situation. A two-item questionnaire was developed for this purpose. It queried children's reasons for choosing an easy or hard package of math tasks (Appendix J). In previous research, students were asked to tell the researcher why they made their choice (Cain, 1990; Dweck & Smiley, 1994). The reasons were recorded and later coded according to the extent to which they indicated a preference for challenge or avoidance of challenge. These were then used to assess the level of correspondence between individuals' reasons and their task choices to establish task choice as an indicator of motivational orientation. In previous research, the correspondence was high. The two items used in this study were: 1) "I chose this envelope so I could get all the answers right.", and 2) "I chose this envelope because I like to work hard to figure out the ones I get stuck on." For each item, students indicated, "For me this is: not at all important to very important", by filling in response circles of varying sizes. Students also ranked these two items according to their perceived order of importance. No hypotheses was generated specific to this measure. It was included in the present study for exploratory purposes, namely, to examine whether this was a useful way to capture students' reasons for their task choices in a whole group situation. More specifically, the intent was to examine the extent to which the first reason to 'get all the answers right' correlated with easy Task Choices and the second reason 'to work hard to figure out the ones I get stuck on' correlated with hard Task Choices. The questionnaire was included in the present study but not analyzed.

Motivational Orientation Questionnaire

The purpose to the Motivational Orientation Questionnaire (MOQ) was to provide a measure that could be used to analyze the effect of motivation instruction on students' motivational orientation over the course of the study. A number of considerations led to the develop of the MOQ (Appendix K). First and foremost, in order to analyze the effect of the treatment on motivational orientation across sessions a continuous measure was sought. While Task Choice is a primary indicator of motivational orientation in young children (Cain, 1990; Dweck & Smiley, 1994), it is a categorical measure. Also, preference for challenging or non-challenging tasks only assesses the behavioural component of motivational orientation. There are also important affective and cognitive indicators of motivational orientation that the study sought to assess..

The search for an appropriate measure led to an examination of a ten-item subset of the Intellectual Achievement Responsibility Scale (IAR) that has been used extensively in previous research to identify motivational orientation in older children (Diener & Dweck, 1978, 1980; Licht & Dweck, 1984; Stipeck & Kowalski, 1989). It consists of ten hypothetical item stems regarding reasons for failure on academic achievement tasks. Answers are forced choice with one of the choices relating to effort and the other choice relating to aspects beyond the student's control, i.e. teacher bias, task difficulty or luck. Upon investigation, this measure was deemed inappropriate for Grade 2 children for two reasons. First, the item stems refer to academic situations outside of the experience of Grade 2 children and, the readability was too advanced. Furthermore, the 10-item questionnaire concentrates only on individuals' attributions for academic failure. So, even modifying it would not provide assessment of other important cognitive indicators of motivational orientation nor affective indicators. This study sought to measure the whole constellation of different behavioural, cognitive, and affective components

that differentiate negatively and positively motivated children. The aim was to thoroughly assess treatment effects on a wide range of components, and, to bolster confidence that motivational orientation was being measured.

The solution was to develop a measurement tool. A six-item questionnaire was developed for use in a whole group format with young children based on interview questions previously used successfully with young children (Cain, 1990; Dweck & Smiley, 1994).. A variety of questionnaire items were used rather than concentrating solely on individual's attributions for academic failure. The six items measured affective and cognitive components of motivational orientation. The cognitive items included self-evaluation of math ability, self-evaluation of expectations of future success on math tasks, and two items regarding attributions for failure. Two other items pertained to affective responses to the math activities. The specific individual items follow:

a) Self-evaluation of math ability

Doing number patterns (or hundreds chart activities) I am... not so good to very good.

b) Expectations of future success on math tasks

Next time I do a number pattern (or hundreds chart) activity I will do...not so well to very well.

c) Attributions for failure

1) If I had lots of time...I could get the hard ones if I tried my very hardest. This is like me...a tiny bit to a lot.

2) If I had lots of time...I still couldn't get the hard ones because I'm just not good enough at patterns. This is like me...a tiny bit to a lot.

d) Affect

1) I think this activity was...not so good to very good.

2) When I was doing this activity I was feeling...not so good to very good.

Each of the six items was scored on a five-point Likert scale for a possible item score of between one and five. Scores on the six items were combined to provide a Motivational Orientation score of between five and thirty. Higher overall scores indicated relative positive motivation and lower overall values indicated relative negative motivation. For the second attribution item, the value of the different sized circles was reversed so that the small circle was scored as five and the large circle was scored as one. This was done to maintain consistency in the wording of the stems and the students' marking of the questionnaire, as well as a consistent scoring scheme. For this item, a high score meant that the student did not ascribe to the belief that their failure was due to the fact that they weren't good enough. And, this belief is consistent with that of a positively motivated individual. The questionnaire was administered six times: pre- and post-treatment and after the Math Lessons 1, 3, 5, and 7.

Pattern Recognition Measure

The number of correct answers on ten mathematical pattern recognition tasks (Appendix L) was used to determine individuals' pattern recognition scores. This measure was administered pre- and post-treatment to assess the effect of the different treatments on the children's math pattern learning. The difference between individuals' pre-treatment and post-treatment scores was considered to represent math pattern learning over the course of the study.

The pattern recognition tasks consisted of ten different incomplete number patterns presented on separate illustrated pages. Completion of the pages required students to recognize a mathematical pattern. Task difficulty increased from page to page as the solutions involved recognition of one or more patterns involving addition and/or subtraction. The 10 pages had a total of 21 blanks. Scores were calculated according to correctly filled in blanks.

These tasks have been used in research investigating individual differences in learning (Kanevsky, 1994; 1995). They were designed so the first ones could be done independently but increased in difficulty. Previous research determined that although they became very challenging, with instruction, Grade 2 students were capable of doing them. Grade 2 students also found them enjoyable.

One of the foci of the present study was the influence of the treatment on students' learning response to challenge, and, more specifically, whether the motivation instruction would influence students to apply pervious skills and knowledge to solve a challenge. The math lessons used in the present study did not specifically provide instruction about how to do the pattern recognition tasks. They pertained to math patterns generally, using the hundreds chart to explore, identify, and extend patterns. Thus, rather than teaching to a test to assess learning, this study sought to see if students' developing understanding about math patterns, derived through experiences with math pattern activities, would be applied to the pattern recognition tasks.

Procedure

The study consisted of a total of nine whole group, in-class sessions. Each session was approximately 45 minutes in duration. All sessions were conducted by the experimenter and schedules for the research sessions were coordinated with the regular classroom teachers. Table 3.1 provides an overview of the administration format, dependent measures, and classroom time to conduct the research.

There were three phases to the study: pre-treatment (one session), treatment (seven sessions), and post-treatment (one session). During the pre-treatment phase, the Task Choice, MOQ, and Pattern Recognition Measure were administered.

Table 3.1. Summary of sessions, administration format, dependent measures, and classroom time to conduct the proposed study.

Task	Session	Administration Format	Time for each Task or Lesson Instruction (minutes)	Total Length of Each Session (minutes)	Purpose of Observation or Measurement
Familiarization Questionnaire	pre-	individual activity in whole group session	5		familiarize students with questionnaire format
Task Choice and Reasons for Choice	pre-	individual activity in whole group session	15		initial primary index of achievement motivation orientation
Pattern Recognition Ability Measure	pre-	individual activity in whole group session	15		baseline measure of pattern recognition ability
Motivation Orientation Questionnaire	pre-	individual activity in whole group session	15		complementary measures of cognitive and affective components of motivational orientation
				50	
Math Lesson Instruction	Lessons 1,2,3,4, 5,6,7,	whole group session	15		
Math Lesson Seatwork	Lessons 1,2,3,4, 5,6,7,	individual activity in whole group session	15		to provide challenge and test and extend individuals' understanding of material presented in lessons
Motivation Orientation Questionnaire	Lessons 1,3,5,7	individual activity in whole group session	15		to assess changes in complementary measures of cognitive and affective components of motivational orientation
				30 - 45	
Task Choice and Reasons for Choice	post-	individual activity in whole group session	15		to assess changes in primary index of achievement motivation orientation
Pattern Recognition Ability Measure	post-	individual activity in whole group session	15		to assess changes in competence with the pattern recognition task
Motivation Orientation Questionnaire	post-	individual activity in whole group session	15		to assess changes in complementary measures of cognitive and affective components of motivational orientation
				45	
			TOTAL	395	

Both groups then received a series of seven math pattern strategy lessons in the treatment phase. Each math lesson involved math instruction and individual paper and pencil seatwork. The seatwork was intended to extend students' understanding of the material covered in the lesson. The math lessons were scripted to ensure consistency across both conditions. These two conditions differed in that the -M condition received the series of math lessons only and the +M condition received the series of math lessons plus additional instruction intended to promote positive motivational orientation. Both groups also received the MOQ in the Math Lessons 1, 3, 5, and 7.

During the post-treatment phase, the Task Choice, MOQ, and Pattern Recognition Measure were administered again.

The +M group was conducted first to avoid the potential confounding variable of positive experimental results being a consequence of the experimenter's improved execution of the lessons due to practice. The class that returned 19 consent forms became the +M group because the consent forms were returned so promptly and the class was ready to start first. The nine sessions were conducted over a two week period.

The -M group was conducted in the two weeks following the +M group. The sessions were conducted in the class of the 14 children who returned consent forms. The other five children from the third Grade 2 classroom came to that class for the sessions.

The pre-treatment, treatment and post-treatment procedures are described below.

Pre-treatment phase

The experimenter was introduced to each of the classes by their respective teachers as a student from Simon Fraser University interested in studying children's learning. The researcher advised students that she would be

conducting a series of math lessons as well as asking the children questions about the lessons. She told them that their participation in the study was voluntary and provided them the opportunity to remain in the room and participate, or join the regular classroom teacher out of the classroom.

The researcher began the pre-treatment session with the Familiarization Questionnaire in order to acquaint students with the questionnaire format used throughout this study. The researcher introduced the questionnaire by saying, "In the time that I spend with you we are going to do all sorts of activities together. I'm trying to figure out the best way to work with children. So...I'm asking kids...you! all sorts of questions to help me figure out how children think. I have a special way of asking questions. I'll show it to you now".

To facilitate accurate completion of this questionnaire and all subsequent questionnaires, the administration format was very structured. First, students were instructed to place their rulers under the appropriate row of circles while the experimenter read the item stem and response options. Next, the experimenter repeated the item stem and possible responses and directed students to mark the circle that best fit the response appropriate for them. When it was determined that everyone had finished that item, the experimenter proceeded with the next item.

Next, two pattern recognition task examples were presented to the students (Appendix M). Each consisted of an incomplete number pattern of the type students would eventually be asked to do independently. Exposure to the two examples provided a practice opportunity (Cain, 1990; Dweck, 1975; Dweck & Smiley, 1994; Stipeck & Kowalski, 1989). Students received an example and it was also projected on a screen. The first task was too difficult for the students to complete in the time allowed. The experimenter guided the children to the pattern solution by demonstrating on the overhead.

The purpose of doing this was to create a sense of challenge as well as to provide the children with the experience of successfully completing the task. The second example was fairly simple, allowing the students to successfully complete the pattern independently. The purpose of the second was to give the children the impression that they were capable of doing this type of task independently.

Task Choice was administered next. The experimenter said, "One thing I know about kids is they don't all like the same things. Some children would prefer to do easy number patterns while some children would prefer to do hard number patterns. Think about which you would prefer to do and when I call your name, you may choose an "easy" package or a "hard" package." Task Choice packages designated "easy" and "hard" were placed in different spots in the room. The children were then allowed to go pick up the package of their choice.

Everyone was asked to return to their desk with their package closed. Once all the children had the envelope of their choice in hand, they were asked to print their name in the appropriate spot, and write why they made their choice. A space was provided on the outside of the envelope for this purpose. The experimenter assured the children that they did not have to worry about their spelling because she was "very good at reading Grade 2 writing".

Next, the Reason for Task Choice Questionnaire was distributed. The experimenter introduced this questionnaire saying, "I want to know more about your choices. Other times, children have said things like, 'I chose this one so I could get all the answers right" and other kids said, 'I chose this one because I like to work hard to figure out the ones I get stuck on'".

The experimenter asked the children to indicate "Which is most important to you, and which is next?" They were instructed to place a 1 in the box corresponding to the reason most important to them. Once their reasons were

ranked, the children also indicated how important each of the reasons was to them on a five-point Likert scale, in the manner described earlier.

Upon completion of this questionnaire, the students opened their envelopes and proceeded with the Pattern Recognition Measure. The measure was administered in a whole group session with each child working independently. The tasks were introduced with the experimenter saying, "I gave these to you to help me figure out what the whole class does and doesn't know about number patterns. That will help me decide how to make the best lessons for everyone. So, all I ask of you is that you do the best you can."

The pattern recognition task pages were stapled together as a booklet. The pages were arranged in order of difficulty but students were not instructed how to do them. In addition to the task pages, scrap paper and hundreds charts were included in the envelopes. Twelve minutes were allotted for this task. Students' pre-treatment performance on the tasks provided the baseline assessment of their pattern recognition skill.

The MOQ was administered after the Pattern Recognition Measure. The items provided self-evaluations of students' pattern ability, their expectations for success on future pattern activities, and their attributions for failure, as well as two items to assess their affect.

Treatment phase

Both treatment groups. -M and +M received the seven scripted math lessons during the treatment phase. In mathematics, patterns are of fundamental importance to building sound mathematical understanding (Burton, Clements, Coburn, Grande, Firkins, Joyner, Leiva, Linquist, & Morrow, 1992). According to the National Research Council Committee report on the Mathematical Sciences in the Year 2000 (1989, p.8), "Working with patterns nurtures the kind of mathematical

thinking that empowers children to solve problems confidently and relate new situations to previous experiences." The report goes on to say, "Second grade is an ideal time to begin making connections between concrete or pictorial patterns and numerical patterns" (p. 13). Consequently, math pattern instruction was chosen for it's meaningful content and because of its particular relevance to the Grade 2 curriculum.

A series of seven math lessons were developed. The math lessons used the hundreds chart to explore, identify, and extend patterns. The series began by providing experiences to familiarize students with the arrangement of numbers on a hundreds chart. This arrangement was further explored to promote the identification of patterns on the hundreds chart. This began with the recognition of such elementary patterns as all of the squares in the left hand column end in 1. The students practiced identifying and describing such patterns. Next, the lessons advanced to investigating the counting patterns plus and minus 1 and plus and minus 10 by considering the arrangement of numbers in horizontal rows or vertical columns. Then, other counting patterns, based on multiples of a number were investigated on the hundreds chart. First, spatial patterns were created by colouring the squares corresponding to the multiples. Eventually, relationships between the spatial patterns and their corresponding number patterns were explored. Each math lesson consisted of instruction followed by an individual paper and pencil seatwork activity to assess students' progress and response to challenge. After the seatwork activity in Math Lesson Sessions 1, 3, 5, and 7, the children completed the MOQ. See Appendix N for math lesson scripts.

-M Condition

The students involved in the -M group received the seven scripted math pattern strategy lessons:

Math Lesson 1

Lesson 1 was an exploration of the "hundreds chart". The purpose of this lesson was to familiarize students with the hundreds chart. Each student was provided with a blank 10 X 10 grid (Appendix O). The experimenter guided the children to fill in the numerals 1 to 100 using a similar grid on an overhead projector. Next, the students reconstructed a cut up hundreds chart to reinforce their familiarity with the hundreds chart. Twenty minutes was allowed for this task. All students then completed the MOQ.

Math Lesson 2

The purpose of Lesson 2 was to identify patterns occurring in the arrangement of numbers found in the hundreds chart. The experimenter projected a hundreds chart (Appendix P) with the overhead and asked students to describe any patterns they saw. Each student observation was demonstrated on the overhead.

Next, students were assigned the task of colouring spatial patterns of their own choosing in a folder of hundreds charts. Twenty minutes was allotted for the task. Ten minutes at the end of the class was spent sharing students' observations and discoveries.

Math Lesson 3

Lesson 3 introduced counting patterns on the hundreds chart. Using the overhead projector, the experimenter projected hundreds charts with horizontal and vertical strips of two blank squares (Appendix Q). Students were asked to determine which numbers were missing. First horizontal strips were used to emphasize the counting patterns plus and minus one. Next, vertical strips were used to emphasize the counting patterns plus and minus ten. The experimenter

created the emphasis by directing students which square to start on to determine the missing number. For instance, starting at 16 requires a computation of plus 1 to figure out a blank to the right, minus 1 to figure out a blank to the left, plus 10 to figure out a blank below, and minus 10 to figure out a blank above.

Students were provided a worksheet with 40, two to five square strips cut from a hundreds chart. Students were required to determine the number needed in the one blank square of each strip. Fifteen minutes were allotted for this task. All students then completed the MOQ.

Math Lesson 4

Lesson 4 reinforced students' understanding of counting patterns on the hundreds chart. Using the overhead projector, the experimenter projected a hundreds chart with a puzzle piece of blank squares (Appendix R). Students were asked to tell which numbers were missing. The lesson proceeded in a fashion similar to Lesson 3 although the shapes were more complex. Because of the nature of the shapes, the counting concepts plus and minus 1 and 10 were reviewed concurrently.

Students were provided a worksheet with 20, complex puzzle pieces cut from a hundreds chart. Students were required to determine the numbers needed in the one to four blank squares of each shape. This reinforced and tested their understanding of the arrangement of numbers in a hundreds chart because it required students to consider the counting concepts plus and minus 1 and 10 for each shape. Fifteen minutes were allotted for this task.

Math Lesson 5

Lesson 5 introduced "skip counting" patterns on a hundreds chart (e.g. counting by multiples of a number). The purpose of this lesson was to have children recognize and describe spatial patterns in a hundreds chart. The experimenter demonstrated colouring a skip counting pattern on the on the

overhead projector hundreds chart (Appendix S). Then the experimenter demonstrated describing the pattern spatially (counting by threes creates a diagonal line of coloured squares). Students were then called upon to suggest another skip counting pattern. The children were provided with paper hundreds charts so that the experimenter and children could simultaneously color the suggested pattern.

Finally, the experimenter presented a pattern saying that her friend "Kim" wrote her name repeatedly and then coloured in each square containing the last letter of her name. Having chosen a name that corresponded with the first skip pattern demonstrated (three), the experimenter prompted the children to notice the relationship.

Students were provided folders of hundreds charts and directions to colour name patterns and determine their corresponding counting patterns, and complete patterns and determine their counting patterns. Fifteen minutes were allotted for this task. All students then completed the MOQ.

Math Lesson 6

Lesson 6 continued to explore "skip counting" patterns on a hundreds chart. The purposes of this lesson were to have children recognize and record the number relationships in mathematical skip counting patterns originally represented spatially on a hundreds chart and understand the correspondence between spatial and mathematical skip counting patterns.

The experimenter demonstrated a three step process which involved labeling the skip counting pattern, colouring it on a hundreds chart, and recording the numbers comprising the pattern (Appendix T). Recording the numbers of the pattern involved recognizing relationships in the numbers.

Students were assigned an individual paper and pencil activity to assess their understanding of spatial and mathematical patterns in a hundreds chart. Fifteen minutes were allotted for this task.

Math Lesson 7

Lesson 7 was a review session. The children brainstormed to list all of the activities of previous lessons. Teacher recorded these on the blackboard. This was intended to jog students' memories before they began a worksheet providing review activities, as well as extensions, of what had been done thus far. Fifteen minutes were allotted for the math work sheet. All students then completed the MOQ.

+M Condition

The +M group received the seven scripted math pattern strategy lessons plus additional instruction intended to promote positive motivation to learn (Motivation Instruction). The Motivation Instruction focused on: 1) information about the nature of learning (Nature of Learning), 2) valuing learning (Valuing Learning), and 3) attribution training to assist students to effectively apply effort in the pursuit of learning (Attribution Training). These three interrelated elements were used to encourage children to adopt the characteristics typical of individuals with a positive motivation to learn. These individuals are aware of the nature of learning, they adopt a goal of improving their competence and, they believe success is derived from effort which, in turn leads them to effectively apply previously acquired knowledge and strategies to new situations (Dweck, 1975; 1989; 1991).

All three elements of the Motivation Instruction were introduced in Math Lesson 1. References and reminders of the various elements were used frequently throughout the subsequent math lessons. The details of how the elements of the Motivation Instruction were embedded into the various Math Lessons are elaborated in the scripts for the math lessons (Appendix N).

Each of the three elements of the Motivation Instruction will be described in detail below.

Nature of Learning

The experimenter began Lesson 1 with a description of her experience and understanding of learning, to promote awareness regarding the nature of learning. The following were essential aspects of the message: learning is sometimes uncomfortable; learning often requires hard work; effort appropriately applied promotes learning (i.e. using strategies and plans effortfully); mistakes are a natural consequence of the learning process; persistence and practice lead to learning; and everyone learns in their own way and at their own rate.

To make this more salient to the children, the experimenter prompted them to recall their experiences of learning to print their names. The experimenter again emphasized the need for practice, that many mistakes were made along the way, and that sometimes it felt particularly difficult and confusing, but that eventually, they learned to print their names. The Nature of Learning was summed up in the statement, "It often takes lots of hard work and lots of tries and lots of time and lots of mistakes before something is learned." This statement, introduced in the first session, was articulated frequently during the course the seven math lessons and during the students' independent seatwork to promote students' awareness of the nature of learning. The emphasis on Nature of Learning was intended to interfere with maladaptive interpretations of what difficulty in the pursuit of learning means.

Valuing Learning

The experimenter introduced Valuing Learning by stating, "What is important when you're working with me is that you don't give up and that you practice so you learn". She continued with, "What I want for you is to learn". Both of these statements explicitly demonstrated her valuing learning and conveyed that her goal for the children was that they learn. The purpose of Valuing Learning was to

make the goal of improving competence salient in this classroom (Ames, 1992a). Explicitly articulating such a goal is one way to influence adaptive achievement response. This is based on Ames recommendation to "make different goals salient and consequently affect how students think about themselves, their tasks, and others" (1992a, p.261). For positively oriented children, it was expected that Valuing Learning would reinforce adaptive achievement response. It was expected that making a learning goal salient would interfere with the negatively motivated individuals' typical goal, interpretation of, and maladaptive response toward the achievement situation.

Valuing learning was reinforced throughout the math lessons in the experimenter's statements. These would be made when the experimenter suspected children were experiencing some difficulty. For each math lesson, the seatwork was introduced with the statement, "This seatwork gives you a chance to practice and help you learn".

Attribution Training

Attribution Training was used to promote awareness that learning results from one's own efforts appropriately applied, and to assist students to appropriately apply effort in pursuit of learning. Students were not merely directed to try harder when they made mistakes, or advised that in order to learn, they needed to try hard. Instead, they were told that effort plays an important role in learning, but plans and strategies are also important. Additionally, they were instructed in a particular strategy for overcoming difficulty. A modified version of the attribution training established and tested by Borkowski et al. (1988) constituted the Attribution Training.

The introduction of the Attribution Training followed naturally from the Nature of Learning and Valuing Learning. The experimenter began to describe her experience of learning: "Sometimes when I'm learning, I'll try to do something and

I'll think, 'What! I don't get this! This is too difficult! Forget it!' Then a little voice inside of me says, 'You can't learn that way'. So I take a deep breath and tell myself, 'Okay, okay, I can learn this'".

The experimenter continued in this fashion to reveal the four parts of a strategy (self-attribution strategy) intended to assist students to appropriately apply effort in the pursuit of learning. The four parts were, 1) I can learn, 2) Where to start?, 3) What do I already know?, and 4) Help?. She created a poster illustrating these key points of the self-attribution strategy as they arose (Appendix U). The strategy was referred to as "good" or "helpful learning behaviour" and the poster depicted the "good learning reminders".

The poster consisted of four panels. Each included a symbolic stick figure of a thinking student at a desk with a thought bubble over its head. Words in the thought bubbles and other markings on each panel were minimal. The text was confined to elements intended to jog students' memories about the specific details of the four parts of the self-attribution strategy. The poster was created by the experimenter during the introduction of the attribution training for greater effectiveness as a memory aid later.

The first panel read, "I can learn!" This panel reminded students that being stuck or confronted with difficulty merely indicates an opportunity to learn. To draw on the students' experience the experimenter presented the example of learning to print their own name. The point was made that at first this was a difficult task, but over time, and with practice it became virtually effortless.

The second panel asked, "Where to start?" It showed a circular maze with a bright light bulb in the center. The experimenter asked students to think about how it often takes several attempted routes before a maze is successfully completed. This was intended to make salient the understanding that often success often

involves several false starts. In a sense, this panel exemplified the adage, "If at first you don't succeed, try, try again".

The third panel, asked "What do I already know?" These words were accompanied by three nickels and 5, 10, 15. These related to a scenario the experimenter told about a child she was teaching who was having difficulty counting by fives until he realized it was 'like counting nickels'. This part of the self-attribution strategy explicitly encouraged students to apply previous skills and knowledge to the task at hand. Furthermore, at this stage, the experimenter used directional arrows from the second to third panel and back to the second panel to point out that sometime learning requires several starts using different sets of previous knowledge.

Finally, the experimenter acknowledged, "Other times, after talking to myself like this, and trying long and hard, I still just don't get it". She asked students for their suggestions of where to go for help if this happened to them. The final panel asked, "Help?" and included simple drawings representing the children's suggestions. The drawings depicted classmates, the teacher, a computer, the library, etc.

Throughout the remaining six math lessons, the experimenter used verbal prompts to encourage students to use the self-attribution strategy when stuck, and reminded them about the poster if they needed guidance with the specific steps of the strategy. Reinforcement prompts included, "If you get stuck, are you going to give up?" [no, because everyone can learn] and "What can you use to help you?" [the self-attribution strategy; the poster].

Finally, the experimenter reinforced the attribution training through modeling. While demonstrating an activity to the class the experimenter intentionally erred. She then proceeded to model and correctly complete the demonstration by

referring to the poster and employing the steps of the strategy. She thought out loud so the students were involved in the process.

Post-treatment phase

The same instructions and instruments used in the pre-treatment session were used in the post-treatment session. This session commenced with students choosing easy or hard task choice envelopes. Students wrote their reasons for choosing their envelope and completed the task choice reason questionnaire. Next, twelve minutes were allotted for students to work on the pattern recognition tasks contained in the envelopes. Finally, everyone completed the MOQ.

CHAPTER 4

RESULTS

The analyses in this chapter are reported according to the order in which they were conducted. First, the appropriate analysis of variance was determined. Next, the equivalence of the +M and -M groups was established. Finally, the hypotheses, as presented in Chapter 2, were tested. The independent variable was the treatment with two group conditions: inclusion of or absence of Motivation Instruction. Data analysis were conducted on the three dependent measures described in Chapter 3: (1) the behavioural measure of motivational orientation (Task Choice); (2) the combined affective and cognitive measure of motivational orientation (MOQ); and (3) the Pattern Recognition Measure.

Determining Appropriate Analysis of Variance

In order to determine if multivariate analysis of variance (MANOVA) was an appropriate strategy for determining the equivalence of the groups, a Pearson product-moment correlation coefficient was calculated between the MOQ and Pattern Recognition Measure for both groups. This test revealed no significant correlation between these two variables at pre-treatment, ($r = .09$), and post-treatment, ($r = .30$). Because these dependent variables were not correlated, it was determined that an analysis of variance (ANOVA) was the appropriate procedure (Tabachnick & Fidell, 1989) for determining the equivalence of the groups with respect to the MOQ and Pattern Recognition scores.

Establishing the Equivalence of the Groups

Two one-way ANOVA's were conducted to determine the equivalence of the two groups pre-treatment. The ANOVA's were performed on the two pre-treatment dependent variables: MOQ and Pattern Recognition scores, with the independent variable, treatment group: -M or +M. These analyses revealed that the students in the two groups did not differ significantly in MOQ $F(1) = 1.16$, $p=.29$ or Pattern Recognition scores, $F(1) = 1.8$, $p=.19$ pre-treatment. Based on these findings, it was deemed appropriate to perform additional statistical analyses to examine the effects of the +M condition (Hays, 1988).

Behavioral Component of Motivational Orientation

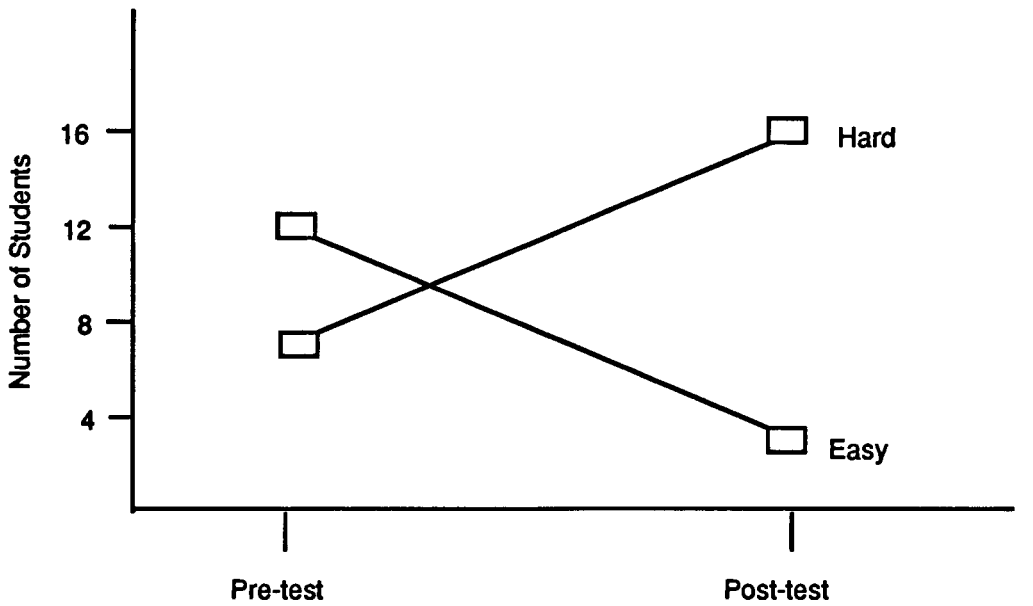
It had been hypothesized that: a) children in the +M group who chose a non-challenging task pre-treatment would choose a challenging task post-treatment, b) children in the +M group who chose a challenging task pre-treatment would again choose a challenging task post-treatment and c) children in the -M group would duplicate their pre-treatment task choice post-treatment. Preference for challenging or non-challenging tasks is considered to be the primary index of motivational orientation for young children (Cain, 1990; Dweck & Smiley, 1994).

The McNemar repeated measures chi-square was used to test this hypothesis. This test was chosen because it is a simple straight-forward test of change sensitive to small numbers of cases (Tabachnick & Fidell, 1989). A binomial distribution was used to compute probability because these groups involved less than 25 cases.

McNemar's repeated measures chi-square revealed a significant change pre- to post-treatment for the +M group, $\chi^2 = 5.8$, $df = 1$, $p = .01$, and no significant pre- to post-treatment change for the -M group, $\chi^2 = .17$, $df = 1$, $p = .69$. These results supported the hypothesis. In the +M group, 10 of the 12 children who initially

chose an easy task changed to a preference for a hard choice in the final session. Only 2 of 8 children in the -M group made a similar change. This finding, then, strongly suggests that the +M condition influenced children's motivational orientation in a positive direction. The children in this group became more inclined to pursue challenge.

Figure 4.1. Pre-treatment versus post-treatment task choices for the experimental group.



Cognitive and Affective Components of Motivational Orientation Across Sessions

The second hypothesis predicted that scores on the six-item motivational orientation questionnaire would increase over the course of the lessons for children taught in the +M condition but would remain the same for children taught in the -M condition. The six items included self-evaluation of ability, self-evaluation of expectations of future success, two items regarding attributions for failure, and two items regarding affect. The six items were combined to provide an MOQ score,

so that higher values related to positive motivation and lower values related to negative motivation. First, the results of a repeated measures MANOVA will be presented. This will be followed by *t* test analyses used to determine the specifics of results revealed by the MANOVA. Next a figural version of the analysis will be presented.

To statistically assess effects of the +M condition across sessions, a 2 X 6 (group X session) repeated measures MANOVA was conducted on participants' scores on the MOQ administered across the series of math lessons, pre-treatment, in Lessons 1, 3, 5, 7, and post-treatment (Tabachnick & Fidell, 1989).

The MANOVA revealed no significant between subjects group effect, $F(1,36) = 2.01$, $p = .17$. This comparison of the +M and -M group means suggested that the +M condition did not significantly effect students' motivational orientation.

The within subjects main effect for time was also not significant, $F(5,32) = 1.58$, $p = .19$, suggesting that there was no change in students' scores each time the MOQ was administered.

The within subjects group by time interaction effect was statistically detectable at $F(5,32) = 2.43$, $p = .056$. This finding indicated different patterns of change on the six MOQ scores for the two groups and as such, supported the hypothesis. These findings are displayed in Table 4.1.

Table 4.1. Summary of repeated measures multivariate analysis of variance.

SOURCE	F	p
Between Subjects		
Group	2.01	.17
Within Subjects		
Time	1.6	.19
Group X Time	2.43	.06

To determine the specifics of the different patterns of change on the six MOQ scores for the two groups, planned comparisons were conducted. An LSD test was applied to the different group means for each of the different times (Tabachnick & Fidell, 1989). The tests revealed no significant differences between the groups pre-treatment , and in Lessons 1, 3, and 5. Lesson 7 and post-treatment show significant differences, t (36) = -2.15, p = .04 and t (36) = -2.43, p = .02 respectively, with the +M group earning higher scores on the motivational orientation scale than the participants from the -M group. This indicates that the motivational orientation of the students in the +M group gradually altered in a positive direction such that, by the final sessions, it significantly surpassed the motivational orientation of the students in the -M group. MOQ means, standard deviations, t values and p values for the comparisons between the two groups, pre-treatment, during Lessons 1, 3, 5, and 7, and post-treatment are presented in Table 4.2.

Table 4.2. Comparison of -M and +M groups in terms of MOQ scores across sessions.

	-M		+M			
	MEAN	SD	MEAN	SD	*t*	*p*
pre-treatment	24.11	4.28	22.21	6.38	1.07	.29
LESSON 1	24.42	3.80	25.84	5.26	-.96	.35
LESSON 3	23.32	4.01	24.68	5.33	-.89	.38
LESSON 5	22.88	5.75	25.57	5.60	-1.52	.14
LESSON 7	22.95	5.12	26.37	4.66	-2.15	.04*
post-treatment	22.42	5.52	26.32	4.27	-2.43	.02*

*≤.05

Further tests were conducted to determine what contributed to the group by time interaction. Split group *t* tests were performed to assess the change in each of the group's MOQ scores pre- to post-treatment, thereby assessing the effect of time on the findings. These tests revealed a significant effect for the +M condition pre- to post-treatment on the motivational orientation measure, $t(18) = -2.82$, $p = .01$. There was no significant pre- to post-treatment effect for the -M condition on the motivational orientation measure, $t(18) = 1.45$, $p = .16$. These results support the hypothesis and suggest that the +M condition was effective. Over the course of the treatment, the +M group became more positively motivated. MOQ means, standard deviations, *t* values and *p* values for the two groups at pre- and post-treatment are displayed in Table 4.3.

Table 4.3. Split group *t* test for pre- and post-treatment MOQ means.

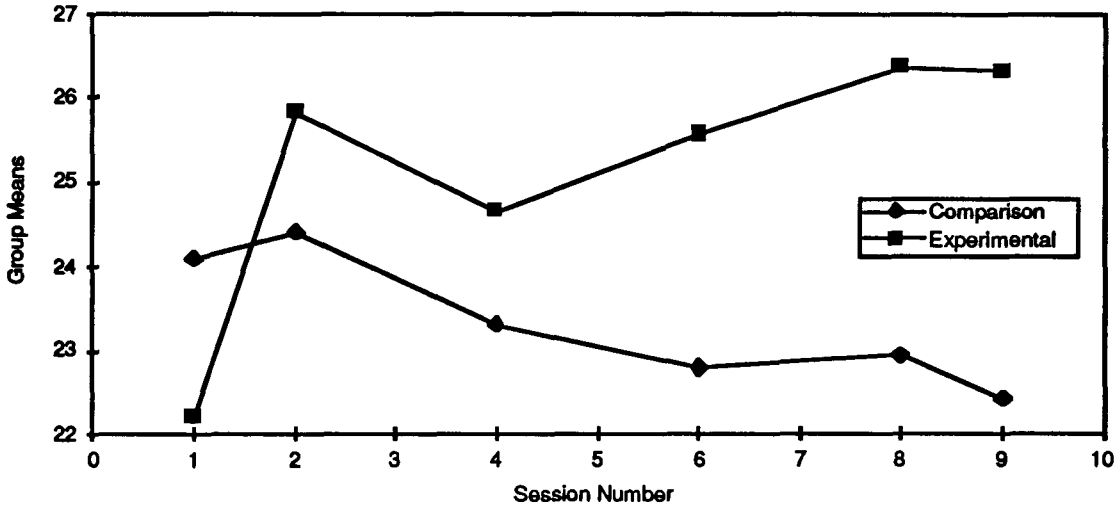
	PRE		POST			
	MEAN	SD	MEAN	SD	*t*	*p*
+M GROUP	22.21	6.38	26.32	4.27	-2.82	.01**
-M GROUP	24.11	4.28	22.42	5.52	1.45	.17

**P≤ .01

Effects of the two conditions on motivational orientation across sessions are graphically displayed in Figure 4.2. It indicates that the scores of the students in the +M group increased across sessions and the -M group scores decreased across sessions. This graphic representation provides insight into why the

MANOVA revealed no significant main effects for group or time, but did reveal a statistically detectable interaction effect.

Figure 4.2. MOQ means across sessions.



No main effect for group emerged because for this part of the analysis all of the six sessions' scores were combined and then the groups were compared. Because the groups changed in opposite directions, their overall scores are similar. It was not until the groups were separately analyzed across sessions that the differences became apparent. The series of *t* tests comparing the two groups at each session revealed that group differences became significant at Sessions 8 and 9.

No main effect for time emerged because for this part of the analysis the group means at each session were combined and these combined means are compared session to session to determine changes across sessions. Because there was a high and low mean at each session, when these were combined, changes across

time were masked. But, when split group t tests were conducted, it became apparent that the +M group changed significantly in pre- to post-treatment motivational orientation while the -M group did not.

Because the six-item questionnaire used to assess motivational orientation was developed for this study, the six items were examined separately to determine the relative contribution of each of the items to the overall questionnaire scores. No statistical analyses were performed. Mean scores for each of the items for the different groups at pre- and post-treatment are presented in Table 4.4.

Table 4.4. The six items of the MOQ for each of the groups, pre- and post-treatment.

		-M Group		+M Group	
item	content	pre	post	pre	post
	Affective				
1	-liked activity	4.21	3.42	3.73	4.47
2	-happy during activity	4.36	3.84	3.89	4.47
	Cognitive				
3	-ability self-assessment:	4.00	3.89	3.42	4.31
	Failure Attributions:				
4	-didn't work hard enough	4.63	4.15	3.94	4.47
5	-not good enough	2.68	3.00	3.42	4.05
6	-expectations of future success	4.21	4.11	3.78	4.21
Total		24.11	22.42	22.21	26.32

The affective component items altered for both groups, but in opposite directions. That is, scores on both of these items went down for the -M group and they both rose for the +M group. For item 3, the self assessment of ability, the -M group maintained their original assessment. The +M group experienced a substantial increase on this item. The -M group scores dropped on the effort attribution item whereas the +M group scores increased. On the item attributing failure to not being good enough, the -M group rose slightly and the +M group rose substantially. At first glance this is confusing, however, the scoring on the Likert scale was reversed on this item, so an increased score meant that the student did not ascribe to the belief that their failure was due to the fact that they weren't good enough. For the last item regarding expectations of future success, the -M group basically remained the same, and the +M group rose slightly from pre- to post-treatment.

The patterns of change observed in the six items for the +M group are consistent with the hypothesis that the six-item MOQ scores of the children taught in the +M condition would increase over the course of the lessons. The second part of the hypothesis stated that the MOQ scores of the children in the -M condition would remain the same. Some unexpected changes occurred in the -M condition.

The -M group did maintain their pre-treatment scores in three areas: (1) self-assessment of ability; (2) in their relatively low assessment that their failures were due to their lack of ability; and (3) in their relatively high expectations of future success. In contrast, the motivational orientation items of -M group decreased on both affect items. Further, these students became substantially less confident that their own efforts could overcome failure.

Pattern Recognition Scores Pre- to Post-Treatment

The last hypothesis predicted pre- to post-treatment increases in Pattern Recognition scores for the +M group but not for the -M group. Students' scores on a challenging math pattern task administered pre- and post-treatment were used to assess students' learning.

Split group *t* tests were performed to assess the change in each of the groups' Pattern Recognition scores. The total possible score on the Pattern Recognition Tasks was 21. Pattern Recognition score means, standard deviations, *t* values and *p* values for the two groups at pre- and post-treatment are displayed in Table 4.5

Table 4.5. Split group *t* tests for pre- and post-treatment Pattern Recognition scores.

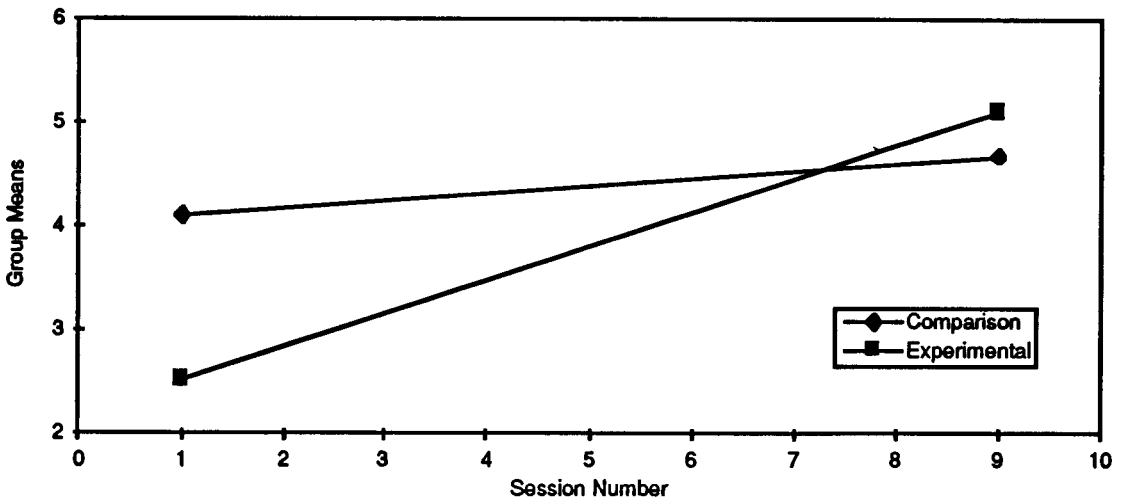
	PRE		POST			
	MEAN	SD	MEAN	SD	*t*	*p*
+M GROUP	2.53	1.84	5.11	4.74	-2.78*	.01**
-M GROUP	4.11	4.80	4.68	5.27	-.74	.47

**P ≤ .01

These tests revealed a significant difference for the +M group between pre- and post-treatment scores on the Pattern Recognition Measure, $t(18) = -2.78$, $p = .01$. There was no significant difference for the -M group between pre- and post-treatment scores on the Pattern Recognition Measure, $t(18) = -.74$, $p = .47$. In other words, Pattern Recognition scores of the students in the +M condition increased significantly, while they remained constant for the -M condition. These results are

graphically displayed in Figure 4.3. The results support the hypothesis and suggest that the +M condition was effective. The students exposed to the +M condition learned more than the students who were not.

Figure 4.3. Pre- to post-treatment Pattern Recognition scores.



The post-treatment standard deviation of the +M group more than doubled pre- to post-treatment. This raised concern that the significant pre- to post-treatment Pattern Recognition mean score increase could be the result of one or two children experiencing large score increases. Were this the case it would weaken the argument that the Motivation Instruction had a positive impact on learning. Consequently, the post-treatment score changes of both groups were examined to ascertain the size of the changes individuals in each group experienced. The changes are detailed in Table 4.6.

Table 4.6. Comparisons of +M and -M post-treatment changes in Pattern Recognition scores.

	- or no change	+1 or 2	+ 3 or 4	+≥ 5
+M	3	10	1	5
-M	8	6	4	1

The significant pre- to post-treatment increase in the Pattern Recognition score mean of the +M group resulted from various sized increases of most of the children in the group. Of 16 children who experienced increased scores, five, experienced increases of 5 or more In contrast, while scores of 11 children in -M group increased, only one child experienced an increase of five or more. It is also interesting to note that eight children in the -M group experienced no change or a decrease in their score, pre- to post-treatment. This was the case for only three children in the +M group. All of these changes support the claim that the +M group learned more than the -M group.

In the present study the +M condition positively effected behavioral, cognitive, and affective components of motivational orientation, as well as learning. Students in the +M group became more inclined to pursue challenge. Cognitive and affective components of motivational orientation were also effected. These students felt better when confronted with challenge and they came to believe in their own ability and efforts as agents in overcoming challenge. These students also gained confidence that they would overcome future challenges. Finally, these students learned more than their counterparts in the -M condition. These findings are discussed more fully in the next chapter.

CHAPTER 5
DISCUSSION

The purpose of the present study was to investigate the effect of an experimental treatment for promoting positive achievement motivation and influencing students' learning.

This chapter discusses the findings with respect to each of the hypotheses presented in Chapter 2. Limitations and generalizability of the study are outlined. Recommendations for future research are made and instructional and theoretical implications are discussed. Finally, a summary of conclusions is provided.

Behavioral Component of Motivational Orientation

Task choice was used to see if children would change from a preference for easy tasks to a preference for hard tasks after being exposed to a teaching method specifically intended to promote positive motivation to learn. Ten out of twelve children in the +M group who chose easy tasks before encountering the teaching method chose hard tasks after encountering it. This finding suggests that this particular teaching method influenced these children to choose tasks knowing they might not be able to do them immediately.

These children appeared to become less concerned about making mistakes and more willing to persist and work hard. This may have occurred because they were informed that learning is often hard work involving mistakes and requiring many attempts (Diener & Dweck, 1978). Basically, the Motivation Instruction provided these children with a new definition of learning. Likely, this provided new insight for the children since normally in school it is right answers that are valued.

The researcher also explicitly emphasized that what she valued was learning. The children were told that the researcher's purpose for being in their classroom

was to help her figure out how best to help children learn. And, more specifically, she told them she was interested in *their* learning. So, in addition to becoming aware that learning requires hard work and involves mistakes, the researcher encouraged the children to learn. In a sense, she gave them permission to be seen experiencing difficulty and making mistakes. Given the new definition of learning, experiencing difficulty and making mistakes became evidence of learning and not evidence of low ability, thus eliminating the need for students to protect themselves from negative judgements (Elliot & Dweck, 1988).

Children who show preference for easy tasks tend to react badly to situations in which they encounter difficulty or uncertain success (Cain, 1990; Diener & Dweck, 1978; Dweck & Leggett, 1988; Dweck & Smiley, 1994; Elliot & Dweck, 1978). They interpret such situations as evidence of their incompetence (Dweck & Leggett, 1988). This results in bad feelings and a sense of low self-worth (Cain, 1990; Dweck & Smiley, 1994). Consequently, they tend to avoid potential difficulty (Cain, 1990; Dweck & Leggett, 1988; Dweck & Smiley, 1994). Effectively, this reaction interferes with their learning (Dweck, 1975). It is maladaptive in the classroom context where learning requires encountering challenge and difficulty.

In addition to providing the interpretation that a difficult situation or challenge provides an opportunity for learning, the motivation instruction provided a concrete suggestion for how to confront challenge (Borkowski et al., 1988; Reid & Borkowski, 1987). This was accomplished by the experimenter explaining that when she encounters something she can not do, she knows that it is something she has not learned yet. She tells herself, "I can learn this. I can learn this," and proceeds to use a strategy that she has found to assist her in such situations. She provided the students with a detailed description of the self-attribution strategy, complete with a poster to help them remember the steps. Through the course of the treatment she reminded students of the strategy and encouraged them to use it.

The format for this training was derived from a previous attribution training intervention (Reid & Borkowski, 1987) designed to train hyperactive children in a self-control strategy. The present study involved Grade 2 children from a regular class and the content modeled a strategy of self-talk, the intent of which was to assist students to effort-fully and strategically confront challenge (Borkowski et al., 1988; Groteluschen et al., 1989; Reid & Borkowski, 1987; Salomon, 1989).

The interpretation of challenge or difficulty as an opportunity to learn is less likely to elicit maladaptive reactions than the interpretation that it is evidence of one's incompetence (Dweck, 1975). In previous research, merely telling children that their mistakes mean they need to try harder prevented maladaptive responses to failure (Dweck, 1975). In the present study, children were not only told that difficulty could be overcome by their own effort, they were taught a step by step method for dealing with difficult situations in school. The step by step strategy for overcoming difficulty and learning may have bolstered their confidence that they could do this. In at least one instance, a child was overheard chanting to himself, "What do I know? What do I know? Oh ya, the hundreds chart!" Then, he proceeded to complete what he had been stuck on. In summary, then, what may have happened is that children became more comfortable with challenge because they came to believe that they could deal with it. And because they came to understand that learning involves difficulty, they came to believe that by choosing and attempting a challenging task, they would be more likely to learn. The desire to learn may have been influenced by the teaching method which explicitly valued learning and assured the children that everyone is capable of learning.

It might be argued that these children changed their task choices because of assumptions they made as a result of the treatment. They may have assumed that choosing hard tasks would please the experimenter, who had been saying throughout the treatment that learning is often hard work. Or the children may have

assumed that because the treatment emphasized the importance of effort in learning, there was some hidden agenda and they were supposed to choose hard tasks. In fact, the changes in task choice appear to be related to other changes in achievement response. For instance, the typical achievement response of positively motivated individuals is to choose challenging tasks and apply previous skills and knowledge to overcome challenge. The children exposed to the teaching method intended to promote positive motivation to learn chose challenging tasks and they experienced a significant increase in scores on the Pattern Recognition scores. In other words, they responded like positively motivated individuals not only in their task choice, but also in their learning (Borkowski et al., 1988; Dweck, 1975; Reid & Borkowski, 1987). Similar changes did not occur among the students in the -M group.

Another possible explanation for the students changing to challenging tasks is that they thought they should choose something different from what they chose the first time. If this were the case, though, the same rationale might also be applied to the -M group. The explanation is discounted as the -M group tended to make similar choices both times.

One other possible explanation that arises is that students in the +M group were responding to peer pressure. So, as they saw their classmates make the hard choice, they did also. But, peer pressure does not account for the significant increases in the motivation scores and the Pattern Recognition scores of this group.

Cognitive and Affective Components of Motivational Orientation Across Sessions

The second hypothesis considered whether continued exposure to the experimental treatment would result in students feeling better about challenging tasks they were required to do in school, and becoming more likely to judge

themselves as capable, expecting themselves to experience future success on class work, and attributing their difficulties to their own lack of effort rather than inability. Items pertaining to these issues were combined to form the Motivation Orientation Questionnaire (MOQ). Individual items' scores were summed to provide an index of an individual's achievement motivation. Changes in overall scores on the questionnaires were used to assess changes in students' achievement motivation over the course of the experiment. The changes indicated an interaction with students in the treatment group experiencing increased scores while the scores of the students in the -M group decreased. The increase experienced by the +M group was statistically significant, so it is inferred that the teaching method intended to promote positive learning motivation influenced this change. Initially the +M group had a lower mean score than the -M group (although not significantly lower). In other words, the students in the +M group began the study less positively motivated than the students in the -M group. After experiencing the treatment, the +M group was more positively motivated than the -M group. Not only did the achievement motivation of the students in the +M group increase, but the achievement motivation of the students in the -M group decreased (see Figure 4.2). Although the decrease in mean achievement motivation score for the -M group was not statistically significant, the fact that it is a drop is interesting. Why might this group have experienced a drop in achievement motivation? Exploring the positive findings may provide a framework for understanding the decreased scores.

The children in the +M group appeared to become less stressed about challenge and more confident about overcoming difficulties through their own effort. Perhaps the children altered their beliefs and reactions in response to the explicit information about learning provided in the treatment. It was explained that learning requires effort, that it often involves mistakes and many attempts, that it

often causes feelings of frustration and uncertainty in one's own abilities, that everyone is capable of learning, and that during the process of learning, everyone struggles at times (even the experimenter). It is highly likely that for most students, this is the first time they encountered such explicit information about learning. In its absence, some children develop beliefs that undermine learning. This description addresses two key bits of relevant information that differentiate individuals with negative and positive achievement motivation. They hold different beliefs about ability and they interpret the need to exert effort differently.

For instance, children with negative achievement motivation believe that ability is a fixed entity (Dweck & Leggett, 1988); they believe they either have enough of it to deal with challenges they encounter or they don't. Consequently, they interpret the need to exert effort when confronting difficulty in school as evidence of their incompetence (Dweck, 1975; 1989; 1991). To preserve self-esteem, these individuals are moved to avoid situations requiring them to exert effort (Cain, 1990; Dweck & Smiley, 1994; Elliot & Dweck, 1988). In situations where effort is unavoidable, negative thoughts and feelings are elicited (Dweck &. Leggett, 1988; Elliot & Dweck, 1988; Stipeck & Kowalski, 1989). They often make derogatory comments about their lack of ability or make derogatory comments about the situation to divert attention away from themselves (Stipeck & Kowalski, 1989; Wine, 1971). They also lack persistence and fail to apply previously displayed skills and knowledge to the situation they are in (Fowler & Peterson, 1981). The Nature of Learning description used it the present study encourages a different belief about ability. The treatment refers to the fact that everyone is capable of learning, but at their own pace and in their own way. This suggests that ability is malleable, which is the understanding of ability that positively motivated children hold (Dweck & Leggett, 1988). And this belief leads to an interpretation that the need to exert effort in an achievement situation is an indication of something not yet learned

(Dweck & Leggett, 1988). This interpretation in turn leads to feelings and thoughts conducive to learning (Cain, 1990; Dweck & Smiley, 1994; Stipeck & Kowalski, 1989). The Nature of Learning also explicitly reinterpreted the need to exert effort. Rather than something to be avoided because it signals one's incompetence, effort is crucial to learning. This mimics the understanding and beliefs of positively motivated individuals, which in turn elicit positive feelings and thoughts conducive to learning (Stipeck & Kowalski, 1989). Perhaps students in the +M group internalized the information provided in this condition and reacted in a manner indicative of positively motivated individuals as is indicated in the increased scores on the MOQ.

In summary, improved scores on the MOQ by +M students may have occurred because the treatment provided information consistent with the understandings and beliefs of positively motivated individuals (Dweck & Leggett, 1988; Elliot & Dweck, 1988) as well as a strategy for applying effort for the purpose of learning (Borkowski et al., 1988; Groteluschen et al., 1989; Reid & Borkowski, 1987). These aspects of the Motivation Instruction may have bolstered students' beliefs that they could overcome challenge through their own efforts (Dweck, 1975; Reid & Borkowski, 1987) and learn. All of these aspects of the treatment may have combined to provide a view of learning and a view of oneself as a learner that is quite different than that typical of individuals with negative motivation orientation. The children were no longer left to their own maladaptive perceptions, understandings and beliefs. Rather, they became aware of learning as an enterprise that requires effort, were coached that everyone can learn, and were provided with some suggestions about what they could do to help themselves learn. Armed with this information, they may have felt better about challenges placed before them and have come to believe in themselves as learners.

It is conceivable that the children in both groups perceived this situation as evaluative or a test of their math competence or a comparison of their class to other children. They knew that they were involved in a research study. According to Stipeck and Kowalski (1989, p. 391) "most children automatically interpret the experimental situation as an evaluative one, often, in spite of our disclaimers." Past research provides evidence that situational conditions such as evaluation are capable of undermining positive motivational orientation and exacerbating negative motivational orientation (Elliot & Dweck, 1988; Stipeck & Kowalski, 1989). Perceiving the research situation as evaluative may have increased students' concern about the sufficiency of their own abilities thus promoting negative feelings and thoughts (Elliot & Dweck, 1988; Stipeck & Kowalski, 1989), as captured in the MOQ scores of the students in the -M group. The present study was also designed to be challenging to the participants because the different motivational orientations become emphasized in situations involving challenge (Cain, 1990; Chapman, 1988; Dweck, 1975; Dweck & Leggett, 1988; Dweck & Smiley, 1994; Stipeck & Kowalski, 1989). In other words, the study combined conditions known to elicit feelings and thoughts indicative of negative motivation (albeit conditions not unlike those common to regular classrooms). In addition, though, the treatment included Motivation Instruction intended to alleviate concerns and responses elicited in negatively motivated individuals in such situations. The -M group appears to have succumbed to negative influences that are natural conditions of the classroom context. The Motivation Instruction not only suppressed a decline in motivation score, but promoted an increase, despite the presence of the unfavourable variables, evaluation and challenge (Dweck, 1975).

Children in both groups were exposed to the same math lessons and required to do the same seatwork. Both groups of children knew that they were participating in educational research. But, the +M group had the benefit of the Motivation

Instruction. This instruction appears to have focused the children's attention on improving their competence through their own effort (Dweck, 1975) rather than proving their competence. This promoted positive feelings and thoughts (Elliot & Dweck, 1988; Stipeck & Kowalski, 1987) as captured in the MOQ. These findings support evidence that regular classroom conditions have a negative impact on motivation (Alderman &. Maehr, 1994; Maehr & Midgley, 1991). They also highlight the need for imbedding a treatment like that developed for this study into regular classrooms.

Pattern Recognition Scores Pre- to Post-Treatment.

The final hypothesis addressed whether children taught with the teaching method intended to promote positive motivation to learn would experience greater improvement (Borkowski et al., 1988; Dweck, 1975; Elliot & Dweck, 1988; Salomon, 1989) in their Pattern Recognition scores than children taught without the method. Students' scores on a set of challenging math Pattern Recognition Tasks administered pre- and post-treatment were used to assess improvement. From pre- to post-treatment the improvement in Pattern Recognition mean score for students in the +M group was significant, whereas the improvement for the -M was not significant. These changes were as predicted, suggesting that the experimental condition positively effected learning (Borkowski et al., 1988; Dweck, 1975; Elliot & Dweck, 1988; Salomon, 1989).

Students in the +M appear to have applied what they had learned in the math lessons to the Pattern Recognition Tasks. Perhaps this occurred because they came to understand that successfully doing school work requires strategic effort (Borkowski et al., 1990; Groteluschen et al., 1990). And this may have been prompted by the combined influence of different parts of the experimental condition. Despite the fact that they became aware that learning often involves

much effort, mistakes, many attempts, and frustration (Diener & Dweck, 1978), they became willing to subject themselves to this because the researcher continually expressed the value of learning and her desire for the students to learn (Ames, 1992b). As well, the learning strategy that specifically encouraged students to think about how they could apply previous knowledge to situations when they were stuck (Borkowski et al., 1988) may well have had an impact on this result. The training for the present study was a modification of that used by Borkowski et al. (1988). Impressive long term maintenance and generalization of strategies resulted from that study. It appears that the training was effective in promoting heightened self-efficacy which in turn promoted greater learning (Borkowski et al., 1988; Dweck, 1975). This claim is based on the fact that, although both groups received the same math instruction, only the +M group experienced a significant increase in their Pattern Recognition scores pre- to post-treatment.

The improvement in Pattern Recognition scores for the +M group is particularly exciting because the math lessons did not teach to the Pattern Recognition Tasks. In other words, the content of the math lessons was not specifically related to the Pattern Recognition Task. The math lessons explored number patterns using the hundreds chart. The students were not given the opportunity to practice the Pattern Recognition Tasks during the math lessons (Dweck, 1975; Stipeck & Kowalski, 1989). The math lessons merely provided useful bits of information if adapted properly to the Pattern Recognition Task. Both groups of students had the benefit of the same math lessons yet only the +M group experienced a small but significant increase in their Pattern Recognition scores. The mean increase pre- to post-treatment was 2.58 while the total possible score on the Pattern Recognition Tasks was 21. Scores pre-treatment, ranged from zero to seven. Post-treatment, scores ranged from zero to 16 with sixteen children experiencing post-treatment score increases. Five of these increased by five points or more. What appears to have

happened is that, as the +M group's achievement motivation raised, they became more self-regulated and applied previous knowledge to the task at hand (Groteluschen et al., 1990).

It is also possible that once aware of the nature of learning, that contributed to the students in the +M becoming more comfortable with the realities of learning. They came to understand that a challenge was not evidence of their inferiority but rather an opportunity for them to learn. The level of comfort they gained along with the information about learning further contributed to a belief in their own self-efficacy. This allowed them to engage in adaptive behaviour of expending effort rather than maladaptive behaviour of avoiding the task at hand (Dweck & Leggett, 1988; Fowler & Peterson, 1981).

An alternate explanation for both groups' increased scores post-treatment is that the children had already done this task once and experienced a practice effect. However, this could not explain why the increase for the +M group greatly surpassed that of the -M group.

This might be accounted for with the explanation that the difference in the increases in the respective groups' scores was a result of pre-treatment knowledge differences, not treatment condition differences. In other words, the +M group needed instruction while the -M group was not taught anything they didn't already know. This explanation arises because pre-treatment, the mean score of the -M group was higher than that of the +M group. On the other hand, although the -M group had a higher pre-treatment score, it was not significantly higher than that of the +M group

The +M condition appears to have had positive impact and it seems reasonable that it at least partially influenced the significantly increased Pattern Recognition mean score of the students in that group. Both the Pattern Recognition and achievement motivation mean scores of the +M group increased significantly pre-

to post-treatment while those of the -M group did not. This supports a relationship between motivation and learning (Dweck 1975; Dweck & Leggett, 1988; Borkowski et al., 1988).

Limitations and Generalizability

The findings of this study are limited by a number of factors related to attempting to do ecologically valid classroom research with intact groups. The findings can not be generalized beyond the children involved in this study because the participants were not randomly assigned to their respective groups. The groups were made up according to the consent forms returned in each classroom. The fact that the +M group was comprised of a whole class of nineteen students while the -M group was comprised of fourteen children from one class and five from another, may have effected the results. Perhaps the findings resulted because the +M group was settled and comfortable while the -M group was disrupted. Before the sessions began in the -M group the regular classroom teacher gathered up the group of children who were not participating in the research and ushered them out of the classroom. Then the five students from the other classroom found themselves desks. It is worth noting however, that four of the five children who came to this class for the research had actually been part of this class for the four Fall months. They were moved out of the class in January when an influx of new students to the school caused the creation of a third Grade 2 class.

Limitations pertaining to the two classroom teachers also arise. Because the teachers of the participants may have had quite different influences on the students in their respective classes, we can not be certain that the findings reflect treatment effects. The children were exposed to the research conditions for only forty-five minutes of the five hour school day. It is difficult to unequivocally determine the relative contributions of the experimental treatment and conditions in each of the

classes beyond the researcher's control. For instance, although the teachers were blind to the details of the research, they may have influenced the findings by their actions toward their classes. The teacher of the children in the -M group may have done something to raise the anxiety level of her children about the research, while the teacher of the children in the experimental condition may have inspired a relaxed attitude and good feelings about the research. The teachers of the respective groups may have influenced the findings in a more subtle way. It is conceivable that each established different group dynamics in their classrooms and that the researcher reacted to these dynamics differently. For instance perhaps the researcher reacted well to the +M group but not well to the -M group. There was nothing obvious to suggest this, although it is a possibility. In retrospect, to avoid this, the researcher could have met with the teachers and told them how important it was that they not talk to the children about the research. The researcher could also have prepared a script and asked both teachers to use the same script to introduce the research to the children.

The findings are also limited to this researcher and the order in which the two conditions were conducted. The researcher conducted the +M condition first and then the -M condition. Perhaps she was enthusiastic with the first run and bored by the time she conducted the second condition.

A potential confound results from the fact that both treatment conditions were conducted consecutively in the same school. Children in the +M group may have told children in the -M group about the research. If this did occur in the present study, there is no blatant evidence of any confounding influence that this had. Furthermore, the researcher's declarations that she was interested in each individual, and her pleas that children answer the questionnaires according to what was true for them, may have counterbalanced any potential confound with regard to the two groups being conducted consecutively in the same school.

Another classroom condition that limits the findings is the seating arrangement in the respective classrooms. In the +M group, the desks were arranged end to end into three sides of a rectangle with a cluster of six desks (two rows of three desks facing each other) in the center. In the -M group, the desks were clustered into groups of four (two rows of two desks facing each other). In both classes, the teachers said the children, for the most part, were allowed to sit where they wanted. And, class work related talk amongst students was encouraged by both teachers. During the research math lessons the class work routines of each class were maintained. However, in the pre- and post-treatment sessions and at the end of the math lessons in which the Motivation Orientation Questionnaire was administered, students were asked not to talk and to work independently. To facilitate this screens were provided to shield students' work from each other. Also, they were repeatedly reminded to mark their questionnaires according to what was true for them, rather than with concern for how someone else marked their questionnaire. Nonetheless, the close proximity of the children one to another and the fact that they were used to helping one another make it impossible to really know how much copying and chatter influenced children's answers and questionnaire responses. This limitation is one of the pitfalls of attempting to do ecologically sound research. In future research, arrangements could be taken to ensure that students can't copy or talk.

The findings of this study are also limited to the age of the children involved. While the findings were favourable with this group of seven and eight year old children, it is not clear how older or younger children might respond.

This research was conducted with a very small group of children. It compared two groups of nineteen children. Although it is encouraging that significant results occurred with such a small number of children, the size of the groups certainly limits the generalizability of the findings.

Finally, the findings based on the Motivation Orientation Questionnaire pose a limitation because, although the specific questionnaire items are based on interview questions asked of young children in previous research, they have never been used in the questionnaire format nor in a whole class situation before. The questionnaires were well received by the students and no problems arose administering them to the whole class simultaneously. But, as a new measure, the approach warrants more testing.

While the findings of the present study are encouraging, the limitations outlined prompt recommendations for future research.

Theoretical Implications

The present study was based on goal theory of achievement motivation, (Lepper, 1988) and more specifically, the Social-Cognitive Model of Motivation and Personality (Dweck & Lepper, 1988). As in previous research, (Cain, 1990; Dweck & Smiley, 1994; Stipeck & Kowalski, 1989) this research found children in regular classrooms to range in their motivational orientations. And, as in previous research (Elliot & Dweck, 1988; Salomon, 1989; Stipeck & Kowalski, 1989), conditions of the study influenced students to react in hypothesized ways, consistent with the Social-Cognitive Model of Motivation and Personality. In other words, the study appears to support the theory upon which it was based. This is extremely important because the underlying assumption of the study is that this theory can be applied to practice, to meet the goals of promoting the development of empowered life-long learners (B.C. Ministry of Education, 1990).

Research Implications

A variety of recommendations for future research emerge. These include highly controlled research with large groups of students, replication studies, adapting the study for the teacher-as-researcher, running correlational studies to test the validity of the Motivation Orientation Questionnaire items, and testing the effects of the treatment in other domains. Each of these areas of research will be considered separately.

Drawing large numbers of participants from different age groups and from a variety of schools would be beneficial for two reasons. First, it would increase the potential for ensuring that students with equivalent ability and achievement motivation were being randomly assigned to conditions for comparison. Second, it would allow for detailed investigation and comparison of the different effects of the motivation instruction treatment on positively and negatively motivated children of different ages. These conditions could be facilitated by pre- testing students on ability and motivational orientation, sorting them according to their scores and then randomly assigning them to -M and +M groups appropriate to their age. Groups of children thus formed could then be brought together into controlled conditions. If each pair of groups compared were being brought together for the research (as opposed to remaining in their regular classroom), several variables could be standardized. These would include seating arrangements, ensuring that students worked independently, and limiting the influence of teachers talking to students about the research. Research with greater numbers of students and more controlled conditions would allow for greater generalizability of findings. Nonetheless, other problems and concerns arise with this sort of research. Practicality is a major problem. How would these children be transported to a common location, and where would that common location be? Involving children in the proposed research indicates a major disruption to their schooling.

Additionally, it is conceivable that for some children, this situation would be very stress provoking (Stipeck & Kowalski, 1989).

On the other hand, classroom research allows for greater ecological validity. Replication of this research by other researchers would be valuable to discount the findings being isolated to one researcher. For replication studies it would also be useful to change the order in which the two conditions are conducted to see if that effects the influence of the treatment. Furthermore, conducting each of the conditions in different schools would avoid the confound of students telling each other about the research. Replication studies would also provide a reliability check for the Motivation Orientation Questionnaire. Finally, it would be useful to add a long-term follow-up to see if the benefits last beyond the immediate treatment.

Adapting this study for the teacher-as-researcher provides several avenues for future research. Firstly, this would test the ease with which the treatment could be learned and implemented by classroom teachers. Secondly, this would allow for testing the treatment in different subject areas as well as adopting it as teaching practice used throughout the day across the entire curriculum. It would also be interesting to administer the Motivation Orientation Questionnaire at a different time of the day other than in the lesson in which the motivation instruction is being given. This would provide a test of whether influence of the motivation instruction provided in one subject crosses over to others. Thirdly, teacher research would allow for monitoring benefits of long term use which in turn opens up the possibilities for including different dependent measures and different forms of research. For instance, this would lend itself quite nicely to qualitative research. Other measures that would add depth to the research include pre- and post-treatment measures of students' perceptions of the classroom goal (Ames, & Archer, 1988) and teachers' assessments of students' approach to learning (Reid & Borkowski, 1987). Additionally, participant interviews could be used to get a richer

sense of how the treatment effected students and how and why it influenced their learning. Lastly, the treatment could be tested at a variety of grade levels.

The Motivation Orientation Questionnaire was developed for this study and, although the items were derived from interview questions used in previous research, this does not guarantee that they correlate. Running correlational studies to determine whether interview questions and related questionnaire items measure the same construct would establish the validity of the questionnaire. This was not done in the present study because of the limited number of participants available.

Another line of research pertains to the transfer of positive achievement motivation to other domains. If it is promoted in school, do children respond to challenges encountered playing chess, or in social situations with friends, or when putting a model together, or when learning a new piece on the piano, in as adaptive a manner as they approach academic achievement challenges?

Instructional Implications

In the course of investigating optimal forms of content and strategy instruction, motivation has emerged as a key element in effective learning. This has giving rise to research investigating means of promoting motivation conducive to effective learning. Findings of this study suggest there are benefits to embedding motivational instruction into content instruction. An adaptive response to school work was elicited including willingness to confront challenge, feeling good when confronted with challenge, believing one's own effort overcomes challenge and applying previous knowledge to resolve challenge and thus learn. It appears that educators need to explicitly state the nature of learning, emphasize the importance of learning in school, and encourage students to persist and apply previous knowledge in their school work in order to bolster their motivational response to

challenge. Carefully structuring the content and delivery of the math lessons was not enough.

The tested teaching method does not require extensive training to learn. It is reasonable to imagine teachers preparing to implement the intervention by reading a description of it. Once the teacher understands the intervention and begins implementing it, it can be used throughout the day and across content areas.

Recently, there has been an emphasis for schools to develop empowered and lifelong learners. If we are to accomplish this, one very important consideration is what it is within an individual that contributes to a propensity to learn. Findings in this study suggest the answer is positive achievement motivation. Consequently, as educators charged with the responsibility of helping children learn we need to attend to ways and means of promoting positive achievement motivation in our students. The tested treatment informs teaching practice to accomplish this.

Conclusions

Based on the results of this study, the combination of providing information about the nature of learning, endorsing a classroom learning goal, and providing instruction about how to apply effort appropriately in the pursuit of learning appears to be effective in promoting positive achievement motivation and effective math pattern learning in a regular Grade 2 classroom. While the relationship of effort attributions to learning has long been acknowledged in educational research (Borkowski et al., 1989; Dweck, 1975; Fowler & Peterson, 1981; Licht & Kistner, 1986; Marsh; 1986; Paris & Byrnes, 1989), it was made explicit in this study in a unique manner. Students in the present study were provided with information that explicitly stated that learning requires effort (Nature of Learning) and were provided a specific strategy for exerting effort in the pursuit of learning (Attribution Training). This occurred within a context in which the experimenter assured the

students that learning was highly valued (Valued Learning). In fact, learning was the experimenter's expressed goal for the children she taught.

Also, previous research acknowledges the importance of making learning goals salient to children (Ames, 1992a). But, attempts to accomplish this have generally been limited to de-emphasizing evaluation (Stipeck & Kowalski, 1989) or focusing on the task rather than personal involvement in the task (Elliot & Dweck, 1988; Nicholls, Patashnick, & Nolen, 1985; Salomon, 1989) in an attempt to minimize students' perceptions of being judged and maximize student's comfort level related to difficult tasks. In the short concern about evaluation was alleviated. It is naive, though, to imagine the effect enduring with subsequent difficult tasks. These manipulations in their given contexts lessen the judgement component so aversive to individuals with negative achievement motivation, but they do little to alter the underlying beliefs that contribute to this sensitivity. The present study attempted to influence these beliefs by providing descriptions of beliefs conducive to effective learning. That is, that everyone is capable of learning, that it is a process fraught with difficulty, but nonetheless achieved through one's own efforts (Nature of Learning).

Finally, previous research isolated aspects of positive motivation and manipulated them in an attempt to promote adaptive achievement responses (Dweck, 1975; Stipeck & Kowalski, 1989). The assumption was that attending to one aspect of motivation would influence all of the related aspects and result in the desired achievement response. Again, these attempts resulted in context specific positive results. They did little to alter individuals' beliefs or to provide contexts within which those beliefs could be developed and reinforced through practice in situations evidently endorsing the same beliefs.

The +M treatment of the present study was effective with young children suggesting it had an impact on their beliefs about the role of effort in learning and

about their beliefs about themselves as learners. These beliefs are fundamental to learning. They promote or undermine motivation, metacognition, and self-regulated learning (Dweck & Leggett, 1988; Borkowski et al., 1990; Lepper, 1988; Paris & Byrnes, 1989; Zimmerman, 1989). A common goal in all three domains is the development of beliefs conducive to learning. Perhaps this treatment provides one useful means of accomplishing this in the classroom situation. And if so, it follows that this treatment potentially provides prevention against the development of beliefs that undermine learning. This is particularly important considering conditions inherent to a regular classroom appear to promote negative achievement motivation.

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APPENDIX A

Consent Information Letter and Form

Dear Parent,

Hello, my name is Cindy Bell. I am a teacher with twelve years teaching experience currently doing my Master's degree in the Faculty of Education at Simon Fraser University.

During February and March, 1995, I will be conducting a study at _____ School which will involve the Grade 2 students. Its purpose is to improve our understanding of how teachers can promote positive achievement motivation and influence optimal learning. I would like your permission to include your son or daughter in this study. It is described in more detail in the next paragraph. If you and your child are willing, please sign the attached consent form and have your child return it to his or her teacher by _____. This will indicate that you understand the purpose and nature of the study, and agree to let your child participate.

Only the students who have returned consent forms will be involved the study. The children who have not returned consent forms will do an activity with the regular classroom teacher outside of the classroom. I will conduct all ten sessions that comprise this study in the regular classroom. All sessions will be whole group, in-class sessions in which the children are involved in math activities, are asked to independently do lesson-related paper and pencil activities, and answer simple two- to six-item simple questionnaires. All sessions will be of approximately 45 minutes duration.

In Sessions 1 and 10 children will do an activity to provide an indication of their motivational orientations. Everyone will also do a pattern recognition task to provide a base-line measure of ability and then any change in competence gained over the course of eight math lessons. The eight math lessons will be offered to students in Sessions 2 through 9.

All information collected (questionnaires, worksheets, field notes) will be kept confidential as I will be the only person handling the data. Your child's name will never be used in any reports of this research. Anonymity will be guaranteed by assigning subject numbers to all students and eliminating all signs of students' names from collected data. Individual results will not be discussed with teachers. Eventually, you can obtain the completed report of this study by contacting me.

You and your child have the freedom to discontinue participation in this study at any time, for any reason. Should a concern arise regarding this study please contact me at 291-9903 or 291-5443. Should your concern not be addressed adequately by me you may contact the Director of Graduate Programs, Dr. M. Manley-Casimir, Faculty of Education, Simon Fraser University at 291-4787.

If you would like any further information before signing the consent form, please call me. I will be happy to talk with you.

Thank you for taking the time to consider this request. I hope you and your child will agree to participate.

Sincerely,

Cindy M. Bell, B.Ed.
Graduate Student

Please complete this form and have your child return it to his or her teacher by _____.

As the parent or guardian of _____,
(child's name)

I consent to my child's participation in the learning study described in the preceding letter. I understand that I can contact Cindy Bell before or during the study if I have any concerns or questions. If I choose, I may withdraw my child from the study at any time.

Child's birthdate: _____

Child's gender: Boy Girl (please circle one)

Date: _____

Signature: _____

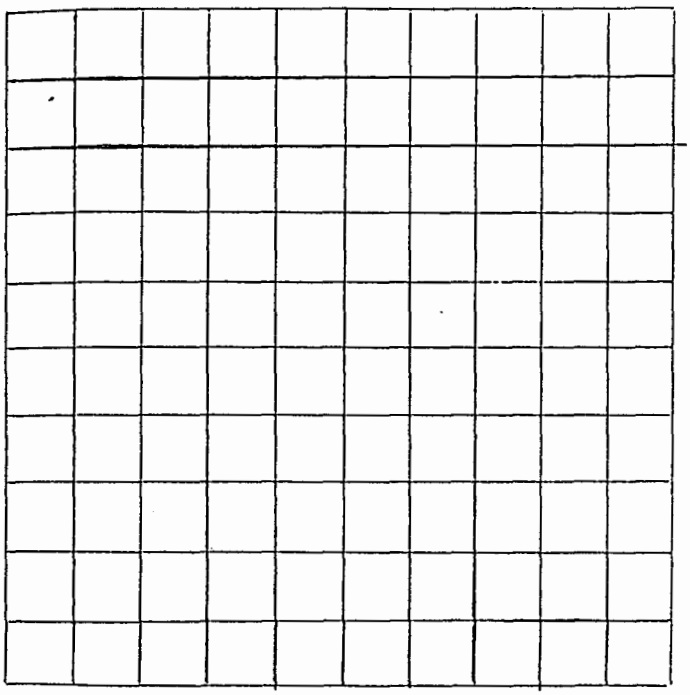
Name (please print): _____

Thank you again for your time and support!

APPENDIX B

Math Lesson 1 Seatwork

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

APPENDIX C

Math Lesson 2 Seatwork

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

HUNDREDS CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

HUNDREDS CHART

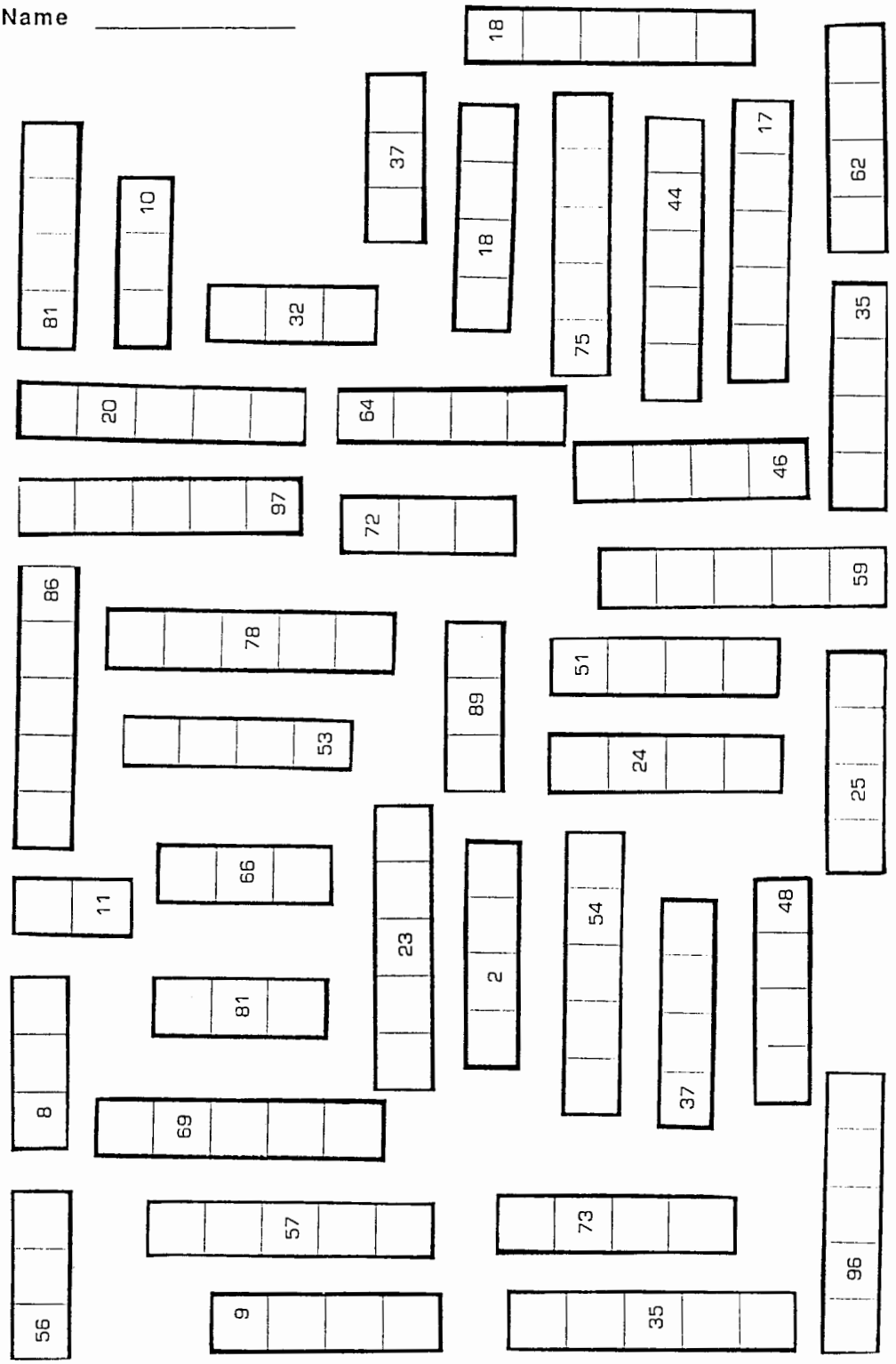
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

APPENDIX D

Math Lesson 3 Seatwork

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

Name _____

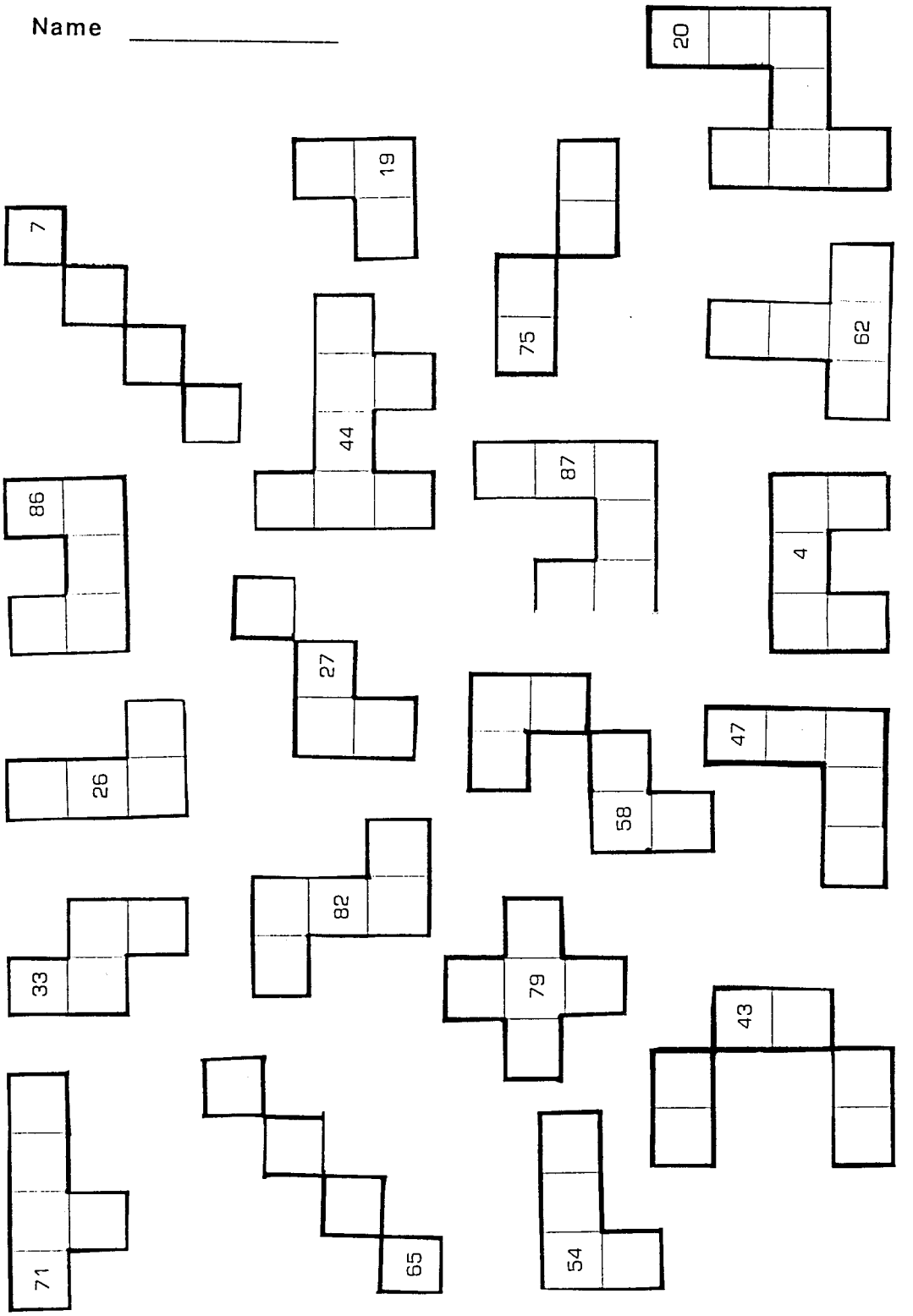


APPENDIX E

Math Lesson 4 Seatwork

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

Name _____



APPENDIX F

Math Lesson 5 Seatwork

Source: Sarkissian, J., Marsh, F., Connelly, R. D., Calkins, T., O'Shea, T., Sharp, J. N. C., Johnson, R., & Tossell, S. (1987). *Journeys in math: Teachers' resource manual.* Scarborough, Ont.: Ginn.

Name_____

1. What is the counting pattern for your name? _____

Colour the name patterns for:

2. June

3. Larry

5. Kirsten

What is the counting pattern for:

4. June ____?

5. Larry ____?

6. Kirsten ____?

Complete the patterns:

5. 2, 4, 6, __, __, 12, __, __, 18. **The counting pattern is** _____.

6. 7, 14, __, 28, __, 42, __, __, 63. **The counting pattern is** _____.

7. 9, 18, 27, __, 45, __, __, __, 81. **The counting pattern is _____.**

8. 8, 16, __, __, __, 48, __, __, __,80. **The counting pattern is _____.**

9. 6, 12, __, __, __, 36, 42, __, __, 60, __, __, 78. The counting pattern is _____.

APPENDIX G

Math Lesson 6 Seatwork

Source: Sarkissian, J., Marsh, F., Connelly, R. D., Calkins, T., O'Shea, T., Sharp, J. N. C., Johnson, R., & Tossell, S. (1987). *Journeys in math: Teachers' resource manual.* Scarborough, Ont.: Ginn.

HUNDREDS CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

HUNDREDS CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

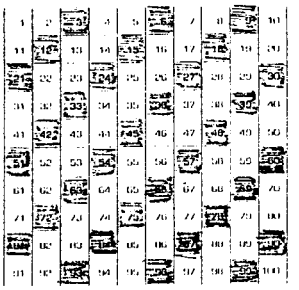
1. Start at 7. Count by 3's.
2. Start at 4. Count by 7's.
3. Start at 3. Count by 5's.
4. Start at 8. Count by 2's.
5. Start at 9. Count by 6's.

APPENDIX H

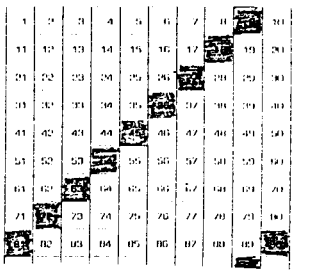
Math Lesson 7 Seatwork

Source: Coburn, T.G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

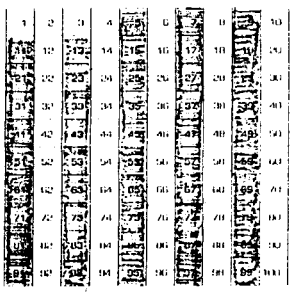
Name_____



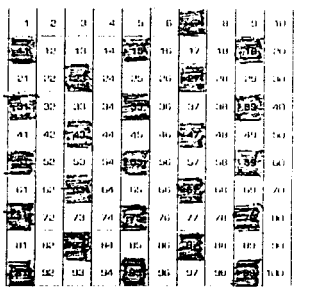
The counting pattern is ____.



The counting pattern is ____.

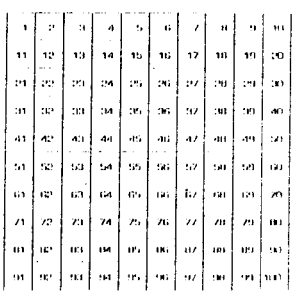


The counting pattern is ____.



The counting pattern is ____.

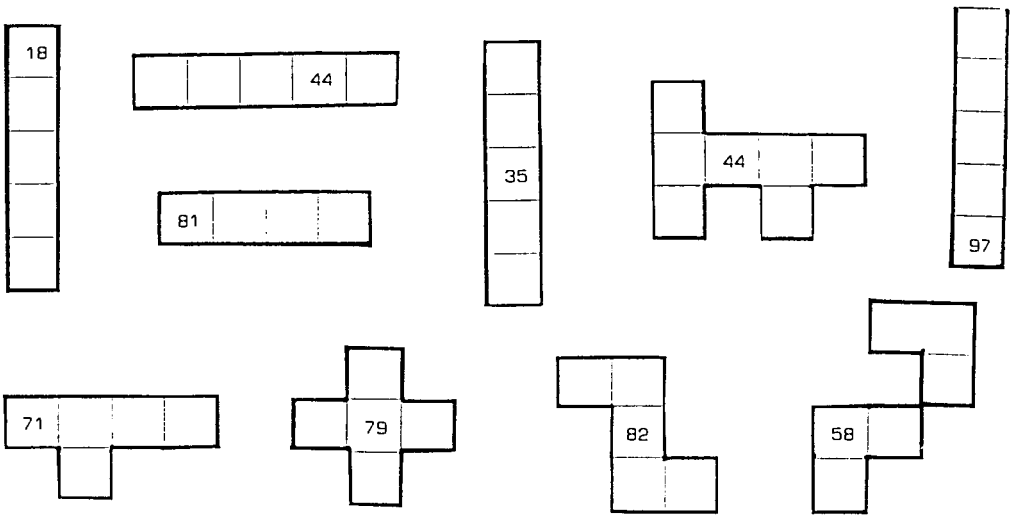
Colour your name pattern.



What is the counting pattern for your name? ____

Print the first 10 numbers in your name pattern.

___ ___ ___ ___ ___ ___ ___ ___ ___ ___



30 40 50 60 70 80 90

The counting pattern is ____.

2 8 14 20 26 32 38.

The counting pattern is ____.

12 16 20 24 28 32 36.

The counting pattern is ____.

4 9 14 19 24 29 34.

The counting pattern is ____.

3 6 9 12 15 18 21.

The counting pattern is ____.

21 28 35 42 49 56 63.

The counting pattern is ____.

Count by 2.

5 7 9 ____ ____ 15 ____ 19 ____ ____ 25.

Count by 4.

11 15 19 ____ 27 ____ ____ 39 ____ 47.

Count by 5.

55 50 45 ____ 35 ____ ____ 20 ____ ____ 5.

Count by 3.

2 5 8 ____ ____ 17 20 ____ ____ ____ 32.

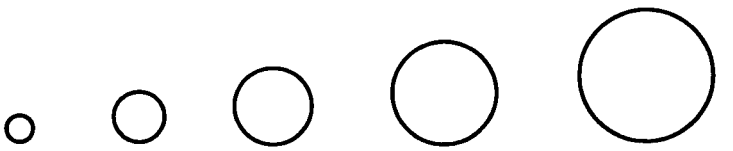
Count by 6.

20 26 32 ____ 44 ____ 56 ____ ____ 74.

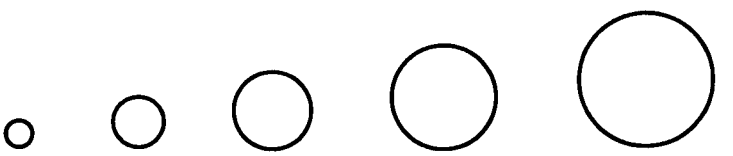
APPENDIX I

Familiarization Questionnaire

Name_____



2 4 6 ___ ___ 12 14



Script for Familiarization Questionnaire Items

1) "When I get a special treat I feel...
- not at all happy, a little bit happy, happy, quite happy or very happy?"

"Please mark the circle that tells how happy you feel when you get a special treat: not at all happy, a little bit happy, happy, quite happy or very happy." [repeating the possible responses and indicating the corresponding circles].

"Now, put your ruler under the row of numbers." [2 4 6 ___ ___ 12 14].

"This is a number pattern."

"Think about what numbers go in the blanks. You may write the numbers in if you like, but you don't have to." [pause].

"Everyone listening...we're going to mark some more circles now. Put your ruler under the next row of circles and think about how to answer this..."

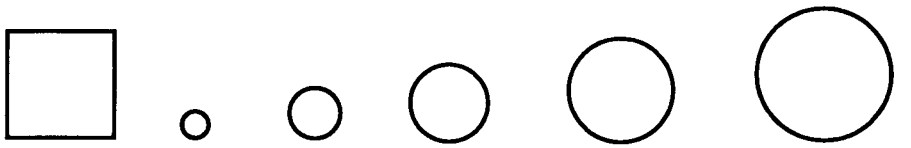
2) "Doing number patterns I am...
- not at all good, a little bit good, good, quite good, very good."

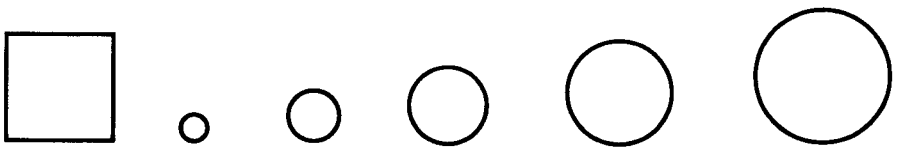
"Please mark the circle that tells how good you think you are at number patterns not at all good, a little bit good, good, quite good, very good." [repeating the possible responses and indicating the corresponding circles].

APPENDIX J

Reasons for Task Choice Questionnaire

Name_____





Script for Reasons for Task Choice Questionnaire Items

"Put your ruler down under the first row of circles. See the square there? If you chose this envelope because the most important thing to you is getting all the answers right, put a one in the square." [experimenter demonstrates on overhead].

"But if that's not the most important to you, just wait a minute."

"Put your ruler down under the bottom row of circles. See the square there? If you chose this envelope because the most important thing to you is working hard to figure out any you get stuck in, put a one in the square."

"You should only have one one on your page."

"Okay, now go back and put your ruler under the top row of circles. This time, I want you to tell me how important it is to you to get all the answers right. Starting with the little circle...not at all, a little bit, some, quite a bit, a whole bunch."

"Think about how to answer this."

1) "For me, getting all the answers right is...
Please mark the circle that tells how important getting all the answers right is to you: not at all, a little bit, some, quite a bit, a whole bunch." [indicating the corresponding circles].

"Now, move your ruler back down under the bottom row of circles. This time I want to know how important it is to you to work hard to figure out any you get stuck on."

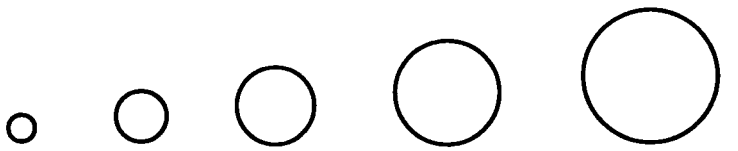
"Think about how to answer this"

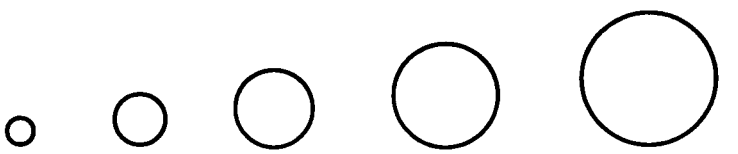
2) "For me, working hard to figure out any I get stuck on is...
Please mark the circle that tells how important working hard to figure out any you get stuck on is to you: not at all, a little bit, some, quite a bit, a whole bunch." [indicating the corresponding circles].

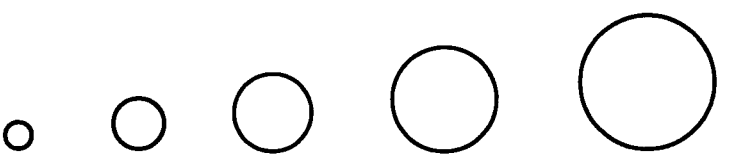
APPENDIX K

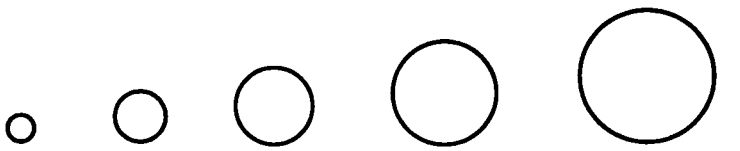
Motivational Orientation Questionnaire

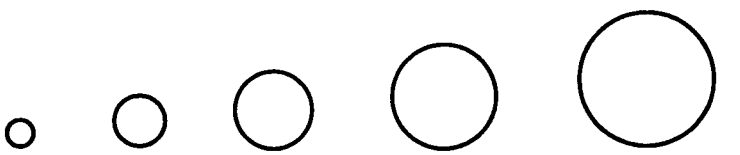
Name_____

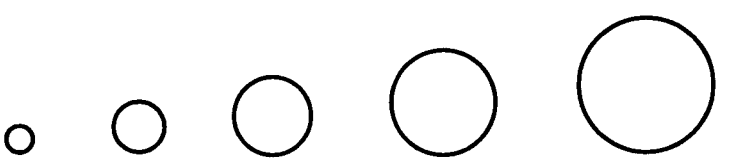












Script for Motivational Orientation Questionnaire Items

Affect

"Please make sure your name is on this."

"Finally, my last set of questions! Remember, no one except you and I are going to see this so really think about what you are like and tell me about you."

"The first thing I want to know, is how much you liked this activity."

"Please put your ruler on the page under the first row of circles. It says..."

"I liked this activity...not at all, a little bit, some, quite a bit, a whole bunch."

"Please mark the circle that tells how much you liked this activity: not at all, a little bit, some, quite a bit, a whole bunch." [indicating the corresponding circles].

"Move your ruler down under the next row of circles [experimenter demonstrates on overhead]. Now, I want to know how happy you were feeling when you were doing this activity?"

"This one says...

When I was doing this activity I was feeling: not at all happy, a little bit happy, happy, quite happy, very happy."

"Please mark the circle that tells how happy you were feeling when you were doing this activity: not at all happy, a little bit happy, happy, quite happy, very happy." [indicating the corresponding circles].

"Now, move your ruler down under the next row of circles [experimenter demonstrates on overhead]. I want to know how good you think you are at doing number patterns. This one says...

Self-evaluation of ability

"Doing number patterns I am: not at all good, a little bit good, good, quite good, very good."

"Please mark the circle that tells how good you think you are at doing number patterns: not sat all good, a little bit good, good, quite good, very good." [indicating the corresponding circles].

"Move your ruler down under the next row of circles [experimenter demonstrates on overhead]."

Attributions for failure

"Now think about the number patterns you worked on."

"Some of the number patterns you could do and some you got stuck on."

"I wonder how you could do if you had lots of time. If you tried very hard could you do them all or are you just not good enough at number patterns?"

"Remember, everyone is different. Think about what you're like."

"The first one says...
I could do all of the number patterns if I tried very hard.
This is: not at all like me, a little bit like me, some like me, quite a bit like me, a whole bunch like me."

"Please mark the circle that tells how much this is like you."

"I could do all of the number patterns if I tried very hard.
This is: not at all like me, a little bit like me, some like me, quite a bit like me, a whole bunch like me." [indicating the corresponding circles].

"Now, move your ruler down under the next row of circles. This one says...
I could not do all of the number patterns because I'm just not good enough at number patterns. This is: not at all like me, a little bit like me, some like me, quite a bit like me, a whole bunch like me."

"Please mark the circle that tells how much this is like you."

"I could not do all of the number patterns because I'm just not good enough at number patterns. This is: not at all like me, a little bit like me, some like me, quite a bit like me, a whole bunch like me." [indicating the corresponding circles].

"Move your ruler down under the last row of circles."

Self-assessment of future expectations

"How well will you do the next time you do a number pattern activity?"

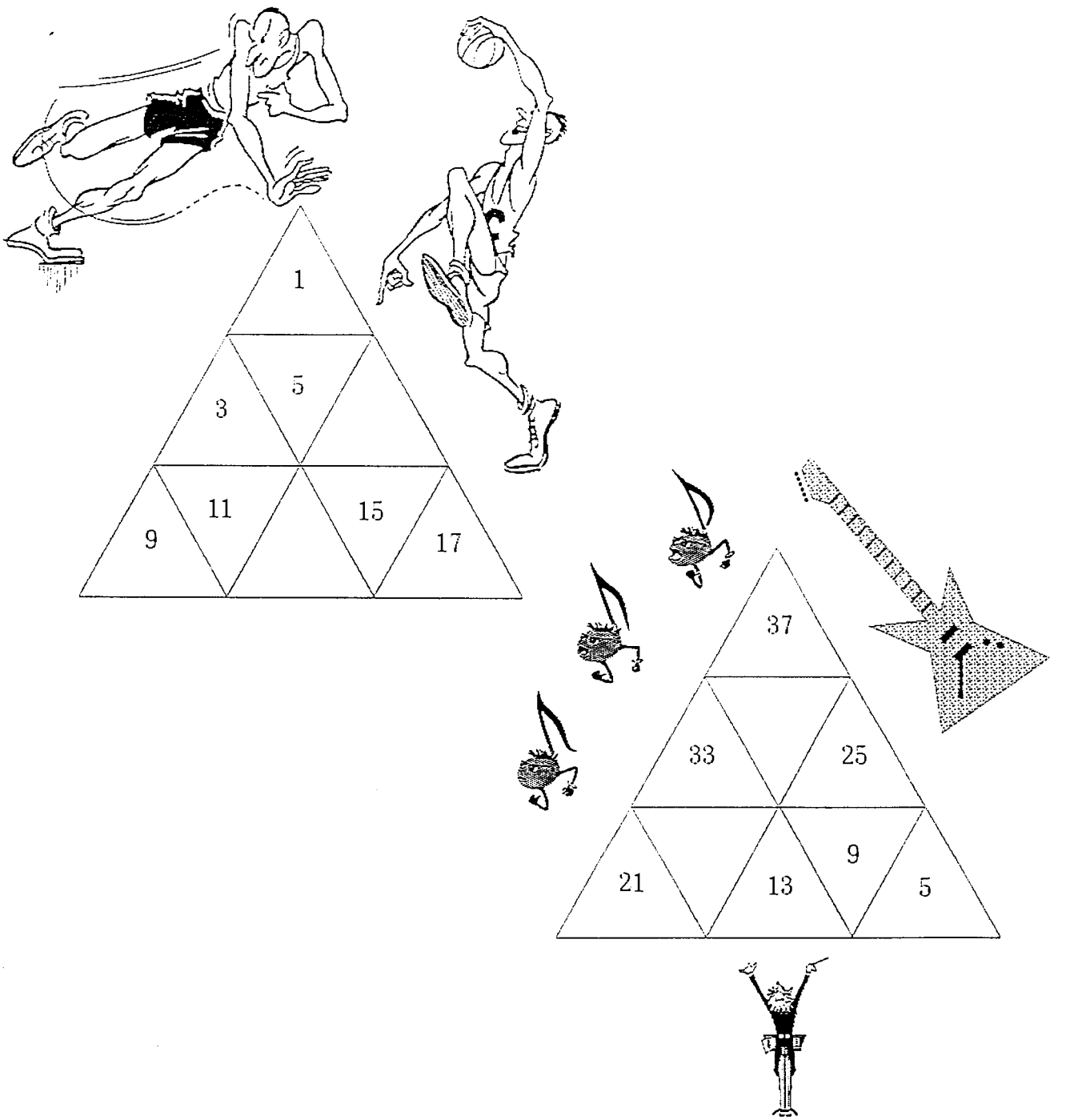
"This one says...
Next time I do a number pattern activity I will do: not at all well, not so well, okay, quite well, very well."

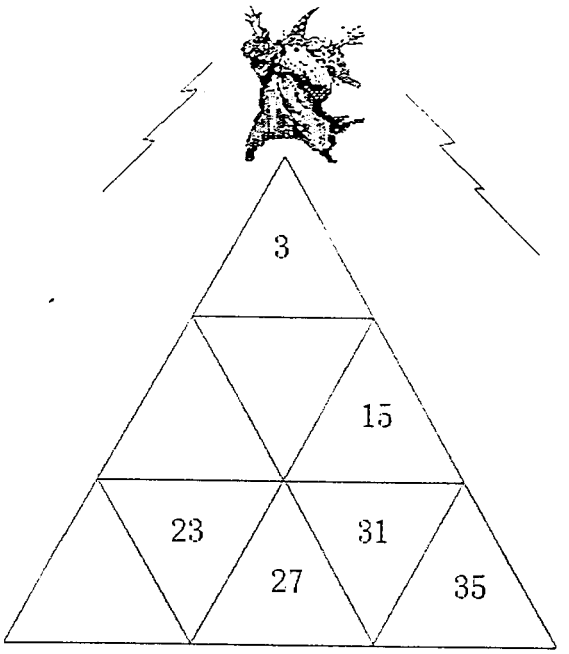
"Please mark the circle that tells how well you will do the next time you do a number pattern activity: not at all well, not so well, okay, quite well, very well." [indicating the corresponding circles].

APPENDIX L

Pattern Recognition Ability Measure

Source: Prepared by M. McGinn for SSHRC supported research of Dr. Lannie Kanevsky .

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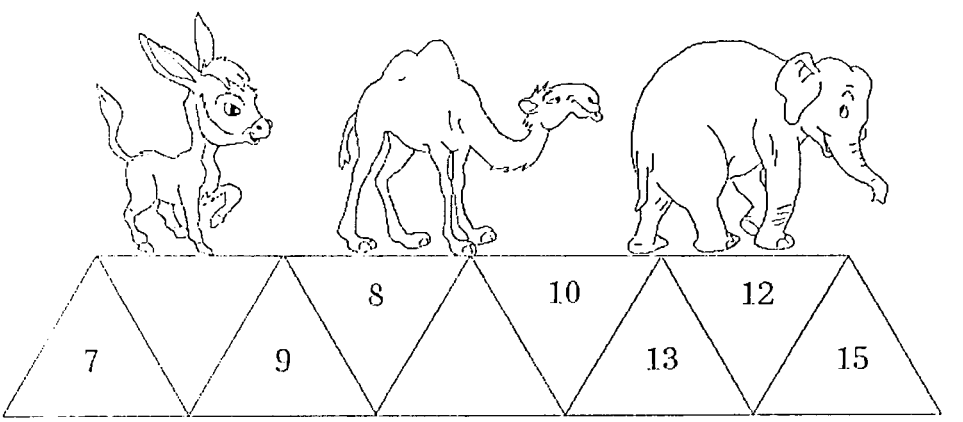
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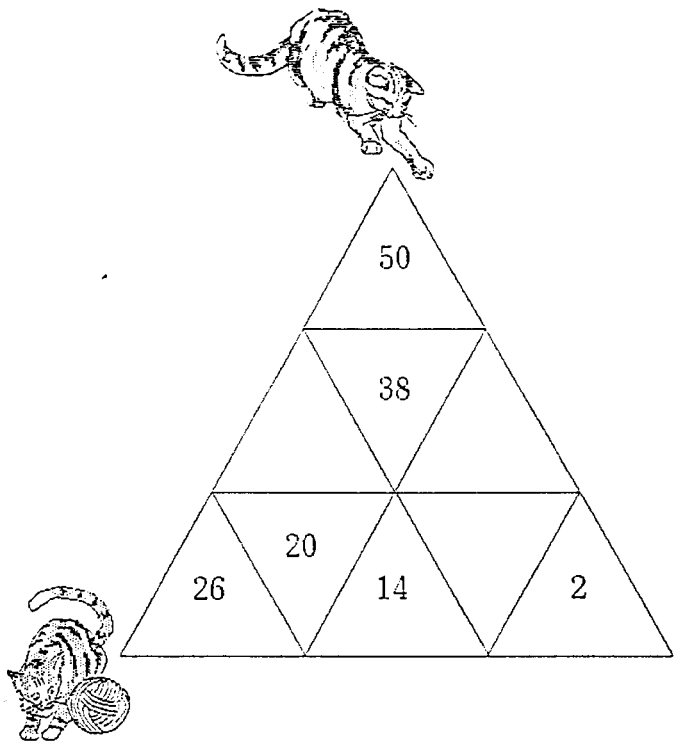
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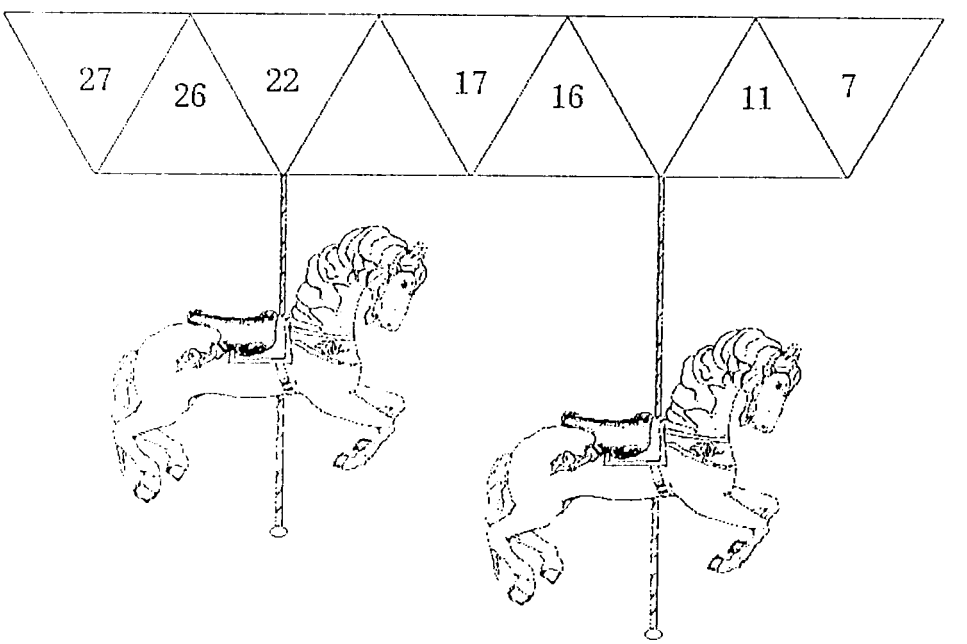
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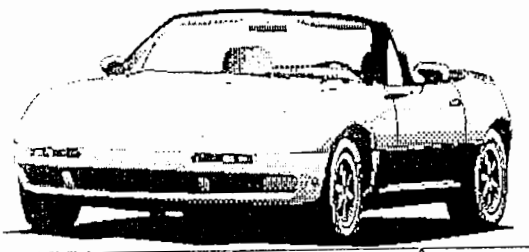

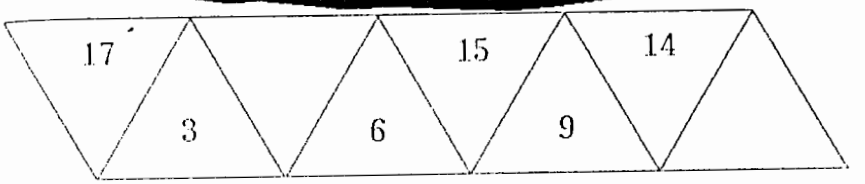
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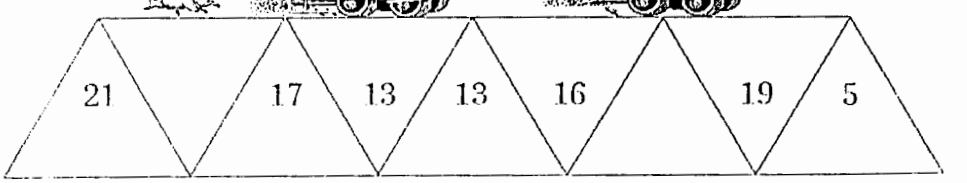
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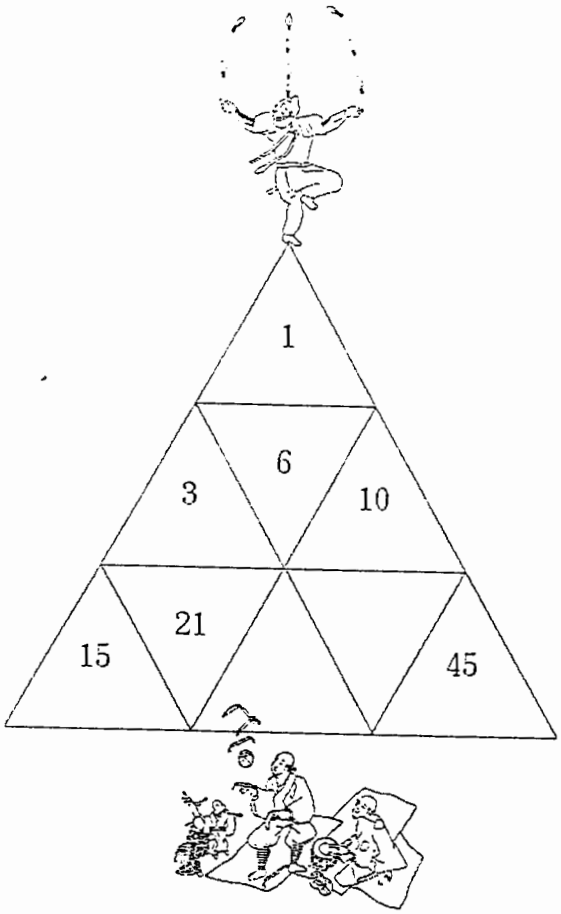
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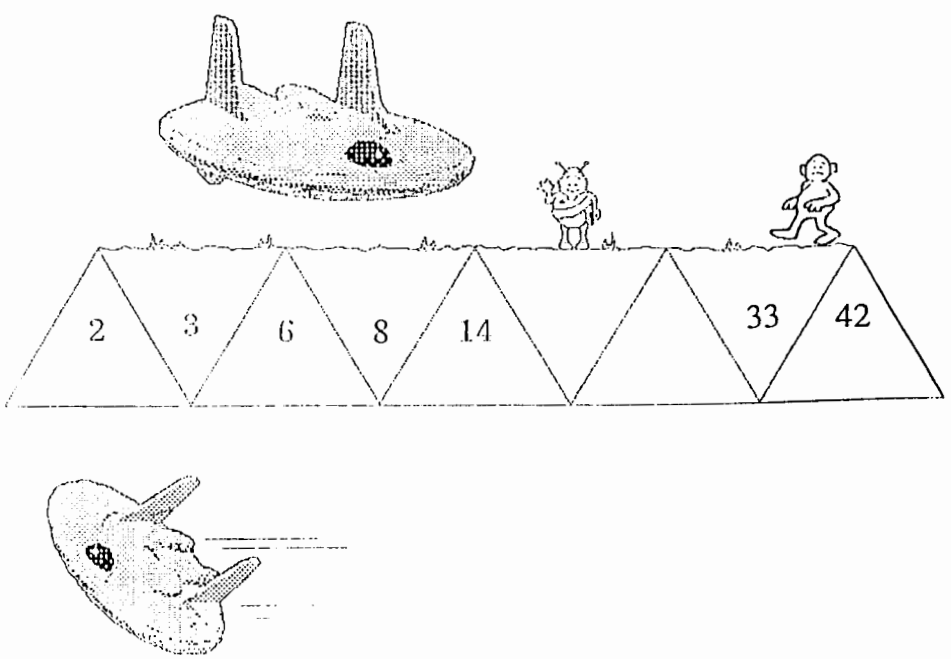
45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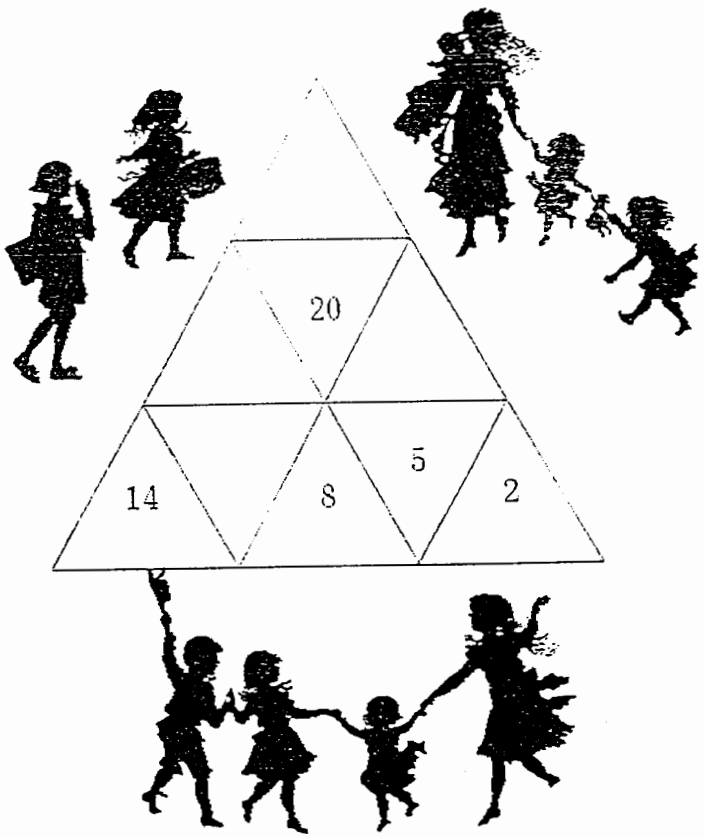
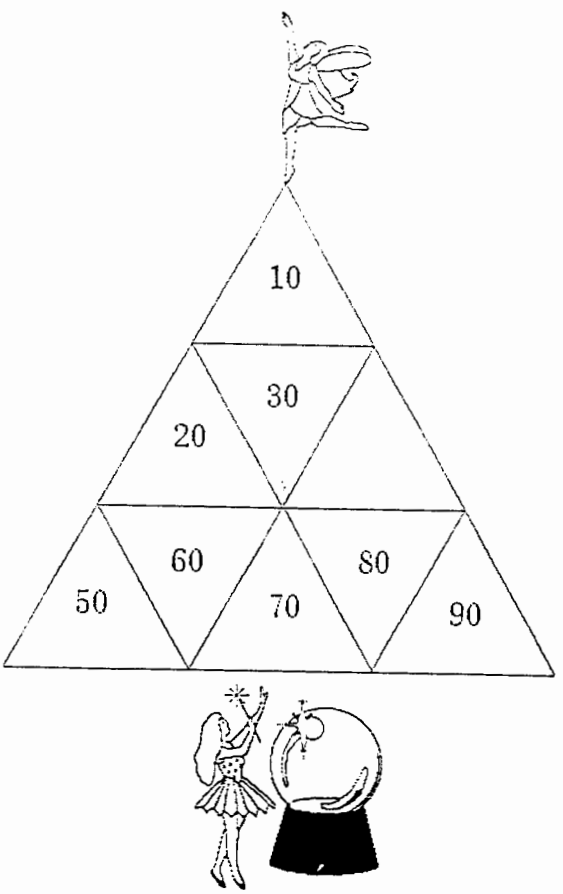
8
14
33
42

APPENDIX M

Pattern Recognition Task Examples

Source: Prepared by M. McGinn for SSHRC supported research of Dr. Lannie Kanevsky .





Script for Introducing Pattern Recognition Task Examples

"Now we're going to do some number patterns. They look like this." [task {#4} projected on the overhead and students handed individual sheets]."

"Please put your name on the sheet."

"Your job is to fill in any blanks you see."

In response to students' laments about not getting it experimenter commented:
"- just look at all the numbers and see what you can figure out .
- see what you can come up with.
- just a little bit longer.
- keep trying."

After giving the students three minutes to attempt a solution to the problem, the experimenter will offer:
"I realize this isn't the first one I should have given you. Let's work this one out together."

"Has anyone got any ideas about what we need to know to figure this out?" [the counting by pattern: how much the pattern changes from triangle to triangle].

"A good place to figure that out is where there's a group of numbers already in the puzzle. You can use the numbers that are already there to find out how much the numbers are changing from triangle to triangle."

"Let's see here. How much are the numbers changing from triangle to triangle? Two, three, four, five [as experimenter demonstrates counting on]. Five, six, seven , eight [again demonstrating counting]. How much are the numbers changing from triangle to triangle?" [while still holding up the counting on fingers].

"Hmmm, the next triangle is blank, so we need to figure out what goes in there. Okay...two, three, four, five. Five, six, seven, eight {all the while re-demonstrating the counting on technique]. So, the next number must be...eight, nine, ten, eleven." [again, using the counting on technique].

"Is the next number correct? Help me check it out. Everyone...eleven, twelve, thirteen, fourteen." [together, whole class does counting on technique to check the numeral in the fifth triangle].

"Let's keep going. Fourteen, fifteen, sixteen, seventeen. So what needs to go in this triangle? [17]. Everyone write that in and let's continue."

"Seventeen, eighteen, nineteen, twenty. Is everything all right here?" [yes].

"What next?" [continue using counting on technique with three to determine the number that belongs in the next blank triangle].

Experimenter guides whole class to completion of the number pattern in this manner.

"Great. That's how these number patterns work. Any questions?"

"Here's another number pattern for you to try." [projected on overhead and handed out to children].

Once everyone has completed the number pattern the experimenter asks:

"So what goes in this blank?" [40].

"How do you know that?" [because the numbers go 10, 20, 30, and 40 is missing, then it goes 50...90].

'What's the counting by pattern on this page? How much do the numbers change by from triangle to triangle?" [10].

APPENDIX N

Session Scripts

Pre-Treatment Session Script

"You're here today because your parents signed a form allowing you to be in my study. I just want to remind you that it is also up to you. If you decide for any reason, that you don't want to join in today, please let me know and you may join your teacher and other classmates out of the room."

"Hi, my name's Ms. Bell. I'm a student from Simon Fraser University. I'm trying to figure out the best way to work with children and help them learn.

"In the time that I spend with you we are going to do all sorts of activities together. I'll also be asking you questions about your learning. I have a special way of asking questions. I'll show it to you now."

"I know some children might like privacy so I've made these little screens for everyone." [experimenter hands out screens to everyone; questionnaire Appendix R handed out and projected on overhead].

"Please get out a pencil, an eraser, and a ruler."

"Print your name at the top of the page [in space provided]. Everyone ready?"

"Please put your ruler on the page under the first row of circles like this." [experimenter demonstrates on the overhead and reads item stem].

"The first thing I want to know is, how happy do you feel when you get a special treat."

"Think about how to answer this..."

Familiarization Questionnaire (see Appendix I for script).

"Please put your name on the sheet."

"Your job is to fill in any blanks you see."

In response to students' laments about not getting it experimenter comments:

"- just look at all the numbers and see what you can figure out .
- see what you can come up with.
- just a little bit longer.
- keep trying."

After giving the students three minutes to attempt a solution to the problem, the experimenter will offer:

"I realize this isn't the first one I should have given you. Let's work this one out together."

"Has anyone got any ideas about what we need to know to figure this out?" [the counting by pattern: how much the pattern changes from triangle to triangle].

"A good place to figure that out is where there's a group of numbers already in the puzzle. You can use the numbers that are already there to find out how much the numbers are changing from triangle to triangle."

"Let's see here. How much are the numbers changing from triangle to triangle? Two, three, four, five [as experimenter demonstrates counting on]. Five, six, seven , eight [again demonstrating counting]. How much are the numbers changing from triangle to triangle?" [while still holding up the counting on fingers].

"Hmmm, the next triangle is blank, so we need to figure out what goes in there. Okay...two, three, four, five. Five, six, seven, eight {all the while re-demonstrating the counting on technique]. So, the next number must be...eight, nine, ten, eleven." [again, using the counting on technique].

"Is the next number correct? Help me check it out. Everyone...eleven, twelve, thirteen, fourteen." [together, whole class does counting on technique to check the numeral in the fifth triangle].

"Let's keep going. Fourteen, fifteen, sixteen, seventeen. So what needs to go in this triangle? [17]. Everyone write that in and let's continue."

"Seventeen, eighteen, nineteen, twenty. Is everything all right here?" [yes].

"What next?" [continue using counting on technique with three to determine the number that belongs in the next blank triangle].

Experimenter guides whole class to completion of the number pattern in this manner.

"Great. That's how these number patterns work. Any questions?"

"Here's another number pattern for you to try." [projected on overhead and handed out to children].

Once everyone has completed the number pattern the experimenter asks:

"So what goes in this blank?" [40].

"How do you know that?" [because the numbers go 10, 20, 30, and 40 is missing, then it goes 50...90].

'What's the counting by pattern on this page? How much do the numbers change by from triangle to triangle?" [10].

"Any questions?"

"One thing I know about kids is they don't all like the same things. Some children would prefer to do easy number patterns and some children would prefer to do hard number patterns like the first one we did."[

"Think about which you would prefer to do and when I call your name, you may choose an "easy" envelope or a "hard" envelope." [pointing to each designated pile where they are arranged at the front of the classroom for children to pick up].

"Any questions?"

"Okay, when you get your envelope, please go back to your seat and put your name on the envelope, but don't open it yet."

Once everyone has returned to their seats, the experimenter requests that everyone write why they made the choice they did on the outside of the envelope:

"Would you please take a minute and tell me why you chose this envelope. Just write why under your name. Don't worry about your spelling. I'm real good at reading grade 1 and grade 2 work. Is everyone ready to move on?"

Experimenter circulates to take dictation if children need it.

Once everyone is ready, the experimenter continues by handing out the two-item reasons for choice questionnaire.

"Please put your name on this page. And then turn it over for now."

"Listen very carefully. Like I already told you, I know all children are different. I'm interested in what you are like."

"I want you to know that no one except you and I are going to see what you answer. Your teacher won't see it and your parents won't see it. So when you answer the questions, please think really hard about what you are like."

"Okay, you chose an easy number patterns envelope or you chose a hard number patterns envelope. Then you wrote on the outside of the envelope and told me why you chose that one. I want to know more about your choices. Listen."

"Other times, children have told me things like:

'I chose this one so I could get all the answers right.'"

"Other kids said:

'I chose this one because I like to work hard to figure out the ones I get stuck on.'"

"Which of these reasons is most important to you:

- getting all the answers right?

OR

-working hard to figure out any you get stuck on?"

"Think about that for a minute. Which is most important to you and which is next?"

"Turn your paper over."

Reasons for Task Choice Questionnaire.(see Appendix J for script).

After the questionnaires are completed the session continues.

"In the envelopes are number patterns like we worked on earlier. I gave these to you to help me figure out what the whole class does and doesn't know about number patterns. That will help me decide how to make the best lessons for everyone. So, all I ask of you is that you do the best you can."

'Everyone open up the envelopes and take everything out."

"Everyone should have a stapled together bunch of number patterns like this." [holding it up].

"You should also have some scrap paper and a hundreds chart that you can use to help you figure things out on if you like." [holding these up].

"Any questions."

After the children have been allowed time [12 min.] to work on the number patterns, the experimenter will ask them to pack everything up in the envelope provided.

"Please put everything back in the envelope."

Next, the motivation orientation questionnaire will be handed out to the children. For subsequent administrations of this questionnaire, the phrases "math patterns work" and "hundreds chart work" will be interchanged depending on which is most appropriate for the session in which the questionnaire is being conducted. "Math patterns work" is used in the Pre-Treatment Session. "Hundreds chart work" is used in Math Lesson 1. These different formats are provided in full, in the Pre-Treatment Session and Math Lesson 1 scripts respectively. Consequently, for each subsequent administration of the questionnaire, the reader

will be referred to either the Pre-Treatment Session or Math Lesson 1 for the appropriate form of the Motivational Orientation Questionnaire.

Motivational Orientation Questionnaire (see Appendix K for script).

"We're done! Thank you all so much for helping me. See you tomorrow."

Math Lesson 1 Script

NATURE OF LEARNING

At the beginning of the first lesson, the teacher will initiate a discussion about her experience of learning and her beliefs about learning:

"When I don't know something or can't do something, and someone else can, it tells me that that is something I haven't learned yet. Sometimes, it takes me a long time to learn things that my friends can already do."

"Remember, when you're learning something new you don't always get it right away. It often takes lots of hard work and lots of tries and lots of time and lots of mistakes before something is learned."

"Or think of yourself and learning to print your name! When you were very little you probably did scribbles on paper and told people that it said your name."

"Your parents would have been very happy about that. They probably told grandma and grandpa and their friends how wonderful you were. Even though you didn't have it quite right yet, they knew you were learning!"

"When you got a little bit older do you remember how hard it was to copy your name when some adult showed you how to do it. It was so tricky to get all those letters right!!!"

"It took years and lots of practice. And, you made lots of mistakes along the way but now I imagine it's pretty easy (even if you do get mixed up sometimes). After all you're still learning. You certainly know how to write a lot more than your name now, and every week you learn more and more."

VALUING LEARNING

The experimenter will continue with:

"I know learning is hard work! I know that when you are doing the lessons with me that sometimes it will feel tough, you might not like all the mistakes you make, and sometimes you might feel like giving up.

But, don't! If you keep trying, you <u>will</u> learn. You might not learn it at the same time as your neighbour but you will learn. What is important when you're working with me is that you don't give up and that you practice so you learn. You all learned how to print your name didn't you? Even though it was real tough in the beginning, but you kept practicing."

ATTRIBUTION TRAINING - poster introduction

And, the experimenter will further continue with:

"Sometimes when I'm learning I'll try to do something and I'll think 'What! I don't get this! This is too hard! Forget it!'"

"Then a little voice inside of me says...You can't learn that way. Ugh, ugh, ugh, ugh. So...I take a deep breath [demonstrate]and tell myself...Okay, okay, I can learn this."

"Let me draw a picture to help you remember this." [experimenter draws first panel of poster].

"Next I ask myself, 'Is this like anything I already know? Then I ask myself, do I see anything here that I know?"

"I'll tell you what I mean. One day I had a class that was doing number patterns like you did the other day. I could see a child who looked like he was stuck. Then suddenly he said, 'Oh, I get it---it's like counting nickels! Five, ten, fifteen, twenty.' and he filled in the blank and went on to the next one!"

"What you know; what you've already learned, helps you learn other things."

Experimenter proceeds to draw second panel of poster.

"What do I know? I'll draw some nickels and counting, five, ten, fifteen, twenty, to remind you to think about what you know."

"So, I tell myself, 'I can learn' [pointing to the first panel] and I think about what I know; if this thing I'm trying to figure out is like anything I know." [pointing to the second panel].

"And, I think about where to start!"

Experimenter begins to draw third panel.

"You know what it's like doing a Maze? You try one place and that doesn't work so you try another place and then maybe another and another and then [experimenter draws light bulb on panel] you get it!"

"All of this is part of learning.

"Those thoughts help me come up with different ways of trying the thing I don't understand. Lots and lots of times, different ways of trying, helps me get it! Then I can go on to learn something else." [experimenter indicates with arrows between panels two and three].

"Other times, after talking to myself like this and trying long and hard, I still just don't get it."

"Where could you go for help?" [experimenter draws children's suggestions to creates fourth panel of poster].

VALUING LEARNING

"School is for learning. What I want for you, is that you learn."

NATURE OF LEARNING - review

"Remember what I said about learning? What's something that might happen when you are learning?" [make mistakes; be unhappy; get stuck; feel like giving up].

"If any of this happens to you are you going to give up?" [no].

ATTRIBUTION TRAINING - review

The attribution dialogue poster will be displayed prominently for students to refer to as necessary. This cartoon will be used as a reinforcement of the attribution training throughout subsequent sessions. The experimenter will point the bits out on the poster as they are being reviewed.

"What are you going to say to yourself?" [deep breath and 'Okay, okay, I can learn this!'].

"Then what are you going to think about to help yourself?" ['Is this like anything I already know?'; 'Where could I begin?...trying different ways'].

"Why are you going to do all this again?" [to learn].

"And remember, if you've really, really done all of this and you still don't get it, think about the best place to go for help."

"Let's get on with today's lesson."

The children were provided with a copy a 10 X 10 grid and the experimenter projected a 10 X 10 grid with the overhead projector.

"Please put your name on this.'

The experimenter then marks a one (1) in the top left-hand square. Indicating the next square to the right, the experimenter instructs:

"Everyone mark a one on their paper in the same place that I marked mine. Now, what do you suppose goes in here (indicating the next square to the right)?" [2].

"Okay, let's put that in."

"Next?" [3].

"Write that in."

"And what next?" [numbers 4 to 100 need to be entered on grid].

After ten minutes, the experimenter asks:

"Does anyone know what we this is called?" [a hundreds chart].

"Before I say anything more, has anyone else got any questions or anything to say?"

"Now we'll do a seat work activity"

VALUING LEARNING

After the experimenter announces the seat work, she adds:

"This seat work gives you a chance to practice and help you learn."

Students will be provided with a cut-up hundreds chart and a piece of construction paper with a blank hundreds chart grid photocopied onto it, upon which to glue the cut-up hundreds chart. Every chart will be cut in the same way.

"Please spill the contents of your envelopes out onto your construction paper. Hmmm, tell me what we have here." [a cut-up hundreds chart].

"Yes, this is your hundreds chart puzzle. Your job is to put this hundreds chart puzzle back together again."

"The green construction paper with the box of squares printed on it is like the blank one we just filled in. But this time, instead of printing the numbers in, you're going to glue the puzzle pieces on."

"When you have all the puzzle pieces in the right order put a bit of glue on the back of each piece and press in back down on the green box so it all stays together."

ATTRIBUTION TRAINING - poster reminder

After the description of the seat work has been given and the children have been allowed three (3) minutes to tackle the task, the experimenter interrupts the class to remind the children about the questions intended to promote appropriately applied effort presented in the attribution dialogue.

"Remember, if you get stuck are you going to give up?" [no].

"What are you going to do to help yourself?" [the questions outlined in the attribution dialogue described above].

"If you forget what to do to help yourself what can you use to remind yourself?"

NATURE OF LEARNING - standardized statement

"Remember, you might make mistakes, or get confused or frustrated, or maybe feel dumb at times. But eventually you will learn."

After twenty minutes all students' work will be collected.

Next, the Motivation Orientation Questionnaire will be completed by the children. Where necessary the phrase "hundreds chart work" will replace "number patterns work", so that the items make sense in the context of this session.

"Once again, I need information from you to help me figure out what is best for children. [while handing out six-item questionnaires and screens].

"We know how to do these so let's get started."

"And, remember...No one except you and I are going to see these. I want you to really think, and tell me about <u>you</u>. If you do, that will really help me."

"Please make sure your name is on this page." [in designated space].

"Please put your ruler on the page under the first row of circles."

<u>Motivational Orientation Questionnaire</u> (see Appendix K for script but substitute "hundreds chart work" for "number patterns").

"We're done! Thank you all so much for helping me. See you tomorrow."

Math Lesson 2 Script

The experimenter projects a hundreds chart.

"Hmmm...what have we here?!" [hundreds chart].

"Yes, a hundreds chart like we made and talked about yesterday. Today, we're going to explore the hundreds chart to see what discoveries we can make about it."

ATTRIBUTION TRAINING - discussion

"Just before we get started, did anyone have a chance to use the helpful learning reminders since yesterday?"

"Please tell us about it."

"If what we're doing starts to get tough, or you start to make mistakes, what could you use to help you?" [the questions; the poster].

"Right, because that helps you come up with an idea of how to solve your problem. Hard work and plans equal solutions! Thinking about what you already know, and using that, is one way to combine hard work and plans."

So, let's all take say...three (3) minutes to check this hundreds chart out!"

"Great, what did you notice about this hundreds chart?"

If necessary, the experimenter can prompt with such questions as:

"What do you notice about the numbers in the last column?" [all end in zero (0); adding or subtracting by ten (10) depending on whether going up or down].

"What happens as you go across any row? How much does the next number change by?" [each consecutive number changes by one

(1), in other words, adding or subtracting counting by one (1) depending on which direction across].

"Where are all the numbers with a five (5) in the ones place; a nine (9) in the tens place? etc."

"What numbers are in that set?"

"Let's write them out."

The experimenter will encourage the students to use the spatial (coloured) pattern to supply the numbers comprising the mathematical pattern.

Students' observations will be demonstrated on the overhead hundreds chart for the benefit of the whole class.

NATURE OF LEARNING - standardized statement

During the lesson, when the experimenter is prompting exploration of the hundreds chart, the standardized nature of learning statement will be interjected.

"Remember, what I've told you about learning...if you're making mistakes, or getting confused, or not feeling great about what you're doing, that's okay. That's all part of learning. Eventually, you'll learn some useful things."

"Now we'll do a seat work activity"

VALUING LEARNING - seat work instructions

After the experimenter announces the seat work, she adds:

"This seat work gives you a chance to practice and help you learn."

All students receive a folder of hundreds charts upon which to explore. What the student chooses to colour will be entirely up to the individual.

"Here are hundreds charts for you to color any observations that you make. I'd also like you to write the number pattern that goes with each pattern you colour. You'll have time for sharing what we discover in a little while."

ATTRIBUTION TRAINING - poster reminder

After the description of the seat work has been given and the children have been allowed three (3) minutes to tackle the task, the experimenter interrupts the class to remind the children about the questions intended to promote appropriately applied effort presented in the attribution dialogue.

"Remember, if you get stuck are you going to give up?" [no].

"What are you going to do to help yourself?" [the questions outlined in the attribution dialogue described above].

"If you forget what to do to help yourself what can you use to remind yourself?"

NATURE OF LEARNING - standardized statement

Through the course of the seat work, the experimenter will make regular declarations that **"you might get a little confused, maybe feel a little dumb at times---but eventually, you'll learn..."** (Elliot & Dweck, 1988, p.7).

After twenty minutes, the experimenter draws the activity to a close with:

"Okay, let's see what you've come up with? Who would like to start?" Who has a pattern that they've coloured that they'd like to share with us?"

"Please tell us what you were thinking to make you colour this." [the particular coloured pattern will be coloured and projected on the overhead for the entire class to see].

Ten minutes will be allotted for sharing.

Math Lesson 3 Script

ATTRIBUTION TRAINING - discussion

"Has anyone had a chance to use the helpful learning reminders since yesterday?"

"Please tell us about it."

The experimenter projects a hundreds chart.

"Once again, we'll be dealing with the hundreds chart. Today though we're going to explore the hundreds chart in yet another way."

The experimenter places a two square, plain paper shape horizontally over forty-four (44) and forty-five (45). Then, pointing at the covered forty-four (44) square asks:

"What goes here?" [44].

Regardless of whether or not students supply the answer, in order to emphasize the counting concept of plus one (1), the experimenter proceeds with:

"Say the numbers out loud as I point to them. [41, 42, 43,]. So, the next one will be...?" [44] [experimenter writes in number to the class response].

"And then...?" [45] [again experimenter exposes number to the class response].

"And then...?" [experimenter covers 46 and then reveals it again when class responds].

"So, what happens as we go across the row like this [pointing from square to square]?" [The number in each square over is one more, then one more, then one more].

Placing the two square blank shape over seventy-seven (77) and seventy-eight (78) the experimenter comments:

"Let's try that somewhere else."

Next, the experimenter proceeds in the manner outlined above.

For the third and forth trials the two square blank shape will be placed over:
- five (5) and six (6) [right to left]

-twenty-three (23) and twenty-four (24) [right to left].

Although the experimenter proceeds in the manner outlined above, for these trails, the movement will be from right to left rather than left to right. This facilitates emphasizing the counting concept of minus one (1).

NATURE OF LEARNING - standardized statement

"Don't get worried if you feel confused by this at first."

"I have a little skit I want to you t watch."

The experimenter goes on to role play getting stuck and referring to the effort, strategy, solution poster. But, she gets stuck on the first step:
"I can learn! I can learn! I can learn!"

Then asks:
"What's wrong with this picture?" [Hard work is not enough!].

"The first step toward learning <u>is</u> trying hard but your also need plans or strategies."

"That's why we have the other steps on this poster.
Bringing what you already know to the problem at hand is a very helpful."

"Also, remember, figuring out where to start is very Important."

"Learning takes hard work and plans."

"So, if you are trying hard and still seem stuck think about if you are also working on a plan."

"So if what we're doing starts to get tough, or mistakes start to be made, what could you use to help you?" [the questions; the poster].
"Right, because that helps you come up with an idea of how to solve your problem."

"Hard work and plans equal solutions! Thinking about what you already know, and using that, is one way to combine hard work and plans."

Next the two square blank shape is placed vertically to emphasize place value and the counting concepts of plus and minus ten (10). Two examples will be used for plus ten (10), covering:

- fifty-two (52) and sixty-two (62)

-twenty-five (25) and thirty-five (35).

Next, two examples will be used to emphasize minus ten (10), covering:

- seventy (70) and sixty (60)

-twenty-seven (27) and seventeen (17).

The lesson will proceed in the manner used for the first example.

If at any time the class is stymied and can not supply the answer, the experimenter will prompt with such comments as:

"Remember what happens when we move this way?" [pointing] [the next square is one (1) more or one (1) less or ten (10) more or ten (10 less].

"Now, we'll do a seatwork activity."

VALUING LEARNING - seatwork instructions

After the experimenter announces the seatwork, she adds:
"This seatwork gives you a chance to practice and help you learn."

Students will be provided with a sheet printed with forty (40) shapes purportedly cut from a hundreds chart. These shapes will be similar to the shapes used in the class work except instead of being blank, these shapes will have a numeral printed in one of the squares. The students' task will be to supply the missing numerals that belong in the other squares of the shape.

"Your job is to fill in the numbers that belong in the blanks of the shapes."

ATTRIBUTION TRAINING - poster reminder

After the description of the seatwork has been given and the children have been allowed three (3) minutes to tackle the task, the experimenter interrupts the class to remind the children about the questions intended to promote appropriately applied effort presented in the attribution dialogue.

"If you get stuck remember, what can you ask yourself?" [the questions outlined in the attribution dialogue described above].
"If you're not sure, what can you use to help you?" [the poster].

Throughout this time, the teacher will occasionally direct the attention of the entire class to the cartoon and it's message.

NATURE OF LEARNING - standardized statement
"Remember, while you're working on these, mistakes, confusion, maybe even feeling a little dumb at times are all part of learning."

Next, the Motivation Orientation Questionnaire will be completed by the children. Use the Appendix K script but substitute "hundreds chart work" for "number patterns."

"We're done! Thank you all so much for helping me. See you tomorrow."

Math Lesson 4 Script

ATTRIBUTION TRAINING

"Take a look at your work from yesterday."

"The number inside the purple circle is how many of the squares you filled in correctly."

"The number with the X beside it is how many you got mixed up on."

"Please turn your papers over. Don't do any corrections. Right now I want talk about learning."

"A very special congratulations to those people who got 10, 9, 8... or 0 mistakes...Way to go! You used good learning behaviour."

"It seems to me that the people who spent the most time saying 'this is easy' are the people who got mixed up on 20, 30, 40, 50, even 60!"

"What do you think, do you think saying 'this is easy' is a good learning behaviour?"

"Doesn't look like it does it?"

"BUT using the learning reminders is!"

"For instance, I heard Harold (not real name) say, 'Wait a minute, this isn't so easy!'"

"But he didn't give up." [experimenter points to poster].

"Then I heard him say, 'I need to get a picture of the 100's chart in my mind to help me'."

"He was thinking about something that he knew about that could help him." [point out poster].

"Then a couple of times I heard him saying, 'Wait a minute...[erase, erase]. and saw him restart [point out poster] several he'd done because he realized they didn't look like the 100's chart [point out poster]."

"Excellent learning behaviour Harold, who only mixed up 4 and worked out over 50!"

VALUING LEARNING

"I showed you these to remind you that mistakes are part of learning. I don't want you to worry about how many you got mixed up on."

"So, today, what I want for you is to:

- learn from your mistakes and

- build on what you learned yesterday."

Experimenter recollects papers.

"Once again today, we're going to work with the 100's chart."

"Let's take a quick look at what we talked about yesterday."

"What happens to the numbers as we move:

-left to right [numbers increase by plus one]

-right to left [numbers decrease by minus one]

-top to bottom [numbers increase by plus ten]

-bottom to top? [numbers decrease by minus ten]"

"So, what numbers go in here...?" [use prepared overhead].

ATTRIBUTION TRAINING - poster reminder

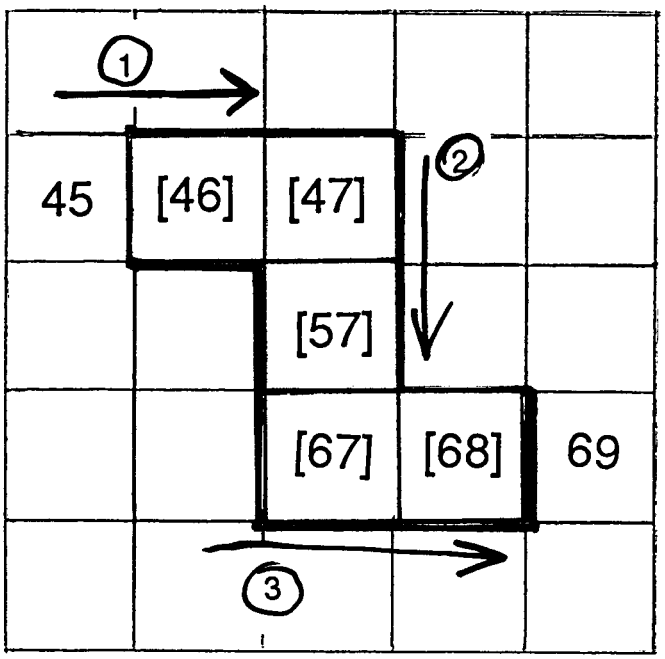
When the first complex shape is placed on the hundreds chart the experimenter reminds the class of the 'effort appropriately applied' prompt.

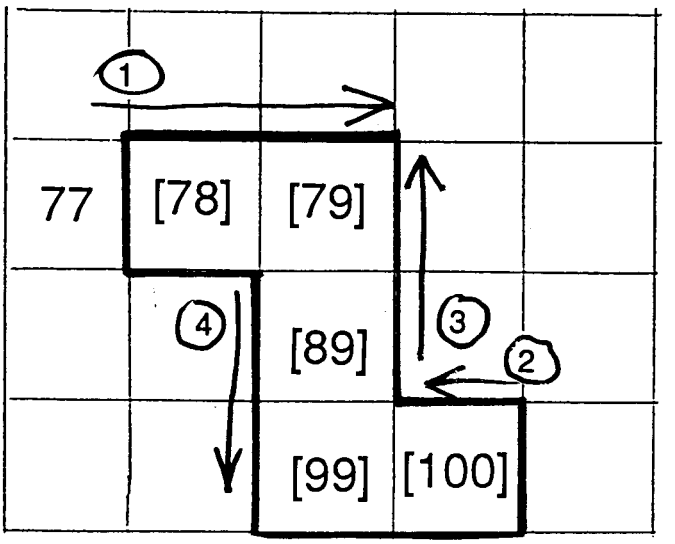
"Okay, if you get stuck on these ones, what is useful to help you learn?" [the questions; the poster].

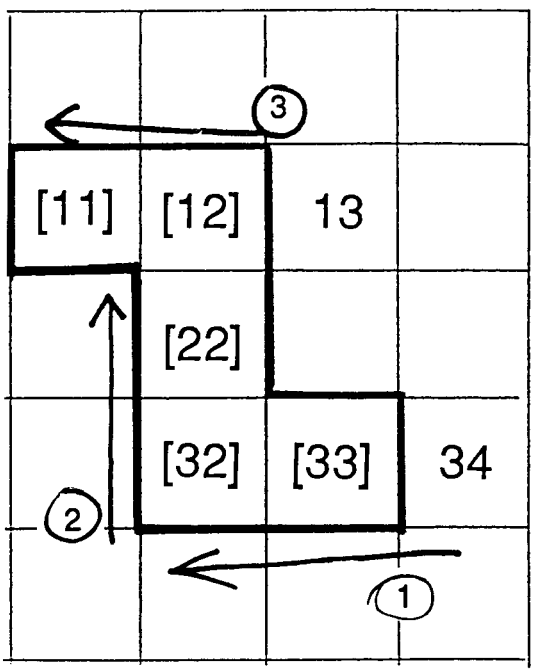
The experimenter projects a hundreds chart.

Shapes combining the counting concepts plus and minus one (1) and (10) will be used. The different shapes to be used, the comments the experimenter will use, the shapes' placement on the hundreds chart, and the order in which the experimenter will ask for blanks to be filled in are as follows:

"Here's what we're doing today."




1
77
[78]
[79]
4
[89]
3
2
[99]
[100]


3
[11]
[12]
13
[22]
[32]
[33]
34
2
1

ATTRIBUTION TRAINING - modeling

After the second example, the experimenter models positive self-attribution by demonstrating. The experimenter proceeds with the demonstration in a manner as if talking to herself. On the above example she starts:

"Let's first go...33, 32, then...31, 30."

She falters as if stuck and continuing to talk as if to herself says:

"Oh dear, oh dear, what am I doing here?"

After a brief pause she continues:

"Oh ya, okay...I can learn this [glancing at poster]. What do I already know?...okay get the hundreds chart in my mind. So, where should I start?."

"Going this way, it's minus one. But going upwards it's 10. So, it will be two at the end...32. Then there's 22 and 12. And, then one less than 12 is 11!

"Now, we'll do a seatwork activity. Your job is to fill in the numbers that belong in the blanks of the shapes."

VALUING LEARNING - seatwork instructions

After the experimenter announces the seatwork, she adds:

"This seatwork gives you a chance to practice and help you learn."

Students will be provided with a sheet printed with twenty (20) shapes purportedly cut from a hundreds chart. These shapes will be similar to the shapes used in the class work except instead of being blank, these shapes will have a numeral printed in one of the squares. The students' task will be to supply the missing numerals that belong in the other squares of the shape.

ATTRIBUTION TRAINING - poster reminder

After the description of the seatwork has been given and the children have been allowed three (3) minutes to tackle the task, the experimenter interrupts the

class to remind the children about the steps intended to promote appropriately applied effort.

"If you get stuck remember, what can you ask yourself?" [the good learning behaviour poster].

"If you don't remember the good learning behaviour reminders what can you use to help you?" [the poster].

While students are working on the seat work, the teacher will occasionally direct the attention of the entire class to the poster and it's message. She also stated:

NATURE OF LEARNING - standardized statement

"Remember, you could make a bunch of mistakes, get a little confused, maybe feel a little dumb at times---but eventually, you'll learn some useful things."

Math Lesson 5 Script

ATTRIBUTION TRAINING - poster reminder

At the beginning of the lesson the experimenter reminds the class of applying effort appropriately.

"Has anyone had a chance to use the helpful learning reminders?"

IF yes THEN:

"Please tell us about it."

IF no THEN:

"What are the helpful learning reminders?" [on poster].

The experimenter projects a hundreds chart on the overhead.

"Once again, we're going to work with the hundreds chart...Surprise, surprise! We're going to look at number patterns on the hundreds chart today."

VALUING LEARNING

"I keep using the 100's chart because I want you to learn about it so it can help you learn other things."

"Like I said yesterday, what I want for you is to:

- **learn from your mistakes and**
- **build on what you learn."**

"Let's look at counting by 3."

"For this one, let's start at zero." [demonstrate previously demonstrated counting on strategy].

"Let's see...three (3). One (1), two (2), three (3)."

Experimenter proceeds by counting quietly, but loudly announcing multiples of three (3). Additionally, when the multiples of three (3) are stated, the experimenter colours that appropriately numbered square on the hundreds chart.

"Four (4), five (5), six (6)." [colour in six (6) square...].

"Do this with me. Ninety-seven (97), ninety-eight (98), ninety-nine (99)." [colour in ninety-nine (99) square].

"What do you see now that we have this all coloured in?" [diagonal coloured pattern].

Student responses will be discussed with the experimenter drawing attention to the spatial arrangement of the counting by three (3) pattern on the hundreds chart.

"I think you need a chance to try this."

NATURE OF LEARNING - standardized statement

Before commencing the practice experimenter will remind the students of the nature of learning.

"You know how I keep saying that you might get a little confused at first when you're learning?"

"But then I've told you if you do, think about something you already know to help you."

"Well, if you really work hard and pay attention when we're all doing this together, it can help you tremendously when you start to work on your own."

Individual papers handed out.

"Names on your papers please."

"Who has a suggestion?"

Now kids and experimenter work on number pattern simultaneously on overhead and individual sheets.

Next the experimenter will present a pattern saying someone wrote their name repeatedly and then coloured in each square containing the last letter of that name. Using a name that corresponds with one of the skip patterns already demonstrated (e.g. 3), the experimenter will have the children relate the name pattern to a skip counting pattern.

"My friend Kim coloured this pattern for me. She just wrote her name over and over again, and every time she wrote the last letter in her name, "m", she coloured that square in."

"What do you notice about this pattern?' [the coloured squares are on the diagonal; it's a multiples of three pattern].

"What is the counting pattern for 'Kim'?" [3].

"Why don't you colour the pattern of your name."

Experimenter circulates to ensure that students are getting it.

"Now, we'll do a seatwork activity."

VALUING LEARNING - seatwork instructions

After the experimenter announces the seatwork, she adds:

"Your number one job when you are with me is to learn."

"This seatwork gives you a chance to practice and help you learn."

"Today, I've given you a bunch of tasks to do on 100's charts."

Each child will receive a folder of hundreds charts and a list of tasks to complete. The tasks include figuring out the counting pattern for their own name, determining the skip counting pattern for a variety of names and colouring them on hundreds charts, and finally colouring skip counting patterns of their choice, and being prepared to describe them to the class. Time will be provided at the end of the class for students to share their findings.

"Let's see what this page asks you to do." [after packages with the instruction sheet and a folder of hundreds charts have been handed to each child and they have their names on them].

ATTRIBUTION TRAINING- poster reminder

After the description of the seatwork has been given and the children have been allowed three (3) minutes to tackle the task, the experimenter interrupts the class to remind the children about the questions intended to promote appropriately applied effort presented in the attribution dialogue.

"If you get stuck remember, what do you need to think about?" [the steps outlined in the attribution training poster].

"If you're not sure what to think about, what can you use to help you?" [the poster].

NATURE OF LEARNING - standardized statement

"Remember, what I've told you about learning...It often involves mistakes, getting confused, not feeling so great about you're doing---but eventually EVERYONE LEARNS."

"This doesn't mean that everyone learns the same things at the same time though..."

'You might think some people in here are learning things that you don't get yet. That might be true...but if you practice good learning behaviour you to will learn."

Next, the Motivation Orientation Questionnaire will be completed by the children. Use the Appendix K script but substitute "hundreds chart work" for "number patterns."

"We're done! Thank you all so much for helping me. See you tomorrow."

Math Lesson 6 Script

"The reason I've been having you colour number patterns on hundreds charts is so that you could see and understand that different number patterns LOOK different when they're coloured on hundreds charts."

Experimenter presents poster with coloured number pattern 100's charts presented on it, and provides time for class to observe.

"There are patterns in the way that number patterns LOOK."

"AND...there are also patterns in the NUMBERS that make up these patterns."

"Today, we're going to concentrate on what we can discover about the NUMBERS in the patterns that we colour."

"So...this is how it works...
Right now, I want you to pretend that I am a video that you are watching. You must watch very carefully so when it's your turn, you can do what I'm going to show you.'

"What number pattern do I want to colour...Hmmmm...8!"

"Okay, so I write that here so I don't forget."

"Now to colour...1, 2, 3, 4, 5, 6, 7, EIGHT [colour 8]."

"Oh ya, teacher said colour in the whole square with a light colour."

"1, 2, 3, 4, 5, 6, 7, EIGHT [colour 16]...1, 2, 3, 4, 5, 6, 7, EIGHT [colour 96]."

"That looks neat."

"Hmmmm? Now I have to write out the numbers!"

"Okay, small and neat..."

"8 [demo by touching the number in the hundreds chart and then writing it down below], 16, 24, 32, 40, 48. Hey, wait at minute here...8 and 48...they both have 8 at the end. I'm going to put the 48 under the 8.

"So, let's see 48, 56, 64, 72, 80, 88...no, put 88 under here."

"88, 96!"

"Hey cool! Look at how these numbers work out into a pattern!!!" [experimenter demonstrates end digits are the same down columns].

"Okay, no messy work and no shortcuts today."

"I WANT TO SEE HOW WELL YOU CAN FOLLOW INSTRUCTIONS:"
"#1 - decide what you're counting by and write the number down [point to overhead to reinforce].

#2 - colour that counting pattern remembering to colour the whole square in neatly with a light colour [point to overhead to reinforce].

#3 - copy down the numbers of that number pattern small and neatly so we can clearly see the number pattern [point to overhead to reinforce]."

"It is not okay to just whip through a whole bunch of patterns today. For each pattern that you do I want you to see how many discoveries

you can come up with. Let's all work on this one." [brainstorm for observations of the spatial and numerical patterns - GIVE THIS SOME TIME AND EFFORT].

"Now, you can do your seatwork activity."

VALUING LEARNING - seatwork instructions

After the experimenter announces the seatwork, she adds:

"This seatwork gives you a chance to increase your learning so really have your thinking caps on when you do this today."

All students receive a folder of hundreds charts upon which to explore.

"Names please."

Math Lesson 7 Script

"Help me out...Why am I in your classroom? What am I interested in?" [children's learning].

"I'm interested in helping you understand about learning because I think that helps YOU learn."

NATURE OF LEARNING - review

"Does everyone in here learn the same things at the same time?" [no].

" Some learn quicker and some learn slower BUT EVERYONE LEARNS."

"So if you don't understand something yet and other people do, that's okay. Remember, mistakes, being a little confused, or feeling a little dumb at times are all part of learning."

"Is learning easy?" [no].

"Things are easy once you KNOW them!"

"Think back to learning to print your name...Learning it took hard work and lots and lots of practice...NOW IT'S *PRETTY* EASY!"

"Think about this question...don't just call out. I want you to really think."

"As a matter of fact, close your eyes and put your head down...

If people all around you are calling out 'this is easy, this is easy' does that mean they know something that you haven't learned yet?"

"NO IT DOESN'T! When that happened in here we figured out that the 'THIS IS EASY' PEOPLE were wasting their energy! The people who learned the best were those who put their energy into using good learning behaviour!!!!!"

"Heads up."

ATTRIBUTION TRAINING - poster reminder

"Tell me about good learning behaviour?" [refer to the poster].

"Thinking in this way HELPS YOU LEARN."

"Today's seatwork is about everything we've done so far."

"What have we done so far?" [brainstorm and record on board].

VALUING LEARNING - seatwork instructions

After the experimenter announces the seatwork, she adds:

"This seatwork gives you a chance to practice and help you learn more than the last time you did it."

Students will be assigned an individual paper and pencil activity to assess their learning thus far. Questions pertaining to Lessons 1 through 6 will be included.

"Remember names on your papers please."

ATTRIBUTION TRAINING - poster reminder

After the description of the seatwork has been given and the children have been allowed three (3) minutes to tackle the task, the experimenter interrupts the

class to remind the children about the **strategy** intended to promote appropriately applied effort presented in the attribution dialogue.

"If you get stuck, remember the 'good learning behaviour' things to think about?"

"If you're not sure what they are, what can you use to help you?" [the poster].

NATURE OF LEARNING - standardized statement

"Remember, mistakes and confusion are part of learning. Don't give up. Practice good learning behaviours."

Next, the Motivation Orientation Questionnaire will be completed by the children. Use the Appendix K script.

"We're done! Thank you all so much for helping me. See you tomorrow."

Post-Treatment Session Script

Session 10 will be similar to Session 1. It will not involve the Familiarization Questionnaire. It will commence with students choosing a mathematical pattern activity in a range of difficulty of their choosing. The balance of the session will be conducted in the same manner as the pre-treatment session. That is, the students will write their reasons for choosing the envelope they did, complete the Reason for their Task Choice Questionnaire, they will have time to work on the Pattern Recognition Tasks and they will complete the Motivational Orientation Questionnaire.

"Once again, today you get to choose the type of number pattern activity you would like to work. Knowing that some kids prefer easy number patterns work on, and others prefer hard or challenging numbers patterns work, I once again have prepared both kinds of envelopes." [indicating the two piles].

"When I call your name you may go choose the type of number patterns that you would prefer to work on PLUS a privacy screen and a ruler." [make these available near envelope piles].

"Put your name on the envelope, but do not open it yet."

When everyone has their envelope, the experimenter proceeds with:

"Because I am interested in your learning please tell me on the white space on the envelope why you chose the one you did. I don't care about your neighbour...I care about YOU...so really think about your reason and write that."

When everyone has written their reason, we will proceed:

"Every envelope contains a stapled together group of number patterns as well as a scrap piece of paper for rough work and a hundreds chart to use if you want."

"Any questions?"

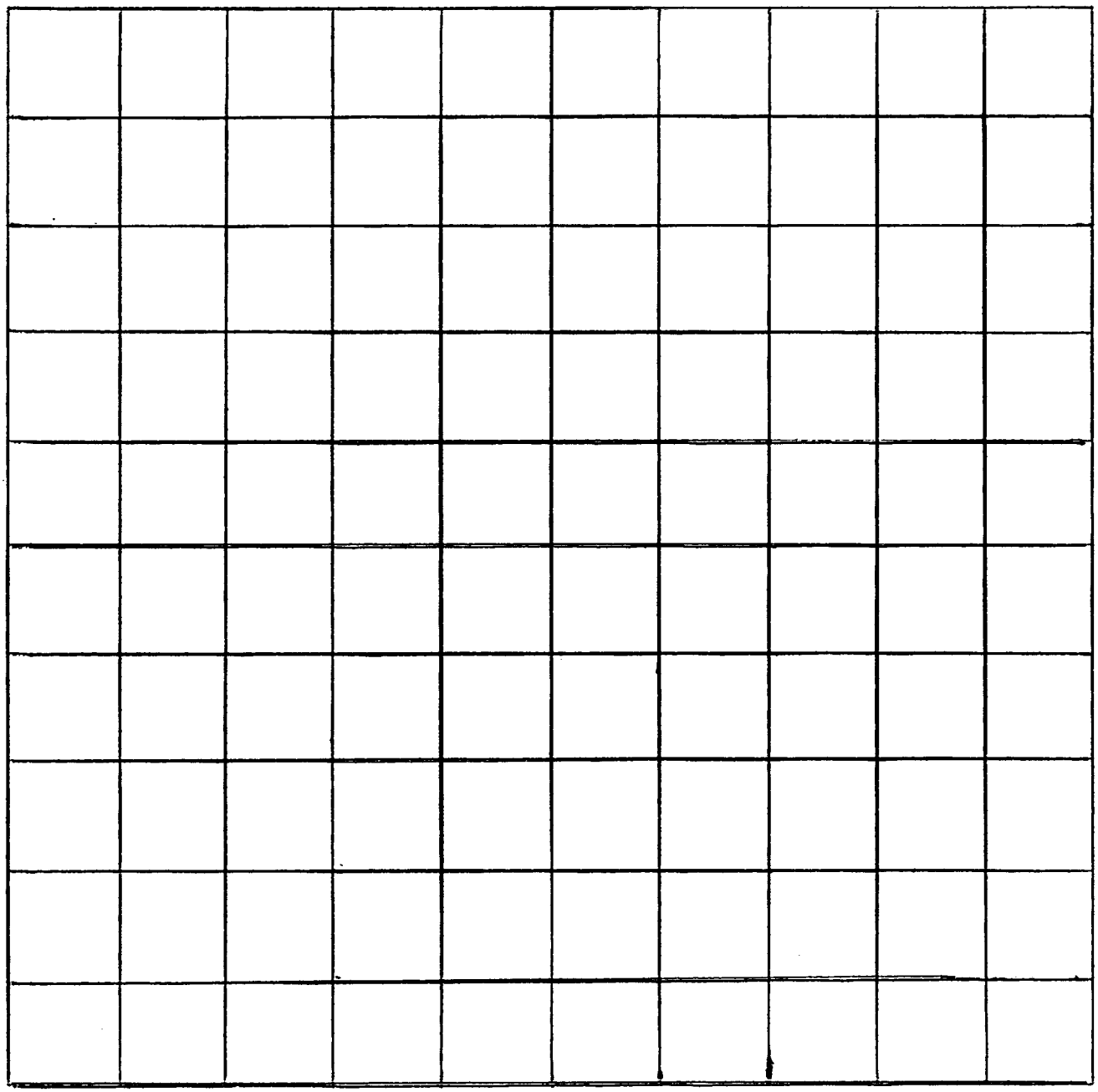
"You may start now."

Go to Pre-Treatment Session script for balance of Post-Treatment Session script.

APPENDIX O

Math Lesson 1 Whole Group Instructional Material

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.



APPENDIX P

Math Lesson 2 Whole Group Instructional Material

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

HUNDREDS CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

APPENDIX Q

Math Lesson 3 Whole Group Instructional Material

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

HUNDREDS CHART

1	2	3	4			7	8	9	10
11	12	13	14	15	16		18	19	20
21	22			25	26		28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43			46	47	48	49	50
51		53	54	55	56	57	58	59	
61		63	64	65	66	67	68	69	
71	72	73	74	75	76			79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

APPENDIX R

Math Lesson 4 Whole Group Instructional Material

Source: Coburn, T. G. (Ed.). (1993). *Curriculum and evaluation standards for school mathematics addenda series, Grades K-6: Patterns.* Reston, VA: National Council of Teachers of Mathematics.

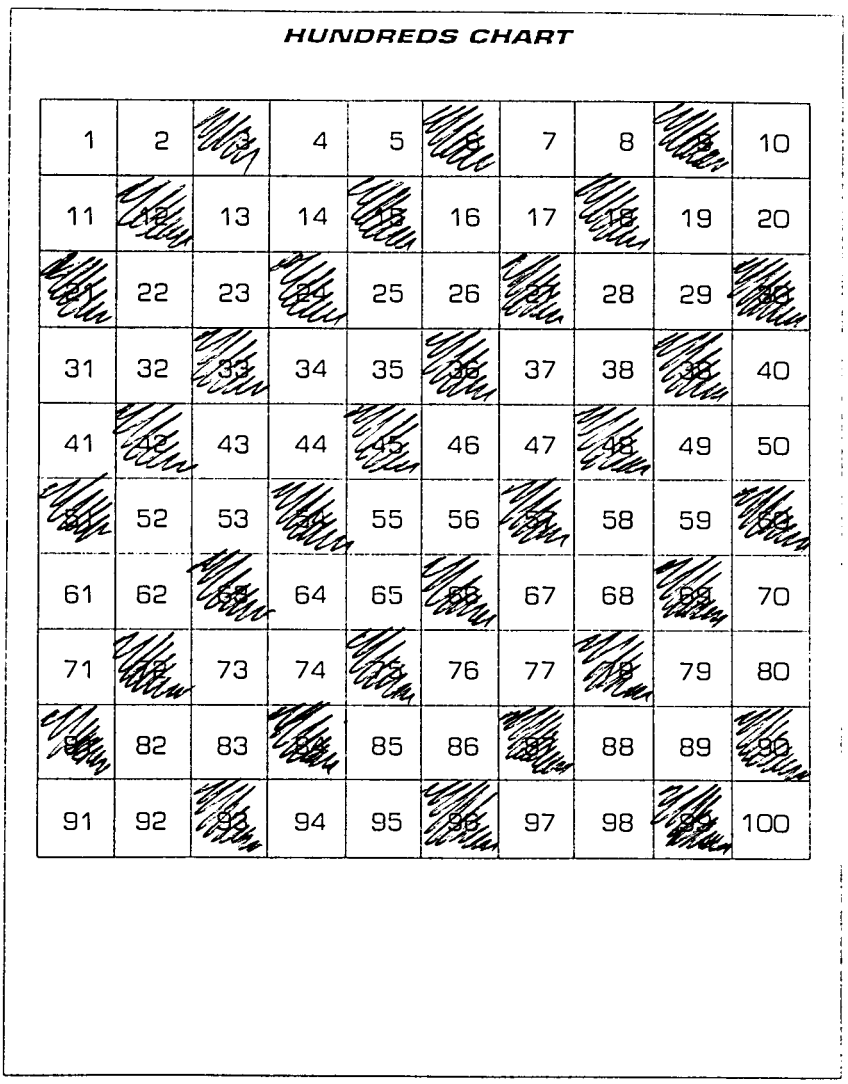
HUNDREDS CHART

1	2	3	4		6	7	8	9	10
		13				17	18	19	20
21		23	24		26	27		29	30
31			34	35	36				40
41	42	43	44	45				49	50
51	52	53	54	55	56		58	59	60
61	62	63	64	65	66			69	70
71	72	73	74	75	76	77			80
81	82	83	84	85	86	87	88		90
91	92	93	94	95	96	97	98		

APPENDIX S

Math Lesson 5 Whole Group Instructional Material

Source: Sarkissian, J., Marsh, F., Connelly, R. D., Calkins, T., O'Shea, T., Sharp, J. N. C., Johnson, R., & Tossell, S. (1987). *Journeys in math: Teachers' resource manual.* Scarborough, Ont.: Ginn.



HUNDREDS CHART

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

APPENDIX T

Math Lesson 6 Whole Group Instructional Material

Source: Sarkissian, J., Marsh, F., Connelly, R. D., Calkins, T., O'Shea, T., Sharp, J. N. C., Johnson, R., & Tossell, S. (1987). *Journeys in math: Teachers' resource manual.* Scarborough, Ont.: Ginn.

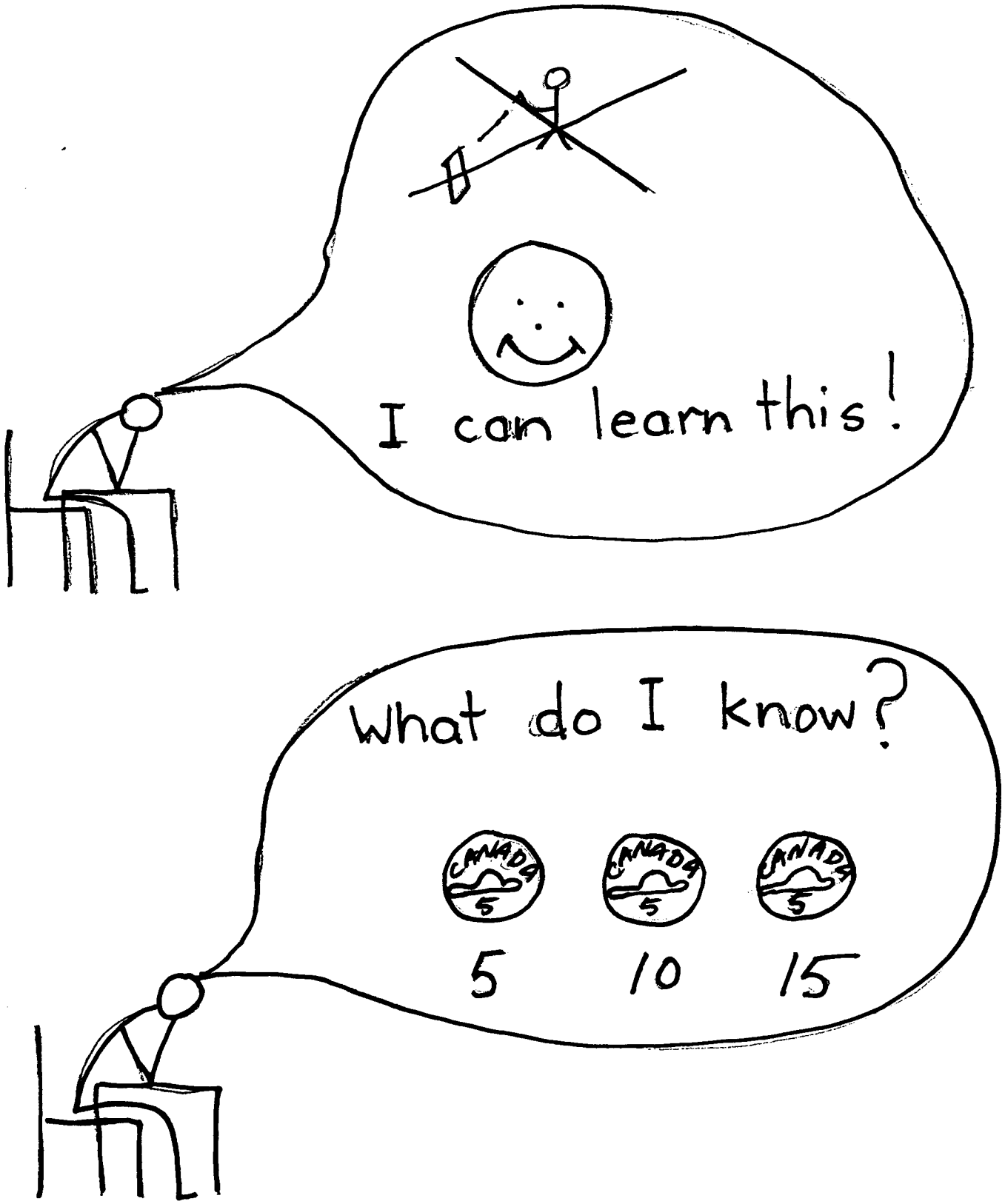
HUNDREDS CHART

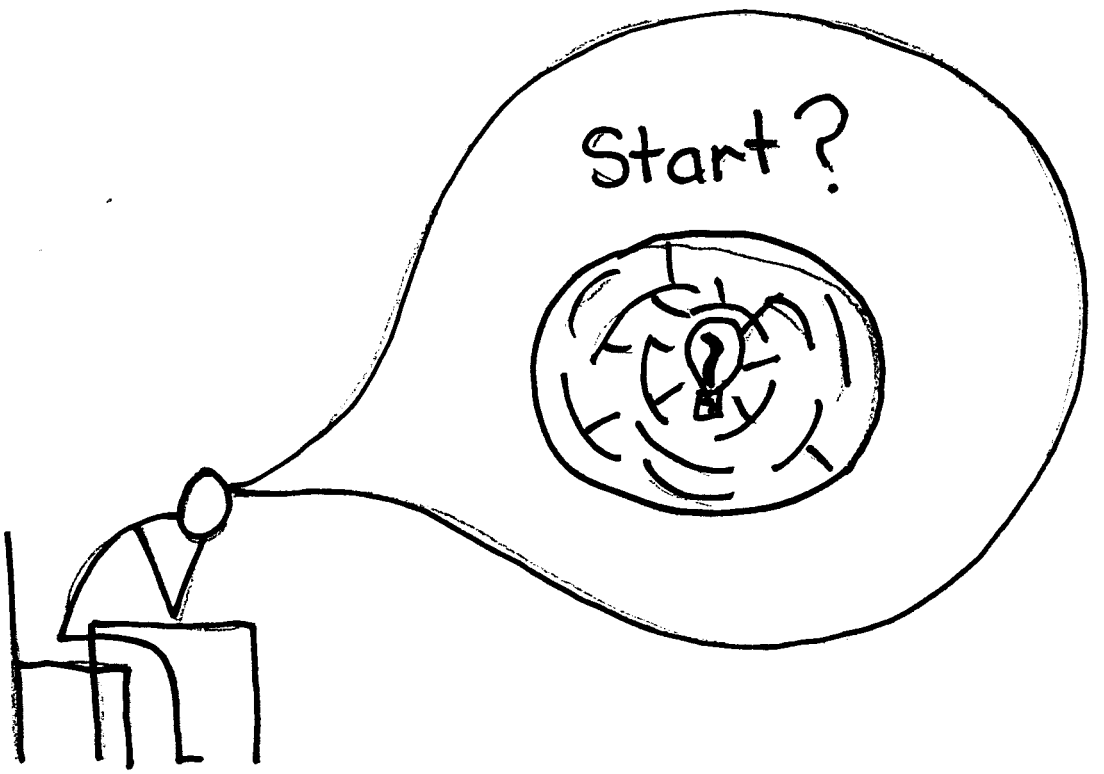
1	2	3	4	5	6	7	[redacted]	9	10
11	12	13	14	15	[redacted]	17	18	19	20
21	22	23	[redacted]	25	26	27	28	29	30
31	[redacted]	33	34	35	36	37	38	39	[redacted]
41	42	43	44	45	46	47	[redacted]	49	50
51	52	53	54	55	[redacted]	57	58	59	60
61	62	63	[redacted]	65	66	67	68	69	70
71	[redacted]	73	74	75	76	77	78	79	[redacted]
81	82	83	84	85	86	87	[redacted]	89	90
91	92	93	94	95	[redacted]	97	98	99	100

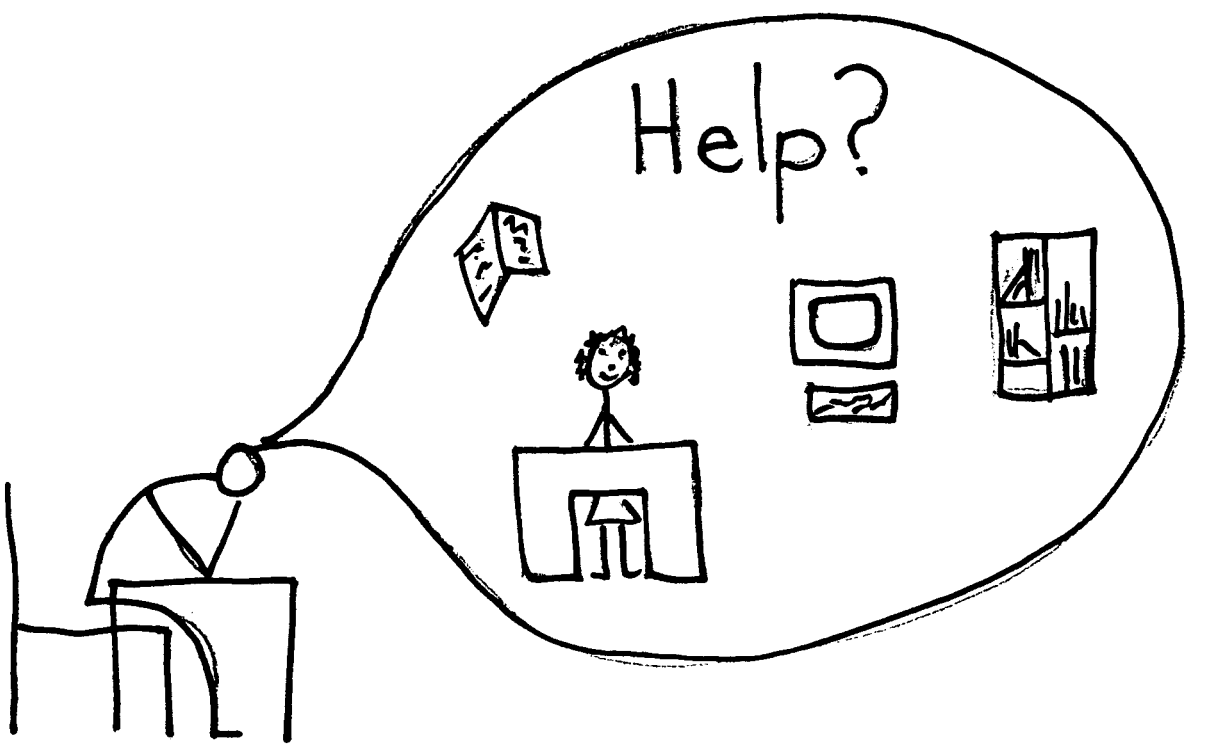
8 16 24 32 40
48 56 64 72 80
88 96

APPENDIX U

Attribution training poster




Start?


Help?