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INDUCING ADAPTIVE COPING SELF-STATEMENTS IN THE LEARNING DISABLED THROUGH A COGNITIVE BEHAVIORAL INTERVENTION

by
Michael P. Kamann
B.E.D., Simon Fraser University, 1984

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Inducing Adaptive Coping Self-statements in the Learning Disabled through a Cognitive Behavioural Intervention.

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ABSTRACT

The influence of self-talk (private self-dialogue) on behaviour has only recently received attention in the field of Special Education, particularly in the area of learning disabilities. Little direct investigation of the influence of self-talk has been conducted with the learning disabled population. This study investigated the effects of a Cognitive Behavioural Modification coping strategy in reducing math anxiety in learning disabled subjects. Specifically, the study examined the qualitative differences between the self-talk of learning disabled and average achieving peers, evaluated the effects of the self-instructional training procedure on increasing positive self-talk in learning disabled children, and determined the effects of the change in self-talk on academic performance. During an initial two week period, prior to intervention, a learning disabled group (N=10) and average achieving group (N=10) completed mathematics tasks, during which their spontaneous self-talk was collected and compared. Subsequently, learning disabled subjects received intensive training in a self-instructional coping strategy over a six week period. A post-test of both self-talk and mathematics performance was conducted for both groups.

The results indicated clearly marked qualitative differences in the spontaneous self-talk of the learning disabled group as compared with the average achieving group at both the pre and post tests. Specifically, at pre-test learning disabled subjects were found to produce significantly more negative and significantly less positive self-talk than the average group while completing mathematics tasks. Significant quantitative differences were also found on mathematics

procedure effectively reversed trends in the self-talk patterns of the learning disabled subjects, to approximate those of the average achieving group. As well performance on mathematics tasks were not significantly different between the groups on the post-tests.

The results indicated the effectiveness of a Cognitive Behavioural Modification procedure for positively affecting both the self-talk and mathematics performance of learning disabled subjects. Implications for research and practice, as well as limitations of the study are discussed.

For my mom
who by her example has shown me
the value of commitment and
hard work.

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I wish to express my sincere appreciation to my Senior Supervisor Dr. Bernice Wong for her constant support and guidance; Dr. Stan Shapson for participating as my second committee member; the "kids" for their dedication and persistence in completing the many training tasks; and especially to my wife April for her constant encouragement, support and love.

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CHAPTER I

INTRODUCTION

There is now a substantial pool of research data available to support the proposed relationship between self-talk (herein also known as guided self-speech, private speech) and academic performance (eg. Luria, 1934; Vygotsky, 1964; Hollon & Kendall, 1979; Craighead, 1978; Torgeson, 1977; and Harris, 1982). Researchers have investigated the relationship between an individual's self-communication and task performance as far back as the early 30s. For example, in an investigation of the private speech of children, Luria and Vygotsky (1934/62) concluded that private speech serves the cognitive functions of orienting, organizing, and structuring behaviour. According to Vygotsky, private speech dialogues are engaged in by children to consciously understand or focus on specific aspects of a problem which prove to pose significant difficulty for the individual. With increasing age the speech, which was previously supplied externally by adults (parents or teachers) comes to be controlled by the individual, eventually becoming a self-regulative internalized process. Failure to engage in "healthy private speech", speech which assists the individual in productive activity, results in performance decrements. Healthy private speech is superceded by negative defeating private speech, which short circuits productive activity and impedes the academic performance of the individual.

One approach to analyzing the inefficiency and passivity with which learning disabled children approach academic tasks has been through impaired (unhealthy) self-talk. Although there has been little direct

investigation of the private speech of exceptional children, several preliminary studies have pointed to the existence of qualitative differences in the self-talk of learning disabled children (Harris, 1982). According to Torgeson (1977) the poor academic performance characteristic of learning disabled children can be accounted for, in part, by the higher proportion of negative self-talk engaged in by learning disabled children, when compared to non learning disabled counterparts, as they work through academic tasks. The negative content of the self-speech interferes with the processing of incoming information at various points in the problem solving sequence, distracting the subject's attention from the task and refocussing cognitive energy onto affective evaluations and interpretations. Similar conclusions, in support of Torgeson's hypothesis, have been reported by Chapman and Boersma (1979), Pearl, Bryan and Donahue (1980), and Peterson, Swing, Braverman and Buss (1982).

The failure of learning disabled children to engage in and attend to specific relevant self-talk in working through a problem, thus allowing competing negative self-talk to interfere with performance, has been characterized in the research literature as a "production deficiency". A production deficiency, according to researchers, is a failure on the part of the learner to produce and respond appropriately to relevant self-verbalizations (Luria, 1934). Typically, a production deficiency occurs among students who have the intellectual capabilities and strategies required to successfuly perform the task. In a convincing argument, Flavell (1981) parallels this difficulty in generating appropriate positive self-dialogue with "metacognitive deficiency". Metacognition refers to processes which encompass cognitive monitoring and

strategic actions which are viewed as facilitative to effective human performance (Flavell, in Harris, 1982). Flavell suggests that the recognition of one's own cognitive machinery is equivalent to the internal dialogue and self-communication one emits before, during and after the performance of a specific task.

Although the present body of research literature has emphasized and pointed to the interface of the cognitive and affective components and the influence of these components on academic performance, little direct investigation of the affective dimensions of metacognitive acquisition with the learning disabled population has been attempted.

In a recent article, Harris (1982) notes the recent trend in cognitive training/retraining research in investigating spontaneous self-verbalizations of learning disabled individuals as a regulating mediator of behaviour. Harris argues that learning disabled children's cognitions are characterized by significantly more task irrelevant speech (word play, descriptions of irrelevant stimlui, and general affective statements) than their average non learning disabled counterparts when presented with a problem solving task. Harris hypothesized that direct intervention to alter this pattern of cognitions to become more adaptive (replacing maladaptive self-communication patterns with more adapative facilitative self-communication) should in turn promote increased academic performance. In fact, Harris (1982) has demonstrated that through direct intervention the negative self-dialogue of young learning disabled children can be modified to be more productive. Cognitive Behavioural Modification techniques (CBM) have been used successfully to increase task persistence thus assisting

learning disabled children in achieving at a level more closely resembling their actual potential.

Generally, research studies which have employed Cognitive Behavioural Modification Interventions point to the appropriateness of this type of intervention in dealing with the poor self-communication patterns of the learning disabled (cf. Kendall and Hollon, 1979; Meichenbaum, 1975, 1977). CBM in the present study refers to the selective but purposeful integration of principles and procedures from various but complementary training regimens or intervention procedures with the intent purpose of instating/modifying cognitions, feelings, or behaviours (Harris, 1982). In the most basic terms, CBM procedures work from an emphasis of "learning how to think" as opposed to "learning what to think". That is, CBM focusses on process rather than product. Moreover, CBM procedures emphasize the active/ interactive participation between learner and teacher (instructor), focussing on the role played by the learner in reshaping their own behaviour and gaining self-control and self awareness over their individual learning process. These qualities of CBM procedures with the emphasis on direct remediation of internal processes make them particularly relevant for dealing with the learning disabled. The latter tend to exhibit characteristics of learned helplessness, production deficiencies and problem solving difficulties -- focussed on means-end-thinking (Harris, 1982).

Current research findings which point to the effectiveness of Cognitive Behavioural procedures with learning disabled children provide the framework for the present research study. The present researcher considered that if taught to recognize and modify

inappropriate and negative self-dialogue caused by anxiety over mathematics, learning disabled childrens' performance on mathematics tasks would improve. Specifically the goals of the present research project were to determine:

1) Whether the coping self-talk of learning disabled children differed significantly from non learning disabled peers in terms of quality and quantity?

2) Whether coping strategies training (based in Cognitive Behavioural Modification) has significant positive effects on the coping style of the learning disabled subjects?

3) Whether trained learning disabled subjects improved in academic performance in areas where negative coping behaviour was abundant prior to Cognitive Behavioural Modification training?

4) How the generic strategies (CBM) used in training sessions are modified by trained subjects over time?

5) Whether a relationship between academic performance and self-talk exists?

Because of apparent ambiguity in the current research literature and confusion concerning the criteria used in defining "learning disabilities", it is appropriate and essential to provide a summary of the guidelines used in defining the learning disabled sample in the present research (Kavale and Nye, 1981). In the present study, children defined as learning disabled were classified based upon a minimum of a 1.5 year discrepancy between academic potential and corresponding performance (as recorded in psychometric reports for each subject). In addition, all children classified as learning disabled had experienced

prolonged failure (ie. failed consistently in academics which were part of the regular curriculum) in mathematics (more specific definitions are outlined in the methodology section of this thesis).

CHAPTER II

REVIEW OF THE LITERATURE

It is clear from the introductory comments that the learning disabled are characterized by a passivity and inefficiency in responding to academic tasks. Self-talk patterns of the learning disabled have also been characterized in the research literature as containing large amounts of irrelevant private speech with little task-directed speech. In a search to find methods to enhance the academic performance of learning disabled children, techniques have largely addressed academic skills. The affective domain has largely been left unexplored in relation to the remediation of the learning disabled. Such neglect resulted in limited success in enhancing and developing task-efficient response in the learning disabled.

Recent trends in dealing with the academic and social-emotional needs of the learning disabled point to the effectiveness of Cognitive Behavior Modification (CBM) strategies. The focus of this chapter is to explore the foundations of CBM and to provide a theoretical grounding for this study. In the second section of this review, the general application of CBM with various clinical and educational populations will be traced. In the third section research related to self-instruction with the learning disabled will be discussed in terms of direct academic application and indirect academic application. Included in this final section will be a discussion of test anxiety and self-talk as they pertain to the learning disabled.

Foundations of Cognitive Behavior Modification

The framework of Cognitive Behavior Modification (CBM) represents the systematic blending and selective integration of various

theoretical constructs including: Behaviourism, Social Learning Theory, Cognitive Psychology, Self-Regulation Principles, and Instructional Theory. Features of each of these major contributors will be highlighted In this section of the literature review, and discussed in terms of their contribution to the development of CBM.

Behavior Modification

Adaptive and maladaptive behaviors have traditionally been explained by behaviorists as resulting from environmental antecedents and consequences. The underlying assumption of behaviorism is that through the direct manipulation of measurable overt behaviors, changes in thoughts and feelings will occur (Ledgewidge, 1978). Cognitive variables are seen as irrelevant or at best trivial.

Durable and consistent results have been achieved when strict behavioral techniques have been used with exceptional learners. However, these results have been largely limited to a restricted and narrow group of behaviors such as, academic response rate, prosocial behavior or attending behavior (Kendall & Hollon, 1979; Sabatino, Miller and Schmidt, 1981). When behavioral techniques have been used to enhance, modify, or extinguish more complex behaviors, less durable and consistent results have been achieved. Among professionals, there has been increasing dissatisfaction with the sole use of behavioral techniques. For example, restrictive use of operant techniques may lead to undesirable effects such as poor generalization of skills, frequent disruption in academic performance, and dependence upon extrinsic rewards (Abikoff, 1979; Meichenbaum, 1979). More specifically, long term effects, resistance to extinction, and maintenance of appropriate behavior have not been achieved when strict behavioral training is used

as a remedial technique with exceptional learners (Douglas, 1975 and Douglas, Parry, Marton & Garson, 1976). Sabatino et al. (1981), noted that an emphasis on behavior modification to the exclusion of alternate approaches, within the special education field, has led to an overdependency on interventions which are unrelated to cognitive development and may in fact prevent the exceptional child from "learning how to learn".

The gradual expansion of Behavior Modification to include cognitive components such as: self reports, imagery, attitudes, and the involvement of clients in their own treatment has led to the development of several theories or constructs which have made critical contributions to the development of CBM. Social Learning Theory, one such extension of behaviourism, provides CBM with the view of the internal processes (ie. cognitions) as critical to understanding human behavior. According to Social Learning Theory, cognitions (eg. internal dialogue, perceptions, and beliefs) mediate both environmental antecedents and consequences. Further, the "internal environment" or cognitions may themselves act as antecedents and consequences (Mahoney & Thoresen, 1974). In short, Social Learning Theory provides CBM with a framework for understanding the complexity of human behavior, describing it as the interplay of environmental, personal, and behavioral variables. Bandura (1978) has coined the term "reciprocal determinism" to describe this reciprocal nature of personal, behavioral and environmental variables. In addition, he points to the importance of self-efficacy and modeling as critical to Social Learning Interventions. Many of these variables, particularly modeling and the internal process, are extended within most CBM procedures.

Self-Control/Self-Regulation Theory

CBM also utilizes features of self-control theory, a further extension of behavior modification, and particularly the processes of self-regulation in its training procedures. Self-regulation is considered a developmental process in which the individual gradually takes over the communicative and regulative processes previously assumed and directed by external sources (eg. parents or teachers). Described in the literature as a basic or general cognitive strategy, self-regulation takes into account the interaction of motivation, individual differences, and learning history (Craighead, 1982). Kanfer and Karoly (1972) describe self-regulation as a three step or three stage process involving self-monitoring, self-evaluation, and self-reinforcement. These features of self-regulation are particularly relevant to CBM training procedures as the ultimate goal of CBM is to develop self-regulation in the learner.

Cognitive Psychology

While the underlying assumptions about human behavior proposed by cognitive psychology are incompatible with the views described by behaviourism, various features and principles of cognitive psychology co-exist with principles and features of behaviourism within the framework of CBM. Although environmental events are considered by cognitive psychologists as important, the influence of covert and unconscious operations are seen as the critical determinants of human behavior. Typically, cognitive interventions focus on the systematic replacement or modification of maladaptive thought processes with more adaptive and effective processes. Cognitive theorists view covert behaviors (ie. cognitions) as being guided by the same principles which

are used to modify overt behaviors. It is therefore not unusual for cognitive theorists to incorporate operant principles into training interventions (eg. extinction, shaping, positive reinforcement) as a means of stimulating behavior change. According to various researchers (eg. Hollon & Kendall, 1978; Keogh & Glover, 1980), Cognitive Psychology so closely resembles CBM that it is difficult to distinguish cognitive training from CBM training. In fact, Keogh and Glover (1980) suggest that it is neither necessary or practical to distinguish between the two, as both focus on changing cognitive processes (eg. private self-speech, thoughts, perceptions and imagery).

Private-Speech and Instructional Theory

Principles of both private speech and instructional theory have been influential forces in the development of CBM. Described in the literature as a self-directed dialogue, not intended for communication with others, private speech directs or redirects, organizes, and structures behavior (Vygotsky,1934; Luria, 1960; and Zivin, 1979). According to Zivin (1979), private speech is self-regulative in nature, operating at both the covert or overt level, mediating motor activity, cognitive processes or perceptual processes. In his seminal work on the developmental nature of private speech, Vygotsky (1934) describes the self-generated language of children as a regulator of behavior. He suggests that private speech aids the individual in developing, modifying, or maintaining behavior. He reports that the private speech of young children is generally overt and externally mediated, but with increasing age becomes more covert and internally mediated. Further, Vygotsky suggests that as the private speech becomes more covert, it also changes in semantic and grammatical form making it more

functional for the individual. Finally, Vygotsky suggests that an individual may resort to the more naïve "thinking out loud" when he/she is confronted with a difficult problem. Extending Vygotsky's notion of the function of self-talk, Luria (1960) proposed that private speech may also serve the function of mediating and controlling inappropriate overt behavior. Supplementary investigations of the mediational characteristics of private speech by Western researchers (eg. Kendler, Kendler, & Wells, 1960; Kuenne, 1964; and Flavell, 1967), confirmed the notions proposed by the Soviet psychologists. Private speech (also labelled self-talk, self-dialogue) in combination with self-regulative processes is a major focus of cognitive behavioural techniques, particularly in dealing with exceptional learners. Within the CBM framework, private speech is used to tap the relationship between thought and behavior.

Finally, instructional theory offers valuable contributions to CBM by focussing on learner, task and instructor variables (Henker, Whalen & Hinshaw, 1980). In the most basic sense instructional theory provides the blueprint for creating appropriate CBM training procedures for children in the classroom setting. It places an emphasis on improving the learners' perception of self-control and self-awareness of their own learning processes (Brown, Campione & Day, 1981). In short, instructional theory provides the practical instructional considerations necessary for developing effective CBM procedures with both exceptional and average learners.

By looking at the specific features and principles drawn from each of the major contributing paradigms and combined into the framework of CBM, it is clear that CBM procedures emphasize the

interactive and reciprocal nature of cognitions, feelings and behaviors. These approaches then demonstrate the successful blending of cognitive and behavioral psychology as well as considering essential features of instructional theory and principles of self-regulation.

While CBM interventions have a common underlying goal and rationale, that of altering behavior by focussing on the interaction of cognitions, feelings, and actions, CBM is a generic or umbrella term encompassing various procedures, techniques, and formats. The complexity of training regimens and approaches make it difficult to obtain a clear picture of the underlying structure of CBM interventions. For example, training procedures cover the concrete to the abstract and include interventions designed to facilitate metacognitive change, changes in attribution style, memory skills, and modification of information processing strategies (Harris, 1982). This review of Cognitive Behavior Modification will be narrowed to focus on one type of CBM intervention which has been cited in the research literature as the most effective in dealing with the needs of the learning disabled: Self-Instruction.

In the most basic sense self-instruction involves training in self-verbalized directions which are designed to guide an individual through a series of steps leading to the solution to a problem (Hallahan, Kneedler & Lloyd, 1984). Self-Instruction training has been identified as a particularly suitable procedure for addressing the needs of the learning disabled who are generally passive learners and engage in significant amounts of inhibiting irrelevant self-talk. The self-instructional technique directly addresses passivity by focussing on reducing learned helplessness through increasing the self-governing

and self-guiding processes. As well, the technique explicitly teaches task relevant private speech as a replacement to the inhibiting self speech (Meichenbaum, 1977; Kendall & Finch, 1979; Reid & Hresko). Prior to looking at the application of self-instruction with learning disabled children, a review of the early literature related to self-instruction application with various clinical and educational populations will be provided as a contextual framework for the present study.

General Applications of Cognitive Behavior Modification

Self-instruction training regimens have been used extensively with various clinical populations. For example, Meichenbaum (1969) first realized the value of self-instructional procedures with schizophrenics, who were previously trained to emit healthy self-talk in an isolated interview situation. They spontaneously generated similar healthy self-talk in follow-up situations as a way of controlling their interfering language and behaviors. These rather intriguing findings stimulated Meichenbaum and his colleagues to look at the potential of using self-instruction interventions with other clinical populations. Studies have included investigation of self-instructional procedures with neurotics, phobics, and test and speech anxious individuals.

In the early application of self-instructional interventions with neurotic patients, Blumenthal (1969) used an insight procedure to assist neurotic subjects in recognizing the presence of maladaptive self-statements which maintained the neurotic behavior. As well, neurotic subjects were trained to replace the maladaptive self-talk with a set of more adaptive self-verbalizations. As in the case of

Meichenbaum's schizophrenic subjects, neurotic patients taught to engage in healthy self-verbalizations showed significant improvement in behavior following training.

Speech anxious and test anxious subjects have also responded well to self-instruction training. In an investigation of methods for reducing speech anxiety, Paul and Shannon (1966) used self-instructional procedures which focussed the subject's attention on the awareness and systematic replacement of maladaptive self-statements. These techniques were found to be the most effective with subjects who experienced distress related to public speaking. These findings have also been supported by Lazarus (1971), and Karst and Trexler (1970).

Self-instructional procedures have also been found to be successful with test anxious individuals. Various researchers (eg. Liebert & Morris, 1967; Mandler & Watson, 1966; Wine, 1972) have described test anxious individuals as "ruminators". When presented with an evaluative situation (ie. a test) they tend to ruminate over alternatives, feelings of inadequacy, the anticipated punishment for failure, and loss of self-esteem. Meichenbaum (1974) suggested that it is this worry component which leads to decrements in performance by diverting attention from the task to affective evaluations.

In an early study of test anxiety, Meichenbaum (1972) investigated the potential of a self-instructional procedure to enhance the coping behavior of test anxious subjects. He compared a cognitive behavioral (self-instruction) group with a desensitization group and wait list control group. Prior to intervention, an "insight" procedure was employed to assist subjects in becoming aware of the influence

that their thoughts and self-verbalizations (emitted prior to, during, and following a test situation) had on their performance. In the second phase of the study, subjects assigned to the self-instruction group were trained to emit task relevant and positive self-statements as replacements for their less adaptive and irrelevant self-statements. A third and final phase involved instructing subjects in a coping imagery technique. As a means of overcoming and dealing with "during task" anxiety, subjects were taught to visualize coping behaviors as well as mastery behaviors. The results of this study indicated that the cognitive behavioral treatment procedure was superior to the standard desensitization and wait list control groups in reducing test anxiety. Subjects trained in the cognitive behavioral technique did not differ significantly from low test anxious subjects on post-test measures (ie. performance on tests and self-report questionnaires).

Further evidence as to the effectiveness of self-instructional procedures with test anxious individuals is provided by Wine (1971). Using modelling and behavioral rehearsal of self-instructional components, as opposed to the cognitive rehearsal procedure used by Meichenbaum, Wine found that significant reduction in test anxiety was achieved when direct training and application of the self-instructional statements was provided. These results clearly demonstrate the necessity of practice in using the newly acquired self-instructional set if training is to efficiently stimulate behavior change.

Considered a form of test anxiety, mathematics anxious individuals have been described in the literature as also being "ruminators", focussing attention on the emotional components of a testing situation. Rounds & Hendel (1980) suggest a possible

relationships between the term mathematics anxiety and test anxiety. These researchers point to the fact that many math anxious individuals are comfortable with "some" mathematics but when performing mathematics involves evaluation (ie. a test) they become unable to perform adequately behaving in a way similar to that of a test anxious individual.It is this paralyzing anxiety in relation to math tests that would lead one to assume that test anxiety and mathematics anxiety share common symptoms and therefore would respond well to similar treatments. In fact, CBM interventions used in the treatment of test anxiety and mathematics anxiety are identical. The systematic replacement of negative self-talk with more adaptive self-talk is a common procedure used in dealing with the math anxious individual.

Phobics represent a third group for whom self -instructional procedures have proven superior to alternative methods. A study conducted by Meichenbaum (1971) illustrates the effectiveness of a self-instructional procedure with phobics. The purpose of the study was two-fold: 1) to examine the efficacy of modeling procedures in self-instruction interventions, and 2) to look at the effectiveness of self-instructional procedures with phobic clients. Two treatment groups were compared, one with a self-verbalization model and the other without a self-verbalization model. A second feature of this study involved an exploration of model style. One group was exposed to a coping model while the other received exposure to a mastery model who demonstrated fearless behavior. Results indicated the superiority of the coping model over the mastery model in facilitating behavioral change through self-verbalizations. Bandura (1965) provides an explanation for these findings from the Social Learning perspective.

Information which an observer gains from a model is converted to perceptual-cognitions which are retained for later use by the observer. Thus, a model who demonstrates "coping", as opposed to a mastery model, provides observers with strategies for coping or dealing with the anxiety-provoking task (ie. a test). Various other researchers report similar findings from the use of self-instructional coping models with phobic patients (eg. Wolpe & Lazarus, 1966; Solyom & Miller, 1967).

From these studies, it is clear that self-instructional procedures are effective for dealing with the needs of various clinical populations. As well, it is through these studies that refinements and modifications to self-instructional techniques (eg. use of coping models and an insight procedure) have resulted. As well, more recent investigations in the application of self-instruction have provided further information which has allowed for the further streamlining of self-instructional procedures and techniques. More recently the application of CBM procedures, particularly self-instruction, as a technique for dealing with the needs of the learning disabled has taken hold within the Special Education field. In the following section the literature on the application of CBM (self-instruction interventions) with learning disabled children will be examined.

Self-Instruction Procedures with the Learning Disabled

The rapid growth in the application of verbal self-instruction with the learning disabled can be attributed to three developments within the field of education: 1) Traditional approaches for remediating academic needs of the learning disabled are restricted and limited in effectiveness; 2) The match between CBM interventions and the

learning characteristics of the learning disabled (ie. problems in self-regulation, and inconsistent strategy application) are becoming clearer as more thorough investigation of CBM procedures with the learning disabled are explored; and 3) Empirical evidence as to the effectiveness of CBM approaches in addressing various populations of exceptional learners are now emerging (Hallahan & Kaufman, 1985). In this section the literature on the application of self-instruction with the learning disabled will be reviewed.

Meichenbaum has been credited as the pioneer in the application of Cognitive Behavioural procedures (ie. Self-Instructional intervention) with learning disabled children. Two early studies with impulsive/hyperactive children conducted by Meichenbaum and his associates served as the impetus for the self-instructional interventions literature which followed in later years. In a series of observational and experimental investigations, Meichenbaum & Goodman (1969) found that hyperactive and impulsive subjects were less able than average non-hyperactive peers to gain and exercise verbal control over motor behavior. The private self-speech of hyperactive subjects, like the schizophrenic subjects investigated earlier, contained significantly more non-productive and irrelevant self-verbalizations in comparison to non-hyperactive counterparts. He further concluded that retraining of self-verbalizations to be more adaptive should stimulate self-regulation and self-direction.

In the first of theses studies, Meichenbaum & Goodman (1969) compared the difference between impulsive and reflective kindergarten aged children on their verbal control over motor tasks. Subjects were required to press a foot pedal when cued by a blue light and avoid

pressing the foot pedal when cued by a yellow light. Only 40% of impulsive children met a 90% accuracy in responding correctly. A supplementary finding reported by Meichenbaum et al., demonstrated that when impulsive children were trained to direct their motor behavior (pushing pedal) with verbal cueing (ie. saying "don't push or "push"), surprisingly, correct verbal responding did not lead to a correct behavioral responding. These findings demonstrated that although self-directed speech is highly maleable, in order to gain control over motor behaviors, the link between self-speech and behavior must be taught directly.

Using a self-Instruction sequence, Meichenbaum and Goodman (1971) trained second grade hyperactive children to use a self-instructional procedure to gain control over various learning tasks. Dramatic shifts in the cognitive reflectivity of the hyperactive children were found on dependent measures relative to control groups (ie. Assessment and Attention groups). Evidence for the superiority of self-instruction coupled with modeling as opposed to modeling alone was also demonstrated.

A study conducted by Palkes, Stewart, & Kahana (1968) which runs parallel to those of Meichenbaum and his associates further demonstrates the effectiveness of self-instruction procedures with exceptional learners in achieving verbal control over non verbal behaviors. Using a "stop","look" and "listen" procedure, Palkes et al. trained hyperactive boys to slow down and think before responding on various perceptual and perceptual motor tasks. Qualitative and quantitative differences on dependent measures (ie. scores on the Porteus Maze Test) were found between the control and experimental

groups. Furthermore, self-instruction procedures were found be superior in assisting subjects in making fewer errors on tasks and reduced the likelihood that errors made reflected an implusive response (eg. crossing over lines or cutting corners).

While these three early studies provide clear evidence as to the effectiveness of self-instructional procedures with exceptional learners they are limited by the focus on developing nonimpulsive behaviors and increasing attending behavior through verbal mediation, as measured by laboratory-type task (eg. Porteus Mazes or Matching Familiar Figures Test). The body of self-instructional studies which followed these initial three investigations examined the application of self-instructional procedures to more ecologically valid settings and tasks.

Looking at the effectiveness of self-instructional procedures with classroom analogous tasks (a matching word task) Wozniak and Neuchterlein (1973, in Hallahan & Kaufman,1985) compared three groups of second grade students reading significantly below grade level. A control group, a materials only group and a self-instruction group were compared following an intervention period in which subjects met once per week for a period of five months. While pre to post test did not yield significant differences on overall reading scores on the Metropolitain Achievement Test, subjects in the self-instructional group demonstrated substantial gains in overall reading scores.

In a second self-instructional study, Robertson and Keeley (1974) investigated the use of a self-instructional procedure with a group of five impulsive primary-aged children. Using the same "Stop", "Look" and

"Listen" procedure used by Palkes et al. (1968) four dependent measures were collected (scores on the WRAT), two before and two following the intervention. All training took place in the classroom setting, subjects met for fifteen half hour sessions over a three week period. Improved performance in spelling skills among trained subjects, as determined by scores on the WRAT,were reported for subjects trained in the self-instruction procedure.

An addition study which demonstrated the effectiveness of self-instructional procedures for enhancing academic performanace are Camp, Blom, Herbert & VanDoorninck, (1977). Camp et al. reported that following training in a think aloud procedure to reduce aggression in a sample of elementary aged boys reduction in aggressive tendecnies were accompanied by significant improvement in reading performance, as measured by the Wide Range Achievement Test.

Finally, a findings reported in a study conducted by Glenwick & Barocas (1979) did not support the effectiveness of self-instruction with learning disabled children. Specifically, Glenwick et al. (1979) compared the effectiveness of four self-instruction interventions in reducing impulsive responding in a group of fifth and sixth grade impulsives. Scores of 16 dependent variables, calculated from the WRAT did not indicate the effectivenss of self-instructional procedures with exceptional learners.

The studies described above focussed specifically on the treatment of behavioral difficulites (eg. hyperactivity) or the cognitive response style of subjects (eg. reducing impuisive responses). The data collected on academics was used to determine the indirect effect of CBM interventions on academic performance. In the

studies to be described below an emphasis is place upon investigating the direct effects of self-instructional procedures which focus in augmenting academic performance (eg. developing copy and handwriting skills, increasing reading comprehension, and increasing survey and study skills).

Robin, Armel and O'Leary (1976), compared the effectiveness of a self-instructional procedure on the letter copying skills of non handicapped kindergarten aged children. A self-instruction with praise group was compared to a control group and a feedback and praise group. Using a self-instruction procedure based upon the techniques described by Meichenbaum and Goodman (1971) subjects were taught to self-verbalize statements which were directly related to copying letter performance. In twenty sessions spread over a seven week period all three groups received instruction in copying four letters. On post tests, evaluating performance of the four trained and 30 untrained symbols, both experimental groups outperformed the control group on trained letters and untrained letters. The self-instruction group outperformed subjects in the praise and feedback condition.

In another study of handwriting performance Kosiewicz, Hallahan, Lloyd & Graves (1981) taught an elementary aged learning disabled boy a self-instructional procedure to guide and maintain appropriate letter formation. Correctly copied letters increased dramatically following self-instruction training.

Bommarito & Meichenbaum (in Meichenbaum ,1979) explored the application of self-instruction in reading skills acquistion. Bommarito et al. trained a group of junior high students self-instruct with self-guiding and coping verbalizations as a means of encouraging retention

of details, and coping with frustration in dealing with reading comprehension tasks. Of the three groups (ie. control, materials only group, and self-instruction group) the self-instruction group showed marked improvement on sentence completion and reading comprehension tasks.

Finally, an additional group of related studies in which intervention procedures bear a marked similarity to self-instruction will be discussed as these studies focus on the systematic application of self-verbalization and planned attack strategies for enhancing academic performance on mathematics tasks. Lovitt & Curtiss (1968) found that by requiring subjects to self-verbalize a number sentence (eg., Six plus four equals what?) substantial improvements in response accuracy were found. In a second study conducted by Cullian, Epstein & Lloyd (1978, in Hallahan, Kneedler and Lloyd, 1987) the self-verbalization strategy used by Lovitt & Curtiss was not effective in increasing academic performance of subjects. Knapczyk & Livingston (1974) demonstrated that prompting subjects to self-question during the completion of reading assignments led to greater accuracy in answering comprehension questions.

While the majority of studies described above have narrowed the self-instructional technique to focus on a specific academic area, they clearly demonstrate the effect that "thoughts" (expressed in self-statements) have in mediating behavior. As well, the evidence points to the efficacy of self-instructional techniques with various educational populations, particularly with learning disabled children. Torgeson (1977) reports that not only do learning disabled children produce significantly more negative or irrelevant self-verbalization in

comparison to average peers, but it is this irrelevant self-verbalization which explains, at least in part, the inefficient learning style characteristic of this group of children. The observations reported by Torgeson are further substantiated by Harris (1982), who found that learning disabled children produced significantly more task irrelevant private speech while completing problem solving tasks than did normally achieving peers. Finally, it is clear that the self-instructional techniques are superior to other more unidimensional procedures (ie. traditional behavioral techniques) in increasing the proportion of task relevant self-verbalizations, which in turn stimulate increases in academic performance.

The inconsistency in the results of the research described above makes it difficult to evaluate the effectiveness of CBM interventions with the learning disabled. Studies which come under the heading of indirect effects upon academic performance (Robertson et al., 1974), generally include self-instructional procedures which are non-specific (i.e. of the "what is my problem?", "what is my plan" type). This type of self-instruction may be too general in that it does not provide a focus on specific areas of academic performance and therefore mitigates the likelihood of success with academic tasks. In contrast, self-instruction studies which more directly addressed self-enhancement of academic skills, may have been facilitative in that they contained self-instructions to which the subject could readily relate. On the other hand, these narrow self-instructional interventions may make it difficult for those students who did not possess the necessary pre-skills. Two pertinent issues related to the focus of self-instruction with the learning disabled arise from this review of the literature.

First, it is unclear as to which specific components within self-instructional procedures (eg. self-verbalization, imagery, or self-guided speech) are necessary and the most effective in dealing with the remedial needs of the learning disabled. Second, which groups of learning disabled children respond to specific features or components of self-instruction (eg. Are there specific subgroups of children for which self-guided instruction or retraining of coping self-statements are best in affecting academic performance?).

It is in response to the issues raised with regard to the effectiveness of self-instruction programmes with the learning disabled that the present study is developed. Specifically, the present study will explore a single component of self-instruction, coping self-talk. Coping self-talk is chosen as the focus of this study as both the educational literature (see Torgeson, 1979 and Harris, 1982) and observational data clearly demonstrate the significant discrepancy in the coping self-talk patterns of learning disabled children. As well, the early self-instruction research studies point to the modifiability of self-talk and its effect in reducing anxiety, phobic behavior and speech anxiety (Meichenbaum, 1979). In addition, the present study will further extend and improve upon methodological procedures used in self-instruction interventions. For example, where earlier studies typically relied upon follow-up self-report measures, or paper and pencil post-task measures (eg. Alpert-Haver Anxiety Test) to evaluate changes in the irrelevant self-talk patterns of clients, a spontaneous think-aloud procedure will be employed in the present study as a means of tapping directly the spontaneous self-talk of subjects. This modification of methodological procedures reduces the possibility of

collecting inaccurate self-talk reports (typical of early studies). A second extension of methodological procedures in the present study is to extend the self-instructional procedures into a more immediately relevant setting, the classroom. Finally, the sampling procedures which will be used in this study will focus on the selection of a specific group of learning disabled children. These children will be characterized by significant discrepancies in learning and performance on mathematics tasks. Through this methodological procedure, the present study will respond to the request from earlier research to look for a match between self-instructional tactics and specific subgroups of learning disabled children.

In addition to these methodological considerations, tactics found to be critical within the CBM framework (as reported by Meichenbaum and Goodman, 1969/71) will also be considered and concluded in the development of the self-instruction intervention used in this study. These include an "insight" procedure, modelling procedures, feedback procedures, and practice procedures. In the following chapter, the methodology developed from these considerations is detailed.

CHAPTER III

METHOD

Overview

For a total of 13 weeks, using a think-aloud procedure, self-report data from subjects were collected. The initial two week period was designated for baseline data collection, followed by a six week session of intervention. After a three week interval, post-test data were collected in a two week period. During the initial two week period and prior to the intervention phase, all subjects (both Learning Disabled and Average Achievers) were given a mathematics test to complete with a request to think aloud as they completed the task. The self-talk which was spontaneously generated by learning disabled subjects was collected and compared to that of their average achieving peers. During the six week intervention period, 10 Learning Disabled subjects were taught a self-instructional coping strategy adapted from Meichenbaum and Goodman (1971) .

The researcher was responsible for all levels of data collection with the exception of the final maintenance post-test which was collected by a colleague blind to the purpose of the study. In order that procedures and instructions remained consistent across sessions and between school settings, procedural guidelines were provided for the colleague in charge of the final data collection.

All sessions took place in the Learning Assistance Centres located at the two school settings. Self-report data were collected by means of portable cassette tape recorders fitted with tie clip microphones. Supplementary data (mathematics tests) were collected by means of paper and pencil measures.

For all training sessions, data were collected in a group setting. Each training session lasted for a period of 30 minutes. Over the course of training, three five minute follow-up interviews were conducted immediately following the training session, scheduled at the beginning, middle, and end of the training sessions, where subjects were asked to "re-think aloud" a question attempted during the training session. Both Learning Disabled and Average Achieving subjects participated as a group in completing the pre and post-test data collection sessions.

Procedures

Recruitment. Twenty subjects, eleven male and nine female elementary school aged students participated in the present study. Subjects were selected from two independent Catholic Elementary dayschools located in the suburbs of Vancouver, British Columbia. From a list of students currently enrolled in grades four through seven at each of the two schools, a Learning Disabled subpopulation and an Average Achieving subpopulation were identified. Subjects assigned to the Average Achievers list were characterized by an overall school academic performance between 69% - 75% based upon cumulative academic records which were recorded on Permanent Record Cards housed at each school. These included group administered Standardized Achievement Test scores - Gates MacGinite, school specific performance test scores, and anecdotal reports. Subjects assigned to the Learning Disabled subject list were characterized by a 1.0 to 1.5 year discrepancy between performance and ability, as determined by diagnostic assessment. In addition, all subjects in the Learning Disabled sample had a history of academic difficulty which was not primarily due to other handicapping conditions such as, mental

retardation or emotional disturbance.

From the sorting procedures described above, a pool of 213 potential subjects were identified from the two schools. One hundred and twelve of the subjects were registered in School A -- located in an upper middle class neighbourhood of North Vancouver, catering to a predominantly Irish Catholic population. The remaining 101 subjects were registered in School B -- located in a working class neighbourhood of Burnaby, catering to a predominantly Italian Catholic community. For the purposes of the present study children in the upper end of achievement levels (high achievers) were not considered in these numbers.

Following the criteria described above, 94 of the112 subjects at School A were assigned to the Average Achievers list and 14 were assigned to the Learning Disabled list. Four subjects were dropped from the pool due to incomplete school records.

The 101 subjects at School B were similiarly assigned to either one of the two lists using the same criteria as described above. Eighty-eight of these subjects were assigned to the Average Achievers list while 13 were assigned to the Learning Disabled list.

From each pair of school lists, five subjects were randomly selected for the study from each of the two defined subpopulations (Learning Disabled sample and Average Achievers sample) for a total of 20 (10 average -- five from each school and 10 LD -- five from each school). Attempts were made to keep the sample equally distributed by age, grade, and sex.

For each of the targetted subjects, an information package (see Appendix A through A-3) was sent home summarizing the purpose of

the study. Accompanying each information package was a request for the parent(s) or guardian(s) to attend an information meeting at their child's school in order that details of the investigation could be provided and the degree of participation required by their child could be explained. All parents and/or guardians attending the meeting gave written consent for their child to participate in the study at that time. One parent who was unable to attend the meeting at the scheduled time was given information over the telephone and gave consent for her child to participate. Written consent was received at a later date.

Learning Disabled Sample. The Learning Disabled sample consisted of six males: two fourth graders, three fifth graders and one sixth grader and four females: one fourth grader, one sixth grader, and two seventh graders. Ages ranged from 9 years 2 months to 13 years 6 months, with a mean age of 11 years, 2 months. All subjects in this group had experienced a prolonged period of academic failure (based upon cumulative and diagnostic records), and had demonstrated a great deal of anxiety and frustration towards school, particularly in the area of mathematics. All subjects were designated by school based criteria as having a specific learning disability, a discrepancy between potential and academic performance between 1.0 and 1.5 years or more, in mathematics and language skills. In addition, all of the subjects in the Learning Disabled sample had received instruction in a Learning Assistance Centre for a period ranging from nine months to two years, one month with the mean Instructional time in the Learning Assistance Centre being one year, two months.

Average Achievers Sample. The Average Achievers sample consisted of five males: one fourth grader, one fifth grader, two sixth

graders, and one seventh grader; and five females: one fourth grader, one fifth grader, one sixth grader, and two seventh graders. Ages ranged from 9 years, 10 months to 13 years, 4 months, with the mean age of 11 years, 6 months. These subjects were characterized by an overall average performance profile (grade percentages varying between 69 - 75% across the core subject areas of language Arts and Mathematics) throughout their scholastic history. In addition, achievement test data completed just prior to implementation of this investigation placed all of these subjects within the mid range in overall academic performance.

Protocol

Setting. All sessions took place in the Learning Assistance Centres located in each school. Both Learning Assistance Centres were approximately 6 X 4 m in size and were equipped with desks, tables, study carrels, and stationary blackboards. Furnishings and layout were reorganized to provide optimal space and minimize distractions between subjects in completing the pre, post, and intervention tasks (for the layout of each room see Appendix B). In addition, portable cassette tape recorders with tie clip microphone attachments were stationed under each desk at which subjects worked while completing the pre, post, and intervention tasks. Tie clip microphones were used in order to minimize distraction caused by the recording devices as were the use of smaller portable cassette recorders equipped with C 60 minute cassette tapes.

Process. Prior to the commencement of a session the researcher, using a procedural checklist (see Appendix C), ensured that all equipment was in working order replacing pieces as needed, and

ensured that the room was arranged to allow for privacy and to provide maximum space between subjects. Once the room was set up and equipment checked, C 60 audiotapes were labelled with the date, session number, and subject identification number. All subjects were identified by a code to ensure subject anonymity and to mainitain confidentiality of the contents of session recordings (eg. Subject identification numbers contained an L or A to identify a subject as either Learning Disabled or Average, an M or F to identify subject as male or female, a number between four and seven to indicate grade level, a number 1 through 10 to indicate subject identification number, and the letter T or H to indicate home school). As an additional record-keeping safeguard, the leader on each cassette tape was recorded with the same information as that written on the label of each cassette tape.

Baseline Collection Procedures. A two-day baseline data collection took place prior to the implementation of the training procedures. The first of the two baseline collection periods took place early in the last week of April (ie. on either the Monday or Tuesday) while the second session took place eight or nine days later (either Wednesday or Thursday in the first week of May). Both Learning Disabled and Average Achieving subjects participated as a group in this two-day baseline collection.

Using a prepared written script the researcher, who acted as the instructor for the duration of the study, provided subjects with directions for completing a mathematics task. To provide subjects with a clearer sense of the procedures to follow in completing the task that they would receive later in the session, the researcher modelled

completion of a sample mathematics question which had been written on the blackboard prior to the subjects' arrival. In completing the sample task the researcher demonstrated three levels of self-talk with a focus on affect-laden statements which according to Meichenbaum (1977) inhibit or enhance performance. The first type of self-statement demonstrated was a neutral or task specific statement: " I have to carry that number here". The second and third types of self-talk were two levels of task-approach statements: a positive statement " I'm doing just fine, I got that part finished", and a negative statement " I'll never get this I'm too dumb". A complex addition question with regrouping was used as the example question (see Appendix D Skills Development Phase for example question) as it was sufficiently different from items on the training task so as not to influence the completion of target task items (fraction questions), but yet still focussed on strategy application to mathematics.

Following the modelling procedure, the whole group was engaged in a discussion which focussed on the kinds of things they said to themselves while completing a mathematics task. To assist subjects in recalling their own self-dialogue they were asked to close their eyes and run a movie in their minds of a past experience in which they completed either a mathematics exercise or test. Subjects were asked to focus their attention on remembering how they were feeling and what they were thinking as they completed that task. After approximately 10 minutes of discussion and reflection time, subjects were assigned the desk space set up with a tape recorder and microphone labelled with their identity number. Subjects were taught how to operate both the microphone and tape recorders. When subjects

were comfortable with the equipment operation they were given a fractions mathematics task which was drawn up to simulate an actual mathematics test. Subjects were instructed to think out loud, trying to let everything that passed through their heads to be said aloud so that the taping equipment could pick it up (based on Dunker and Claperede, 1934). A request to think out loud was used as opposed to a request to describe what was going on in their head as the former request stimulates a kind of spontaneous verbalization while the latter stimulates only a limited kind of verbalizations focussed more on evaluating thought (Epstein, 1977).

Eight or nine days following the initial baseline data collection (depending upon which school setting subjects were located), the second and final day of baseline collection was conducted. A procedure similar to that used in the first baseline collection was used with the omission of the modeling procedure. The modelling procedure was replaced with a verbal reminder to think out loud throughout the entire time of working on the mathematics task. Each session for baseline collection lasted for a total time of 45 minutes, 30 minutes of which was spent on the completion of the mathematics task and 15 minutes spent in providing direction for completing the tasks and for wrapping up the session.

Following the completion of this second baseline collection, subjects in the Average Achievers sample were released and given instructions to return for a third and fourth session to be conducted in the final three weeks of school. Alternately, subjects in the Learning Disabled sample were given a time schedule outlining the meeting times for the six week intervention period. All subjects in the

intervention group met once a week.

Intervention Protocol. The 10 Learning Disabled subjects (five from each school) attended six training sessions beginning the first week of May and ending the second week in June. Each groups met once a week at prearranged times during the school day in the Learning Assistance Centres located in their respective schools. Each session lasted forty minutes; with thirty minutes used for the completion of the task and ten minutes used for follow-up.

An oral and visual presentation on the role played by self-talk in maintaining poor performance was provided to all subjects in the intervention group (see Appendix D). The two purposes underlying this presentation were: 1) to heighten subject awareness of their own maladaptive style of thinking, bringing it to the conscious level; and 2) to develop the efficacy for the use of strategies presented in the training that was to follow. Following this presentation the research reviewed the goals of the training session (using both a verbal and written format to meet the needs of the learning style of the subjects): 1) To enhance students' performance on mathematics tasks; 2) To teach students a strategy to help them deal with and cope with mathematics tasks; and 3) To provide students with ample practice in using these strategies on actual mathematics tests. Subjects were provided with an opportunity to ask questions to clarify the goals and procedures outlined by the researcher.

The training in the fundamentals of the procedure to follow in completing the tasks was facilitated by means of a pair of cue cards prepared to assist subjects in completing the tasks. One card provided an outline of the stages in the coping process as adapted from

Meichenbaum (1977).

Cue Card One:

Steps in the Coping Process
(A) Assessment of the situation
Label and plan
(b) Recognizing and controlling the impulse of negative thoughts
Recognizing that negative thoughts hurt my work
Controlling by replacing
(c) Reinforcing
Pat yourself on the back for a good job

The companion card provided subjects with sample self-statements to assist them in applying the strategies at each level in the coping process. The companion card was further subdivided into sections focussing on various levels of the coping process. Language was modifed to meet the reading and language level of the subjects.

Cue Card Two:

Coping Self-Statements
(A) Assessment of the situation
What is it that I have to do?
Look over the task and think about it.
(b) Recognizing and controlling the impulse of negative thoughts
Recognition:
Okay I feel worried and scared...
I'm saying things that don't help me... I can stop and think more helpful thoughts.
Confronting/ Coping/ Controlling
Don't worry. Remember to use your plan.
Take it step by step - look at one question at a time.
Don't let your eyes wander to other questions.
Don't think about what others are doing. Take it one step at a time.

When you feel your fears coming on ... take a deep breath, think "I am doing just fine. Things are going well."
(d) Reinforcing
I did really well in not letting this get the best of me.
Good for me. I did a good job.
I did a good job in not allowing myself to worry so much.

Once subjects had the opportunity to review the cue cards the researcher (using an enlargement of each cue card) completed a mathematics task applying the strategies as outlined on the cue cards. The researcher encouraged subjects to ask for clarification if necessary. Once the procedure was clear to all subjects they were hooked up to their tape recorders and provided with a practice mathematics task, plus copies of the cue cards (one pair per subject). Instructions to keep thinking out loud were given (as opposed to subjects being asked to describe what they were thinking, as this type of request elicits a type of self-evaluation). During the application period in which subjects completed the tasks using the cue cards, the researcher did not intervene with statements to encourage or to coach the subjects to use the cue cards, nor was instruction provided for completing a specific item on a task. The only interference from the researcher during the completion of a given training task was to remind subjects that had stopped "verbalizing" to remember to keep thinking out loud. When a subject failed to "think out loud" for a period of three minutes the researcher cued the subject orally to continue to think out loud.

Sessions one through three were completed as described above. On the fourth session the researcher provided the subjects with a mid-

intervention booster session. This session was conducted in a similar fashion to that described in the baseline collection procedures. In addition, subjects were provided with a review of the strategies (cue cards) applicable to a demonstration question completed by the researcher. The remaining sessions were completed following the same procedures as outlined for sessions one through three.

Modification of Strategy Use. At the close of the first, fourth, and final training sessions, or when the subject had completed the assigned task, the researcher,randomly selected a completed question from each individual subject's mathematics sheet, and with the tape recorder still in record mode asked the subject to "rethink" the completion of that question without the assistance of the cue cards. During the interview periods all subjects remained at their stations either completing the task or waiting for their turn to be interviewed. This procedure was implemented in order to tap the development of coping repertoires of the individual subjects. According to research, when a strategy is internalized the individual begins to alter or adapt the structure to suit his/her need for application, focussing on specific features in the coping process that they deem relevant (Meichenbaum, 1977; Luria, 1932). The more internalized a strategy becomes the more noticeable the degree of modification in the strategy plan. In addition, this procedure was used to tap the actual modification, by individual subjects, of the coping process as presented on the cue cards.

Maintenance Check. On the day following the last intervention training period the Average Achievers group were brought together with the Learning Disabled group to complete a mathematics task similar to the tasks provided in the baseline collection phase of the

study. All subjects were reminded of the procedures in the earlier baseline sessions, accompanied by a modelled completion of a math question complete with some sample self-statements characteristic of three levels of self-talk (ie. a neutral self-statement or task specific statement, and two task approach statements, positive and negative) used in the initial baseline collection session. In addition, all subjects were reminded to try and think out loud when completing the task. As in the training phase and the baseline collection phase subjects were prompted with a neutral cue when they ceased to verbalize for a three minute interval. A second and final maintenance check was conducted two weeks later. During this final phase of collection subjects were not provided with the coping prompt cards. The first maintenance check was monitored by the researcher while the second and final maintenance check was monitored by a colleague working at specific school settings.

Instrumentation and Materials

Pre-Test and Post-Test Collection Measures. All subjects (both Average and Learning Disabled) completed four mathematics measures, two during the pre-test collection phase and two during the post-test collection phase of the study. Each of the four measures contained a sampling of questions to represent each of the goals and objectives for the fraction strand outlined in the teachers' guides of Investigating School Mathematics, for grades four through seven. Several master teachers compared the four measures for content and level of difficulty to the summative tests provided by the publishers for Investigating School Mathematics. The four measures were also compared to levels tests prepared by the Catholic School District. In all cases measures

were found to be similar in content and level of difficulty to both Summative tests and District tests.

Intervention Tasks The intervention tasks used in this study were based on the Ministry Prescribed Mathematics series for British Columbia Public Schools - Investigating School Mathematics Levels 4-7. The Instructional Strand of Fractions was the conceptual level from which all measures were created for the study. For the purposes of this study a total of forty eight mathematics tasks were produced prior to the collection of data. Each intervention task focussed on a single concept. Six operations with fractions were covered on the training task, with each task focussed on one operation. The training tasks as a whole covered writing equivalent and converting fractions, addition and subtraction of unit fractions, addition and subtraction of mixed fractions without regrouping, multiplication of unit fractions, and division of unit fractions. Each of the mathematics measures were constructed with consideration of the level of expected mastery for individual grades and the present level of mastery achieved by the individual subject. In addition, the format of the mathematics tasks were designed to resemble as closely as possible an actual mathematics test. Each measure included between thirty and forty-five items presented in a regular block format accompanied by specific directions for completion (see Appendix E). All tests were scored out of thirty points.

To ensure validity of the mathematics measures each measure was compared, by colleagues, in terms of content and level of difficulty to Summative Tests provided by the Investigating School Mathematics Programme. As well, each test was compared to levels

tests given in the regular classrooms (random comparison at each school). In only three cases was it necessary to rewrite a portion of a measure for clarity.

Self-Talk Measure. At all three levels of the study (pretest, intervention, post-test) the self-talk of subjects was collected. Self-talk is defined as the guiding self-dialogue engaged in by an individual while completing a task. For the purpose of this study self-talk was characterized as either positive, negative, or neutral. Self-talk has been divided into two levels: task specific and task approach (Meichenbaum, 1979; Brown et al, 1981). Both negative and positive self-talk come under the general category of task approach statements. Generally task approach statements focus on characteristics of the learner which facilitate or inhibit performance. In terms of the present study a positive self-statement is one which facilitates performance, encouraging continuance at a task, and reinforces the subject after completing a specific item. This category of self-talk also includes statements aimed at the completion of a task... " What am I supposed to do here... take the first step"; or a statement which describes the subject, "I must remember to go slowly... I am doing my best". In contrast a negative task approach statement is one which inhibits or interferes in the successful completion of a task, for example: "I am hopeless at this... I'll never get this right".

The neutral or task specific statements according to Harris (1985), are statements which are relevant to the specific task at hand, for example, " I have to carry the one... I have to reduce to lowest terms".

Data Treatment

Self-Talk Measures. Following the completion of each session, hardcopy transcripts of the recorded audiotapes were produced. Transcripts were coded against a master evaluation key which operationally defined each type or level of self-talk. A total of 200 individual sessions were recorded over the duration of the ten week study period, which translates to 100 hours of recorded self-report data. Of the 200 individual sessions one session was not completed due to subject absence. The 199 remaining sessions were transcribed verbatim to produce a hardcopy of each session. To ensure that each session had been transcribed accurately each hardcopy was compared to the original tape; any missing or inaccurate transcriptions were noted on the hardcopy to be corrected at a later time. Final copies of the corrected transcripts were encoded onto a data disk with accompanying hardcopy produced. Each hardcopy was labelled with the subject number, session number, date, and school location.

Ten percent of the total data pool or 20 sessions were evaluated by a coder, blind to the procedures, using a coding key which outlined the three levels of self-talk in operational terms.

Mathematics Measures. For each of the 48 mathematics measures produced, a master key was created. The keys for each task were checked by a colleague at the school settings to ensure that all answers listed were correct. Each of the completed math tasks were marked against the appropriate key by the researcher. Each raw score, with accompanying percentage accuracy, was then recorded on a master sheet which listed subjects by identity number.

CHAPTER IV

RESULTS AND DISCUSSION

Overview

In this chapter, the results of the coping strategies training programme are presented and discussed. The findings are discussed in relation to each of the five research questions under investigation, with implications drawn for future research.

Research Question No. 1:

> Do the coping self-statements of learning disabled children differ systematically (qualitatively and quantitatively) from normally achieving peers?

Tabulated means of the spontaneously generated private self-dialogue for both learning disabled and average achieving groups for both baseline sessions are presented in Table 1. Subject's self-talk was rated as either positive, negative, or neutral. Operationally, positive self-talk is defined as statements which contain a phrase identifying a problem coupled with phrases of affirmative action. Illustrative examples of positive self-talk are: " Oh, oh I can't ... I am thinking in a more helpful way.. take a deep breath and take it step by step." Negative self-talk is operationally defined as a statements which contain one or more phrases of self depreciation but not coupled with affirmative action phrases. Illustrative examples are: "I can't do this I'm stupid" or "This is hopeless. I'm stuck, I can't". Neutral self-talk is operationally defined as statements which neither facilitate

performance or interfere with performance of the task. Statements of this type would include observational evaluation of the surroundings such as " Boy it's cool in here", " What did he say?". To facilitate comparisons, means were calculated and expressed in percentages for each of the three categories. In addition, individual means were calculated for each of the **two baseline sessions.** The percentage means calculated for positive self-talk for the learning disabled group and average achieving group are reported in the first column of Table 1. Of the 611 self-statements generated by learning disabled subjects on the first of the two baseline sessions, 108 or (17.6% SD= 7.11) of the self-statements were categorized as positive -- self-statements which facilitated performance on academic tasks. In comparison, 275 (42.4% SD= 10.05) of the 623 self-statements generated by average achieving subjects, during the first baseline collection, were rated as positive. Significant differences between learning disabled and average achievers were found on these pre-test comparisons [t (9) = -7.635, p<.05].

In the second baseline session, similar findings were observed. Specifically, learning disabled subjects as a group engaged in significantly less positive self-talk than did normally achieving peers while completing baseline mathematics tasks. A comparison of 145 (23.4% SD = 12.51) of 612 self-statements being rated as positive for learning disabled subjects to 328 (48.5% SD= 7.56) of 675 self-statements being rated as positive for average achieving subjects. This difference was significant [(t, (9) = -4.96 p <.05].

The means for negative self-talk across the two baseline sessions for both the learning disabled and average achieving groups

Table 1 Pre-test 1 and Pre-Test 2 Comparisons of Self-Talk Data by Category for Learning Disabled and Average Achieving Subjects

Pre-Test 1	Learning Disabled (N = 10)	Average Achievers (N = 10)
Positive Statements	17.6% (108)*	42.4% (275)
Negative Statements	53.4% (326)	19.4 %(120)
Neutral Statements	29.0% (177)	37.9% (228)
Pretest 2		
Positive Statements	23.4% (145)	48.5% (328)
Negative Statements	42.0% (257)	17.2% (120)
Neutral Statements	34.4% (210)	35.6% (227)

* refers to the total number of self-statements generated for that category calculated from raw data on pre-test summaries.

are presented in the second column of Table 1. Negative self-talk accounted for 326 (53.4% SD = 12.03) of the total 612 self - verbalizations generated by learning disabled subjects during the completion of the first baseline task, and 257 (42.0% SD = 14.93) of 623 self-statements on the second baseline collection. In contrast, negative self-talk accounted for only 120 (19.4% SD = 5.17) of 623 self-statements generated by the average achieving subjects during the first baseline collection session, and 120 (17.2% SD = 6.015) of 675 for the second baseline collection. These differences were significant [t (9) = 7.267 $p<.05$ and t (9) = 5.39 $p<.05$]. Learning disabled subjects were found to engage in significantly more negative self-talk while completing both baseline tasks than did average achieving subjects.

Summary and Discussion

When self-talk is considered as a whole, the two groups did not differ significantly in the **quantity** of self-talk produced. Over a thirty minute session both learning disabled subjects and average achieving subjects produced approximately similar amounts of self-talk; the mean average for learning disabled subjects was 66.4 self-statements compared to a mean of 65.4 self-statements for the average achieving subjects. However, clearly marked **qualitative** differences were noted in the spontaneously generated self-talk of learning disabled and average achieving subjects when self-talk was partitioned by category or type and compared in terms of the quantity of positive and negative self-talk. Learning disabled subjects were found to produce significantly more negative self-talk and significantly less positive self-talk than average achieving peers. It is interesting to note that the groups did not produce significantly different amounts of neutral

self-talk, self-talk which did not facilitate nor interfere with the completion of a task. The learning disabled group averaged 21.25 neutral self statements across the two pre-test sessions while the average achieving group produced 22.75 neutral self-statements across the two pre-test sessions. Figure 1 and Figure 2 depict the patterns of self-talk of learning disabled and average achieving subjects across the two baseline sessions.

The patterns of self-talk revealed by the baseline data sessions support the findings reported in the early self-instruction research literature. Specifically, Meichenbaum (1968) found that implusive hyperactive children were less able than average peers to exercise verbal control over non-verbal behaviours. The self-verbalizations of hyperactive subjects were found to contain significantly more negative self-verbalizations as compared to positive or relevant verbalization. Self-instruction training coupled with cognitive modelling led to improvement among the hyperactive subjects to perform more accurately on dependent measures. Other researchers report similar results, extending their investigation to demonstrate the maleability of the self-dialogue and tying self-speech directly to the control of motor behaviours.

The present study extends these early findings to include the influence of self-speech on academic performance. The present findings substantiate those reported by Harris (1982) who looked more specifically at the influence of the debilitating and irrelevant self-speech patterns of learning disabled subjects on success with problem solving tasks. Where early self-instructional programme studies focussed on the control of motor and nonverbal behaviours through

Figure 1 Comparison of Qualitative Self-Talk: Pre-Test 1

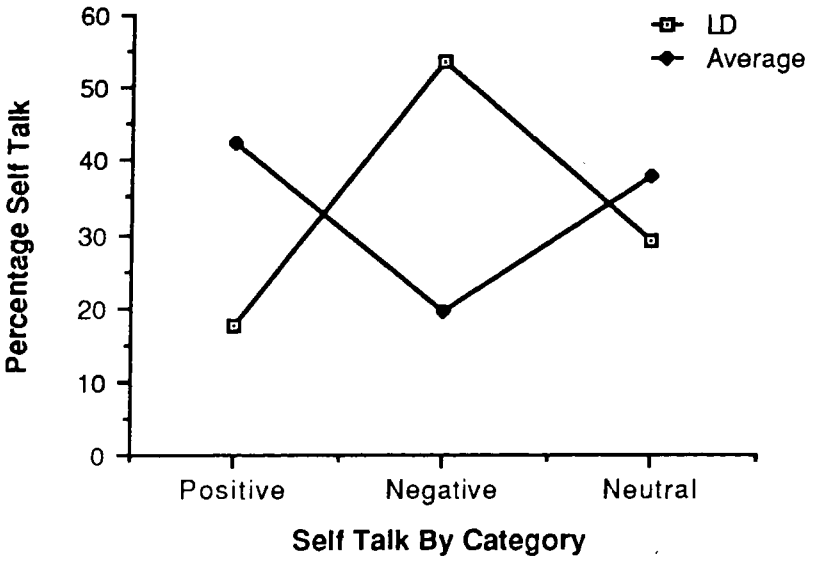
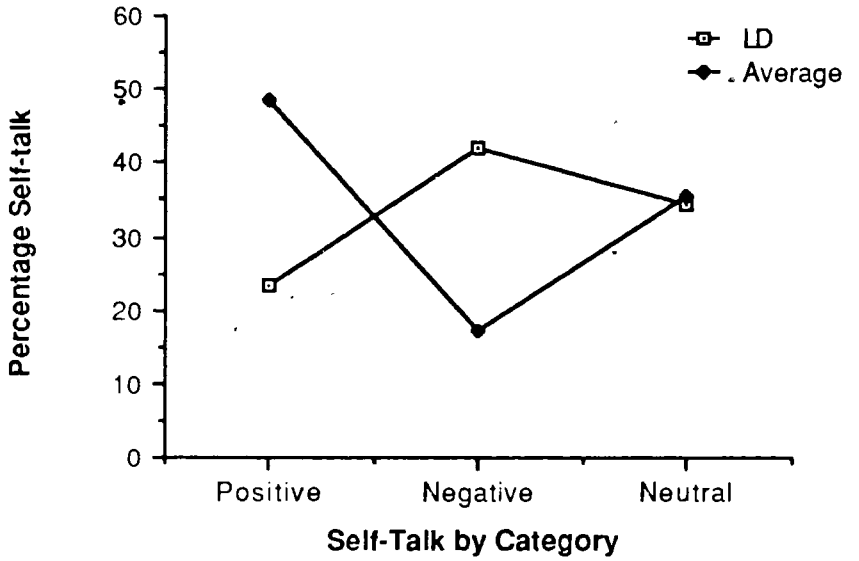


Figure 2 Comparison of Qualitative Self-Talk: Pre-Test 2



self-talk and quasi-academic tasks (problem solving tasks), the present findings clearly demonstrate the influence of self-speech on **academic** tasks. As well, the present study applied self-instructional procedures to actual tasks found within the regular school curriculum where earlier applications tended to focus on clinical and laboratory based tasks. In short, a conscientious attempt was made to use ecologically valid tasks.

Research Question No. 2

> Does the coping strategies training programme have a significant positive effect on the coping style of the learning disabled subjects?

In order to answer this question, within-group differences across the three levels of self-talk (dependent variables) in both pre-test and post-test conditions will be explored. As well, in order to draw some tentative conclusions as to the effectiveness of the coping skills training programme, a comparative analysis of differences in self-talk between average achievers and learning disabled subjects during training will be explored.

Within-Group Self-Talk Comparisons. Table 2 presents self-talk data collected and classified by category (positive, negative and neutral) for the learning disabled group across the pre and post test conditions. To facilitate within and across group comparisons, means are presented as percentages. Differences in the coping style of learning disabled subjects from the pre-test condition to the post-test condition are reflected by the differences in percentage means on each

Table 2 Pre to Post Test Comparison of Self-Talk Means for Learning Disabled Subjects

Self-Talk	Pre-Test 1	Pre-Test 2	Post-Test 1	Post-Test 2
Positive	17.6*	23.4	41.2	45.7
Negative	54.1	41.8	25.8	22.8
Neutral	28.3	34.6	32.9	31.5

* percentages

level of self-talk. In the pre-test conditions, learning disabled subjects engaged in proportionally more negative self-talk than positive self-talk. Comparisons of post-test situations revealed a **reversed** trend, with learning disabled subjects engaging in significantly more positive self-talk accompanied by significantly less negative self-talk. This reversed trend is clearly observed in Table 2.

Statistical analysis by t-test confirmed the trends observed. Significant differences at the $p < .05$ level between pre-test and post-test means for both negative and positive self-talk were found for learning disabled subjects. However significant differences were not found between the pre-test and post-test scores on neutral self-talk for the learning disabled subjects. Table 3 presents the calculated critical T values for each of the three levels of self-talk across pre and post test conditions for learning disabled subjects.

Comparison of Learning Disabled to Average Achievers on Self-Talk Measures. Comparative analysis of the coping self-talk patterns (ie. patterns of the three levels of self-talk) of learning disabled and average achieving subjects provide further support for the research question under investigation. When self-talk patterns of learning disabled subjects were compared to those of the average achievers, across pre and post test situations, marked differences in the coping self-talk patterns were noted at the pre-test condition, but these observed difference were not apparent at the post-test condition. The coping self-talk patterns of average achievers in the pre-test condition contained a greater proportion of positive self-talk to negative self-talk. In comparison, self-talk generated by learning disabled subjects, during the pre test condition, contained significantly more negative and

Table 3 T-Test Results for Comparison of Pre to Post Test Self-Talk for Learning Disabled Sample

Self-Talk	Pre/Post 1	Pre/Post 2
Positive	-6.612*	-5.941*
Negative	5.758*	3.2*
Neutral	.237	.98

* significant at $p<.05$.

significantly less positive self-talk. The clearly discernable patterns between the positive and the negative self-talk of average and learning disabled subjects have been presented previously in Table 1. The self-talk patterns of learning disabled subjects at the post-test condition more closely approximated those of the average group. Calculated critical t values for self-talk comparisons are provided in Table 4. These values demonstrate that significant differences were found between learning disabled and average achievers on both pre-tests for negative and positive self-talk but not for neutral self-talk. At the post-tests, no significant differences were found between these two groups on either positive, negative, or neutral self-talk.

Summary and Discussion

The coping skills training programme was found to have had significant positive effects on the coping style of learning disabled subjects when comparative analyses of the patterns of self-talk across and within groups were performed. Significant differences in the patterns of self-talk among learning disabled subjects were revealed when pre to post test data were compared. In pre-test conditions the coping self-talk of learning disabled subjects tended to contain signficantly larger porportions of negative to positive self-talk. **Reversed** trends in the coping self-talk patterns of learning disabled subjects were noted at the post-test condition; learning disabled subjects' coping self-talk contained significantly more positive self-talk and significantly less negative self- talk. Comparisons of coping self-talk patterns of the average achieving group to the learning disabled group revealed significant differences in terms of the content of coping self-talk at the pretest condition (see Figure 1 above). In

Table 4 Pre/Post T-Test Comparisons of the Self-Talk Patterns of Learning Disabled Subjects to Average Achievers

	Critical T-values			
	Pre-Test 1	Pre-Test 2	Post-Test 1	Post-Test 2
Positive	7.635*	4.96*	.26	.423
Negative	-7.267*	-5.39*	2.052	.088
Neutral	1.915	.334	-.609	.778

* significant at $p<.05$.

post-test conditions, however, the coping self-talk patterns of learning disabled subjects more closely approximated patterns of coping self-talk displayed by average achievers. Figures 3 and 4 depict, graphically, the similarities in self-talk patterns of learning disabled and average achievers at the post-test condition. Of particular interest is the fit of the self-talk patterns of learning disabled subjects to average peers on the second post-test measure (far maintenance task), administered three weeks after the first post-test (see Figure 4). The self-talk patterns of both groups were almost identical in proportion of positive, negative, and neutral self-verbalizations.

These findings demonstrate that training in the coping strategy was sufficient for altering the self-dialogue patterns of learning disabled subjects to mirror those of average achieving peers. The present researcher had hypothesized that training in the coping strategies sequence would stimulate the replacement of negative self-talk with more adaptive positive self-talk. The results however, showed that negative self-talk, across sessions, continued to account for approximately 25 percent of the entire self-talk dialogue for both groups of subjects. According to the literature, a certain amount of negative dialogue is necessary for effective coping to occur. This might suggest that the presence of the proportion of negative self-talk found within the self-talk patterns in both groups was necessary to stimulate active coping, and therefore is a desirable characteristic in the self-dialogue patterns. Safran (1981) suggests that the presence of negative self-speech within the self-dialogue works as a marker or cue to the individual to engage in more adaptive productive coping self-talk. Thus, the residual negative self-talk in all the subjects appears to

Figure 3 Post-Test 1 Comparisons of Self-Talk for Learning Disabled and Average Achievers

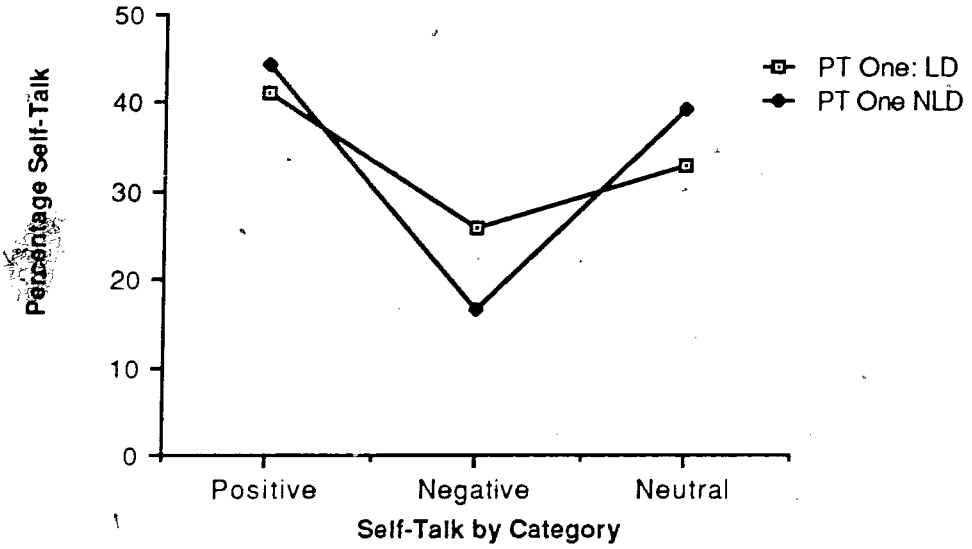
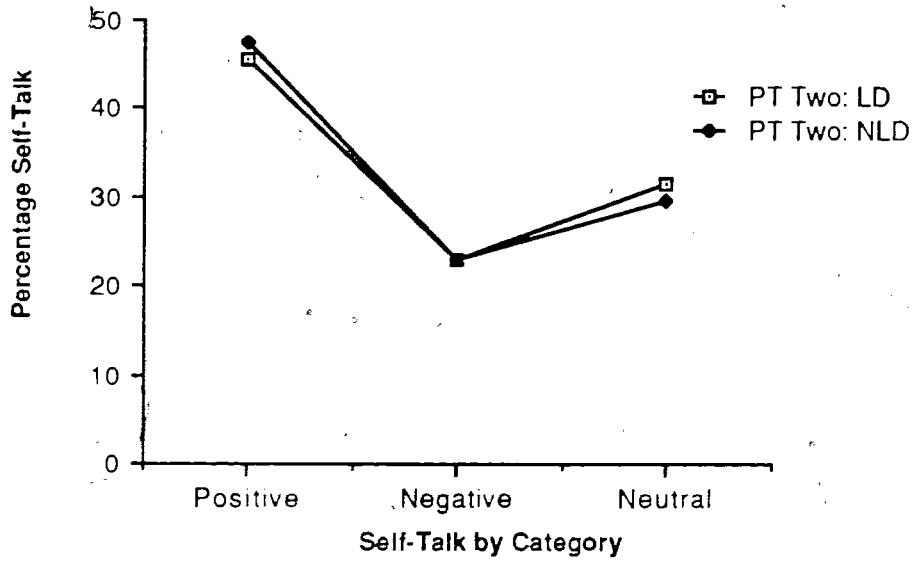


Figure 4 Post-Test 2 Comparisons of Self-Talk for Learning Disabled and Average Achievers



be understandable.

Research Question No. 3

> Do trained learning disabled subjects improve in academic performance in areas where negative coping behaviour was abundant prior to Cognitive Behaviour Modification training?

A comparative analysis of performance scores from pre to post test conditions for learning disabled subjects was conducted in order to answer the question of the effectiveness of the cognitive behaviour modification training strategy in improving academic performance. Table 5 provides individual subject means, with grand means calculated for the learning disabled subjects across both pre and post test conditions. Performance scores for learning disabled subjects on the first pre-test measure are presented in the upper half of column one of Table 5. Scores for the learning disabled group on the first pre-test ranged from 1 through 55 with a mean of 22.9%. Performance scores of learning disabled subjects for the first post-test, described in the upper half of column two on Table 5 ranged from 19 through 80 with a mean of 57.9%. T-test analyses conducted on pre-test one means and post-test one means yielded a significant difference [t (9) = -9.642 $p<.05$].

A second analysis was performed comparing the data collected for the second pre and post tests (see the lower half of Table 5). There was a three week interval separating the administration of the first and second post-test. The mean performance for the learning disabled subjects on the second pre-test was 26.9% with scores ranging from 7

Table 5 Pre-Test/Post-Test Performance Data by Subject for Learning Disabled Subjects

Subject Number	Pre-Test 1 Percentages	Post-Test 1 Percentages
1	17%	62%
2	12	55
3	31	59
4	17	68
5	55	80
6	6	19
7	1	43
8	23	60
9	37	64
10	30	69
	Mean: 22.9	57.9

Subject Number	Pre-Test 2 Percentages	Post-Test 2 Percentages
1	21	49
2	10	27
3	29	60
4	31	61
5	54	71
6	14	7
7	7	5
8	26	5
9	36	60
10	41	62
	Mean: 26.9	46.0

through 54. On the second post-test, the average score for learning disabled subjects was 46.0% with a range in scores from 5 through 71. T-test analyses conducted on the second set of data were significant [t (9) = -4.435, $p<.05$].

Table 6 provides the calculated percentage means for both negative self-talk and performance of learning disabled subjects across the six training sessions. Exploratory analysis revealed a trend in the negative self-talk patterns and performance scores. As negative self-talk decreased there was a corresponding increase in performance.

Over the duration of the training sessions, there was a 19% decrease in the negative self-talk of learning disabled subjects with a corresponding 27.9% increase in the performance. The largest notable decrease in negative self-talk accompanied the greatest increment in performance found between session two and session three; an 8.9% decrease in negative self-talk accompanied by a 4.9% increase in performance. Of interest to the present study was the 1.4% increase in negative self-talk (during session four) and the effect it had on performance. Although performance improved, the increment was smaller than that found in earlier and later sessions (1.2%).

Summary and Discussion

Significant academic improvement among learning disabled subjects, was noted from the pre to post test conditions. Significant differences found between the learning disabled and average achieving subjects on the pre test measures were not apparent on post-test measures. In fact the performance of learning disabled subjects on the post-test measures approximated the performance of the average achievers (see Table 5).

Table 6 Percentage Means for Negative Self-Talk and Performance for Learning Disabled Subjects by Group Across Training

Training Session	Negative Self-Talk (N = 10)	Performance (N = 10)
1	43.4 %	28.4 %
2	37.1	36.4
3	28.2	41.3
4	29.6	42.5
5	26.8	43.4
6	24.4	56.3

Patterns of negative self-talk and performance across training sessions provide further evidence in support of the positive effects of the cognitive training procedure on academic performance. As the academic performance of the learning disabled subjects increased there were corresponding decreases in the generated negative self-talk. Based upon these findings, one could speculate that cognitive variables (ie. negative self-talk) greatly limited the learning disabled subjects from performing efficiently on the academic tasks. This finding points to and provides support for the production deficiency hypothesis that the difficulties of the learning disabled to perform effectively within the academic setting are related to an inability to call up appropriate cognitive and metacognitive routines. These difficulties are caused, at least in part, by the interferences of negative self-talk. While the subjects in this study were not instructed in mathematics (ie. fractions), performance increments on mathematics tasks were found following training in a cognitively based procedure (Self-Instructional procedure for coping with maladaptive self-instructions). As discussed in the literature review, Meichenbaum explained that the maladaptive self-instruction characteristic of this group acts as a competing stimulus, distracting the subject's attention from successfully coping with the alternate stimulus (the task). By bringing the maladaptive self-talk patterns to the conscious level and offering replacement alternative, more adaptive positive self-statements, the attention of the subject is redirected to the task at hand. These findings highlight the importance of not only focussing on pure academic instruction (skills acquisition) within the classroom setting, but to provide appropriate parallel instruction at the affective

level. Instruction must contain components aimed at altering and modifying the ineffective and irrelevant self-speech characteristic of the learning disabled child.

Research Question No. 4

Is there a relationship between academic performance and self-talk?

Clearly marked differences in the coping style, as revealed by self-talk, of learning disabled subjects when compared to average achieving subjects have been cited. Changes in the coping style of learning disabled subjects have been noted in terms of self-talk comparisons and performance comparisons. Similarities were also noted between the self-talk patterns of average achieving and learning disabled groups on post-test measures. However, in order to look at the relationship between self-talk patterns and performance more specifically, the interaction between self-talk and performance variables must be explored. Pearson's Correlation Coefficient formula was used to analyze the relationship between performance and self-talk data. Coefficients were calculated to determine the relationship between: (a) pre-test performance and positive, negative, and neutral self-talk values; and (b) post-test performance and positive, negative, and neutral self-talk values. Findings from the correlational analysis are presented in Tables 7 through 7.2

Correlational Analysis by Total Group. Theoretically, as performance scores increase there should be a corresponding increase in positive self-dialogue accompanied by a substantial decrease in

Table 7 Table of Correlations Comparing Performance Measures with Self-Talk Measures for Total Population

	Math Tasks			
Self-Talk	Pre-Test 1	Pre-Test 2	Post-Test 1	Post-Test 2
Positive	.60*	.61*	.43	.54**
Negative	-.49*	-.37*	-.21	-.03
Neutral	.12	.18	.02	-.10

Correlations based upon total population (N = 20).
* = significant at $p<.05$
** = significant at $p<.01$

Table 7.1 Table of Correlations Comparing Performance Measures with Self-Talk Measures - Learning Disabled Group

	Math Tasks			
Self-Talk	Pre-Test 1	Pre-Test 2	Post-Test 1	Post-Test 2
Positive	.46	.17	.50*	.73*
Negative	-.17	-.32	-.26	-.32
Neutral	.08	.07	-.32	-.54

Correlations based upon total population (N = 20).

* = significant at $p<.05$

** = significant at $p<.01$

Table 7.2 Table of Correlations Comparing Performance Measures with Self-Talk Measures - Average Group

	Math Tasks			
Self-Talk	Pre-Test 1	Pre-Test 2	Post-Test 1	Post-Test 2
Positive	.29	.20	.42	.41
Negative	-.33	.03	-.04	.15
Neutral	-.40	.12	.20	-.51

Correlations based upon total population (N = 20).
* = significant at p<.05
** = significant at p<.01

negative self-dialogue. As indicated on Table 7, when the data generated by the two groups is considered as a whole, there is a moderate positive relationship found between positive self-talk and performance on pre-test measures (.60 for pre-test one, and .61 for pre-test two, $p<.05$). A moderate negative relationship was found between negative self-talk and performance at the pre-test condition (-.49 for pre-test one, and -.37 for pre-test two, $p<.05$). In addition, a slight positive relationship exists between neutral self-talk and performance at the pre-test condition (.12 and .18, $p>.05$). With the exception of neutral self-talk, correlational findings were significant at the $p<.05$ level.

Correlational analysis of post-test findings were found to be similar to those reported for the pre-test. A moderate positive relationship was found between performance and positive self-talk (.43 for post-test one and .54 for post-test two). A slight to moderate relationship was found between performance and negative self-talk (-.21 for post-test one and -.03 for post-test two). As in the pre-test condition only a slight relationship was found between neutral self-talk and performance (02 for post-test one and -.10 on post-test two).

Correlational Analysis by Sample. When the sample population was treated separately, categorized as learning disabled and average achievers, a moderate positive relationship was found between positive self-talk and performance for learning disabled subjects on the pre-test condition ($r= .46$, $p.>.05$ for pre-test one and $r=.17$,$p>.05$ for pre-test two). In addition, there was only a slight negative relationship found between negative self-talk and performance at the pre-test condition ($r= -.17$, $p>.05$ for pre-test one and $r= -.32$, $p>.05$ for pre-

test two). A slight positive relationship was found between neutral self-talk and performance at the pre-test condition (r=.08, p>.05 for the first pre-test and r= .07, p>.05 for the second pre-test).

When correlation coefficients were calculated for the post-test data for learning disabled subjects a *strong* positive relationship between positive self-talk and performance was found (r=.50, p<.05 for post-test one and r= .73, p <.01 for post-test two), accompanied by a slight negative relationship between performance and negative self-talk (r= -.26, p>.05 post-test one and r= -.32, p>.05 for post-test two). Unlike the earlier findings, which showed only a slight positive relationship between performance and neutral self-talk, the relationship between neutral self-talk and performance of learning disabled at the post-test condition was found to be positive and moderate (r= -.32, p>.05 and r= -.54, p< .05).

Correlation coefficients calculated for average achievers across the pre and post test conditions and the relationship between performance and the three levels of self-talk (negative, positive, and neutral) showed a slight positive relationship between positive self-talk and performance and neutral self-talk and performance with a slight negative relationship between negative self-talk and performance. Confirmation of these findings was found when correlation coefficients were calculated for the second set of pre-test data and second set of post-test data. The data is summarized in Table 7.2.

Summary and Discussion

As pointed out by Sabatino et al. (1981), no one intervention can

account for all the aspects of any academic behaviour as learning proficiency represents a composite of many skills. While it is clear that the correlational findings demonstrate that only some of the variance in the performance may be accounted for by type of self-talk interesting conclusions may be tentatively drawn. Specifically, a significant positive relationship exists between positive self-talk and academic performance. This was coupled with a moderate negative relationship found between performance and negative self verbalizations. One could tentatively conclude that positive self-talk can enhance academic performance while negative self talk has an opposite more detrimental effect on performance. The less robust correlation found between negative self-talk and performance could be related to the necessity for having some negative self-talk in order to stimulate active coping behaviour. These findings suggest that a substantial proportion of academic performance could be explained by particular patterns of self-talk. Thirty-six percent of effective academic performance may be accounted for by positive self-verbalizations and approximately 25% of decrements in performance could be explained by negative self-verbalizations. These findings provide further support for the need to address the affective domain within the instructional setting.

Research Question No.5

How are the generic strategies (CBM) used in the training session modified by subjects over time?

Over the course of training, three follow-up interviews were conducted, one at the beginning of training, one at the midpoint in the training interval (Session 4), and one at the end of the training. Using one of the completed or attempted items on the training task as a prompt, subjects were asked to rethink the question aloud, focussing on the strategies they used to deal with that specific question. Cue cards were not available for reference during these interviews. Subjects' reponses were recorded on audiotapes and later transcribed. All ten of the learning disabled subjects completed the three interviews. Trends in the modification of strategy use by subjects are presented as a number calculated out of ten. Table 8 below summarizes the data collected by category of statement. The number reflects the use of the statement,without modification, by individual subjects across the three sessions. Thus, if subjects verbally reported the full strategy statements a score of one was recorded for that statement use. Over time a reduced reliance on the verbatim use of coping self-statements was noted. Most subjects tended to rely more heavily on the verbatim use of the coping self-statements at the beginning of training and less so overtime. Eighty percent of the subjects engaged in "Assessments of Situation Statements", while 65% of subjects engaged in verbatim use of "Recognizing and Controlling Negative Thought Statements" and 56% of the trained subjects used "Self-Reinforcing" statements in the first of the three interviews. By the mid point in training only 50% of the subjects engaged in verbatim use of coping self-statements across the three phases of training in the coping process (see Table 8 for summary and actual percentages). In the third and final interview subjects appeared to be relying less on verbatim use of coping self-statements

Table 8 Self-Statements Modification by Trained (LD) Subjects Over the Three Modification Interviews

Modelled Self-Coping Statements	Interview 1	Interview 2	Interview 3
A) Assessment of the Situation			
What is it that I have to do?	7 *	3	5
Look over the task and think...	9	7	6
B) Recognizing negative thoughts			
Okay, I feel worried and scared...	6	5	4
I can stop and think more helpful thoughts	7	6	5
Controlling negative thoughts			
Don't worry remember to use...	6	4	2
Take it step by step.	6	5	5
Don't let your eyes wander.	8	4	4
When you feel fear coming on...	5	6	5
I can do this, think through...	8	7	5
C) Reinforcing			
I did really well in not letting...	6	5	2
Good for me. I did a good job.	5	5	3
I did a good job in not allowing...	6	6	3

* indicates 7 out of 10 subjects used this statement.

in recognizing and controlling negative thoughts (43%) and Self-reinforcing (26%), but continued to rely on Assessment of the Situation Statements (55%).

Interesting strategy modifications of a more idiosyncratic nature were also observed. Among trained subjects the most notable trend in the modification of coping self-statements was found in the recognition and controlling of negative thoughts. Subjects tended to incorporate only the functional vocabulary from each of the self-statements in addition to a personalizing of the coping self-statements. For example, instead of saying.. "I can stop and think more helpful thoughts... The subject might say " Stop, think... like a football star" or "Stop. Play it in your head right" as did one subject who played on a football team. It was also found that statements categorized as "Assessment of the Situation" tended to be less personalized and more verbatim recall. Finally, subjects tended not to self-reinforce for successful completion. Those who did however, tended to focus on only selected positive experiences while completing the training tasks, making statements which reflected very item-specific self-reinforcements such as, "I did good on that question", or "I made it through the last question".

Summary and Discussion

The modification of self-statements, as seen above, may be explained as one of efficiency in the application of the strategy. Subjects apparently internalized the strategy statements into their personal self-dialogue and the personalization of the statements is the reflection of this internalization. An alternative explanation may be that in order that the subject can remember the positive self-

statements, they changed the statements to reflect an area of personal strength. It may be concluded that an essential feature of any cognitive behavioural approach should include the consideration of individual differences among subjects. In developing the reportoire of self-statements, characteristics that the learner brings to the situation must be carefully considered if training is to be effective. That is, the idiosyncrases of the learner must be considered in developing the goals of training.

Post Hoc Analysis

In this section of the results chapter, post hoc analysis of differences in self-talk and performance by age and sex will be explored. While conducting the planned analysis, differences in the coping self-talk style among individual subjects became apparent. While the specific differences did not affect the results of the planned analysis, they did raise some specific questions with regard to the interaction and/or effect of grade and age on the ability for subjects to develop the strategies focussed on in the training sessions. Subjects from the fifth, sixth, and seventh grade responded in a similar fashion: increased performance was accompanied by decreasing negative self-talk, increased positive self-talk, and a fairly stable amount of neutral self-talk across training. However, the response style of the two fourth graders was markedly different from that of the other subjects. Unlike subjects in grades five, six, and seven there was no discernable trend or pattern in the response style of these two subjects across the training sessions.

Table 9 provides the calculated means for performance and the three levels of self-talk by grade groupings. Looking more specifically

Table 9 Comparisons of Self-Talk and Performance for Trained (LD) Subjects by Grade

	Grade			
	4 (N = 3)	5 (N = 3)	6 (N = 2)	7 (N = 2)
Positive Self-Talk	30.9%	42.8%	44.2%	37.4%
Negative Self-Talk	36.1	28.8	22.0	26.7
Neutral Self-Talk	32.9	28.3	33.7	29.7
Performance	29.0	43.2	47.3	52.8

at these trends, significant differences were found between fourth graders on performance, positive self-talk and negative self-talk when compared to other grade groups. However, there were no significant differences between groups on neutral self-talk levels. The differences in the reponse of the fourth graders are limited by the sample size (N=2). Replication will be required in order to determine whether the differences observed are actual differences or are an anomaly of the study.

As mentioned earlier, the task requirements of the training procedure used in the present study may not have been compatible or appropriate for this particular subsample, the fourth graders. The limits on the memory ability or poor information processing skills of younger and less able students, or the complexity of the strategy itself may account for the inability of these subjects to successfully use the strategy taught in this study.

There were no apparent differences in performance or self-talk when analyzed by sex. Both males and females performed similarly and produced comparable amounts of negative, positive, and neutral self-talk. Data is summarized in Table 10.

Table 10 Comparisons of Self-Talk and Performance for Trained (LD) Subjects by Sex

	Male (N = 6)		Female (N = 4)	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Positive Self-Talk	20.6%	43.5%	20.3%	43.8%
Negative Self-Talk	49.6	25.2	47.6	23.0
Neutral Self-Talk	29.5	31.5	31.1	32.2
Performance	23.1	57.1	25.0	59.2

CHAPTER V

CONCLUSIONS

Summary of Findings

This study investigated the relationship between the self-talk and academic performance of learning disabled children. Specifically, the application of coping self-instructive verbalizations was successful in increasing the targeted subjects' academic performance through modifications of self-verbalizations. While the self-talk patterns of learning disabled children were not quantitatively different from average non-learning disabled peers, significant differences in the quality of self-talk were found. Following training in the coping intervention, the nature of self-talk of learning disabled students changed from being negative to being positive. The qualitative differences found at baseline in this study are consistent with those documented in earlier research (Harris, 1982; Meichenbaum, 1977; Torgeson,1977). However, the similarity in quantity of self-talk of average and learning disabled children has previously not been reported.

Significant academic gains on mathematics measures were found to be correlated with increases in positive self-talk. Negative (maladaptive) self-talk continued to be present in the self-dialogue patterns of the learning disabled subjects but was significantly reduced from the pre to post test conditions. While positive self-affirming statements are associated with adaptive performance (Wine, 1971), as reported earlier, a small amount of negative self-talk may serve a facilitative function, cueing the individual to respond in a coping manner (Meichenbaum, 1977). Exploratory analysis of the modification of the instructional coping statements indicated that a

grammatical and structural change in the self-statements used by learning disabled subjects occurred over the intervention period. This finding exemplifies the notion proposed by Vygotsky (1962) that in the shift from the overt to the covert level of self-speech, self-statements take on a personalization characterized by shifts in semantic and grammatical structure.

Limitations of the Study

While the present study demonstrates the effectiveness of self-instructional procedures with the learning disabled, specific limitations related to methodology and generalization of results are apparent. The most significant limitation of this study is the sample size (N = 20). While subjects were carefully selected based on the criteria for learning disabilities in a Catholic school system (a 1.5 year discrepancy between potential and ability), the small number of candidates classified as learning disabled makes it difficult to generalize across all learning disabled children. Moreover, a potential confound exists in terms of the sampling population (all children were selected from the Catholic school system). The fact that these children come from private schools which are governed by strict religious philosophies may make them different from the learning disabled population in general. In future investigations of this type where learning disabled children are trained in a self-instructional coping procedure, it would be essential to consider a more diverse sampling population, including both private and public school systems and extending the sample size in order that generalizations can be made more confidently.

Significant differences in the performance of trained learning disabled children must be viewed cautiously as completing several mathematics tests over a short period (six week period) may partially account for performance increments among the learning disabled subjects. In replication studies or follow-up studies of this nature, it is essential that the effects of completing many training tasks be considered. Exposure to the same type of tasks many times may partially account for the performance increments noted among the learning disabled subjects. In order to evaluate the possibility that multiple exposure and practice to task could account for changes in performace a control task-only group may be included in follow-up studies as a means of evaluating this effect.

Research and Practical Implications

Research Implications. The results of this study point to the effectiveness of coping self-instruction to enhance performance of learning disabled subjects on mathematics tasks. Clearly, extensions of this research is warranted. Specifically, future research should focus on instruction across a variety of educational domains in which student performance is impaired by anxiety. This way we can determine the general effectiveness of coping self-instruction procedures across different student populations (eg. high school or or university) and different cognitive domains.

The present findings point to the need for further research into the power of self-talk. Specifically, future research may seek to determine: 1) The optimal combination of positive, negative, and neutral self-talk needed for optimal academic performance.; 2) The role

played by neutral self-talk in the overall self-dialogue.; and 3) The amount of negative self-talk required for effective coping.

While coping self-instruction procedures were successful in altering the academic performance of the fifth through seventh graders by modifying self-statements, the fourth graders failed to demonstrate as much improvement as the older learning disabled subjects. The difficulty experienced in effecting change in the fourth graders points to the need to focus on procedures which have a strong match between learner variables and characteristics and the intervention strategy. That is, the specific self-instruction strategies used here may not have been suitable for younger or less mature individuals. Consequently, for younger children, the coping strategy used in this study needs to be modified. Such modifications may include: 1) the use of picture cues or mnemonics for remembering steps or patterns as a means of reducing the load on memory; or 2) breaking down the strategy into smaller more manageable parts, thus allowing for more opportunity to master components of the strategy before actually trying them out on academic task.

Practical Implications. The present findings imply that self-talk of learning disabled children can be changed through the use of self-instructional techniques. Also, these findings imply that changes in self-talk have positive effects on academic performance. More traditional remedial techniques which focus exclusively on building academic skills to date have had limited success in enhancing the performance of the learning disabled. The present results thus underscore the necessity of addressing the affective domain in conjunction with academic skills acquisition in order that learning

disabled children can be academically successful across settings and tasks. In a more practical sense, these findings point to the need to explicitly instruct teachers in techniques for developing appropriate coping skills programmes.

In sum, the present study not only substantiates earlier findings but also extends application of self-instruction procedures with the learning-disabled by demonstrating its effectiveness with more ecologically valid academic tasks. Further, self-instruction procedures were found to alleviate the anxiety among the learning disabled by focussing and directing the learner to alternative coping strategies (ie. coping self-dialogue) and by assisting the learner in developing a sense of control over his/her own learning situation. The striking results reported in this study clearly demonstrate the necessity and importance of addressing the affective domain within academic programmes and point to the power of self-instructional techniques for achieving this goal.

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Appendix A

INFORMATION SHEET

Title of Project: Inducing adaptive coping skills in the learning disabled through a cognitive behavioural modification intervention.

This research project is aimed at gaining a better understanding of the influence of self-talk on children's ability to cope with academic tasks. To this end subjects involved in this research will be taught a coping strategy developed from a framework of Cognitive Behavioural Modification (CBM). The application of strategies and its influences on learning will be evaluated through audiotaped self-talk engaged in by subjects as they completed various mathematics tasks. At various points throughout the ten thirty minute sessions subjects will be asked to review with the research various items completed in order to obtain a measure of how the subject has modified the strategies presented over time as well as to provide the subjects with the opportunity to express ideas about the tasks assignments.

All sessions will be conducted by the researcher - a trained learning disabilities instructor. The procedures to be employed are based in the framework of cognitive behaviour modification and have been found to have positive influences on learning. In this respect, that an alternate form of instruction is being employed, the present research is experimental in nature.

The sessions are provided to you at no cost in return for your cooperation in data collection (completing mathematics tasks and taping self-talk).

The audio recordings of your sessions become the property of the research project and rigorous steps will be taken to safeguard their confidentiality. These tapes may be reviewed by the researcher or supervisory staff for the purpose of data analysis.

Your full identity will be known only to persons in direct contact with you during the research. In any publications of the research results your anonymity and the confidentiality of the actual content of your sessions will be safeguarded.

Your cooperation with all aspects of this reserch project is important to me, however if you find that you cannot continue as per our agreement, you may withdraw.

Please feel free to ask questions or discuss any aspect of the research that is unclear to you or that you feel uncomfortable about. Any complaint about this research project can be directed to: Dr. Jaap Tuinman, Dean of Education, Simon Fraser University. Dr. Tuinman's telephone number is: 291-3148.

Appendix A-1

Faculty of Education
Simon Fraser University
Burnaby, B.C. V5A 1S6
Tel: (604) 291-3395

STUDENT CONSENT FORM

I, _____ have read the attached information sheet and I
(participant's name)

understand the procedures as outlined in the document: Inducing adaptive coping skills in the learning disabled through a cognitive behavioural modification intervention.

I understand the personal risks to me in taking part, and that I may withdraw my participation in this experiment at any time.

If I have any questions or concerns about the study I can contact either Michael Kamann or Dr. Bernice Wong at the address above.

If I wish to receive a copy of the final report of this study I may do so by contacting Michael Kamann.

Signature: _____ Date: _____

Birthdate: _____

School: _____

Grade: _____

CONSENT FORM
FOR
PARENT OR GUARDIAN

Please indicate whether or not you and your son/daughter agree to participate in the project described in the document: *Inducing adaptive copings skills in the learning disabled through a cognitive behavioural modification intervention.* Any questions regarding the project may be directed to me at 984-4084, or to my senior supervisor, Dr. Bernice Wong, at 291-4115. You may also obtain results of this project upon its completion by contacting Michael Kamann at the address below:

Michael Kamann
Graduate Studies
Faculty of Education
Simon Fraser University
Burnaby, B.C. V5A 1S6

Please retain the above part of this form for your information. Return the bottom half signed to school.

PLEASE CHECK ONE OF THE FOLLOWING:

YES ____ my son/daughter will participate
NO ____ my son/daughter will not participate

My son/daughter and I have read the attached information sheet and understand the nature of the project. I understand that all data collected will be confidential and that it is possible to withdraw at any time. I may direct any questions or comments to Michael Kamann or to Dr. Bernice Wong (at the address above), and I amy also obtain a copy of the results from them.

Signature: _____ _____
(Signature of parent/ guardian) (Signature of student)

_____ _____
(Parent's or Guardian's full name) (Student's full name)

_____ _____
(Today's date) (Student's birthdate)

Appendix A-3

Michael Kamann
Graduate Studies
Faculty of Education
Simon Fraser University
Burnaby, B.C. V5A 1S6
April 21, 1987

Dear Parent(s),

My name is Michael Kamann and I am a graduate student at Simon Fraser University. As part of the requirements for the Masters of Arts (Education) degree at Simon Fraser University, I am conducting a study using a coping skills programme to aid students in improving their academic performance.

I am pleased to say that your son/daughter has been chosen to participate in this study. In order to provide you with a clearer understanding of the procedures and programme to be conducted, an information meeting has been set for 7:30 pm, Thursday, April 23, 1987, at Saint Helen's School.

I look forward to our meeting.

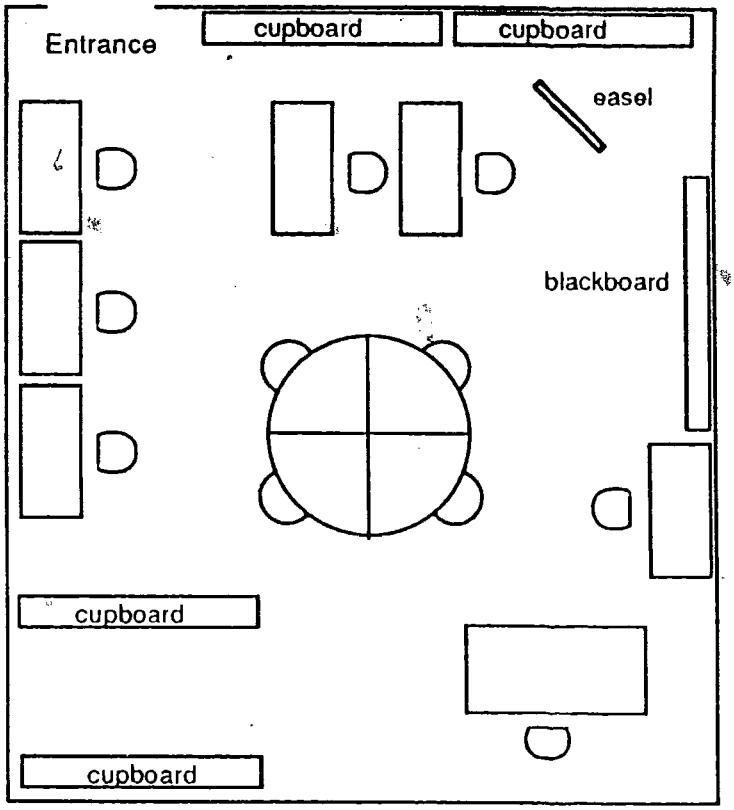
Sincerely,

Michael Kamann
Graduate Student.

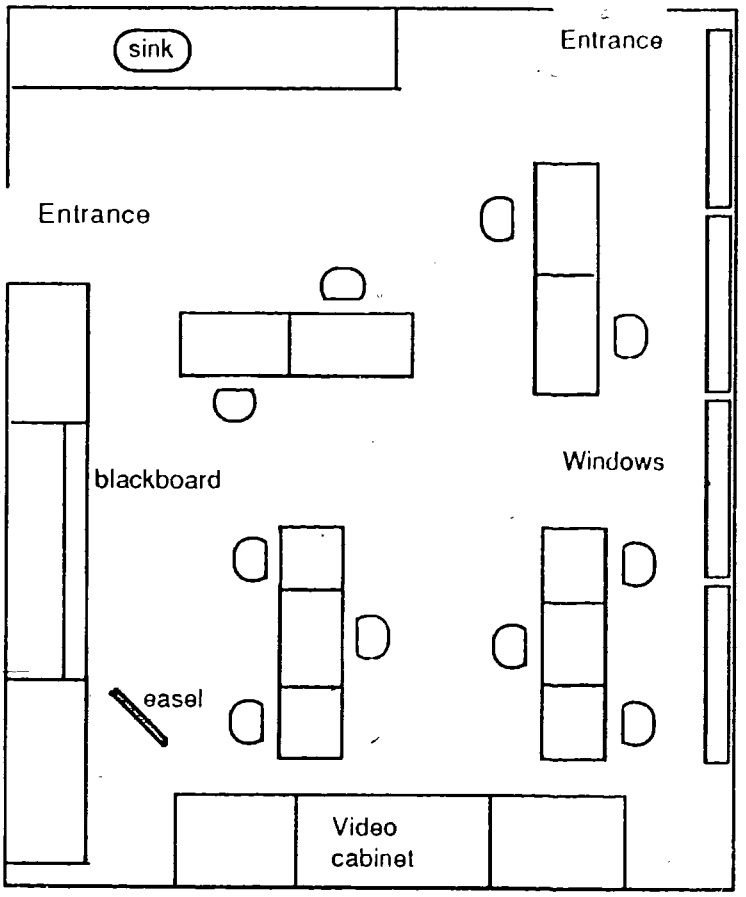
(detach and return to the school by Wed. April 22, 1987)

We/I, _____. will attend the meeting.
(name of parent(s))

We/I, _____ will not be able to attend the meeting.
(name of parent(s))



Training Room Setup - School A



Training Room Setup - School B

Appendix C

CHECKLIST FOR RESEARCHER PREP

Title of Project: Inducing adaptive coping self-statements in the learning disabled through a cognitive behavioural intervention

Materials:

1.Clean copies of training task are ready

2.Pencils and erasers available (one for each subject)

3. Clean clear copies of reference cards (one for each subject)

Equipment and Room Preparation:

1. Prepare each tape recorder:
   - check battery charge
   - check record /play keys
   - check battery power on mic.

2. Attach recorders and microphones

3. Label tapes with ID, date, session number

4. Record label information on leader of each tape
   check recording by listening back
5. Set up room (use chart) re-arrange where necessary

End of Session Procedures:

1. Rewind all cassette tapes

2. Machines off

3. Microphones off

4. Tapes recased and placed in dated envelope

5. Microphone wires wrapped up and stored

6. Recorders off and stored

SCRIPT FOR COPING INSTRUCTION

1) DEVELOPING EFFICACY

Subjects will be brought together to discuss the program and to discuss the extent of their anxiety in completing an academic task such as a mathematics test.

RESEARCHER: (developing the educational framework)

GOOD MORNING (AFTERNOON), TODAY WE WELL BEGIN TO EXPLORE THE STRATEGIES AND SKILLS THAT WE WILL BE USING THROUGHOUT OUR TIME TOGETHER. BEFORE WE ACTUALLY BEGIN TO USE THE STRATEGIES WE SHOULD SPEND SOME TIME TOGETHER IN DISCUSSING AND EXPLORING WHAT IT IS WE WILL BE DOING, AND HOW IT ALL WORKS.

At this point the researcher will lead subjects in a discussion concerning their anxieties about school tasks with emphasis placed on mathematics.

CONTINUING:

LET'S BEGIN BY LOOKING AT THE WAY YOU RESPOND TO A TASK SUCH AS A MATHEMATICS TEST. HOW DO YOU FEEL WHEN YOU FIRST ARE GIVEN THE ASSIGNMENT? WHAT THOUGHTS GO THROUGH YOUR HEAD? (get responses from subjects and list these on the blackboard or chart paper). (In order to tap the nature of the thoughts more closely the subject will be asked to "run a move" in their head about the last task they did).

NOW I WOULD LIKE YOU TO CLOSE YOUR EYES AND "RUN A MOVIE" OF THE LAST TIME YOU WERE DOING A MATHEMATICS TEST - WHAT KINDS OF THINGS WERE YOU THINKING ABOUT WHEN THE TEACHER FIRST GAVE YOU THE TEST?, WHAT WERE YOU THINKING WHILE YOU WERE COMPLETING THE TASK? AND HOW DID YOU FEEL WHEN YOU WERE FINISHED?

WHAT I SEE FROM WHAT YOU DESCRIBED IS A SENSE OF FEAR, HELPLESSNESS, ETC. (As each subject group may express a different type of response the overall summary should be general and reflect subject thoughts).

WHAT IS PARTICULARLY IMPORTANT HERE IS THAT HOW YOU WERE TALKING TO YOURSELF WHILE APPROACHING, WORKING ON THE TEST, AND COMPLETING THE TEST CAN HAVE A BIG EFFECT ON HOW YOU DO. IF WE SAY ALL KINDS OF NEGATIVE STUFF LIKE *"I CANT'T DO THIS"* OR *"I'LL NEVER BE ABLE TO DO THIS"* WE ARE MORE LIKELY NOT TO DO AS WELL IN THE LONG RUN (tie back to the information on chart/board). **SO MY GOAL IS TO HELP YOU TO CHANGE THOSE NEGATIVE SELF-STATEMTNS, WHICH SEEMS TO ALWAYS BE THERE IN YOUR HEADS, TO BE MORE POSITIVE AND**

THE IDEA IS THAT IF YOU KNOW THAT YOU WILL FEEL ANXIOUS, OR WORRIED, ABOUT YOUR TEST YOU CAN BE PREPARED IN ADVANCE, AND SO YOU WILL LEARN TO CONFRONT THE ANXIETY AND HANDLE IT, AND FINALLY YOU WILL BE ABLE TO CONGRATULATE YOURSELF FOR COPING (DOING BETTER).

This phase in the instructional sequence allows subjects to become sensitive to the presence and power of negative thoughts on performance. As well, subjects come to see that an instructional procedure is available to them for learning how to short-circuit these negative thoughts, becoming better able to cope.

2) SKILLS DEVELOPMENT PHASE

At this phase actual experience in using the coping strategies is provided in a controlled setting. As well, subjects become collaborators in the development of an active coping plan. (incorporated into this phase of instruction is the use of the Coping Phase Sequence Chart).

IN ORDER TO ALLOW YOU TO SEE HOW THESE STEPS ARE USED TOGETHER IN THE COPING PROCESS I AM GOING TO DO THIS QUESTION (A prepared question using decimals [see below] is on the board to be completed - researcher will engage in a think-aloud as he completes the task, referring to coping charts which have been enlarged for the group).

QUESTION: 2163.936

+ 161.1

203.0016

STEP ONE: OKAY WHAT IS IT THAT I HAVE TO DO, A DECIMAL QUESTION, IT IS AN ADDITION QUESTION, THAT'S OKAY - WHAT IS MY PLAN FOR GETTING THIS DONE.

STEP TWO: OKAY, THIS IS REALLY HARD, I'M NOT GOING TO BE ABLE TO DO THIS - OH, STOP THAT YOU CAN DO THIS ALL I HAVE TO DO IS GO SLOWLY AND GO STEP-BY-STEP. FIRST YOU LINE UP THE DECIMAL. OKAY, A COUPLE OF DEEP BREATHS WILL CALM ME DOWN. KEEP GOING YOU ARE ALMOST THERE.

(Recognition and controlling of negative self-statements).

STEP THREE: GOOD FOR ME, I DIDN'T DO HALF BAD HERE. IF YOU STOP THE BAD THOUGHTS AND REPLACE THEM WITH OTHER MORE HELPFUL ONES YOU DO BETTER. I EVEN GOT THIS QUESTION RIGHT.

(This third level of instruction is the acknowledgement stage - where subjects recognize the relabeling and effect of alternative self-statements).

3) APPLICATION

Once subjects have had the opportunity to view the model (the researcher) completing the mathematics task - seeing examples of three types of self-statements) they will be given the opportunity to practice using the strategies.

BEFORE YOU GET SOME TIME TO PRACTICE, IT MAY HELP TO HAVE SOME GENERAL POSITIVE SELF-STATEMENTS TO REPLACE NEGATIVE ONES. A review of the two coping charts is provided for each subject. Subjects will be provided with the first practice set. (As well they will be wired with lapel microphones and told):

SO THAT I CAN HELP YOU GET USED TO USING THE STRATEGIES I AM GOING TO TAPE YOUR SELF-TALK SO WHAT YOU WILL NEED TO DO IS TALK ALOUD AS YOU COMPLETE THE SAMPLE TEST - TELL ME EVERYTHING THAT GOES THROUGH YOU HEAD - DON'T LEAVE ANYTHING OUT.

APPLICATION PHASE LEVEL II

Once proficiency in applying the strategies taught in the first phase of application is reached, subjects will be provided with training tasks and given the following directions:

NOW THAT YOU HAVE HAD TIME TO DEVELOP THE COPING SKILLS YOU ARE NOW GOING TO HAVE THE OPPORTUNITY TO TEST OUT YOUR COPING SKILLS ON ACTUAL MATHEMATICS TESTS. SO I CAN KEEP TRACK OF WHAT YOU ARE DOING I AM GOING TO ASK YOU TO USE THE TAPE RECORDERS AND MICROPHONES JUST LIKE IN THE EARLIER PRACTICE SESSION. AS YOU DO EACH TEST ALL I WANT YOU TO DO IS TO QUIETLY TALK OUTLOUD, REMEMBERING TO SAY OUTLOUD EVERYTHING THAT GOES THROUGH YOUR HEAD AS YOU COMPLETE EACH TEST. I WILL BE HERE BUT I WON'T BE ABLE TO ANSWER ANY OF YOUR QUESTIONS, IT WILL BE LIKE A REAL TEST. IF YOU STOP TALKING I WILL SIMPLY REMIND YOU TO KEEP TAKING OUTLOUD. DO YOU HAVE ANY QUESTIONS? (When all questions are answered task one is provided and subjects are told that this is the first of six tests they will complete).

MATH TEST A

Name: _____ Date: _____

Target: _____ Time: _____

Find the next three fractions for each set of equivalent fractions.

1. $\{ \frac{3}{5}, \frac{6}{10}, \frac{9}{15}, \ldots \}$
2. $\{ \frac{3}{11}, \frac{6}{22}, \frac{9}{33}, \ldots \}$
3. $\{ \frac{4}{5}, \frac{8}{10}, \frac{12}{15}, \ldots \}$
4. $\{ \frac{6}{8}, \frac{12}{16}, \frac{18}{24}, \ldots \}$
5. $\{ \frac{2}{9}, \frac{4}{18}, \frac{8}{27}, \ldots \}$
6. $\{ \frac{7}{12}, \frac{14}{24}, \frac{21}{36}, \ldots \}$
7. $\{ \frac{3}{8}, \frac{6}{16}, \frac{9}{24}, \ldots \}$
8. $\{ \frac{4}{6}, \frac{8}{12}, \frac{16}{18}, \ldots \}$
9. $\{ \frac{4}{9}, \frac{8}{18}, \frac{12}{27}, \ldots \}$
10. $\{ \frac{8}{10}, \frac{16}{20}, \frac{24}{30}, \ldots \}$

Tell whether the two fractions are equivalent.

11. $\frac{2}{5}, \frac{7}{35}$
12. $\frac{4}{9}, \frac{9}{18}$
13. $\frac{3}{10}, \frac{12}{40}$
14. $\frac{5}{8}, \frac{40}{64}$
15. $\frac{3}{5}, \frac{8}{10}$
16. $\frac{6}{22}, \frac{9}{33}$
17. $\frac{7}{15}, \frac{9}{30}$
18. $\frac{8}{9}, \frac{16}{18}$
19. $\frac{7}{8}, \frac{11}{18}$
20. $\frac{2}{10}, \frac{8}{40}$

Circle the lowest terms fraction for each set of equivalent fractions.

21. $\{ \frac{20}{24}, \frac{35}{42}, \frac{5}{6}, \frac{10}{12}, \frac{45}{54} \}$
22. $\{ \frac{25}{55}, \frac{50}{110}, \frac{5}{11}, \frac{15}{33}, \frac{35}{77} \}$
23. $\{ \frac{7}{72}, \frac{63}{18}, \frac{42}{27}, \frac{56}{36}, \frac{28}{9} \}$
24. $\{ \frac{56}{10}, \frac{14}{90}, \frac{21}{60}, \frac{28}{80}, \frac{7}{40} \}$

Turn to the next page

Give the differences

25. $\frac{5}{6} - \frac{1}{6} =$ 26. $\frac{3}{7} - \frac{2}{7} =$ 27. $\frac{5}{6} - \frac{1}{3} =$

28. $\frac{1}{2} - \frac{1}{6} =$ 29. $\frac{7}{10} - \frac{2}{5} =$ 30. $\frac{8}{10} - \frac{3}{10} =$

Give the product

31. $\frac{2}{5} \times \frac{4}{6} =$ 32. $\frac{7}{10} \times \frac{3}{2} =$ 33. $\frac{2}{7} \times \frac{3}{7} =$

34. $\frac{3}{4} \times 7\frac{2}{5} =$ 35. $1\frac{1}{8} \times 6\frac{1}{3} =$ 36. $\frac{5}{7} \times 7 =$

Division.

37. $7 \div \frac{3}{4} =$ 38. $\frac{5}{21} \div \frac{6}{27} =$ 39. $\frac{9}{16} \div \frac{15}{24} =$

40. $\frac{20}{27} \div \frac{5}{9} =$ 41. $\frac{7}{6} \div \frac{14}{15} =$ 42. $\frac{3}{10} \div \frac{4}{15} =$

Stop here.

MATH TEST B

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Circle the fraction(s) which are equivalent to the given fraction.

$\frac{3}{5} = \frac{3}{6}, \frac{5}{11}, \frac{7}{15}, \frac{6}{12}$ $\frac{2}{3} = \frac{10}{15}, \frac{6}{8}, \frac{4}{6}, \frac{8}{12}$

$\frac{7}{10} = \frac{8}{11}, \frac{28}{50}, \frac{21}{30}, \frac{14}{21}$ $\frac{7}{9} = \frac{21}{24}, \frac{8}{10}, \frac{14}{18}, \frac{28}{35}$

$\frac{2}{5} = \frac{4}{10}, \frac{8}{20}, \frac{12}{30}, \frac{10}{24}$ $\frac{5}{8} = \frac{30}{40}, \frac{20}{32}, \frac{10}{16}, \frac{15}{25}$

---

b) Write 2 equivalent fractions for the following.

$\frac{2}{4} =$ $\frac{5}{6} =$ $\frac{7}{10} =$ $\frac{3}{9} =$

---

c) Write the following in lowest terms.

$\frac{9}{10} =$ $\frac{4}{6} =$ $\frac{9}{18} =$ $\frac{2}{6} =$ $\frac{16}{3} =$

Turn to the next page.

d) Find the sum.

$$\begin{array}{r} \frac{3}{4} \\ +\ \frac{1}{3} \\ \hline \end{array} \qquad \begin{array}{r} \frac{1}{4} \\ +\ \frac{3}{8} \\ \hline \end{array} \qquad \begin{array}{r} \frac{2}{3} \\ +\ \frac{1}{2} \\ \hline \end{array} \qquad \begin{array}{r} \frac{2}{6} \\ +\ \frac{1}{24} \\ \hline \end{array}$$

$$\begin{array}{r} 7\ \frac{5}{8} \\ +\ 5\ \frac{1}{4} \\ \hline \end{array} \qquad \begin{array}{r} 9\ \frac{1}{2} \\ +\ 1\ \frac{7}{8} \\ \hline \end{array} \qquad \begin{array}{r} 6\ \frac{3}{4} \\ +\ 8\ \frac{1}{3} \\ \hline \end{array}$$

---

e) Find the least common denominator for each pair of fractions.

$\frac{1}{4}, \frac{1}{5}$ $\qquad$ $\frac{5}{16}, \frac{7}{12}$ $\qquad$ $\frac{1}{14}, \frac{7}{20}$

$\frac{5}{18}, \frac{13}{27}$ $\qquad$ $\frac{11}{16}, \frac{9}{20}$ $\qquad$ $\frac{7}{36}, \frac{13}{48}$

---

f) Find the difference

$\frac{3}{7} - \frac{5}{9} =$ $\qquad$ $\frac{7}{9} - \frac{1}{4} =$ $\qquad$ $\frac{4}{5} - \frac{1}{6} =$

---

g) Find the product

$\frac{4}{5} \times \frac{3}{9} =$ $\qquad$ $\frac{7}{10} \times 2\frac{1}{6} =$ $\qquad$ $3\frac{1}{2} \times 1 =$

Turn to the next page.

h) Division.

$\frac{3}{6} \div \frac{1}{2} =$ $\quad 4\frac{1}{2} \div 1\frac{7}{8} =$ $\quad 10 \div 8\frac{3}{5} =$

$4\frac{1}{2} \div 18 =$ $\quad 6\frac{7}{8} \div 9\frac{2}{7} =$ $\quad 1\frac{5}{6} \div 3\frac{1}{2} =$

Stop here.

MATH TEST C

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the equivalent fractions.

$(\frac{1}{5}, \_\_, \frac{3}{15}, \_\_, \frac{5}{25}, \_\_, \frac{7}{35})$ $(\frac{5}{7}, \frac{10}{14}, \_\_, \_\_, \_\_, \frac{30}{42})$

$(\frac{2}{6}, \_\_, \frac{6}{18}, \_\_, \frac{10}{30}, \_\_, \frac{14}{42})$ $(\frac{3}{8}, \frac{6}{16}, \_\_, \_\_, \_\_, \_\_, \_\_)$

---

b) Write the following in lowest terms.

$\frac{7}{42} =$ $\frac{8}{24} =$ $\frac{11}{66} =$ $\frac{12}{48} =$

$\frac{18}{62} =$ $\frac{9}{36} =$ $\frac{6}{36} =$ $\frac{9}{54} =$

---

c) Give the factors for the following.

5 = 6 =

15 = 12 =

25 = 9 =

30 = 72 =

50 = 8 =

30 = 15 =

Turn to the next page.

d) Find the sums.

$\frac{1}{6} + \frac{2}{6} =$ $\quad$ $\frac{7}{15} + \frac{3}{5} =$ $\quad$ $\frac{9}{10} + \frac{3}{30} =$

$1\frac{1}{9} + 3\frac{2}{9} =$ $\quad$ $2\frac{1}{6} + 3\frac{2}{3} =$ $\quad$ $5\frac{4}{23} + 1\frac{5}{20} =$

$3\frac{1}{6} + \frac{1}{6} + 3\frac{1}{12} =$ $\quad$ $\frac{5}{11} + \frac{3}{55} + 2 =$ $\quad$ $7\frac{1}{6} + 3\frac{2}{5} + 4\frac{1}{10} =$

---

e) Find the differences.

$\frac{3}{5} - \frac{1}{5} =$ $\quad$ $\frac{4}{15} - \frac{1}{5} =$ $\quad$ $\frac{6}{25} - \frac{3}{25} =$

$4\frac{1}{6} - \frac{2}{3} =$ $\quad$ $1\frac{1}{7} - 1 =$ $\quad$ $4 - \frac{3}{6} =$

$5\frac{3}{11} - \frac{2}{22} =$ $\quad$ $6\frac{3}{15} - 5\frac{4}{15} =$ $\quad$ $17 - 3\frac{1}{6} =$

---

f) Find the products.

$\frac{3}{6} \times \frac{5}{10} =$ $\quad$ $\frac{4}{10} \times \frac{3}{6} =$ $\quad$ $\frac{9}{5} \times \frac{3}{6} =$

---

g) Find the quotients.

$\frac{3}{6} \div \frac{1}{5} =$ $\quad$ $\frac{7}{11} \div \frac{4}{9} =$ $\quad$ $\frac{7}{15} \div \frac{5}{30} =$

$1\frac{1}{6} \div 3 =$ $\quad$ $\frac{7}{11} \div 9 =$ $\quad$ $9 \div \frac{1}{3} =$

Turn to the next page.

h) Complete the following (Solve for a , b , c).

$$7\frac{1}{2} + 3\frac{1}{6} = (a + 3) + (b + \frac{1}{6}) = c$$

$$7\frac{3}{4} + 1\frac{3}{5} = (7 + a) + (\frac{15}{20} + b) = c$$

---

i) Solve.

$$(\frac{1}{6} + \frac{3}{5}) \times \frac{6}{11} =$$

$$(\frac{3}{9} \div 1\frac{1}{6}) + \frac{1}{10} =$$

$$(3\frac{1}{11} + 4\frac{5}{15}) \times \frac{6}{30} =$$

$$(3 \div \frac{1}{7}) \times \frac{5}{6} =$$

Stop here.

MATH TEST D

Name: _____ **Date:** _____
Target: _____ **Time:** _____

1) Find the set of common factors for each number pair.

a) 16:
17:

b) 24:
20:

c) 12:
15:

d) 6:
18:

e) 9:
39:

f) 14:
18:

---

2) Give 2 equivalent fractions for each fraction below.

$\frac{9}{15} =$ $\frac{7}{14} =$ $\frac{6}{20} =$

$\frac{3}{5} =$ $\frac{12}{45} =$ $\frac{6}{30} =$

---

3) Give the sums.

$\frac{3}{9} + \frac{5}{9} =$ $\frac{3}{5} + 2\frac{1}{5} =$ $5 + \frac{6}{12} =$

$4\frac{1}{3} + \frac{6}{9} =$ $\frac{4}{5} + 3\frac{1}{15} =$ $3\frac{1}{8} + \frac{2}{24} =$

Turn to the next page.

4) Write the following in lowest terms.

$\frac{4}{20} =$ $\frac{3}{15} =$ $\frac{10}{24} =$

$\frac{7}{42} =$ $\frac{6}{31} =$ $\frac{4}{12} =$

---

5) Find the differences.

$\frac{6}{12} - \frac{5}{12} =$ $3\frac{1}{9} - 2\frac{1}{9} =$ $6\frac{3}{15} - \frac{4}{15} =$

$3\frac{1}{2} - \frac{2}{4} =$ $7\frac{3}{6} - \frac{4}{12} =$ $3 - \frac{1}{2} =$

---

6) Find the products.

$\frac{5}{15} \times \frac{6}{5} =$ $\frac{4}{6} \times \frac{1}{3} =$ $\frac{9}{15} \times \frac{4}{10} =$

$3 \times \frac{1}{9} =$ $\frac{4}{6} \times 3\frac{1}{9} =$ $2\frac{1}{2} \times 1\frac{3}{6} =$

---

7) Division.

$\frac{1}{6} \div \frac{3}{5} =$ $3 \div \frac{1}{9} =$ $4\frac{1}{2} \div 6\frac{1}{9} =$

$4\frac{3}{11} \div 6\frac{1}{7} =$ $4 \div \frac{6}{12} =$ $5\frac{1}{9} \div \frac{4}{6} =$

Turn to the next page.

8) Give the multiples for each number below (give 6 for each).

6	16
15	28
9	14
43	18

---

9) Give the missing numerator or denominator.

$4 = \frac{\quad}{6}$	$\frac{11}{12} = \frac{22}{\quad}$	$\frac{4}{17} = \frac{\quad}{34}$
$11 = \frac{33}{\quad}$	$\frac{6}{15} = \frac{30}{\quad}$	$\frac{9}{18} = \frac{\quad}{2}$

Stop here.

MATH TEST 4-2

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) What fraction is suggested by each of these?

3 out of 5	2 out of 7	9 out of 18
9 out of 11	3 out of 12	11 out of 16
12 out of 30	12 out of 36	2 out of 17

---

b) Give the multiples for the following.

6 {0, 6, 12, , 72}	7 {0, 7, 14, , 84}
9 {0, 9, 18, , 108}	5 {0, 5, 10, , 60}
11 {0, 11, 22, , 132}	4 {0, 4, 8, , 48}
3 {0, 3, 6, , 36}	10 {0, 10, 20, , 120}

---

c) Give the next 3 equivalent fractions.

$\{\frac{1}{6}, \frac{2}{12}, \frac{3}{18}, \_, \_, \_\}$	$\{\frac{3}{6}, \frac{6}{12}, \frac{9}{18}, \_, \_, \_\}$
$\{\frac{3}{4}, \frac{6}{8}, \frac{9}{12}, \_, \_, \_\}$	$\{\frac{4}{5}, \frac{8}{10}, \frac{12}{15}, \_, \_, \_\}$
$\{\frac{5}{11}, \frac{10}{22}, \frac{15}{33}, \_, \_, \_\}$	$\{\frac{7}{9}, \frac{14}{18}, \frac{21}{27}, \_, \_, \_\}$

Turn to the next page

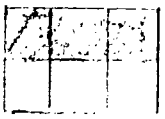
d) Give the following fractions in lowest terms.

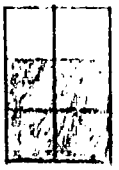
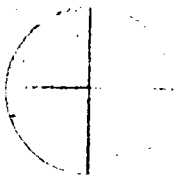
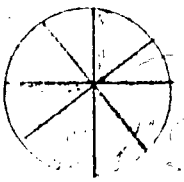
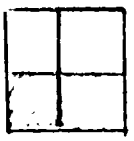
$\frac{4}{6}$ = $\frac{3}{6}$ = $\frac{9}{10}$ = $\frac{7}{10}$ =

$\frac{1}{9}$ = $\frac{4}{10}$ = $\frac{3}{9}$ = $\frac{2}{6}$ =

---

e) Write the fraction suggested by the picture.



---

f) Circle the numerator of each fraction.

$\frac{4}{9}$ $\frac{7}{11}$ $\frac{9}{15}$ $\frac{6}{7}$ $\frac{9}{24}$

Stop here.

MATH TEST 4-3

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Answer T or F for each statement below.

$\frac{1}{2} < \frac{5}{8}$	$\frac{9}{32} = \frac{3}{12}$	$\frac{8}{14} < \frac{8}{15}$
$\frac{3}{8} < \frac{5}{8}$	$\frac{7}{11} > \frac{2}{8}$	$\frac{3}{4} < \frac{6}{8}$
$\frac{8}{16} > \frac{4}{8}$	$\frac{2}{3} = \frac{4}{9}$	$\frac{2}{3} = \frac{3}{4}$

---

b) Find the sums.

$\frac{3}{8} + \frac{4}{8} =$	$\frac{6}{8} + \frac{1}{8} =$	$\frac{5}{7} + \frac{4}{7} =$
$\frac{5}{6} + \frac{1}{6} =$	$\frac{9}{10} + \frac{1}{10} =$	$\frac{2}{3} + \frac{4}{3} =$
$\frac{8}{11} + \frac{3}{11} =$	$\frac{6}{19} + \frac{2}{19} =$	$\frac{2}{7} + \frac{3}{7} =$
$\frac{1}{11} + \frac{2}{11} =$	$\frac{7}{22} + \frac{6}{22} =$	$\frac{6}{15} + \frac{3}{15} =$

Turn to the next page.

c) Give the missing numerators or denominators.

$3 = \frac{6}{\_}$ $\quad 5 = \frac{\_}{3}$ $\quad 12 = \frac{\_}{1}$

$4 = \frac{12}{\_}$ $\quad 1 = \frac{\_}{5}$ $\quad 8 = \frac{\_}{3}$

$\frac{1}{2} = \frac{\_}{10}$ $\quad 11 = \frac{\_}{77}$ $\quad \frac{2}{3} = \frac{8}{\_}$

---

d) Write true or false for each statement.

$\frac{1}{2} = \frac{2}{4}$ $\quad \frac{3}{11} < \frac{5}{22}$ $\quad \frac{7}{22} = \frac{14}{44}$

$\frac{6}{9} > \frac{3}{9}$ $\quad \frac{6}{10} = \frac{3}{10}$ $\quad \frac{11}{45} < \frac{10}{50}$

$\frac{6}{11} = \frac{12}{22}$ $\quad \frac{7}{1} = \frac{9}{9}$ $\quad \frac{9}{10} < \frac{8}{20}$

---

e) Give the multiples for each of the following.

6 {0, 6, 12, , 72} $\quad$ 13 {0, 13, 26, , 390}

15 {0, 15, 30, , 450}

Stop here.

MATH TEST 4-4

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) List the factors.

15 22

17 16

14 18

---

b) Give the lowest term fraction.

$\frac{16}{20}$ = $\frac{9}{27}$ = $\frac{11}{55}$ = $\frac{4}{16}$ =

$\frac{15}{35}$ = $\frac{8}{12}$ = $\frac{9}{36}$ = $\frac{5}{35}$ =

---

c) Find the sums.

$\frac{2}{8} + \frac{1}{2}$ = $\frac{4}{6} + \frac{1}{6}$ = $\frac{7}{8} + \frac{1}{7}$ =

$\frac{4}{5} + \frac{1}{6}$ = $2 + \frac{3}{4}$ = $7 + 1\frac{1}{2}$ =

$\frac{4}{4} + \frac{3}{11}$ = $\frac{11}{55} + \frac{1}{5}$ = $\frac{6}{12} + \frac{1}{24}$ =

Turn to the next page

d) Write mixed numerals for each improper fraction.

$\frac{16}{3}$ = $\frac{17}{9}$ = $\frac{7}{3}$ = $\frac{11}{22}$ =

$\frac{6}{4}$ = $\frac{36}{5}$ = $\frac{21}{8}$ = $\frac{29}{6}$ =

$\frac{13}{6}$ = $\frac{15}{7}$ = $\frac{6}{5}$ = $\frac{9}{5}$ =

---

e) Find the differences.

$4\ \frac{1}{6}$ $11\ \frac{3}{5}$ $6\ \frac{3}{9}$ $7\ \frac{5}{11}$

$3\ \frac{1}{6}$ $1\ \frac{1}{5}$ $2\ \frac{1}{9}$ $6\ \frac{1}{11}$

$4\ \frac{3}{4}$ $6\ \frac{1}{5}$ $9\ \frac{3}{7}$ $4\ \frac{3}{4}$

$1\ \frac{2}{4}$ $3\ \frac{2}{5}$ $2\ \frac{1}{14}$ $1\ \frac{1}{8}$

---

f) Tell whether the two fractions are equivalent.

$\frac{2}{5}$, $\frac{7}{35}$ $\frac{5}{6}$, $\frac{35}{42}$ $\frac{3}{10}$, $\frac{12}{40}$

$\frac{6}{12}$, $\frac{3}{6}$ $\frac{2}{3}$, $\frac{8}{12}$ $\frac{3}{5}$, $\frac{2}{3}$

Stop here.

MATH TEST 4-5

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Write 3 equivalent fractions for each of the following.

$\frac{1}{6} =$ $\frac{4}{5} =$ $\frac{7}{9} =$

$\frac{2}{4} =$ $\frac{6}{12} =$ $\frac{3}{8} =$

$\frac{1}{3} =$ $\frac{12}{30} =$ $\frac{2}{11} =$

---

b) Write the factors for each of the following.

3 = { } 16 = { }

7 = { } 20 = { }

12 = { } 24 = { }

50 = { } 9 = { }

---

c) Answer T or F

$\frac{5}{10} = \frac{1}{2}$ $\frac{2}{3} = \frac{10}{15}$ $\frac{3}{15} = \frac{1}{5}$ $\frac{1}{7} = \frac{3}{21}$

$\frac{5}{6} = \frac{5}{7}$ $\frac{3}{12} = \frac{1}{3}$ $\frac{3}{8} = \frac{9}{24}$ $\frac{6}{8} = \frac{14}{16}$

Turn to the next page

d) Fill in missing numerators or denominators.

$\frac{2}{8} = \frac{\_}{4}$ $\quad \frac{6}{12} = \frac{18}{\_}$ $\quad \frac{9}{11} = \frac{\_}{55}$

$\frac{6}{7} = \frac{\_}{42}$ $\quad \frac{9}{18} = \frac{\_}{2}$ $\quad \frac{2}{5} = \frac{\_}{10}$

$\frac{8}{12} = \frac{\_}{6}$ $\quad \frac{4}{12} = \frac{8}{\_}$ $\quad \frac{3}{6} = \frac{9}{\_}$

---

e) Find the sums or differences.

$\left(\frac{2}{5} + \frac{1}{6}\right) - \frac{2}{3} =$ $\quad \left(\frac{3}{9} + \frac{9}{3}\right) - \frac{1}{2} =$

$\left(\frac{4}{9} + \frac{4}{9}\right) - \frac{8}{18} =$ $\quad \left(\frac{4}{7} + \frac{1}{21}\right) - \frac{2}{3} =$

$$\begin{array}{r} \frac{3}{6} \\ + \\ \frac{1}{2} \\ + \\ \frac{1}{8} \\ \hline \end{array} \qquad \begin{array}{r} \frac{4}{9} \\ + \\ 1 \\ + \\ \frac{3}{18} \\ \hline \end{array} \qquad \begin{array}{r} \frac{4}{5} \\ + \\ \frac{2}{5} \\ + \\ \frac{3}{25} \\ \hline \end{array}$$

Stop here.

MATH TEST 4-6

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) List the factors.

15	30
17	14
21	27
40	39

---

b) Give the common factors of:

24 , 30	75 , 45
16 , 42	18 , 27
20 , 28	14 , 30

---

c) Write lowest terms fractions for the following.

$\frac{25}{50}$ =	$\frac{36}{90}$ =	$\frac{14}{28}$ =
$\frac{75}{105}$ =	$\frac{27}{54}$ =	$\frac{20}{90}$ =

Turn to the next page

d) Find the sums.

$$\begin{array}{r} \frac{3}{9} \\ + \\ \frac{1}{6} \\ + \\ \frac{2}{3} \\ \hline \end{array} \qquad \begin{array}{r} \frac{6}{11} \\ + \\ \frac{4}{33} \\ + \\ \frac{1}{99} \\ \hline \end{array} \qquad \begin{array}{r} \frac{4}{5} \\ + \\ \frac{1}{30} \\ + \\ \frac{2}{45} \\ \hline \end{array}$$

$$\begin{array}{r} \frac{4}{7} \\ + \\ \frac{6}{28} \\ + \\ \frac{9}{14} \\ \hline \end{array} \qquad \begin{array}{r} \frac{6}{18} \\ + \\ \frac{11}{36} \\ + \\ \frac{3}{9} \\ \hline \end{array} \qquad \begin{array}{r} \frac{1}{12} \\ + \\ \frac{3}{4} \\ + \\ \frac{9}{24} \\ \hline \end{array}$$

---

e) Write mixed numerals for each of the following.

$\frac{26}{4} =$ $\frac{73}{40} =$ $\frac{16}{3} =$

$\frac{17}{4} =$ $\frac{16}{9} =$ $\frac{18}{7} =$

---

f) Solve.

$11\ \frac{7}{14} + 3\ \frac{6}{14} = (a+b) + (\frac{7}{14} + \frac{6}{14}) = c\ \frac{13}{14}$

$6\ \frac{3}{7} + 2\ \frac{1}{7} = (6+a) + (\frac{3}{7} + \frac{1}{7}) = c\ \frac{4}{7}$

Stop here.

MATH TEST 4-7

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Write the missing numerators or denominators.

$\{\frac{1}{2}, \frac{2}{4}, \frac{\_}{6}, \frac{4}{8}, \frac{5}{\_}, \frac{6}{12}\}$ $\{\frac{2}{3}, \frac{4}{6}, \frac{\_}{9}, \frac{8}{\_}, \frac{\_}{15}, \frac{12}{\_}\}$

$\{\frac{3}{5}, \frac{6}{\_}, \frac{\_}{15}, \frac{12}{20}, \frac{\_}{\_}, \frac{18}{\_}\}$ $\{\frac{3}{10}, \frac{6}{20}, \frac{\_}{30}, \frac{12}{50}, \frac{\_}{\_}, \frac{21}{\_}\}$

$\{\frac{1}{3}, \frac{\_}{6}, \frac{3}{\_}, \frac{\_}{12}, \frac{5}{18}, \frac{6}{\_}, \frac{\_}{\_}\}$ $\{\frac{1}{6}, \frac{2}{\_}, \frac{\_}{18}, \frac{4}{\_}, \frac{\_}{30}, \frac{6}{\_}, \frac{\_}{42}\}$

---

b) Find the sums.

$\frac{1}{6} + \frac{4}{6} =$ $\frac{2}{5} + \frac{3}{10} =$ $\frac{7}{9} + \frac{1}{9} =$

$\frac{5}{11} + \frac{4}{11} =$ $\frac{3}{9} + \frac{3}{9} =$ $\frac{4}{7} + \frac{1}{7} =$

$\frac{2}{9} + \frac{1}{18} =$ $\frac{3}{5} + \frac{1}{15} =$ $\frac{4}{6} + \frac{1}{3} =$

---

c) Write 2 equivalent fractions for each of the following.

$\frac{1}{3} =$ $\frac{2}{9} =$ $\frac{1}{7} =$

$\frac{2}{11} =$ $\frac{4}{5} =$ $\frac{3}{9} =$

Turn to the next page

d) Solve the equation.

$(\frac{3}{6} \times \frac{4}{5}) + \frac{1}{15} =$

$(\frac{7}{10} \times \frac{3}{5}) \div \frac{3}{5} =$

$(\frac{4}{9} - \frac{1}{18}) \times \frac{5}{15} =$

$(\frac{5}{15} - \frac{6}{15}) \div \frac{1}{6} =$

$(\frac{2}{11} - 3\frac{1}{11}) \times \frac{4}{5} =$

$(\frac{3}{6} \times \frac{1}{9}) + 3\frac{1}{5} =$

---

e) Write a mixed numeral for each improper fraction.

$\frac{7}{2} =$

$\frac{18}{5} =$

$\frac{121}{70} =$

$\frac{15}{2} =$

$\frac{45}{3} =$

$\frac{61}{21} =$

---

f) Solve the equations.

$4 \times \frac{1}{8} \times 2 \times \frac{1}{3} = n \times (\frac{1}{8} \times \frac{1}{3})$

$6 \times \frac{5}{11} \times 5 \times \frac{3}{5} = n \times (\frac{5}{11} \times \frac{3}{5})$

$5 \times \frac{3}{6} \times 4 \times \frac{1}{9} = n \times (\frac{3}{6} \times \frac{1}{9})$

Stop here.

MATH TEST 4-8

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Write the lowest terms fractions for each fraction.

$\frac{9}{21}$ = $\frac{12}{16}$ = $\frac{8}{48}$ =

$\frac{15}{18}$ = $\frac{14}{42}$ = $\frac{11}{132}$ =

$\frac{10}{25}$ = $\frac{18}{27}$ = $\frac{15}{75}$ =

---

b) Write the next 3 equivalent fractions.

$\{\frac{3}{5}, \frac{6}{10}, \frac{9}{15}, \_\_, \_\_, \_\_\}$ $\{\frac{3}{7}, \frac{6}{14}, \frac{9}{21}, \_\_, \_\_, \_\_\}$

$\{\frac{6}{9}, \frac{12}{18}, \frac{18}{27}, \_\_, \_\_, \_\_\}$ $\{\frac{7}{8}, \frac{14}{16}, \frac{21}{24}, \_\_, \_\_, \_\_\}$

$\{\frac{1}{3}, \frac{2}{6}, \frac{3}{9}, \_\_, \_\_, \_\_\}$ $\{\frac{3}{11}, \frac{6}{22}, \frac{9}{33}, \_\_, \_\_, \_\_\}$

$\{\frac{2}{9}, \frac{4}{18}, \frac{6}{27}, \_\_, \_\_, \_\_\}$ $\{\frac{2}{5}, \frac{4}{10}, \frac{6}{15}, \_\_, \_\_, \_\_\}$

Turn to the next page.

c) Give the missing numbers in each function table.

n × $\frac{1}{6}$	
n	f(n)
$\frac{1}{7}$	
$\frac{3}{6}$	
2	
$\frac{7}{9}$	
0	

n ÷ $\frac{3}{5}$	
n	f(n)
$\frac{3}{6}$	
$\frac{4}{6}$	
$\frac{5}{6}$	
1	
$1\frac{1}{6}$	

---

d) Write each complex fraction as a quotient of 2 fractional numbers.

$\frac{\frac{3}{5}}{\frac{1}{2}}$ = $\frac{\frac{1}{8}}{\frac{5}{2}}$ = $\frac{\frac{1}{3}}{\frac{3}{7}}$ =

$\frac{\frac{3}{10}}{\frac{5}{4}}$ = $\frac{4\frac{1}{2}}{9}$ = $\frac{\frac{6}{11}}{\frac{1}{7}}$ =

Stop here.

MATH TEST 5-2

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the sum.

$\frac{4}{7} + \frac{3}{7} =$ $\frac{6}{10} + \frac{3}{5} =$ $\frac{7}{11} + \frac{3}{11} =$

$2\frac{1}{2}$	$4\frac{1}{6}$	4	$7\frac{1}{2}$
$+ \quad 3\frac{1}{6}$	$+ \quad 2\frac{3}{5}$	$+ \quad 3\frac{1}{6}$	$+ \quad \frac{1}{6}$
____	____	____	____

b) Find the difference.

$\frac{4}{7} - \frac{1}{7} =$ $\frac{3}{6} - \frac{2}{6} =$ $\frac{3}{5} - \frac{2}{10} =$

$7\frac{1}{2}$	$11\frac{3}{6}$	$7\frac{1}{3}$
$- \quad 3\frac{1}{2}$	$- \quad 2\frac{1}{6}$	$- \quad 4\frac{2}{12}$
____	____	____
3	$6\frac{1}{3}$	$7\frac{1}{3}$
$- \quad 2\frac{1}{2}$	$- \quad 1\frac{6}{12}$	$- \quad 2$
____	____	____

Turn to the next page.

c) Give the factors for the following.

6 {	}	11 {	}
4 {	}	12 {	}
7 {	}	9 {	}
16 {	}	25 {	}

---

d) Give the correct sign (> , = , <).

$\frac{1}{4}$	$\frac{1}{3}$	$\frac{3}{4}$	$\frac{9}{10}$	$\frac{1}{2}$	$\frac{50}{100}$
$\frac{1}{3}$	$\frac{3}{6}$	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{3}{5}$	$\frac{15}{20}$
$\frac{4}{7}$	$\frac{3}{4}$	$\frac{9}{11}$	$\frac{3}{22}$	$\frac{4}{5}$	$\frac{11}{15}$

Stop here.

MATH TEST 5-3

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the sum.

$$\begin{array}{rrrr} \frac{1}{9} & \frac{3}{7} & \frac{2}{3} & \frac{1}{4} \\ + & + & + & + \\ \frac{3}{6} & \frac{4}{5} & \frac{1}{2} & \frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{rrrr} \frac{7}{9} & \frac{1}{4} & \frac{2}{8} & \frac{7}{9} \\ + & + & + & + \\ \frac{2}{3} & \frac{7}{8} & \frac{3}{10} & \frac{3}{27} \\ \hline \end{array}$$

---

b) Find the differences.

$$\begin{array}{rrrrr} \frac{7}{15} & \frac{1}{2} & \frac{3}{6} & \frac{1}{4} & \frac{7}{10} \\ - & - & - & - & - \\ \frac{2}{15} & \frac{1}{4} & \frac{1}{2} & \frac{1}{5} & \frac{2}{5} \\ \hline \end{array}$$

$$\begin{array}{rrrrr} 7 & 3\ \frac{1}{2} & 6\ \frac{2}{8} & 7 & 17\ \frac{3}{11} \\ - & - & - & - & - \\ \frac{1}{6} & 1\ \frac{1}{3} & 3\ \frac{1}{16} & 2\ \frac{1}{6} & 6\ \frac{10}{22} \\ \hline \end{array}$$

Turn to the next page.

c) Rewrite the improper fractions as mixed numerals (write in lowest terms)..

$\frac{17}{3}$ = $\frac{26}{20}$ = $\frac{16}{5}$ = $\frac{9}{2}$ =

$\frac{29}{15}$ = $\frac{17}{9}$ = $\frac{73}{25}$ = $\frac{61}{50}$ =

---

d) Rewrite the mixed numerals as improper fractions.

$3\ \frac{1}{6}$ = $7\ \frac{2}{9}$ = $14\ \frac{7}{11}$ = $16\ \frac{2}{7}$ =

$8\ \frac{17}{25}$ = $9\ \frac{16}{33}$ = $7\ \frac{8}{20}$ = $4\ \frac{6}{9}$ =

---

e) Find "n".

$5\ \frac{3}{2} = 6 + n$ $4\ \frac{8}{3} = n + \frac{2}{3}$

$6\ \frac{9}{6} = 7 + \frac{n}{2}$ $8\ \frac{5}{2} = 10 + \frac{n}{2}$

Stop here.

MATH TEST 5-4

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the sum.

$\frac{15}{20} =$ $\frac{8}{10} =$ $\frac{60}{90} =$

$\frac{25}{100} =$ $\frac{25}{55} =$ $\frac{12}{30} =$

$\frac{33}{99} =$ $\frac{5}{20} =$ $\frac{9}{15} =$

---

b) Which pairs are equivalent (circle those which are equivalent).

$\frac{3}{4}, \frac{7}{9}$ $\frac{9}{5}, \frac{7}{4}$ $\frac{2}{5}, \frac{5}{10}$

$\frac{1}{5}, \frac{3}{20}$ $\frac{3}{8}, \frac{9}{24}$ $\frac{3}{10}, \frac{30}{100}$

$\frac{75}{100}, \frac{15}{20}$ $\frac{7}{10}, \frac{35}{50}$ $\frac{7}{10}, \frac{13}{20}$

---

c) Find the sums

$5\frac{1}{2} + 6\frac{1}{4} =$ $9\frac{1}{2} + \frac{6}{4} =$ $1\frac{3}{5} + 6\frac{1}{10} =$

$11\frac{3}{10} + 6 =$ $4\frac{1}{9} + \frac{6}{10} =$ $6\frac{3}{8} + \frac{1}{4} =$

Turn to the next page.

d) Write a mixed numeral for each improper fraction.

$\frac{20}{3}$ = $\frac{19}{10}$ = $\frac{61}{5}$ =

$\frac{143}{100}$ = $\frac{23}{10}$ = $\frac{11}{4}$ =

$\frac{20}{7}$ = $\frac{36}{5}$ = $\frac{17}{4}$ =

---

e) Find the differences (reduce to lowest terms).

$6\ \frac{7}{10}$	$9\ \frac{4}{5}$	$5\ \frac{3}{5}$	9
$1\ \frac{1}{2}$	$1\ \frac{3}{10}$	$4\ \frac{1}{6}$	$6\ \frac{1}{5}$
$7\ \frac{1}{11}$	$6\ \frac{1}{5}$	$9\ \frac{1}{6}$	$4\ \frac{1}{11}$
$3\ \frac{1}{22}$	$3\ \frac{2}{5}$	$7\ \frac{1}{5}$	$3\ \frac{6}{11}$

---

f) Find the missing numerator or denominator.

$\frac{6}{10} = \frac{\quad}{50}$ $\frac{7}{11} = \frac{21}{\quad}$ $\frac{7}{9} = \frac{\quad}{63}$

$\frac{5}{20} = \frac{\quad}{2}$ $\frac{6}{10} = \frac{18}{\quad}$ $\frac{11}{50} = \frac{44}{\quad}$

Stop here

MATH TEST 5-5

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find improper fractions for each of the following mixed numerals.

$3\ \frac{1}{6} =$ $7\ \frac{1}{2} =$ $4\ \frac{1}{4} =$

$8\ \frac{9}{10} =$ $4\ \frac{1}{7} =$ $6\ \frac{1}{3} =$

---

b) Find the sums.

$2\ \frac{1}{3} + 5\ \frac{1}{6}$ $6\ \frac{1}{3} + 1\ \frac{1}{7}$ $5\ \frac{1}{2} + \frac{1}{6}$

$5\ \frac{1}{8} + 7\ \frac{1}{6}$ $3\ \frac{2}{3} + 4\ \frac{1}{4}$ $6\ \frac{3}{4} + 2\ \frac{1}{8}$

---

c) Give the answer for a, b, and c.

$1\ \frac{1}{7} + 5\ \frac{2}{7} = (a + b) + (\frac{1}{7} + \frac{3}{7}) = 6 + \frac{4}{7} = c$

$5\ \frac{1}{2} + 3\ \frac{1}{4} = (a + b) + (\frac{1}{4} + \frac{1}{2}) = 8 + c =$

$6\ \frac{1}{5} + 1\ \frac{7}{10} = (6 + a) + (\frac{7}{10} + b) = 7 + c =$

Turn to the next page

d) Find the differences.

$6\ \frac{1}{2}$	$8\ \frac{1}{4}$	$9\ \frac{2}{5}$
$1\ \frac{3}{4}$	2	$6\ \frac{1}{5}$
$9\ \frac{7}{11}$	$6\ \frac{3}{4}$	$11\ \frac{1}{2}$
$8\ \frac{8}{11}$	$5\ \frac{2}{8}$	$6\ \frac{3}{9}$

---

e) Find the solution.

$$\left(\frac{3}{6} + \frac{1}{6}\right) - \frac{2}{12} = \qquad \left(\frac{3}{9} - \frac{1}{18}\right) + \frac{4}{18} =$$

$$\left(\frac{7}{10} - \frac{3}{5}\right) + \frac{1}{10} = \qquad \left(\frac{3}{6} + \frac{3}{6}\right) - 1 =$$

Stop here.

MATH TEST 5-6

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Write the lowest terms fractions.

$\frac{5}{25}$ = $\frac{4}{30}$ = $\frac{9}{15}$ =

$\frac{70}{100}$ = $\frac{14}{30}$ = $\frac{14}{21}$ =

$\frac{35}{100}$ = $\frac{56}{64}$ = $\frac{18}{36}$ =

---

b) Which pairs are equivalent (circle those which are equivalent).

$\frac{3}{4}$, $\frac{7}{9}$ $\frac{16}{30}$, $\frac{48}{90}$ $\frac{15}{45}$, $\frac{1}{7}$

$\frac{3}{8}$, $\frac{5}{14}$ $\frac{7}{10}$, $\frac{35}{50}$ $\frac{3}{8}$, $\frac{16}{40}$

---

c) Write improper fractions for each mixed number.

$3\frac{1}{2}$ = $11\frac{5}{6}$ = $12\frac{9}{14}$ = $7\frac{3}{6}$ =

$7\frac{1}{6}$ = $4\frac{8}{15}$ = $16\frac{3}{9}$ = $11\frac{14}{30}$ =

Turn to the next page.

d) Find the differences.

$6\frac{7}{10}$	$7\frac{3}{5}$	$9\frac{4}{6}$
$1\frac{1}{2}$	$1\frac{1}{10}$	$6\frac{5}{6}$
$8\frac{2}{9}$	$7\frac{1}{4}$	$6\frac{3}{4}$
$3\frac{5}{9}$	$3\frac{1}{8}$	$1\frac{1}{6}$

---

e) Solve.

$3\frac{1}{2} + 5\frac{3}{4} = 9 + n$ $\qquad$ $6\frac{5}{8} + 7\frac{3}{4} = 14 + n$

$3\frac{6}{8} + 5\frac{2}{8} = 8 + n = a$ $\qquad$ $15\frac{7}{10} + 29\frac{2}{3} = 45 + n$

$(\frac{1}{6} + \frac{3}{6}) + (6 + 3) = n$ $\qquad$ $3\frac{1}{6} + 5\frac{3}{9} = (3 + 5) + (\quad + \quad) =$

Stop here.

MATH TEST 5-7

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the value for n.

$\frac{3}{4} = \frac{n}{8}$ $\frac{16}{32} = \frac{32}{n}$ $\frac{9}{16} = \frac{18}{n}$

$\frac{4}{10} = \frac{n}{30}$ $\frac{9}{23} = \frac{18}{}$ $\frac{7}{15} = \frac{n}{45}$

$\frac{4}{7} = \frac{n}{21}$ $\frac{6}{11} = \frac{18}{n}$ $\frac{4}{7} = \frac{12}{n}$

---

b) Write the following in lowest terms.

$\frac{7}{15} =$ $\frac{9}{27} =$ $\frac{6}{10} =$

$\frac{6}{30} =$ $\frac{5}{35} =$ $\frac{8}{32} =$

$\frac{7}{21} =$ $\frac{6}{30} =$ $\frac{9}{54} =$

---

c) Give the missing fractions.

$\{\frac{2}{3}, \frac{4}{6}, \frac{6}{9}, \_\_, \frac{10}{15}\}$ $\{\frac{1}{2}, \frac{2}{4}, \_\_, \frac{4}{8}, \frac{6}{10}, \_\_\}$

$\{\frac{3}{5}, \frac{6}{15}, \_\_, \frac{12}{25}, \_\_, \_\_\}$ $\{\frac{2}{5}, \frac{4}{10}, \_\_, \frac{8}{20}, \_\_, \frac{12}{30}\}$

Turn to the next page.

d) List the factors.

9 = 3 =

12 = 15 =

6 = 18 =

---

e) Find the differences.

$\frac{7}{9} - \frac{3}{9} =$ $4\frac{1}{9} - \frac{1}{9} =$ $6\frac{3}{5} - 2\frac{1}{5} =$

$8\frac{2}{5} - 7 =$ $3\frac{9}{10} - \frac{3}{10} =$ $7\frac{3}{6} - \frac{1}{6} =$

---

f) Write the symbols (> , = , <).

$\frac{1}{2}$ $\frac{2}{4}$ $\frac{7}{10}$ $\frac{4}{20}$ $\frac{7}{11}$ $\frac{14}{22}$

$\frac{5}{15}$ $\frac{6}{45}$ $\frac{11}{30}$ $\frac{22}{35}$ $\frac{7}{19}$ $\frac{21}{38}$

$\frac{6}{15}$ $\frac{12}{40}$ $\frac{9}{15}$ $\frac{15}{20}$ $\frac{7}{16}$ $\frac{3}{16}$

Stop here.

MATH TEST 5-8

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) List the multiple for each number pair. Circle the LCM.

2 { }

6 { }

8 { }

4 { }

25 { }

30 { }

9 { }

6 { }

---

b) List the factors for each number pair. Circle the LCD.

6 = 11 =

8 = 32 =

10 = 12 =

15 = 48 =

Turn to the next page.

c) Find the sums.

$\frac{1}{2} + \frac{1}{2} =$ $\quad 2\frac{1}{5} + 1\frac{2}{5} =$ $\quad 6\frac{1}{9} + \frac{3}{9} =$

$4\frac{2}{3} + \frac{1}{3} =$ $\quad 7\frac{7}{9} + \frac{1}{9} =$ $\quad 3\frac{1}{3} + 1\frac{2}{6} =$

$\frac{3}{6} + \frac{2}{24} =$ $\quad 7\frac{1}{6} + \frac{3}{24} =$ $\quad \frac{1}{5} + 3\frac{9}{10} =$

---

d) Write the mixed numerals.

$\frac{7}{2} =$ $\quad \frac{11}{6} =$ $\quad \frac{23}{21} =$

$\frac{16}{3} =$ $\quad \frac{9}{2} =$ $\quad \frac{25}{3} =$

---

e) Find the differences.

$3\frac{1}{6} - 2\frac{1}{12} =$ $\quad 10\frac{13}{15} - 6\frac{12}{15} =$

$7\frac{3}{9} - 2\frac{1}{18} =$ $\quad \frac{11}{25} - \frac{6}{50} =$

$11\frac{2}{6} - 3\frac{4}{12} =$ $\quad 8 - \frac{1}{6} =$

Stop here.

MATH TEST 6-2

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Write improper fractions for the following.

$3\frac{5}{8} =$ $6\frac{1}{3} =$ $5\frac{5}{6} =$ $7\frac{3}{4} =$

$2\frac{3}{10} =$ $4\frac{2}{3} =$ $3\frac{1}{5} =$ $6\frac{9}{15} =$

---

b) Give the numerator for "a" and the whole number for "b".

$\frac{42}{4} = \frac{a}{4} + \frac{2}{4} = b$ $\frac{68}{5} = \frac{a}{5} + \frac{3}{5} = b$

$\frac{37}{3} = \frac{a}{3} + \frac{1}{3} = b$ $\frac{93}{8} = \frac{a}{8} + \frac{2}{8} = b$

$\frac{67}{8} = \frac{a}{8} + \frac{3}{8} = b$ $\frac{79}{12} = \frac{a}{12} + \frac{7}{12} = b$

$\frac{61}{50} = \frac{a}{50} + \frac{11}{50} = b$ $\frac{139}{12} = \frac{a}{12} + \frac{7}{12} = b$

---

c) Write mixed numerals for each fraction.

$\frac{58}{3} =$ $\frac{19}{18} =$ $\frac{63}{9} =$

$\frac{75}{3} =$ $\frac{70}{12} =$ $\frac{45}{40} =$

Turn to the next page.

d) Give the correct sign (> , = , or <).

$\frac{5}{6}$ $\frac{4}{11}$ $\quad$ $\frac{1}{2}$ $\frac{6}{12}$ $\quad$ $\frac{3}{5}$ $\frac{6}{15}$

$\frac{1}{4}$ $\frac{1}{6}$ $\quad$ $\frac{3}{9}$ $\frac{5}{18}$ $\quad$ $\frac{6}{9}$ $\frac{12}{27}$

---

e) Find the sums.

$3\frac{1}{6} + 4\frac{1}{2} =$ $\quad$ $6\frac{5}{11} + 7\frac{3}{22} =$

$7\frac{3}{9} + 6\frac{2}{18} =$ $\quad$ $14\frac{7}{21} + 6\frac{8}{63} =$

$9\frac{2}{7} + \frac{6}{14} =$ $\quad$ $7\frac{3}{9} + 4\frac{2}{7} =$

---

f) Find the differences.

$8\frac{1}{4} - 2\frac{1}{2} =$ $\quad$ $9\frac{2}{5} - 6\frac{7}{10} =$

$19\frac{2}{3} - 5\frac{9}{10} =$ $\quad$ $83 - 42\frac{7}{8} =$

$16\frac{3}{10} - 5\frac{4}{5} =$ $\quad$ $7\frac{6}{9} - 6\frac{2}{18} =$

Stop here.

MATH TEST 6-3

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Give the missing value.

$$\begin{array}{r} \_\_ \\ + \ \frac{6}{8} \\ \hline 2\ \frac{1}{8} \end{array} \qquad \begin{array}{r} \frac{4}{9} \\ + \ \_\_ \\ \hline \frac{11}{18} \end{array} \qquad \begin{array}{r} 4\ \frac{1}{6} \\ + \ \_\_ \\ \hline 5\ \frac{5}{18} \end{array}$$

$$\begin{array}{r} \frac{1}{9} \\ + \ \frac{3}{18} \\ \hline \_\_ \end{array} \qquad \begin{array}{r} \_\_ \\ - \ \frac{3}{30} \\ \hline 1\ \frac{1}{2} \end{array} \qquad \begin{array}{r} 7\ \frac{3}{8} \\ - \ \_\_ \\ \hline 1\ \frac{2}{8} \end{array}$$

---

b) Give the missing numerators.

$4\ \frac{1}{2} = 4\ \frac{\_\_}{4} = 3\ \frac{\_\_}{4}$

$12\ \frac{2}{5} = 12\ \frac{\_\_}{15} = 11\ \frac{\_\_}{15}$

$5\ \frac{2}{3} = 5\ \frac{\_\_}{12} = 4\ \frac{\_\_}{12}$

$30\ \frac{3}{10} = 30\ \frac{\_\_}{40} = 28\ \frac{\_\_}{40}$

$7\ \frac{2}{3} = 7\ \frac{\_\_}{9} = 6\ \frac{\_\_}{9}$

$1 = 1\ \frac{\_\_}{3} = \frac{\_\_}{3}$

$11\ \frac{9}{10} = 11\ \frac{\_\_}{80} = 10\ \frac{\_\_}{80}$

$9 = 9\ \frac{\_\_}{4} = 8\ \frac{\_\_}{4}$

Turn to the next page

c) Give the missing function rule.

$(5\frac{2}{3} + n) - 2\frac{2}{3}$	
n	f(n)
$3\frac{1}{4}$	
$4\frac{3}{4}$	
$7\frac{1}{6}$	
$2\frac{4}{5}$	
$1\frac{7}{8}$	

$n - 4\frac{1}{3}$	
n	f(n)
$8\frac{5}{6}$	
$7\frac{1}{2}$	
$6\frac{1}{6}$	
$5\frac{1}{4}$	
$9\frac{3}{5}$	

Stop here.

MATH TEST 6-4

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Solve the equations (reduce to lowest terms).

$5\ \frac{9}{8} = 6 + \_\_ =$ $14\ \frac{19}{12} = 13 + \_\_ =$

$15\ \frac{4}{3} = 16 + \_\_ =$ $6\ \frac{15}{10} = 5 + \_\_ =$

$35\ \frac{11}{10} = 36 + \_\_ =$ $21\ \frac{9}{3} = 23 + \_\_ =$

$12\ \frac{6}{5} = 13 + \_\_ =$ $17\ \frac{3}{2} = 16 + \_\_ =$

---

b) Find the Lowest Common Multiple for each number pair.

3 and 5	12 and 11	7 and 2
16 and 4	17 and 3	9 and 5
9 and 7	16 and 3	18 and 36

---

c) Find the sums

$\frac{1}{6} + \frac{2}{3} + \frac{1}{4} =$ $\frac{4}{9} + \frac{5}{10} + \frac{1}{3} =$ $\frac{4}{5} + \frac{1}{25} + \frac{2}{50} =$

$\frac{2}{7} + \frac{3}{8} + \frac{1}{9} =$ $\frac{6}{7} + \frac{1}{3} + \frac{6}{7} =$ $\frac{1}{9} + \frac{1}{8} + \frac{3}{6} =$

Turn to the next page.

d) Solve.

$\frac{16}{3}$ = $\frac{26}{9}$ = $\frac{49}{6}$ =

$\frac{11}{5}$ = $\frac{63}{7}$ = $\frac{71}{10}$ =

$\frac{44}{5}$ = $\frac{16}{5}$ = $\frac{48}{20}$ =

---

e) Solve the equations.

$7\frac{4}{3} = 6 + \_\_$ $9\frac{3}{2} = 10 + \_\_$

$5\frac{9}{5} = 6 + \_\_$ $7\frac{9}{7} = 6 + \_\_$

$11\frac{70}{5} = 17 + \_\_$ $6\frac{11}{3} = 5 + \_\_$

---

f) Find the products.

$\frac{6}{9} \times \frac{5}{11} =$ $\frac{4}{7} \times \frac{8}{9} =$ $\frac{27}{30} \times \frac{32}{42} =$

$\frac{7}{10} \times \frac{3}{9} =$ $\frac{2}{3} \times \frac{9}{11} =$ $\frac{14}{22} \times \frac{33}{49} =$

$\frac{5}{12} \times \frac{16}{30} =$ $\frac{2}{9} \times \frac{15}{16} =$ $\frac{9}{14} \times \frac{25}{49} =$

Stop here.

MATH TEST 6-5

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Write improper fractions for each mixed numeral.

$3\ \frac{3}{5} =$ $\quad 6\ \frac{1}{3} =$ $\quad 7\ \frac{3}{6} =$

$2\ \frac{2}{10} =$ $\quad 6\ \frac{1}{5} =$ $\quad 4\ \frac{3}{4} =$

---

b) Solve the equation.

$7\ \frac{4}{3} = 8 + n$ $\qquad 47\ \frac{10}{7} = 46 + n$

$36\ \frac{13}{4} = 39 + n$ $\qquad 72\ \frac{9}{4} = 74 + n$

$9\ \frac{7}{5} = 10 + n$ $\qquad 26\ \frac{11}{4} = n + \frac{3}{4}$

---

c) Give the correct sign (= or ≠).

$\frac{5}{8}$ $\frac{15}{24}$ $\qquad \frac{14}{20}$ $\frac{28}{40}$ $\qquad \frac{18}{20}$ $\frac{27}{30}$

$\frac{3}{4}$ $\frac{21}{28}$ $\qquad \frac{6}{9}$ $\frac{3}{18}$ $\qquad \frac{12}{21}$ $\frac{20}{35}$

Turn to the next page.

d) Solve.

$(\frac{6}{3} \times \frac{1}{3}) \div \frac{4}{6} =$ $(\frac{3}{9} \div \frac{1}{6}) \times \frac{2}{5} =$

$(1 \times \frac{3}{7}) \div \frac{1}{7} =$ $(2\frac{1}{6} + \frac{3}{6}) \times \frac{1}{7} =$

$(2\frac{1}{9} - \frac{3}{9}) + \frac{1}{6} =$ $(\frac{10}{5} \times 1) \div \frac{3}{7} =$

---

e) Find the quotient.

$2\frac{3}{4} \div \frac{2}{5} =$ $\frac{7}{8} \div 4\frac{1}{4} =$

$3\frac{1}{7} \div 1\frac{1}{3} =$ $4\frac{1}{2} \div 2\frac{1}{6} =$

$4\frac{1}{3} \div 1\frac{7}{8} =$ $2\frac{1}{6} \div 3\frac{2}{3} =$

Stop here.

MATH TEST 6-6

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Solve each equation.

$5 \times 3\frac{1}{2} = (5 \times 3) + (5 \times n) = a$

$6 \times 2\frac{1}{5} = (6 \times 2) + (6 \times n) = a$

$3 \times 1\frac{2}{9} = (3 \times 1) + (3 \times n) = a$

$6 \times 2\frac{1}{11} = (6 \times 2) + (6 \times n) = a$

$\frac{3}{5} \times 2\frac{3}{5} = (\frac{3}{5} \times 2) + (\frac{3}{5} \times n) = a$

---

b) Complete the function table.

$\frac{3}{4} \times n$	
n	f(n)
$\frac{4}{27}$	
$\frac{20}{21}$	
24	
$\frac{4}{3}$	
$\frac{2}{3}$	

$3\frac{1}{4} \times n$	
n	f(n)
8	
$\frac{1}{3}$	
$5\frac{5}{8}$	
$8\frac{4}{5}$	

Turn to the next page.

c) Write improper fractions for each mixed number.

$2\frac{1}{2} =$ $3\frac{15}{24} =$ $5\frac{2}{5} =$

$9\frac{1}{3} =$ $12\frac{3}{7} =$ $8\frac{5}{9} =$

$15\frac{3}{10} =$ $9\frac{1}{10} =$ $7\frac{3}{11} =$

---

d) Find the quotient.

$\frac{1}{6} \div \frac{1}{3} =$ $\frac{10}{27} \div \frac{5}{3} =$

$\frac{12}{25} \div \frac{3}{5} =$ $\frac{3}{9} \div \frac{1}{7} =$

$1 \div \frac{1}{9} =$ $\frac{12}{14} \div \frac{4}{7} =$

Stop here.

MATH TEST 6-7

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Use cross products to determine whether fractions are equivalent.

$\frac{4}{8} \times \frac{6}{9}$	$\frac{10}{18} \quad \frac{5}{9}$	$\frac{16}{12} \quad \frac{8}{6}$
$\frac{20}{30} \quad \frac{6}{9}$	$\frac{8}{12} \quad \frac{4}{6}$	$\frac{4}{12} \quad \frac{8}{20}$
$\frac{7}{15} \quad \frac{30}{21}$	$\frac{21}{60} \quad \frac{42}{120}$	$\frac{1}{6} \quad \frac{3}{18}$

---

b) Give the multiples for each fraction pair. Circle the LCM.

8 =	6 =
10 =	3 =
25 =	11 =
55 =	31 =
9 =	17 =
12 =	18 =

Turn to the next page.

c) Write improper fractions for each mixed numeral.

$6\ \frac{3}{9} =$ $\quad$ $5\ \frac{1}{10} =$ $\quad$ $7\ \frac{3}{4} =$

$12\ \frac{1}{5} =$ $\quad$ $11\ \frac{5}{6} =$ $\quad$ $25\ \frac{6}{11} =$

---

d) Find the sums or differences.

$2\ \frac{1}{3} + 5\ \frac{1}{6} =$ $\quad$ $8\ \frac{1}{3} + 6\ \frac{1}{12} =$

$9\ \frac{1}{2} - 6\ \frac{1}{4} =$ $\quad$ $7\ \frac{2}{10} - 6\ \frac{2}{5} =$

$7\ \frac{1}{6} + \frac{3}{6} =$ $\quad$ $9\ \frac{1}{2} - 3\ \frac{2}{6} =$

---

e) Rewrite the equation.

$3\ \frac{9}{6} = 4 + n$ $\quad$ $7\ \frac{6}{5} = 8 + n$

$11\ \frac{6}{4} = 12 + n$ $\quad$ $7\ \frac{9}{4} = 8 + n$

$6\ \frac{2}{2} = 5 + n$ $\quad$ $8\ \frac{6}{5} = 7 + n$

Stop here.

MATH TEST 6-8

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Give the missing numberators or denominators.

$\frac{3}{2} = \frac{6}{\quad}$ $\quad \frac{7}{15} = \frac{\quad}{30}$ $\quad \frac{9}{36} = \frac{27}{\quad}$

$\frac{2}{8} = \frac{\quad}{48}$ $\quad \frac{6}{9} = \frac{\quad}{54}$ $\quad \frac{3}{11} = \frac{21}{\quad}$

$\frac{2}{12} = \frac{\quad}{108}$ $\quad \frac{6}{32} = \frac{\quad}{96}$ $\quad \frac{7}{23} = \frac{28}{\quad}$

---

b) Solve for a , b , and c.

$3\frac{1}{2} + 2\frac{3}{6} = (3 + a) + (\frac{1}{2} + b) = c$

$7\frac{1}{8} + 6\frac{2}{16} = (7 + a) + (b + \frac{2}{16}) = c$

$12\frac{1}{9} + 3\frac{9}{27} = (12 + a) + (\frac{3}{27} + b) = c$

$7\frac{3}{7} + 16\frac{9}{21} = (a + 16) + (\frac{9}{21} + b) = c$

$11\frac{3}{6} + 9\frac{4}{24} = (11 + a) + (\frac{12}{24} + b) = c$

Turn to the next page.

c) Find the sums.

$3\frac{1}{6} + 4\frac{1}{7} =$ $\quad$ $14\frac{3}{11} + 6\frac{5}{22} =$

$7\frac{3}{4} + 4\frac{1}{4} =$ $\quad$ $6\frac{3}{10} + 5\frac{6}{30} =$

$12\frac{9}{16} + \frac{7}{8} =$ $\quad$ $12\frac{9}{15} + 1\frac{3}{5} =$

$14\frac{7}{13} + \frac{3}{26} =$ $\quad$ $7\frac{3}{6} + 2\frac{9}{18} =$

---

d) Give the LCM for each pair of fractions.

$\frac{6}{14}, \frac{3}{7}$ $\quad$ $\frac{6}{12}, \frac{7}{18}$ $\quad$ $\frac{4}{11}, \frac{9}{15}$

$\frac{3}{7}, \frac{9}{9}$ $\quad$ $\frac{4}{7}, \frac{6}{6}$ $\quad$ $\frac{4}{11}, \frac{9}{17}$

---

e) Function rules.

$(5\frac{2}{3} + n) - 2\frac{2}{3}$

n	f(n)
$3\frac{1}{4}$	
$4\frac{3}{4}$	
$7\frac{1}{6}$	

$n + \frac{1}{4} + \frac{1}{2}$

n	f(n)
$\frac{1}{6}$	
$\frac{1}{3}$	
$\frac{3}{8}$	

Stop here.

MATH TEST 7-2

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Give the lowest terms fraction for each give fraction.

$\frac{21}{35}$ = $\frac{16}{40}$ = $\frac{18}{60}$ = $\frac{27}{37}$ =

$\frac{28}{42}$ = $\frac{24}{64}$ = $\frac{14}{27}$ = $\frac{9}{21}$ =

---

b) Give the correct symbol (< or >) for each fraction pair.

$\frac{2}{3}$ $\frac{27}{30}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{13}{16}$ $\frac{9}{12}$

$\frac{15}{16}$ $\frac{3}{4}$ $\frac{7}{12}$ $\frac{5}{9}$ $\frac{6}{5}$ $\frac{6}{7}$

$\frac{8}{9}$ $\frac{9}{10}$ $\frac{1}{8}$ $\frac{1}{9}$ $\frac{3}{8}$ $\frac{5}{16}$

---

c) Find the sums

$1\frac{1}{2}$	$5\frac{1}{3}$	$2\frac{7}{10}$	$12\frac{4}{7}$	$4\frac{2}{9}$
+ $\frac{2}{3}$	+ $3\frac{1}{4}$ =	+ $5\frac{1}{2}$	+ $2\frac{1}{3}$	+ $1\frac{5}{6}$
____	____	____	____	____
$6\frac{1}{7}$	$4\frac{1}{4}$	$6\frac{1}{9}$	$5\frac{2}{6}$	$3\frac{1}{2}$
+ $1\frac{3}{5}$	+ $3\frac{1}{3}$ =	+ 7	+ $3\frac{1}{8}$	+ $1\frac{1}{7}$
____	____	____	____	____

Turn to the next page

d) Find the differences.

$3\frac{1}{2}$	$8\frac{3}{4}$	9	$4\frac{1}{3}$	$12\frac{4}{9}$
$-\ 1\frac{1}{6}$	$-\ 5\frac{1}{3}$ =	$-\ 1\frac{7}{8}$	$-\ 3\frac{4}{5}$	$-\ 8\frac{5}{6}$
$73\frac{1}{3}$	$11\frac{3}{10}$	$6\frac{1}{3}$	$9\frac{2}{10}$	$4\frac{1}{9}$
$-\ 50\frac{5}{7}$	$-\ 3\frac{3}{4}$ =	$-\ 2\frac{1}{5}$	$-\ 3\frac{1}{6}$	$-\ \frac{2}{18}$

---

e) Find the product.

$\frac{1}{5}$ of 50 =	$\frac{1}{4}$ of 35 =	$\frac{1}{10}$ of 46 =	$\frac{1}{3}$ of 25 =
$\frac{6}{11} \times \frac{7}{8}$ =	$4\frac{4}{9} \times 6\frac{3}{10}$ =	$12 \times \frac{1}{4}$ =	$7\frac{1}{5} \times \frac{6}{3}$ =

---

e) Find the quotients.

$3 \times 7\frac{1}{3}$ =	$\frac{1}{2} \times 60\frac{1}{2}$ =	$\frac{1}{2} \times 4\frac{3}{5}$ =	
$4 \div \frac{3}{5}$ =	$\frac{4}{3} \div \frac{1}{2}$ =	$\frac{1}{2} \div 3\frac{1}{2}$ =	$1 \div \frac{2}{5}$ =

Stop here.

MATH TEST 7-3

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the sums (give answers in lowest terms).

$\frac{2}{6} + \frac{3}{8} + \frac{1}{4} =$ $\frac{7}{8} + \frac{1}{3} + \frac{5}{6} =$

$\frac{3}{10} + \frac{1}{4} + \frac{4}{5} =$ $\frac{4}{9} + \frac{1}{3} + \frac{6}{18} =$

$\frac{4}{15} + \frac{1}{3} + \frac{6}{25} =$ $\frac{11}{12} + \frac{7}{8} + \frac{2}{3} =$

$\frac{5}{8} + \frac{3}{4} + \frac{1}{2} =$ $\frac{6}{7} + \frac{1}{3} + \frac{1}{2} =$

---

b) Find the product by reducing fractions.

$\frac{16}{35} \times \frac{5}{8} =$ $\frac{16}{30} \times \frac{6}{48} =$ $\frac{18}{35} \times \frac{7}{9} =$

$\frac{21}{40} \times \frac{5}{7} =$ $\frac{9}{18} \times \frac{90}{900} =$ $\frac{33}{75} \times \frac{75}{99} =$

$\frac{25}{39} \times \frac{3}{100} =$ $\frac{75}{250} \times \frac{25}{150} =$ $\frac{44}{105} \times \frac{15}{88} =$

---

c) Write mixed numerals for each improper fraction.

$\frac{4}{3} =$ $\frac{163}{25} =$ $\frac{36}{16} =$ $\frac{25}{4} =$

$\frac{19}{7} =$ $\frac{30}{12} =$ $\frac{72}{3} =$ $\frac{210}{150} =$

Turn to the next page.

d) Find the quotients.

$1\frac{1}{4} \div \frac{2}{3} =$ $\quad \frac{7}{9} \div \frac{2}{5} =$ $\quad 3\frac{1}{3} \div 16\frac{2}{3} =$

$6\frac{2}{3} \div 5 =$ $\quad 4\frac{7}{8} \div 4\frac{7}{8} =$ $\quad 35 \div 3\frac{3}{4} =$

$4\frac{1}{6} \div \frac{1}{3} =$ $\quad 6\frac{7}{8} \div 9\frac{2}{7} =$ $\quad \frac{1}{3} \div \frac{2}{5} =$

$1\frac{3}{5}$ $\quad 4\frac{1}{11}$ $\quad 7\frac{1}{9}$ $\quad 7\frac{1}{2}$

$-$ $\quad -$ $\quad -$ $\quad -$

$6\frac{1}{3}$ $\quad 3\frac{2}{8}$ $\quad 3$ $\quad 2\frac{1}{5}$

---

e) Find the difference (give answer in lowest terms).

$\frac{17}{15} - \frac{5}{6} =$ $\quad \frac{11}{30} - \frac{1}{6} =$ $\quad \frac{11}{15} - \frac{3}{12} =$

$\frac{7}{10} - \frac{1}{4} =$ $\quad \frac{9}{8} - \frac{4}{5} =$ $\quad 3\frac{1}{2} - 1\frac{1}{6} =$

$9 - \frac{3}{6} =$ $\quad \frac{46}{80} - \frac{3}{8} =$ $\quad 8\frac{3}{4} - 5\frac{1}{3} =$

---

f) Which number in each group is largest?

$\frac{1}{2}, \frac{1}{4}, \frac{1}{5}$ $\quad \frac{7}{8}, \frac{3}{4}, \frac{9}{12}$

$\frac{4}{9}, \frac{5}{10}, \frac{6}{11}$ $\quad \frac{2}{3}, \frac{33}{100}, \frac{1}{5}$

Stop here.

MATH TEST 7-4

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the GCF of each pair of numbers.

6 and 10	51 and 39	121 and 70
18 and 27	36 and 45	75 and 100
31 and 51	15 and 18	25 and 20
24 and 108	21 and 14	48 and 36

---

b) Find the LCM of each group of numbers.

3 and 7	2, 4, and 5	5, 8, and 16
25 and 40	9 and 12	10 and 25
30 and 45	2, 7, and 8	25, 30, and 75
5 and 15	3, 8, and 12	2, 5, and 20

---

c) Solve

$(\frac{1}{4} + \frac{3}{16}) \times \frac{8}{9} =$

$\frac{7}{9} + (\frac{6}{11} \times \frac{3}{5}) =$

$(\frac{3}{4} - \frac{1}{2}) - \frac{6}{11} =$

$\frac{4}{9} + (3 \times \frac{6}{9}) =$

$\frac{2}{6} + (3 \times \frac{4}{5}) =$

$2 \times (\frac{1}{9} + \frac{3}{5}) =$

$(\frac{3}{9} + \frac{6}{18}) - \frac{6}{5} =$

$(2\frac{1}{2} + \frac{3}{4}) \div \frac{3}{5} =$

Turn to the next page.

d) Write each complex fraction as a quotient of two fractional numbers.

$$\frac{4}{\frac{3}{5}} = \qquad \frac{1}{\frac{2}{5}} = \qquad \frac{7\frac{3}{5}}{3\frac{4}{5}} =$$

$$\frac{\frac{5}{6}}{10} = \qquad \frac{\frac{3}{10}}{\frac{5}{6}} = \qquad \frac{8}{\frac{1}{2}} =$$

$$\frac{10\frac{2}{3}}{4\frac{7}{8}} = \qquad \frac{8\frac{1}{6}}{7} = \qquad \frac{\frac{1}{8}}{\frac{3}{4}} =$$

---

e) Find the sums.

$$5\frac{1}{3} + \frac{2}{3} = \qquad 31\frac{4}{9} + 8\frac{3}{4} = \qquad 4 + \frac{1}{9} =$$

$$12\frac{4}{7} + 2\frac{1}{3} = \qquad 6\frac{4}{5} + 3\frac{2}{3} = \qquad 16\frac{5}{11} + 7\frac{3}{5} =$$

$$23\frac{1}{8} + 7\frac{2}{3} = \qquad 11\frac{1}{7} + \frac{2}{9} = \qquad 9\frac{1}{2} + 3\frac{3}{8} =$$

Stop here.

MATH TEST 7-5

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the GCF of each pair of numbers.

25 , 20	60 , 55	132 , 11
36 , 45	121 , 70	15 , 18
80 , 200	24 , 108	31 , 51

---

b) Find the LCM of each group of numbers.

3 , 7	15 , 20	3 , 8 , and 12
9 , 12	10 , 25	3 , 10 , and 15
8 , 10	3 , 5 , and 20	25 , 30 , and 75

---

c) Find the sums (write answers in lowest terms).

$\frac{3}{4} + \frac{6}{8} + \frac{11}{24} =$ $\frac{1}{10} + \frac{9}{25} + \frac{6}{50} =$

$\frac{7}{15} + \frac{19}{45} + \frac{6}{30} =$ $\frac{3}{10} + \frac{3}{4} + \frac{2}{5} =$

$2\frac{1}{6} + 3\frac{2}{9} + 4\frac{1}{3} =$ $7\frac{1}{9} + 8\frac{3}{10} + \frac{1}{45} =$

Turn to the next page.

d) Find the products.

$\frac{3}{11} \times \frac{6}{20} =$ $\frac{7}{15} \times \frac{5}{14} =$ $\frac{35}{50} \times \frac{5}{7} =$

$\frac{14}{45} \times \frac{9}{7} =$ $\frac{6}{11} \times \frac{55}{36} =$ $\frac{39}{60} \times \frac{3}{12} =$

$\frac{3}{12} \times \frac{6}{9} =$ $\frac{16}{50} \times \frac{25}{40} =$ $\frac{35}{50} \times \frac{5}{7} =$

---

e) Find the quotients.

$1\frac{1}{4} \div \frac{2}{3} =$ $6\frac{2}{3} \div 5 =$ $4\frac{1}{2} \div 18 =$

$35 \div 3\frac{3}{4} =$ $3\frac{9}{10} \div 4\frac{1}{3} =$ $25 \div 8\frac{1}{3} =$

$1\frac{5}{6} \div 3\frac{1}{2} =$ $9\frac{1}{5} \div 6\frac{3}{5} =$ $6\frac{7}{8} \div 9\frac{2}{7} =$

Stop here.

MATH TEST 7-6

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Give the numerators r and s.

$\frac{7}{8} + \frac{1}{2} = \frac{7}{8} + \frac{r}{8} = \frac{s}{8}$ $\quad \frac{9}{2} - \frac{7}{8} = \frac{r}{8} - \frac{7}{8} = \frac{s}{8}$

$\frac{11}{4} - \frac{3}{2} = \frac{11}{4} + \frac{r}{4} = \frac{s}{4}$ $\quad 3 - \frac{5}{6} = \frac{s}{6} - \frac{5}{6} = \frac{s}{6}$

$\frac{1}{8} + \frac{9}{4} = \frac{1}{8} + \frac{r}{8} = \frac{s}{8}$ $\quad \frac{11}{3} + \frac{5}{6} = \frac{s}{6} + \frac{5}{6} = \frac{s}{6}$

---

b) Find the LCM and GCF for each number pair.

45, 9 $\quad$ 16, 12 $\quad$ 14, 7

63, 8 $\quad$ 11, 33 $\quad$ 24, 48

---

c) Use commutative, associative, and zero principles to find the sums.

$\frac{1}{6} + (\frac{5}{6} + \frac{1}{4}) =$ $\quad \frac{3}{10} + (\frac{7}{10} + \frac{1}{3}) =$

$(\frac{1}{2} + 0) + \frac{1}{2} =$ $\quad \frac{5}{6} + \frac{9}{10} + \frac{1}{6} =$

$\frac{3}{7} + \frac{2}{7} + \frac{0}{3} =$ $\quad (\frac{3}{8} + \frac{3}{4}) + \frac{1}{4} =$

Turn to the next page

d) Function rules.

n + $\frac{3}{4}$	
n	f(n)
$\frac{1}{4}$	
$\frac{1}{2}$	
$\frac{3}{4}$	
1	
$1\frac{1}{4}$	

n + n	
n	f(n)
0	
$\frac{1}{4}$	
$\frac{1}{2}$	
$\frac{3}{4}$	
1	

Stop here.

MATH TEST 7-7

Name: _____ **Date:** _____

Target: _____ **Time:** _____

a) Give the correct symbol (< , = , or >).

$\frac{6}{7}$ $\frac{5}{6}$ $\qquad$ $\frac{4}{5}$ $\frac{3}{10}$

$\frac{5}{8}$ $\frac{7}{12}$ $\qquad$ $\frac{5}{11}$ $\frac{6}{13}$

$\frac{7}{15}$ $\frac{3}{9}$ $\qquad$ $\frac{6}{10}$ $\frac{3}{5}$

---

b) Find the product.

$\frac{3}{5} \times \frac{1}{3} =$ $\qquad$ $\frac{5}{9} \times \frac{6}{11} =$

$2\frac{1}{9} \times \frac{3}{15} =$ $\qquad$ $1\frac{2}{3} \times \frac{3}{4} =$

$4\frac{1}{6} \times \frac{3}{12} =$ $\qquad$ $\frac{1}{6} \times 0 =$

$1 \times \frac{1}{6} =$ $\qquad$ $2\frac{1}{2} \times 7\frac{3}{5} =$

---

c) Find the sums.

$6\frac{1}{6} + 3\frac{2}{24} =$ $\qquad$ $7\frac{6}{11} + 4\frac{2}{22} =$

$3\frac{9}{12} + 1\frac{25}{34} =$ $\qquad$ $2\frac{1}{6} + 1\frac{5}{11} =$

$2\frac{3}{4} + 5\frac{1}{9} =$ $\qquad$ $4 + \frac{3}{6} =$

$3\frac{1}{11} + \frac{2}{33} + 6\frac{1}{11} =$ $\qquad$ $6\frac{2}{12} + 3\frac{5}{12} + 6\frac{1}{36} =$

Turn to the next page

d) Find the differences.

$\left(\frac{3}{11} + \frac{2}{22}\right) - \frac{1}{6} =$

$\left(\frac{3}{12} - \frac{3}{12}\right) + \frac{1}{7} =$

$\left(6\frac{1}{11} + 3\frac{2}{24}\right) - 3\frac{2}{6} =$

$\left(4 + \frac{1}{6}\right) - \frac{3}{6} =$

$\left(7\frac{3}{9} + \frac{1}{9}\right) - \frac{6}{18} =$

$\left(7 + \frac{3}{19}\right) + \frac{6}{12} =$

Stop here.

MATH TEST 7-8

Name: _____ **Date:** _____
Target: _____ **Time:** _____

a) Find the GCF for each pair of numbers.

15 and 7	7 and 11	51 and 39
6 and 12	630 and 240	10 and 45
19 and 30	121 and 70	25 and 20

---

b) Find the sums.

$\frac{3}{5} + \frac{4}{15} + \frac{1}{10} =$ $\qquad$ $4\frac{1}{6} + 3\frac{2}{24} + 1\frac{3}{12} =$

$41\frac{3}{9} + \frac{3}{27} + 6\frac{3}{18} =$ $\qquad$ $\frac{9}{15} + \frac{7}{45} + 6\frac{1}{5} =$

$\frac{11}{12} + 3\frac{3}{8} + \frac{2}{3} =$ $\qquad$ $\frac{7}{8} + \frac{1}{3} + 3\frac{5}{6} =$

---

c) Find the products.

$\frac{3}{10} \times \frac{5}{6} =$ $\qquad$ $\frac{7}{10} \times \frac{5}{14} =$ $\qquad$ $\frac{7}{14} \times \frac{6}{12} =$

$\frac{3}{11} \times \frac{9}{15} =$ $\qquad$ $\frac{6}{20} \times \frac{2}{6} =$ $\qquad$ $\frac{20}{60} \times \frac{30}{40} =$

Turn to the next page

d) Solve the equation.

$(\frac{3}{6} \times \frac{4}{5}) + \frac{1}{15} =$ $\quad$ $(\frac{7}{10} \times \frac{3}{5}) \div \frac{3}{5} =$

$(\frac{4}{9} - \frac{1}{18}) \times \frac{5}{15} =$ $\quad$ $(\frac{5}{15} - \frac{6}{15}) \div \frac{1}{6} =$

$(\frac{2}{11} - 3\frac{1}{11}) \times \frac{4}{5} =$ $\quad$ $(\frac{3}{6} \times \frac{1}{9}) + 3\frac{1}{5} =$

---

e) Write a mixed numeral for each improper fraction.

$\frac{7}{2} =$ $\quad$ $\frac{18}{5} =$ $\quad$ $\frac{121}{70} =$

$\frac{15}{2} =$ $\quad$ $\frac{45}{3} =$ $\quad$ $\frac{61}{21} =$

---

f) Solve the equations.

$4 \times \frac{1}{8} \times 2 \times \frac{1}{3} = n \times (\frac{1}{8} \times \frac{1}{3})$

$6 \times \frac{5}{11} \times 5 \times \frac{3}{5} = n \times (\frac{5}{11} \times \frac{3}{5})$

$5 \times \frac{3}{6} \times 4 \times \frac{1}{9} = n \times (\frac{3}{6} \times \frac{1}{9})$

Stop here.