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RELATIONSHIPS OF ACHIEVEMENT, MOTIVATIONAL VARIABLES, AND GENDER

by

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RELATIONSHIPS OF ACHIEVEMENT, MOTIVATIONAL VARIABLES, AND GENDER

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Abstract

This study investigated relationships among academic achievement, gender, mathematics self-concept, and causal attributions. Participants were 234 female and 204 male eighth-grade mathematics students and their 10 teachers. Teachers responded to a classroom environment measure and provided students' first term grades plus three quiz scores gathered over four months of school. At two times over this period, students responded to measures of self-concept and classroom structure. For each of three quizzes, students predicted their score and, after quizzes were returned, classified the score they received as a success or failure and then attributed causes for their performance. Individual interviews with 39 students extended these results.

Several predicted relationships were confirmed. Mathematics self-concept and mathematics achievement correlated positively for both genders after success and after failure. Males' mathematics self-concept was statistically significantly higher than females', although females' achievement was superior. Males were more likely to attribute success to ability.

There were some unique findings. Females attributed success to effort more than males on only one of three occasions. There were no gender differences in attributions to ability or effort following failure. It was expected that internal attributions would correlate positively with mathematics self-concept for females' and males' success and failure events. This expectation was confirmed for ability attributions after success and failure, and for effort attributions after failure. However, effort attributions

did not correlate with mathematics self-concept following success. In addition, it was expected that internal attributions would correlate positively with mathematics achievement for both genders. After success, females' ability attributions did correlate positively with all three mathematics quiz scores, but males' ability attributions correlated positively with only one quiz score. Effort attributions did not correlate with achievement following success. The hypothesis was confirmed for failure. It was expected that females would predict lower quiz scores than males. This was not confirmed.

Relations involving classroom environment subtests also were found. The social comparison scale was correlated positively with general and mathematics self-concept for males. Task organization correlated positively with general self-concept for females. The cooperation scale correlated positively with mathematics quizzes for females.

That males and females tend to ascribe mathematics success to different internal causes has implications for attribution retraining. Females ascribe success to effort, and their mathematics self-concept is lower than males'. It may be appropriate to redirect females' attention by noting that their mathematics achievement tends to be superior to males, and to suggest that personal ability may have played a more prominent role in this success.

Students who held a lower self-concept and tended to attribute failure to lower ability, could benefit from attribution retraining which included feedback redirecting causal ascriptions to lack of effort. Successful students, especially female students, tended to attribute success to ability. Attribution retraining is potentially beneficial for

these students as well. Higher ability students who do not exert optimal effort are courting failure.

Suggestions for future research include confirming the finding that there no gender differences were found in attributions to ability, effort, or studying after failure.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Overview

This dissertation examines the relationships among academic self-concept, achievement, and causal attributions for males and females engaged in meaningful learning tasks. This study extends the work of Marsh, Cairns, Relich, Barnes, and Debus (1984), and Marsh (1984) by examining the relation of these variables over time, with a specific focus on gender differences. Classroom structures are also considered.

The investigation includes three waves of measurement taken over a four month period while students studied the prescribed curriculum in Mathematics 8. Six types of data were collected: academic performance, perceptions about those achievement outcomes, attributions to which students ascribed their personal classroom success or failure, mathematics self-concept, estimates of general academic self-concept, and perceptions of the classroom learning structures. As well, a small group of students were interviewed to provide in-depth corroboration of results.

There have been some methodological limitations in the studies designed by researchers who wish to examine relationships between achievement and motivational variables. For example, academic self-concept and causal attributions have rarely been examined using students' school achievement. If empirical research is to advance theory for classroom instruction, it seems reasonable that the research should be situated in the school and use measures appropriate to classroom learning.

For this dissertation study, students' based their causal attributions on classroom assessment outcomes: therefore, the performance measure used in this study reflects students' classroom learning. Moreover, to date there has not been a longitudinal empirical investigation of relations among academic self-concept, causal attributions, and achievement that focuses on gender differences. The work described in this dissertation included all these aspects to derive information about students' desire to pursue academic tasks. The results should enhance understanding in the field, especially since the interrelations among variables were also investigated for gender differences.

This chapter introduces the study and describes the purpose and research questions to be investigated.

Background to the Study

Over the past two decades, the psychology of education has been influenced by motivation research that focuses on students' concept of self and attributions made about the source of success or failure outcomes. Researchers examining causal attributions (Ames, 1978; Ames & Felker, 1979; Covington & Omelich, 1979, 1985; Weiner, 1974, 1979, 1980, 1984) have found unique differences between students. For example, some students attribute success or failure outcomes to internal causes (ability or effort) and others to external causes (task difficulty or luck) (Ames, 1978; Ames & Felker, 1979, Covington & Omelich, 1979; Weiner, 1974, 1979, 1980, 1984). Other researchers have found statistical evidence of relationships between causal attributions and performance (Pintrich & DeGroot, 1990; Skinner, Wellborn & Connell,

1990: Wentzel, 1989), such that high achievers tend to attribute success to internal causes and low achievers tend to attribute failure to external causes. Woudzia (1991) noted differences between genders in attribution patterns. One might expect that females typically ascribe failure to an internal cause such as low ability, while they ascribe success to an external cause such as task ease. For males there is a greater tendency to select internal causes in success situations.

Researchers have also established that statistical relations exist between self-concept and academic performance (Marsh, 1990b; Marsh, 1992). Again, the pattern of correlations has been found to differ by gender (Byrne & Shavelson, 1987).

The integration of these two fields of research has yielded correlations between self-concept and causal attributions (Ames, 1978; Ames & Felker, 1979, Covington & Omelich, 1985; Craven, Marsh & Debus, 1991), with different patterns being observed for each gender (Ames, 1978; Ames & Felker, 1979, Covington & Omelich, 1979; Woudzia, 1991). In addition, intercorrelations have been established among self-concept, attributions, and achievement (Marsh et al., 1984; Marsh, 1984; Marsh, Walker, & Debus, 1991; Powers, Douglas, Cool, & Gose, 1985).

Thus, the empirical work has produced evidence of connectedness among motivational variables. The concern for this dissertation is to more clearly define how these variables interrelate with performance in an academic domain. The empirical work integrating self-concept, attributions, and achievement has been conducted in the absence of an overarching theory which addresses both individual and gender differences. Consequently, to date, gender differences have not been adequately

investigated. Wigfield and Karpathian (1991) have called for research that explains the interrelating variables. It seems useful to include an examination of gender differences in the investigation.

Education covers many domains of knowledge. Interpretations drawn in one subject area may not be appropriate to another content domain, and precepts that hold within a specific domain may not hold for learning in general. The data in this dissertation have been gathered from students as they engaged in mathematics learning, and the probes were framed to elicit information about students' motivation to learn mathematics. Although the goal of research in student motivation is to contribute to a theory of motivation that applies across academic domains, this study focused on mathematics. Since academic self-concept and achievement were investigated in this research, the information was directed towards how these variables influence causal attributions in mathematics.

Methodological Considerations

Subject-Specific Measures

Psychological research in education that has an academic achievement component should be subject-specific; it is not the general nature of influencing factors that should be measured. For instance, if a researcher is interested in self-concept, causal attributions, and mathematics achievement, the motivational variables should be oriented to mathematics. To investigate relations among these variables, one should use instruments to measure mathematics self-concept and mathematics causal attributions (Marsh, 1984; Marsh et al., 1984; Marsh, 1990b; Marsh, 1992). This

orientation has not been common in motivation research. Until recently researchers tended to treat self-concept as a unitary construct. Using instruments based on this assumption (i.e., Piers-Harris) empirical research failed to establish strong relations between self-concept and academic achievement (Byrne, 1984). This is a methodological problem that Marsh et al. (1984) remedied by implementing academic-specific measures. Collecting measures of verbal, mathematics, and general self-concept, Marsh (1992) was able to produce empirical results which establish that verbal, mathematics, and general academic self-concept are related in differing ways to achievement. Although some relations were found between academic domains, the clearest relations were within academic domains. For instance, although verbal self-concept was found to have a modest relation with mathematics achievement, mathematics self-concept was found to be a much stronger predictor of mathematics achievement.

Classroom Ecology

Education theory is practical theory that is concerned with classroom learning. Thus, research aimed at explaining the influence of academic self-concept and achievement on causal attributions should be conducted within classroom settings. To date, few researchers have adequately examined these relationships in meaningful classroom environments. In some instances, students have been asked to respond to hypothetical situations and ascribe causal attributions to imagined others (Ames, 1978; Ames & Felker, 1979; Covington & Omelich, 1979; Marsh et al., 1984), in what Marsh (1984) has termed situational studies. In situational studies, researchers supply

structured scenarios and ask subjects to make attributions for hypothetical others. In other forms of attribution research students have been asked to make predictions about their ability to complete a learning task (Marsh, Walker, & Debus, 1991). Marsh (1984) has categorized this second type of attribution study as dispositional research, since researchers present ambiguous scenarios and ask subjects to make attributions for themselves.

Marsh made a general criticism of research that lacks a direct connection to classroom learning. He has also questioned the validity of situational research because individuals attribute affect to others. In his own attribution/self-concept research, Marsh has conducted academic-related dispositional studies in which a student may be asked to imagine attributions they are likely to make when experiencing failure on a mathematics test. His attribution instrument was the Sydney Attribution Scale comprised of 60 brief scenarios prompting students to imagine experiencing success or failure. The results of this work provided seeming support for content-specific attributions, but the conclusions are subject to criticisms on methodological grounds. Although the connection between attributions that a student makes to dispositional stimuli and those made when a student experiences actual personal academic failure may be congruent, empirical research in a classroom would provide better evidence for a strong theory of motivation to learn.

If we are to draw implications for learning, more ecologically valid evidence would be gathered from students responding to real-life achievement events based on meaningful tasks within a school setting. The attributions that are reported would be

the ones that are experienced, rather than imagined. In order to be confident in the validity of the attributions that students make, one must be sure that students find the stimulus situation meaningful. It seems reasonable that succeeding or failing in school would have greater meaning to students, would be more highly valued, and act as a more reliable stimulus for students making causal attributions. Including personal achievement outcomes would overcome another flaw of hypothetical scenario-based investigations which ask students to imagine causal attributions for failure outcomes. For high-ability students, imagining failure may be pure supposition since they may not have or only rarely experienced failure in some academic areas. The same could be said about the logic of asking low-ability students to imagine academic success. Asking them to imagine a response to an unfamiliar situation is not likely to yield reliable data. Such data can provide only weak support for a theory.

Another methodological flaw found in published research is the use of inadequate and inappropriate measures (Meece, Blumenfeld, & Hoyle, 1988). For example, the use of standardized measures of achievement, as in Marsh's (1984) study. With standardized tests there is no way of knowing that the knowledge sampled by the questions is congruent with the instruction students have experienced. Since the test does not evolve from instruction, a poor curricular fit is likely. When one wishes to assess students' knowledge or abilities in an academic area, it is more appropriate to use measures with which students are familiar and which are directly related to their instruction. The reasonable and practical solution is to choose measures developed by teachers. According to Doyle (1983), more ecologically-valid

indicators of performance are those used regularly in the classroom, namely, "seatwork assignments, quizzes, teacher-made tests, lab problems, essays, and reports" (Pintrich & De Groot, 1990, p. 34). Although, this course of research has been counselled by Marsh, he may be criticized for failure to conduct research within the classroom using meaningful learning related tasks as well as classroom achievement measures.

The design of the current study has followed the path advised by Marsh, and has also been influenced by the work of Woudzia (1991). Woudzia conducted a construct validation of Weiner's theory of students' internalized motivation system (1986). Weiner hypothesized that persons differ along attribution dimensions according to their self-concept such that high self-concept individuals would attribute success to innate high ability and failure to unstable causes, whereas low self-concept individuals would attribute success to unstable causes and failure to low ability. Woudzia's work serves as a model since the achievement stimulus that he used required each subject to respond to an actual failure or success event they experienced in the course of regular classroom learning. Teachers returned test results to students and students indicated whether they perceived they had successfully mastered work on the previous mathematics unit. Woudzia then administered the attribution instrument which measured how students ascribed their success or failure to effort, ability, task difficulty, and luck. The significance of Woudzia's study was that students were enabled to impute causation for their own academic work. Two considerations that were not fully explored by Woudzia, but are given consideration in the current study, are self-concept as a motivating variable and gender differences.

One final variable to be considered in the present research is classroom learning structure. In addition to classroom measures, researchers examining attributions, self-concept, and achievement have not paid adequate attention to the classroom environment and its potential relation to the kinds of attributions made concerning success or failure. The classroom environment can play a role in the perceptions of students' abilities (Marshall & Weinstein, 1986; Reuman, 1989). For example, Rosenholtz and Wilson (1980) found that students were more likely to hold shared ability perceptions in "unidimensional" classrooms which have more frequent opportunities to make ability comparisons. The classroom environment can also influence students' academic self-concept. Simpson (1981) found more stratification of self-concept in unidimensional third-grade mathematics and social studies classes than in similar classes which teachers had organized to permit more multidimensional structures. While some researchers, such as Woudzia (1991) and Ames (1978), have taken classroom environments into consideration, most research has not.

In this dissertation, classroom ecology has been taken into account by obtaining descriptive information from teachers about how teaching is conducted and by gathering corroborating evidence from students. This provides a broader foundation for understanding relations among self-concept, academic achievement, and causal attributions in a classroom setting.

Purpose

Attribution research has sought to examine the interplay of attributions with other variables that affect motivation, such as self-concept. Using the Piers-Harris

Self-Concept Scale, Ames (1978) and Ames and Felker (1979) found that self-concept was correlated with attributions that children made under conditions of both failure and success. High self-concept children attributed success to high levels of personal ability more frequently than low self-concept children. Low self-concept students more frequently attributed their success to luck. In terms of failure, high self-concept students had lower perceptions of their ability than low self-concept students. Covington and Omelich (1979) found different results with a group of undergraduate psychology students in that there was evidence that self-concept influenced attributions following failure, but the determining factor was the degree of effort that had been exerted to complete the task.

Self-concept researchers have studied the relationship among academic self-concept, causal attributions, and achievement. Marsh et al. (1984), in a sample of fifth graders found positive correlations among ability, effort, and self-concept under successful conditions and negative correlations under failure conditions. Achievement in reading was statistically correlated with reading self-concept and with reading attributions. In addition reading attributions, reading self-concept, and reading achievement were all interrelated. Similar results were found in a study conducted by Marsh (1984) with respect to mathematics. Although work has been done in the form of relations among the three variables, there is a need for additional research that considers gender and examines the implications for learning and teaching.

The purpose of this dissertation is to examine relations among student performance, one dimension of academic self-concept (mathematics), and eighth-

grade students' causal attributions (Weiner, 1986) over a four month period. The study extends the work of Marsh, Cairns, Relich, Barnes, and Debus, (1984), Marsh (1984), Covington and Omelich (1979), Ames and Felker (1979), and Ames (1978) by including classroom-relevant assessment measures in a domain-specific investigation of motivational variables. A secondary purpose is to examine gender differences with regard to the three variables. The terminology and dimensions of attributions used in this research rely on definitions made by Weiner (1986). The attribution research was ecologically more valid in that it was neither situational nor dispositional. Students made causal attributions for stimuli that were actual performance results from a regularly-assigned classroom task. The measures of academic work also had ecological validity, since the performance measure used was created by the teacher to assess students' learning in the classroom. Academic self-concept regarding mathematics was represented by the latest version of the Academic Self Description Questionnaire (ASDQ-II) developed by Marsh (1990a). The causal attribution instrument used was designed by Woudzia (1991).

To expand understandings of interrelations among self-concept components and motivation, Wigfield and Karpathian (1991) have suggested that the validity of questionnaire research could be enhanced by employing other measures such as observations of student performance, ratings by teachers and parents, and open-ended interviews that permit students to provide self-reports about what they are doing and why they are doing it. Collecting information from all participants in the learning environment would provide a better understanding of relations between affect and

motivation by plotting connections and influences among mediating variables. In the present study, hypothetical scenarios were presented to a small sample of students in an interview setting to allow a closer examination of causal attributions, self-concept, and achievement with respect to gender.

Research Questions

In this dissertation the following questions were addressed.

- What is the relationship between mathematics self-concept and attributions about the cause of academic performance?
- What is the relationship between mathematics self-concept and academic performance?
- What is the relationship between causal attributions and academic performance?
- Are there gender differences in the patterns of these relationships?
- What is the relationship between mathematics self-concept and achievement with causal attributions across time?
- What is the relationship of the classroom environment with these variables?

These questions form the foundation for the empirical investigation. Hypotheses that arise from these research questions are stated in Chapter two.

CHAPTER 2

REVIEW OF THE LITERATURE

Overview

This dissertation examines relationships among mathematics self-concept, mathematics achievement, and causal attributions. These variables are defined in this chapter and research related to the focus of this dissertation is reviewed. Most of the research discussed in this chapter shows relations between achievement and causal attributions. A few articles add self-concept to the examination of achievement and attributions. The second section of the chapter organizes the self-concept and achievement literature in terms of gender differences, which are of special concern in this dissertation. The research reviewed here suggests that connections can be established among these variables, and that these connections are different for boys and girls. The final section describes literature about instructional practices within the classroom environment which may influence motivational variables.

Definition of the Motivational Variables

Motivation as used in the psychology of learning is bound up in the use of motive, which "must be the reason why he acts" (Peters, 1958, p. 36).
The usefulness for educators of the term, motivation, lies in the possibility of explaining why some students learn well and pursue learning in school, while others do not. Motivation has both positive and negative components and a clear understanding of the concept may answer "higher level questions about the conditions which facilitate

and hinder learning such as goal-directed sequences and which account for individual differences in goal-directedness" (Peters, 1958, p. 156).

The three traditional behavioral indicators of motivation are: choice of task, level of cognitive engagement in the task (usually inferred from behavioral indicators), and willingness to persist at the task (Pintrich, Marx, & Boyle, 1993). Motivational variables are constructs which influence one or all three of the indicators. Mathematics self-concept has an influence on motivation in the sense that students with a perception of low ability in mathematics may not choose challenging tasks, they may fail to apply their full faculties to learning, and they may not sustain the learning task for sufficient duration to achieve success. Thus, the level of motivation is low when the individual is not directed towards the goal of success at the academic task. Low levels of academic self-concept are associated with low levels of motivation, for individuals who perceive their ability to be inadequate for the learning task.

Causal beliefs are bound up in the self-concept component. As stated above, self-concept influences the three traditional behavioral indicators. Self-concept rests on the evaluations made by individuals about the cause of outcomes. When academic failure occurs, this incident provides a fact that the student assesses by asking the questions "Why did I fail?" When the student makes a judgement that personal mathematics ability is inadequate to succeed at the task, this causal analysis provides for the low mathematics self-concept described above. Thus, causal beliefs affect academic motivation through perceptions of academic self- concept.

The following section clarifies the terminology used in the dissertation, in particular academic self-concept and causal attributions.

Academic Self-Concept

"Academic self-concept is remarkably subject-specific" (Marsh, 1990a, p.623). Shavelson, Hubner, and Stanton (1976) identified general self-concept as a person's perceptions of self in all avenues of life. From the general definition, Shavelson and Bolus (1982) derived an operational definition for academic self-concept as one's perceptions of ability in specific school subjects. How students conceive their personal ability in mathematics is the focus of the current investigation. For education theorists, an important empirical distinction between general and academic self-concept is that academic self-concept is more highly correlated with performance outcomes such as academic achievement (Marsh, 1990a; Marsh, 1992; Marsh, Byrne, & Shavelson, 1988). This follows Marsh (1990a), who found no significant correlations when general self-concept scales from three different instruments were correlated with school grades in English, mathematics, and overall grades. In contrast, the same academic outcomes were substantially correlated with three academic self-concept scales. While weak relations across academic self-concepts and verbal skills have been found, mathematics skills are clearly related to mathematics self-concept (Marsh, 1992). This result was the basis for the quote that begins this paragraph, and led Marsh to counsel the use of self-concept scales specific to the subject matter under investigation.

The view of self-concept has thus evolved from a unidimensional construct that influences all areas of learning into a multi-faceted hierarchy, a pyramid with the general component surmounting numerous lower-level academic and non-academic constituents. From this conceptualization it follows that researchers who are interested in mathematics outcomes should use measures that focus directly on mathematics self-concept. In this study the mathematics and general subscales of the Academic Self Description Questionnaire (ASDQ) which Marsh developed in two different forms for lower and upper intermediate grade students was used.

Attribution Theory

Weiner (1979) defined attributions as causal beliefs students hold about reasons for success or failure. In the academic domain, these attributions present an answer to the question, "Why did I succeed or fail on this task?" The most frequently-reported causes stem from effort, luck, ability, or difficulty of task (Weiner, 1986). In classroom achievement terms, a student who is unsuccessful on a test may attribute the cause to bad luck, insufficient effort, low ability, or the fact that this test was too difficult. With successful results, a student may attribute the result to good luck, trying hard, high ability, or an easy test. In essence these attributions represent a causative analysis an individual makes about personal academic progress.

It is important to note that success and failure are constructs relative to each person. Each student evaluates achievement outcomes according to a personal metric. For example, to high-achieving students, a passing grade, or even an excellent

grade, may not be considered a success outcome. Conversely, for low achieving students a low or even a failing grade may be considered a success outcome.

The causes to which students attribute their experiences can be characterized along dichotomous dimensions as internal or external, controllable or uncontrollable, and stable or unstable. Ability , for example, would stem from stable, internal, and uncontrollable causes whereas effort would stem from unstable, internal, and controllable causes.

Affects are associated with causal attributions about sources of success or failure. When a student exerts a great deal of effort on a task and fails, the outcome is likely to be perceived as evidence of low ability. Low-ability perceptions are likely associated with feelings of humiliation for failure to master a valued task. For the student who does not exert the effort a task requires, shame is the likely affect that a student would feel upon failure. The affect for success events would be pride and surprise. A student who attributes success to internal causes of high ability and high effort would be expected to experience pride on succeeding. A student is likely to be surprised at success if the effort expended was thought to be inadequate for the task (Weiner, 1984). In the current study, affect was investigated during interviews by asking students to supply the emotion that they deemed appropriate for an achievement outcome, either success or failure, under 18 different conditions.

An integrated theory which explained the relations among causal attributions, academic self-concept, and achievement would have both prescriptive and generative benefits. Knowledge about attribution patterns that students are likely to make in

achievement situations opens the field for prescribing appropriate cognitive interventions that teachers may make to encourage students to work harder and continue learning. An example of redirecting feedback that a teacher could offer to a student experiencing difficulty is, "I know this task seems difficult now, but you have the ability to learn it if you continue giving it your best effort." Redirecting students' attributions from ability to effort thus have significant societal benefits as more students work harder, more students experience success, and failure outcomes become less of an impediment to advancement, as students come to view difficulty as an expected feature of a task which may be overcome through sustained effort. This view is an expression of generativity -- the desire of educationalists to make the world a better place by improving schooling.

Critics could discount such an utopian view, since human motivation is mediated by many factors. However, from the stand point of this author, the sanguine view is that determining which factors are significant will give us a better understanding of student learning.

Self-Concept and Causal Attributions

Ames (1978) examined relationships among self-concept, causal attribution, and self-reinforcement under competitive and noncompetitive reward structures in a sample of 112 fifth graders. Students were categorized as high or low in self-concept based on the Piers-Harris Self-Concept Scale. Controlling for both gender and self-concept, students were randomly assigned to success or failure outcomes in either competitive or noncompetitive reward structures. Student pairs worked on contrived picture-

tracing puzzles that resulted in one student succeeding and the other failing to complete the task. In the noncompetitive condition all students were allowed to select a reward whereas in the competitive condition only students with the highest number of correct completions were given a reward. Students were asked to analyze their own performance and also that of their partner in terms of contributions made by effort, luck, ability, and task difficulty.

Results indicated that high self-concept students attributed success to ability more frequently than did low self-concept students. In addition, the high self-concept students experienced more pride following success than low self-concept students following success. Under competitive conditions high self-concept students made more attributions to ability than high self-concept students in noncompetitive conditions, whereas the reward structure did not influence attributions made by low self-concept students. Feelings of pride did not differ significantly among high self-concept students in either of the two conditions. In terms of failure, high self-concept students had lower perceptions of their ability than low self-concept students in both reward structures. Low self-concept children had lower ability perceptions in the noncompetitive condition than the competitive one. The results indicated that self-concept was correlated with attributions that students made under conditions of both failure and success.

Using the same task as Ames (1978), Ames and Felker (1979) examined the relationships among self-concept, causal attributions, and self-reinforcing behaviours under conditions of success and failure within a sample of 64 sixth-graders classified

as either high or low self-concept as measured by the Piers-Harris Self-Concept scale. After a task outcome, students used a pie-graph to indicate how they would apportion the cause of their success or failure to either luck or skill. Feelings of social affect were measured by self-criticism and self-congratulatory statements.

Ames and Felker (1979) found that high self-concept students attributed skill as the cause of success more often than low self-concept students, who frequently attributed their success to luck. In failure situations no differences were found between the two groups' attributions. That students in both groups attributed failure to low effort was an unexpected result. In success situations, high self-concept students reacted with more self-congratulatory statements, whereas low self-concept students tended to react to failure situations with self-criticism. The results lend support to the hypothesis that self-concept influences causal attributions, especially in success situations.

Exactly how this influence occurs is not clear. Some researchers have proposed that affective responses are somehow involved. Covington and Omelich (1985) examined the relationship of self-concept and causal attributions to feelings of shame and humiliation. Their sample of 1,026 undergraduate psychology students was assessed with two measures following hypothetical examination failure. These included a brief version of the Michigan State Self-Concept of Ability Scale and self-ratings of perceived ability and degree of guilt, humiliation, and shame. Students were randomly assigned to vignette conditions according to four categories of perceived ability and degree of certainty; high ability/certain, high ability/uncertain, low ability/certain, and low ability/uncertain. In these vignettes degree of certainty about ability perceptions

was related to level of effort associated with the outcome. The high ability/certain condition presented a success vignette where the character had not studied. The high ability/uncertain vignette was a success outcome following intensive studying. The low ability/certain condition presented a character who also studied intensively but failed on the examinations. The fourth condition low ability/uncertain was a failure event where the character had not studied, leaving doubts as to whether the cause was low ability or low effort.

Results for high ability conditions showed that low self-concept students perceived failure as due to incompetence more often than high self-concept students. Moreover, in high-effort conditions, low self-concept students had greater feelings of humiliation. Because only weak relationships were found, Covington and Omelich warned that these results should be treated with some caution. They did not differentiate between high, and low self-concept groups in subsequent analysis. The factor mediating the relation self-concept had on attributions after failure seemed to be the degree of effort that had been exerted to complete the task. Students' ability conceptions were influenced by the level of effort. Thus the student who failed after exerting optimal effort developed a self-concept of low ability.

If perceived effort has a mediating role in the formation of self-concept, it seems reasonable that experiments designed to improve student self-concept would include information of effort exerted as feedback information. Craven, Marsh, and Debus (1991) attempted to strengthen self-concept in mathematics and in reading by giving performance and attributional feedback to 162 low self-concept students. Subjects

were selected from a pool of students in grades 3 through 6 who scored below the top quartile on the Self Description Questionnaire (SDQ). Students were given the Sydney Attribution Scale and school-devised tests, then matched and paired by level of academic self-concept, sex, and age. Paired students were assigned to control or one of three experimental treatments; administered by the teacher, the researcher, or the teacher and researcher combined. The researcher-administered treatment involved feedback statements about student's strengths in reading and mathematics, and attributional feedback statements relating success to high levels of either effort or ability, and failure to lack of effort. In teacher-administered treatment groups, students received the two types of feedback from the teacher. In the combined group, students received both types of treatment. Assigned mathematics and reading tasks corresponded to ability levels of students in the experimental groups. The lessons for the control group continued with the feedback typical for their classes.

Self-concept was strengthened in the researcher-administered group. Analysis of covariance revealed modest enhancements in several areas, including the target academic areas of reading and mathematics, but the effects were also positive for school self-concept, academic self-concept, general self-concept, and peer self-concept. No effects were noticeable for nonacademic self-concepts. In the combined group, students' self-concept was enhanced to the same extent as that of the researcher administered group. No significant enhancement of self-concept occurred in the teacher-administered group. Effort attributions increased after success situations for students who received the researcher-administered intervention. The treatment did

not affect self-attribution total scores. The intervention period was short, which led Craven et al. (1991) to comment that stronger results might have been found with a longer treatment period. This study gave some evidence that academic self-concept may be enhanced by providing students with positive information about their academic strengths while redirecting failure attributions to insufficient effort. This approach holds promise for the benefits of attribution retraining.

The research which has examined both self-concept and causal attributions has found evidence that self-concept is correlated with causal attributions for success and failure conditions. The relations involve a tendency for high self-concept students to attribute success to ability. These students feel greater pride about their accomplishments than their low self-concept peers, especially in competitive situations. High self-concept students have also been found to attribute their failure to low ability, indicating a relation to internal causes (Ames, 1978).

Low self-concept students display differing attribution patterns. After they experience success, they frequently attribute success to luck, indicating a tendency to perceive the outcome as due to some external factor which they cannct control. Again self-concept has been shown to be correlated with causal attributions especially in success conditions (Ames & Felker, 1979). For failure, the connections are less direct. The strength of the relation between self-concept and causal attributions seems to be mediated by student perceptions of the degree of effort exerted to accomplish the learning task (Covington & Omelich, 1985).

The implication of these findings for instruction has to do with attribution retraining. Although only researchers' feedback was associated with improvements, there is evidence that when students are given specific feedback attributing outcomes to effort or ability, and failure to effort, mathematics self-concept can be enhanced. Both effort and ability are internal causes, but they differ in terms of controllability. It seems reasonable to inform students that success is attainable if the appropriate effort is exerted and that insufficient effort is associated with near-certain failure. If the attributional feedback focuses on effort exerted in a failure outcome this short-circuits one tendency of low self-concept students' to ascribe failure to the uncontrollable internal cause, low ability. This tendency seems detrimental to self-concept formation. The attributional feedback thus serves two purposes, both with positive implications for motivation. Students are less likely to perceive failure as evidence that their ability is low, and they are more likely to perceive success as possible if appropriate effort is exerted. Thus avoiding the low ability perception, sidesteps the causal analysis that might have implications for lowered self-concept. Maintaining self-concept implies that motivation will be sustained as indicated by willingness to engage in learning, and persistence to complete tasks.

Self-Concept and Achievement

The previous section focused on the pair of motivational variables, self-concept and causal attributions. The research discussed in this section covers recent studies which investigated the relationship between self-concept and academic achievement.

In a study examining relationships between academic self-concept and academic achievement, Marsh (1990a) began collecting longitudinal data in the tenth grade following students through the eleventh and twelfth grades, to one year after high school graduation. Academic ability measures collected in grade 10 included IQ, vocabulary, reading comprehension, and mathematical reasoning. Students reported their previous years' average grades (as letter grades) in grades 10, 11, and 12. Students assessed their own academic self-concept in grades 10, 11, and one year after graduation by replying to three self-rating questions about school ability, intelligence, and reading.

Students' grade-point averages reported in grades 11 and 12 were significantly correlated with prior self-concept. Although the results were statistically significant, Marsh (1990a) reported two limitations of the study; the use of a single measure of academic achievement, and the categorization of self-concept as unidimensional when recent evidence indicates multidimensionality (Marsh, Byrne, & Shavelson, 1988).

These limitations were addressed in a subsequent study (Marsh, 1992). Academic achievement for 507 boys in grades 7 through 10 was examined across eight subject areas. In this study, self-concept was measured by the Academic Self Description Questionnaire-II, which contained 14 scales corresponding to the subjects studied. School grades for each of two semesters for each subject area were collected as indices of achievement.

Results provided evidence for the logic of examining mathematics self-concept and its relation to mathematics achievement. Domain-specific academic self-concept

was related to achievement within that domain, suggesting that self-concept is subject specific. The implication of this research is that an examination of self-concept in relation to academic achievement should not rely on a general self-concept measure, rather it should be within the area of achievement being studied. In other words, in the area of mathematics achievement one must examine mathematics self-concept and its relation to mathematics achievement.

Motivational Variables and Achievement

The research discussed in this section is about the relationship of mathematics achievement and motivational variables. Pintrich and De Groot (1990) involved 173 seventh-graders in a correlational study of self-regulated learning, academic performance, and motivational orientation (self-efficacy, value of task to student, and student feelings toward the task ie., test anxiety). Measures included a self-report questionnaire with items pertaining to "student self-efficacy, intrinsic value, test anxiety, self-regulation, and use of learning strategies" (p. 33) and classroom tasks such as homework, quizzes, and essays in science and English.

Although intrinsic value of the task was strongly related to self-regulation and use of cognitive strategies, it was not found to have a direct relation to performance regardless of prior achievement level. Self-regulation, self-efficacy, and test anxiety were the motivational variables which Pintrich and De Groot found to be most reliably related to academic performance.

Academic performance as measured by GPA across mathematics, English, science, and social studies was the focus of Wentzel's (1989) study. For 203 ninth-

through twelfth-grade students, achievement was related to goals (non-academic as well as academic), and cognitions (self-referent and social). A Goal Questionnaire included a three-point scale to assess students' effort to achieve goals, (strength of goal and perceived ability of attaining it), self-referent and social cognitions (perceived opportunity to attain goal, obligation to attain the goal, and perceived teacher expectations that the student would attain it).

Efforts to achieve were measured by items that examined the use of metacognitive and effort management strategies. They included students' willingness to work diligently and persist with tasks perceived to be boring. A typical item query was, "Even when study materials are dull and interesting, I keep working until I finish." (Pintrich & De Groot, 1990, p. 35).

Achievement as measured by GPA was significantly and positively correlated with student reports of effort to attain single learning goals and a significantly negatively correlated with "trying to have fun." To look at the correlations between GPA and efforts to attain multiple goals, students were divided into high, medium, and low achievement groups. The types of goals students reported trying to attain differed between groups. Correlations revealed that GPA was related to social interaction goals for low GPA students, goals pertaining to social interaction and social responsibility for medium GPA students, and goals pertaining to learning and social responsibility for high GPA students. Self-referent and social cognitions were correlated with academic and non-academic types of goals. Perceived ability had the strongest relation to effort across all goals. This study supports the suggestion that GPA is a good indicator of

efforts to achieve in learning situations and that perceived ability predicts effort to achieve learning goals.

Meece, Blumenfeld, and Hoyle (1988) postulated a goal mediational model as a valid means for understanding how individual and situational variables influence students' cognitive engagements during science activities. In this model, goals are behavioral intents that explain variations in cognitive engagement during learning. Goal orientations are assumed to mediate the effects of individual and situational variables. The relationships examined among different kinds of goals included task-mastery "in which students sought to independently master and to understand their work" (p. 515), ego or social goals "in which students sought to demonstrate high ability or to please the teacher" (p. 515), and work-avoidant goals "to get work done with a minimum amount of effort" (p. 515). Meece et al. (1988) predicted that there would be a positive relation between task-mastery goals and students' ratings of their academic competence and also their intrinsic motivation towards school learning. Differences in ability perceptions and intrinsic motivation were examined in order to determine if individual characteristics predispose a student to adopt a particular goal orientation. The expectation was that students' goal orientations would directly influence cognitive engagement in science activities.

The hypothesis was only partially confirmed. Individual difference variables were mediated by task-related goal orientations to some extent. In a path model, intrinsic motivation correlated directly with engagement patterns, and indirectly with goal orientations. Students reporting greater intrinsic motivation to learn placed a stronger

emphasis on task-mastery goals, and students who emphasized task-mastery goals reported more active cognitive engagement in learning activities. This study provides support for goal mediation models which suggest that learners interpret academic learning situations according to personal needs, values, and perceived abilities. An important finding for the present dissertation was that a general measure of academic ability did not contribute to the equation predicting students' goal orientations and cognitive engagement. Therefore, in the current research the achievement measures were specific to the students' classroom achievement tasks.

Another student perception that bears on the learning situation is the degree of perceived control by students. Perceived control was defined as consisting of three sets of beliefs: strategy beliefs, or the factors needed to succeed in school; capacity beliefs, or students' perceptions of whether they possess the necessary factors; and control beliefs, or predictions about the possibility of academic success. Perceived control and its relation to cognitive task performance was investigated by Skinner, Wellborn and Connell (1990). They found a direct relation between students' beliefs in whether they have the power to exert control over the learning situation and their performance. They hypothesized that teacher involvement (student perceptions of teacher empathy) and contingency (student perceptions of the clarity of teacher expectations and consistency of behaviour) influence children's perceived control of their academic achievement. This process model describes a situation in which teacher involvement allows students to perceive that they have greater control over their own learning.

For the 200 elementary students aged 9 to 12, a battery of measures were given and/or collected including the Rochester Assessment Package for Schools; the Perceived Control Scale (measuring strategy beliefs, capacity beliefs, and control beliefs); the mathematics and reading subtests of the Stanford Achievement Test; grades from previous year in mathematics science, social studies, reading, spelling, and language; a teacher-rated measure of student engagement or disaffection with class participation and attitudes; and a Perceived teacher context scale (student rating of contingency and involvement).

A direct, but weak relation was found between achievement and perceived control which led to the suggestion that controllability is a dimension that influences student success. If the locus of control is perceived as internal, students are more likely to exert effort. Because the relation was not large, one might assume that the influence of perceived control is not great. However, Skinner et al. (1991) suggested that the analysis may have underestimated the relationship because perceived control may also have been related to cognitive engagement in learning tasks. Skinner et al. (1991) suggested that perceived control may have interacted with two other self-system processes, perceived autonomy and affiliation with the teacher and other students. All three systems should be maximized in an ideal learning environment. They further surmised that since there are three self-systems, then the effects of a low level in one area may be countered by high levels of other self-systems. In learning situations where students perceive that they have limited capacity to control success or failure, academic engagement may still increase if the other self-systems are

operating, such that students have high perceptions of autonomy or feel a connection to teachers.

Internal causes and self-regulation were examined for 110 gifted secondary students whose mean age was 16.4 years (Powers, Douglas, Cool, & Gose, 1985). The study examined the eight attributions for success/failure described by Weiner (1980) with achievement motivation in mathematics (assessed by the Achievement Motivation Scale), while controlling for effects from anxiety and self-esteem.

The results lend support for Weiner's theory. "Apparently those who attribute their success to effort tend to have a greater achievement motivation" (Powers et al. 1985, p. 752). Effort was found to correlate positively with achievement motivation after success, and negatively after failure. Although, Powers et al. (1985) reached this conclusion, it is interesting that they did not investigate students' real achievement. Between-sex differences (t-test) were not significant. Self-esteem correlated with mathematics ability in both success and failure outcomes. After failure, self-esteem also correlated with task difficulty. Correlations between self-esteem and other attributions were not significant.

No correlations were found for self-esteem and anxiety with achievement motivation. Effort attributions for success in mathematics correlated with achievement motivation. Attributions to lack of effort in failure correlated with achievement motivation. For this sample of gifted students, attributions to effort had a noticeable relation to achievement motivation, but correlations with other attributions were not significant. Powers et al. (1985) concluded that neither self-esteem nor anxiety

contributed greatly to the correlations among effort attributions of mathematics success and failure and achievement motivation.

Interventions may change the pattern of attributions made by students. When Schunk (1982) examined relationships among effort, self-efficacy, and mathematics achievement with 40 seven-year-olds he included a treatment in which students were given feedback about attributions. Two pretest instruments were used, an arithmetic skill test and a self-efficacy scale. After an initial treatment session, in which students worked on an instructional subtraction packet, they were assigned randomly to four treatment groups. In one group (past attribution treatment), students were given effort-related comments in the past tense (i.e., "You've been working hard" p. 551) after students replied to a question about the page they had been working on. The future attribution group received comments related to future effort, "You need to work hard" (p. 551) after students indicated the page they were working on. The third group, were monitored in the same way as the other two treatment groups, but received no comment by the proctor after identifying the page they were working on. The control group received no training beyond the initial instruction package.

The monitoring group who did not receive attribution comments was the only group that did not show a significant increase on the mathematics posttest. The past attribution groups performed significantly better than the other groups ($p < .01$). Past attribution was the only treatment shown to have an effect on arithmetic efficacy. Students in this treatment were also more persistent. They completed significantly more problems than the future attribution, or training control groups.

Task involvement, skill development, and perceived arithmetic self-efficacy were all improved by providing students with specific attributional feedback showing the connection between prior achievement and individual effort they expended to learn (Schunk, 1982). Schunk's results provided support for a positive relationship linking effort attributional feedback with self-efficacy and mathematics achievement.

Attributional feedback and skill-training also had a positive effect on achievement for 84 learned helpless sixth graders (Relich, Debus, & Walker, 1986). Instruments used included the Arithmetic Specific Attribution Scale (ASAS), a division skills test, a time-on-task measure, a self-efficacy measure, and a learned helplessness index. There were four treatment groups including: modelling, self-instructional practice, modelling with attribution, and self-instructional practice with attribution; and a control group. In the modelling group the students watched the experimenter solve division problems for 5 to 10 minutes at the start of the class. This was followed by practice and self-directed mastery. In the self-instructional practice group the experimenter reviewed the instructional booklet for 5 to 10 minutes. Students then tried to solve problems with restricted feedback. In two attribution groups students followed similar procedures, but they also received 10 to 15 minutes of attribution retraining statements relating outcomes to effort or ability.

Compared to the control group, there was a significant increase from pretest to posttest for all treatment groups on the achievement test and on the self-efficacy measure. The two attribution groups also showed a significant improvement on the indices of learned helplessness and persistence. Persistence also improved for the

modelling group. The primary goal was to improve student achievement. That this occurred along with an improvement in self-efficacy suggests that there is an interrelationship between self-efficacy and causal attributions. The learning implication may be that achievement is not directly mediated by students' attribution information. Attributional feedback may be treated by students as evidence of improved self-efficacy which in turn has an effect of improving achievement. Although positive results were found only for the skill training groups, the results were enhanced when attribution retraining was included, such that self-efficacy perceptions improved, while feelings of learned helplessness declined. Relich et al. (1986) concluded that training students in both skills and attributions helps to reduce learned helplessness.

In their study of attributional feedback about students' effort and ability, Schunk and Rice (1986) included an examination of relationships with reading achievement, attributions, and self-efficacy for a sample of 40 fourth- and fifth-grade remedial readers. Subjects were given a self-efficacy measure, and a reading comprehension skill test, then they were randomly assigned to one of four attribution feedback groups. The ability-ability group received feedback related solely to ability, and the effort-effort group received only effort-related feedback. The ability-effort group first received ability feedback followed by effort feedback, while the effort-ability group received feedback in the reverse order. The training period consisted of 30 minute sessions over 15 consecutive days. After the last training session, attributions were assessed and a parallel form of the achievement pretest was administered.

Ability feedback proved to be the most effective method for raising students' valuations of self-efficacy, while effort feedback was significantly less important. The self-efficacy conclusions were supported by a significant difference between causal attributions for ability and effort. Students whose training session ended with ability feedback emphasized ability in their causal attributions. Students who received ability feedback solely were most likely to give high self-efficacy ratings. Self-efficacy ratings were also high for students who received ability feedback followed by effort feedback and this ability/effort feedback group was more likely to attribute success to effort. Thus, ability feedback contributed to improvements of self-efficacy beliefs. Following the ability feedback with effort feedback encouraged students to focus their causal attributions on effort, which is internal and therefore, controllable.

In a specific situation attribution retraining has been found to be effective in facilitating acquisition of a cognitive learning strategy. Borkowski, Weyhing, and Carr (1988) offered 75 learning-disabled students in upper-elementary classes an instructional treatment in summarization strategy use designed to improve reading comprehension. The instruction was augmented by attribution retraining following the logic that in addition to content and strategy knowledge, learning disabled children need to be taught to attribute their success to effort and to avoid attributions to low ability when they encounter failure.

The results showed limited success for the treatment and provide guidelines for future attribution retraining. The results were program-specific. Improved achievement was not reflected in a standardized diagnostic reading measure. Neither was there a

generalized change in antecedent attributional beliefs. However, enhancements occurred in students' ability to activate and implement the cognitive strategy.

Subjects taught to search for topic sentences, to focus on main ideas and details, and to summarize paragraphs showed a fifteen percent improvement in their efficacy to summarize paragraphs after treatment. Those students who were given the reading strategies treatment combined with explanations that effort is required to deploy cognitive learning strategies improved their paragraph summarization skills by fifty percent.

The relative achievement improvement as expressed in gain scores suggests that attribution retraining has a role to play in encouraging learning disabled students to select a cognitive strategy. Borkowski et al. (1988) discussed the results as an argument for supplementing quality instruction that includes training in metacognitive processes with attributional feedback. That attribution feedback influenced student motivation to learn was demonstrated by enhanced strategy maintenance and generalization of inferencing ability some six months after treatment. Borkowski et al. (1988) have suggested that strategy instruction may be ineffective for students with a history of academic failure, as is typical of learning disabled persons.

While generalized change of antecedent attributional beliefs may be more difficult to achieve, the research of Borkowski et al. (1988) holds promise for instituting subject-specific attribution retraining as a component of instruction in strategy knowledge. Within a content domain such as mathematics, the learning may be enhanced if students select appropriate metacognitive strategies and exert the

cognitive effort to engage in the mathematics learning. Students may become more strategic in their learning as they are made aware that negative attributions may hinder efforts to learn (Borkowski, et al., 1988).

This series of articles concerning attribution retraining has relevance to the current study for four reasons: the results suggest that attribution retraining can occur, it can have a positive effect on achievement, that it facilitates strategy acquisition and activation, and that motivational variables are intercorrelated. The focus of the current study is on specific correlations among mathematics self-concept, causal attributions, and achievement.

Self-Concept, Causal Attributions, and Achievement

The results of the study conducted by Marsh, Cairns, Relich, Barnes, and Debus (1984) support a view that attributions may be content-specific and also more complex than bipolar. Their purpose was to investigate relationships among dimensions of self-concept, dimensions of attributions, and achievement. A group of 248 fifth-graders were given four instruments: the Self Description Questionnaire (SDQ) which measures facets of self-concept; the Sydney Attribution Scale; and two standardized reading achievement tests, one a cloze test, The Gap (McLeod, 1977) requires students to supply correct grammatical forms to fill gaps left when words are deleted from a passage, and the other a Primary Reading Survey Test devised by the Australian Council for Educational Research.

The variables, reading self-concept, reading attributions, and reading achievement were all intercorrelated. Reading achievement was significantly correlated

with reading self-concept, and with attributions for three reading scales. Positive correlations were found between total academic self-concept and the success dimensions of ability and effort on the attribution scale. Negative correlations were found for the failure dimensions of ability and effort. Mathematics ability attributions were most highly correlated with self-concept in mathematics. Similarly reading ability attributions had the highest correlation with self-concept for reading. Achievement in reading correlated with reading self-concept, and to a smaller degree with general school self-concept. However, reading self-concept was not related significantly to mathematics or nonacademic topics. Thus ability attributions seemed to be content specific. The authors concluded that, "Mathematics ability attributions are substantially more correlated with mathematics self-concept than with reading self-concept, and contrawise for reading/ability attributions" (Marsh et al., 1984, p. 29).

An interesting finding about attributions is that students will take responsibility for personal success when they have a positive self-concept, but they are less likely to see themselves as responsible for failure (Marsh et al., 1984). Weiner considered success and failure as opposite ends of a single dimension. Based on such a bipolar view, one would anticipate that students take responsibility in both success and failure situations. However, the results Marsh et al. describe undercut such a view since students attributed success and failure to different causes. This makes the assumption of single bipolar dimensions, such as an internal-external continuum, seem less tenable. The results also call into question the generalizability of the model, since

Weiner proposed that the two bipolar dimensions would generalize across outcomes, academic topics, and perceived causes.

Marsh (1984) found similar results when he replicated the Marsh, et al., (1984) study with a sample of 559 fifth-graders using instruments that included a modified Sydney Attribution Scale, the SDQ, Primary Reading Survey Tests, and Class Achievement Test in Mathematics. Students tended to have better academic skills and higher academic self-concepts when they attributed their academic success to internal ability and effort. For students who experience academic failure and attributed the cause of that performance to low ability and low effort, both academic skills and academic self-concepts also tended to be lower. In addition, self-attributions and self-concepts were specific to academic content. For instance, verbal ability attributions were not predictive of mathematics self-concept. Total academic self-concept correlated positively with success/ability and success/effort, and negatively with failure/ability, and failure/effort.

Based on prior research (Covington & Omelich, 1985; Marsh et al., 1984; Relich, 1983) Marsh (1984) expected that achievement would be more highly correlated with ability attributions than with effort attributions. Results confirmed expectations in both success and failure conditions. However, achievement correlated more highly with failure/ability attributions (r = -.41, p < .001) than with success/ability attributions (r = .32, p < .001). Elaborating on the complex interrelationships of motivational variables, Marsh, Walker, and Debus (1991) evaluated an academic self-concept model with an internal/external frame of reference in relation

to achievement and self-efficacy. The academic self-concept of 410 fifth-grade students was measured by Mathematics and Verbal scales of the SDQ-I instrument (Marsh, 1988). The mathematics and verbal self-efficacy scales asked students to predict whether they could correctly answer items on a mathematics and a verbal test. Other academic instruments included the Primary Reading Survey Test, the Paragraph Understanding Test, The Gap, a word problems test, and a mathematics test.

Further evidence that self-concept is a content-specific construct was found in the weak correlation between mathematics and verbal self-concepts (r =.19). This relation was weak despite the finding of high correlations between mathematics achievement and verbal achievement (r = .78) and mathematics self-efficacy and verbal self-efficacy (r = .59). Achievement had a different pattern of effects with self-concept than with self-efficacy. Verbal achievement was correlated was positively with verbal self-concept (.61) and negatively with mathematics self-concept (-.30). Similarly, the correlation of mathematics achievement was positive with mathematics self-concept (.59) and negative with verbal self-concept (-.57). Verbal achievement had a significant correlation with verbal self-efficacy (.28), but not with mathematics self-efficacy. Mathematics achievement was significantly correlated with mathematics self-efficacy (.43), but not with verbal self-efficacy.

For the present study, the most important conclusion from the latter set of studies is that self-concept is subject specific (Marsh et al., 1984; Marsh, 1984). The fact that within-domain relations are strongest is germane to the present study which

examines students' academic self-concept, causal attributions, and achievement all within a single subject domain, mathematics.

Summary of Self-Concept, Causal Attributions, and Achievement

From the research, a number of connections among motivational variables have been described, the first being that students' causal attributions, achievement, and self-concept are all intercorrelated (Marsh et al., 1984). Patterns can be discerned between pairs of motivational variables. Students who have better academic skills and higher academic self-concepts tend to attribute their academic success to the internal factors, ability and effort. Students who attribute the cause of academic failure to low ability and low effort, tend to have both lower academic skills and academic self-concept (Marsh, 1984).

High self-concept students have been found to attribute success to ability more often than low self-concept students (Ames & Felker, 1979; Marsh, 1984; Marsh et al., 1984; Powers et al., 1985), and are more likely to feel pride (Ames, 1978). Low self-concept students more frequently attribute their success to luck (Ames & Felker, 1979). After failure, high self-concept students have lower perceptions of their ability (Ames, 1978; Marsh, 1984), and self-esteem is inversely correlated with task difficulty (Powers et al., 1985). However, Ames and Felker (1979) found no difference between the two groups after experiencing failure, both attributed failure to low effort. Compared to high self-concept students, low self-concept students are more likely to perceive failure as due to incompetence (low ability), and, experience more humilation (Covington & Omelich, 1979). Moreover, mathematics ability attributions are most

highly correlated with mathematics self-concept (Marsh, 1984; Marsh et al., 1984). Therefore, in measuring the relations between self-concept and attributions, measures should be subject-specific.

Literature concerning self-concept and achievement indicates that school grade point averages are significantly related to prior self-concept (Marsh, 1990a). However, self-concept is subject specific and its relationship to achievement in the same domain is stronger than its relation to achievement in other domains, or to achievement in general (Marsh et al., 1984; Marsh, 1992). Particularly, in mathematics, achievement correlates with mathematics self-concept (Marsh et al., 1991).

Ability and effort are dimensions related to student achievement. Achievement as measured by GPA is related to efforts to achieve in learning situations (Pintrich & De Groot, 1990; Wentzel, 1989) and perceived ability is related to efforts to achieve learning goals (Wentzel, 1989). Similarly, a direct relation has been found between students' performance and their beliefs in whether they have the power to exert control over the learning situation and their performance (Skinner, Wellborn, & Connell, 1990). Marsh (1984) found that achievement was more correlated with ability than effort attributions in both successful and failure conditions. Several researchers have found that attribution feedback has a positive influence on achievement in mathematics (Relich et al., 1986; Schunk, 1982; Schunk & Rice, 1986). Marsh et al. (1984) found that subject-like causal attributions and achievement are correlated, that is, reading achievement correlated with reading attributions. In the case of mathematics, achievement correlated positively with mathematics self-efficacy (Marsh et al., 1991).

Drawing from these research findings in the present study it was expected that:

1. Students with high academic performance in mathematics would have a corresponding positive mathematics self-concept. Students with low performance would have low mathematics self-concept.

2. There would be a positive correlation between mathematics self-concept and mathematics achievement in both success and failure conditions.

3. Mathematics ability, effort, and studying attributions would correlate positively with mathematics self-concept under both successful and failure conditions. Of these three correlations, it was expected that the strongest relation would be between attributions to mathematics ability and mathematics self-concept.

4. Correlations of mathematics achievement with ability and effort or studying attributions would be positive for both success and failure conditions. There would be higher correlations between mathematics achievement and mathematics ability attributions that between mathematics achievement and mathematics effort attributions.

5. Students with the higher academic performance would be more likely to attribute success to ability and effort, than to good luck or ease of task.

6. Students in the success condition would have higher correlations between mathematics self-concept and internal attributions than between mathematics self-concept and external attributions. As a corollary these students' achievement scores would have higher correlations with internal attributions than with external attributions.

7. Students in the failure condition would have higher correlations between mathematics self-concept and internal attributions than with external attributions. Achievement scores would also have higher correlations with internal attributions than with external attributions.

Self-Concept, Causal Attributions, and Gender

Gender differences have been noted in the relationship between self-concept and attributions (Ames, 1978). When students were paired, females were found to attribute ability to their partner rather than to themselves more often than males. For males, positive self-talk was used more often in competitive than in noncompetitive

settings, whereas females did not vary self-talk by setting. There was a tendency of males to perceive the tasks as being more difficult than females did.

In Ames and Felkers' (1979) study of attributions, self-concept, and self-reinforcement described previously, few gender differences were found. Contrary to expectations, there were no differences between high self-concept males and females in ascribing success to effort. However, in terms of reward, males made more self-congratulatory statements after successful conditions than females. No gender differences were found in the failure condition for any measures.

As part of an empirical testing of self-worth theory by Covington and Omelich (1979), 360 undergraduates were given a brief form of the Michigan State Self-Concept of Ability Scale to examine whether differences in self-concept are influenced by ability attributions in failure conditions. Students were assigned to four failure vignette conditions: high effort with an excuse (test content was not covered in class), high effort without an excuse, little effort with an excuse (student was sick), and little effort without an excuse. In addition to the self-concept measure, students estimated their ability and feelings of shame following failure on a self-rating scale.

Results indicated that high self-concept females were less likely to attribute failure as evidence of incompetence than low self-concept females, but this difference was not found for males. Females experienced significantly more shame following failure than males did. Covington and Omelich (1985) suggested that this difference was largely due to low self-concept females, who experienced more shame than high self-concept women. Gender differences have also been noted in causal attributions.

In a study of 406 grade 7 students, Woudzia (1991) found the following gender differences: boys attributed failure to low effort more often than girls; girls attributed failure to low ability and task difficulty more often than boys; and after failure outcomes, boys retained a higher self-concept than girls.

These previous studies which cover relationships between self-concept and causal attributions included an investigation about gender. Two relevant conclusions may be drawn: there are between-gender differences and there are also within-gender differences, especially in self-concept. Woudzia (1991) found that failure has less of an effect on boys' self-concept than it does on girls'. Ames (1978) found differences between genders in self-concept and attributions; however, there was no difference in effort attributions made by males and females if both groups held a high self-concept (Ames & Felker, 1979). While attribution patterns between high self-concept males and high self-concept females are similar, there are within-gender differences for females. High and low self-concept females make differing attributions following failure. Failure is perceived as evidence of low ability by females with low self-concept. High self-concept females are more resilient, in that they are more likely to retain a high self-concept after failure.

Academic Self-Concept, Achievement, and Gender

The previous discussion suggested that students with a higher self-concept do not differ by gender in their attributions to causes. If self-concept is associated with between gender similarities in attributions, it seems reasonable to determine whether there are between-gender differences in achievement according to level of self-

concept. Byrne and Shavelson (1987) investigated gender differences in self-concept with 832 grade 11 and 12 students using a battery of self-concept measures, including the Self Description Questionnaire III (SDQ-III), the Affective Perception Inventory, the Self-esteem Scale, and the Self-concept of Ability Scale. For males, they found that academic self-concept correlated higher with mathematics grades than English grades. The reverse was true for females. Although girls had higher mathematics grades, their mathematics self-concept was lower than boys.

Relationships among mathematics, verbal, and general self-concept, and success expectations across genders were investigated by Skaalvik and Rankin (1990). A total of 117 males and 114 sixth-grade females were assessed using mathematics and verbal tasks developed for the study, and the Academic Self-Esteem Scale developed by Skaalvik. Success expectation measures were gathered by asking students to predict whether they could master each of the tasks on the two tests.

Boys predicted more expectations of task mastery than girls. Verbal self-concept correlated strongly with girls' general academic self-concept, but not with boys'. For mathematics self-concept, the correlation with mathematics achievement was positive with boys, and negative with girls. Girls' general academic self-concept was related to mathematics achievement, but not to verbal achievement. The pattern was reversed for boys, showing a contribution to general academic self-concept from mathematics and verbal achievement for both genders. With girls, verbal achievement was related to verbal self-concept, which in turn related to general academic self-concept. This indirect relation was not found in mathematics. Girls' mathematics

achievement was directly related to general academic self-concept. The relations were reversed for boys. General academic self-concept was directly influenced by verbal achievement, whereas the effects of mathematics achievement on general academic self-concept were indirect and mediated by mathematics self-concept.

Two results from these studies are relevant to the current study and form the basis of hypotheses. It is interesting that the tendency for girls was to have a lower mathematics self-concept despite the fact that their grades were higher (Byrne & Shavelson, 1987). That boys are more likely to predict higher scores for mathematics assessments may also be a reflection of higher self-concept for boys in mathematics (Skaalvik & Rankin, 1990).

Causal Attributions, Achievement, and Gender

Travis, McKenzie, Wiley, and Kahn (1988) investigated gender differences in achievement, causal attributions, and cognitive aspects of achievement behaviour for 179 female and 242 male college students. Subjects' causal attributions were related to a success or failure event that they had experienced in the past year.

In success situations, there were no significant differences between the sexes. However, for the failure protocols, men consistently reported higher expectations for future achievement success. This finding was significant, and appeared in all achievement domains. Women typically had lower expectations for their future academic achievement.

For the purposes of the current study, the findings of Ryckman and Peckham (1987a) are relevant, since they suggest that females studying mathematics are more

likely to report learned-helplessness than males. They examined success and failure attributions in both language arts and mathematics, and science domains with 325 students from grades 4 through 12. Attributions were measured by the Survey of Achievement Responsibility and achievement was measured by grades in language arts, mathematics, and science.

Although achievement data did not reveal a difference between males and females, the attributions that females made for the mathematics outcomes differed noticeably from those of males. Females made differing attributions in success and failure situations for language arts and mathematics. When successful in language arts they perceived the outcome as evidence of personal ability. However, "girls see little of mathematics success as attributable to ability ... for boys, there is little difference between subjects on success and only moderate differences for failure" (1987a, p. 124). Males and females had the same pattern of attributions for task difficulty and also for luck attributions in mathematics. For effort attributions, the patterns of males and females were similar but not identical. There was little difference for failure outcomes, except that females rarely attributed mathematics failure to lack of effort. A difference was noted in mathematics success outcomes. Males tended to choose ability attributions, while females chose effort. Thus, males perceived success as evidence that they were good in mathematics, but females perceived success as being caused by high effort. This led to the conclusion that females may not give themselves credit for having high mathematics ability. While the males were likely to see a positive

outcome as evidence of high ability, the females were likely to feel that high achievement was a result of high effort.

One of the key questions of Ryckman and Peckham (1987b) was whether females and males differ in their attributional patterns in mathematics/science. Their sample of 1411 was drawn from a pool of 15,000 Seattle students in grades 4 through 11. The Survey of Achievement Responsibility was again used to measure attributions and grades in mathematics and language arts were the achievement measures. Ryckman and Peckham (1987b) found differences in the attribution patterns between genders and commented that females' attributions were less adaptive. In elementary school, males had higher ability scores than females in success situations while there was no gender difference upon failure. The ability scores for older males were higher for success outcomes and decreased for failure outcomes. The ability scores were also higher for older girls, but the increase was very small. The difference in ability attributions between boys and girls evident for success outcomes in elementary school was exaggerated by the time they reached high school. Ability attributions for success outcome in high school were much higher for males than for females.

While Ryckman and Peckham focused on gender differences in attributions for school age subjects, gender differences have also been investigated for attributions made by adults. The purpose of a study conducted by Sousa and Leyens (1987) was to investigate the causal attributions for women's and men's achievement in terms of stereotypes of gender roles. The sample in this case was 24 male and 24 female university students in Portugal. Using eight pairs of stimulus drawings depicting a man

or woman building a house of cards, subjects were led to believe that they were developing items for a fictitious test to discern gender differences. Each subject wrote a story about success expectations and reasons for the outcome.

In the free-response format which allowed subjects to use their own language rather than experimenter-imposed terminology, men and women were found to use different vocabularies to describe outcomes. Sousa and Leyens focused on the social content of the attributions and suggested that causal explanations offered by persons are influenced by ingrained perceptions of gender roles. A conclusion made by male subjects was that females' success was not produced by ability. Males attributed success by females as a product of effort or luck. For females their causal explanations were related to the task at hand and the gender of the participant did not influence their imputed attributions.

The ability attribution differences between males and females found by Sousa and Leyens provide some evidence that evaluations of others' achievements differ by gender. These findings are of particular interest for this dissertation which includes interviews of males and females who were asked to infer attributions made by participants in hypothetical achievement situations -- once for a male and once for a female. The primary purpose of the interviews was to determine if belief sets supplied in the research were valued by the subjects. Using male and female characters in the stimulus scenarios allowed for a determination of gender differences in imputing both affect and cause in scenario character's success and failure when the character is the same sex as the respondent or when they are of differing genders.

Stipek and Gralinski (1991) examined gender differences in causal attributions about mathematics performance before and after a mathematics exam with 194 third-grade students, and 279 students in junior high school. Prior to their mathematics test, students were given a pretest questionnaire on achievement beliefs. The posttest questionnaire was given 1 to 3 days after the mathematics test.

Girls' beliefs in their ability to achieve were found to be more negative than boys' in that they made lower initial ability ratings, and predicted lower examination scores than boys, an indication of lower expectations. Following the trend noted in prior research, when girls experienced failure they were more likely to ascribe the cause to low ability than boys. Conversely, in success outcomes, that girls were less likely to take credit than boys by attributing their success to personal high ability. However, these differential causal attributions were not associated with shame reactions. Although girls made different (low) ability attributions when failure outcomes were encountered, they did not report feeling any more shame than boys for the same event.

In one recent mathematics attribution study in which gender differences were a central issue it was found that a relatively low expectancy of mathematics success was negatively related to attribution patterns (Tapasak, 1990). Although achievement was similar, males and females exhibited different perceptions about their relative performance. In this study students were more likely to attribute success to unstable factors and failure to stable factors. Tapasak defined relative mathematics expectancy (RME) as the students prediction for mathematics success with a high RME

representing a prediction for success in mathematics. Tapasak allowed subjects to rate their own relative mathematics expectancy (RME) and used chi-square analysis to compare these personal ratings with expected frequencies according to student GPA's. Students were categorized into high, middle, or low expectancy groups according to ranking on a self-rating scale. The high group consisted of students in the top third of success expectancy. The low group consisted of students in the bottom third. The low expectancy group, from a sample of 239 eighth-grade mathematics students, consisted of a disproportionate number of females. Conversely, the high expectancy group contained a disproportionate number of males. Based on the students' mathematics grade point averages (GPA's), the researcher anticipated a more equal distribution of males and females in the high expectancy group, since there was no indication that males' achievement was superior to females' achievement. In fact the reverse was true. The prediction that females would rate themselves lower was examined by analyzing the "expected" frequencies with the "observed" frequencies which were students' self-ratings of high, average, or low.

The correlations between RME and mathematics GPA were found to be positively significant for both males and females. The hypothesis of differential self-rating by gender was upheld. The high RME group contained a significantly larger number of males, while the low RME group had a significantly greater number of females. The low RME group was characterized as having a more "negative" expectancy-attribution patterns, negative in terms of achievement motivation and learning. Thus, females were described as being more likely to predict lower

mathematics achievement. Tapasak noted that this self-rating was discrepant since the grade eight girls' mathematics GPAs were generally higher than the boys'. This response pattern was characterized as "negative" since the girls' tendency was to attribute success not to ability, but to effort, yet low ability was seen as a main cause for failure. Tapasak suggested that future research might examine whether high RME students interpret failure differently, or whether they perceive that causal factors change.

Students with relatively high levels of success would presumably have high levels of academic expectation. Using program placement as an indicator, Boss and Taylor's (1989) study included students with high, medium, and low relative success expectancies. Students' ability groupings were based on their academic placement in Ontario secondary schools which have three academic programs: the advanced program which leads to university, the general program which leads to college, and the basic program which includes vocational courses for students presumed to lack the aptitude necessary for general or advanced studies. Boss and Taylor (1989) hypothesized that students in high-performing academic programs would display internal characteristics and that students in low-performing basic programs would be more external. The sample of 267 Ontario grade nine students from three ability groupings were administered a Locus of Control Scale (Nowicki-Strickland Locus of Control Scale for Children) and the Intellectual Achievement Responsibility Questionnaire.

No gender differences were found for the total group on the locus of control measure. However, when group differences were examined, advanced students were significantly more internal than other students. Within the advanced group, males and females did not differ. Effect sized were not reported. For a more fine-grained analysis of the data, Boss and Taylor subtracted the Internal Success mean from the Internal Failure mean to create a difference score for both genders in all three groups. The difference score was very large for females in the general (1.43) and basic programs (1.27) yet small in the advanced program (0.31). There was little variation in difference scores for males (general=0.26, basic=0.14, and advanced = 0.46).

Since the differences were not apparent for the whole group, Boss and Taylor concluded that an internal-external explanation of differences between males and females does not hold for high-achievers. Different attribution patterns were traced to the attributions made by females at lower achievement levels. For students in general, the conclusion reached was that an internal disposition is associated with higher levels of achievement. Despite non-significant gender differences, Boss and Taylor (1989) did find that the difference between internalized success and internalized failure was smaller for males (mean=0.33) than females (mean=0.88).

If high-school students are grouped by program, those in academic programs directed towards college entrances have higher expectations of success. Students who do enrol in college may be presumed to be in this high success expectancy group. Within this group gender differences may be found. Gaeddert (1987) used the Personal Attributes Questionnaire to determine the extent to which 335 college

students adhered to sex roles. He was interested in the prediction that when students have successful achievement outcomes, females make unstable and external attributions more often than males. If true, this relation could have its source in sex-role stereotypes. The logic of the study required subjects to recall outcomes in five different domains. Work and sports were considered masculine domains. The social-affiliative domain was considered feminine, and the other two domains (scholastic and personal growth) were considered gender-neutral. Students with high acceptance of role stereotypes would be expected to make according attributions. That is, a masculine orientation would be associated with internal attributions while a feminine orientation would be associated with external attributions.

Hierarchical multiple regression revealed no significant differences between genders in their attributions, refuting the sex-role hypothesis. Students made fewer attributions to effort for scholastic achievements than they did for other domains. Causal attributions were influenced by students' achievement standards and goals, their expectations for success or failure.

Because effort and ability attributions are internal Gaeddert predicted that students would make more internal attributions for scholastic achievements which have objective standards of success. The hypothesis was confirmed for ability attributions, but the fact that fewer effort attributions were made was an unexpected result. Gaeddert suggested that future investigations should consider whether achievement attributions are mediated by other motivational variables, specifically standards for academic success.

Kraft (1991) also found evidence for attributional differences between genders. Forty-three successful black undergraduate students at the University of Maryland were interviewed to determine the factors that these students valued as influences for their academic success. The women had an average GPA of 2.45, and the average for men was 2.78. Although Kraft followed the model Weiner established in a general stimulus protocol, the form of student response was much different from other research. Instead of presenting scenarios with a restricted attribution set as probable causes, Kraft (1991) allowed the students to use their own words to describe the source of academic success. There were no limits on the length or form of student response.

Kraft aggregated responses and found that students identified 11 major causes for their academic success. Only two causes from the Weiner attribution set were found, ability and effort. There was also evidence of attributional differences between genders. Although 47% of the males cited ability as important to academic success, fewer that 4% of the females mentioned it. Conversely, supportive faculty was seen as a factor important to academic success by 61% of the females, but only 27% of the males. Males cited ability (47%) and effort (53%) as major causes more often than females (4%, and 11% respectively). Two other significant causes for males were discipline or organized effort (47%) and ambition (40%). Ambition was not a relevant cause for many female students (11%), but they cited discipline as often as males did (46%).

On the basis of these results, Kraft (1991) argued that Weiner's (1979) belief taxonomies are too restricted since the subjects she interviewed made attributions to more factors than Weiner described, leading to the conclusion that open-ended responses are required to get a full picture of student causal attributions. Attributions to effort were more complex than a simple allocation along a locus of control dimension. These subjects also added a quality component to the controllability dimension by separating task persistence or hours of study, from organized effort or discipline.

Based on Kraft's findings, two questions were considered for this dissertation: whether the belief taxonomies should be expanded or whether a methodological enhancement could be used to accommodate Kraft's criticisms. Kraft argued that the causal beliefs her participants valued were broader and/or less discrete than the limited number of dimensions proposed by Weiner. Rather than provide an expanded belief set, a decision was made to use Weiner's structure, but validate it by giving students the opportunity to use their own vocabulary in an open-ended response. This enhancement also accommodates Kraft's second point that validity is lacking if the terms endogenous to the students are not represented in the belief set. Therefore, including open-ended interviews was deemed a reasonable alternative which permits a cross-check on the Weiner belief set. Analogous to discussions about personalizing and internalizing cognitive strategies, students would have the opportunity to describe factors that they deem important to academic success.

Self-Concept, Causal Attributions, Achievement, and Gender

The current study examines the three motivational factors of self-concept, causal attributions, and achievement with respect to gender differences. An exhaustive literature search was undertaken for the present study, and no empirical study was found that included gender in an investigation of this cluster of factors.

Summary of Self-Concept, Causal Attributions, Achievement, and Gender

High self-concept females and males do not differ in ascribing success to effort (Ames & Felker, 1979). For males, self-concept does not influence ability attributions, whereas high self-concept females are less likely to attribute failure to low ability than low self-concept females, (Covington & Omelich, 1979). For failure, Woudzia (1991) found that males made more attributions to low effort, whereas females made attributions to low ability and task difficulty. After failure outcomes, males retained a higher self-concept than girls.

Self-concept is subject specific for both genders. Mathematics achievement has been found to influence girls' general self-concept, but not boys' (Skaalvik & Rankin, 1990). The correlation between mathematics grades and mathematics self-concept was higher for males than for females (Byrne & Shavelson, 1987). Girls' may have a lower mathematics self-concept than boys' even when they have higher mathematics grades (Travis et al., 1988).

While males are likely to attribute success to ability, females are more likely to attribute mathematics success to effort, yet no gender differences were found after failure (Ryckman & Peckham, 1987a, 1987b). An interesting perspective emerges

when subjects are asked to rate peers of the opposite gender. Sousa & Leyens (1987) confirmed that males rate females differently than they rate males. Males attributed females' success to luck, and males' success to ability. Females made no gender differences.

Females' have been found to predict lower exam scores for themselves than males (Stipek & Gralinski, 1991). After success, females are less likely to take personal credit by attributing success to ability. Following failure, females are more likely to ascribe the cause to low ability. Even when their GPAs are higher than males, females are more likely to attribute personal success to effort (Tapasak, 1990).

However, these between gender generalizations have been questioned. Gaeddert (1987) found that achievement expectations were good predictors of attributions for students of both genders. For advanced students (university-bound program), Boss and Taylor (1989) found that students were more internal in their attributions regardless of gender, and concluded that a male/female, internal/external model explaining differences between genders does not hold for high-achieving students. Boss and Taylor (1989) speculated that gender differences noted in other studies may stem from within-gender sources such as lower-achieving females. From these findings the following expectations were derived:

1. Males would have a higher mathematics self-concept than females.
2. Females would have higher mathematics achievement scores than males.
3. Females would predict their score on mathematics quizzes more negatively than males.

4. Mathematics self-concept would correlate higher with mathematics achievement for males than females.

5. Females would attribute success to effort, whereas males would attribute success to ability.

6. Females would ascribe failure to low ability and task difficulty more often than males and males would ascribe failure to low effort more often than females.

7. High self-concept females would be less likely to attribute failure to lack of ability than low self-concept females.

8. Females in the interview group would experience more shame than males following failure.

9. Males in the interview group would rate females in the hypothetical situation differently than males. Males would attribute females' success to effort or luck and males' success to ability. Females would not differ in their ratings.

Classroom Environment

Tasks, evaluation and authority are three components of the classroom environment (Ames, 1992; Blumenfeld, 1992). Tasks have five dimensions: variety, diversity, challenge, control and meaningfulness. Evaluation structures affect the salience of ability comparisons. Rewards, intrinsic or extrinsic, provide information about quality of work and act as feedback which learners use to monitor performance. Blumenfeld (1992) has speculated that the influences of evaluation may vary according to classroom groupings, and that teachers need to be apprised of the best way to maintain motivation while providing evaluative feedback. Classroom authority is discussed in terms of teacher management and student compliance (Haberman, 1992) and also as opportunities for student autonomy and decision making (Ames, 1992). Blumenfeld suggested that a contribution to education could be made by determining

how teachers balance opportunities for autonomy while still providing needed support to learners.

Another question about classroom environment is the reliability of student perceptions about classroom learning structures. There is a need for longitudinal studies which include repeated sampling to determine whether students change their perceptions during a semester or a school year (Blumenfeld, 1992).

Classroom environment has been found to relate to self-concept and causal attributions, but the form that this relationship takes is probably complex. Determining how a classroom operates is difficult without extensive and extended observation (Reid, 1984). Efforts have been made to create objective instruments which researchers could use to gather this information in an objective and psychometrically-defensible format.

Rosenholtz and Wilson (1980) examined student ability perceptions as they related to the classroom environment. They devised a questionnaire about classroom structures which fifth and sixth-grade teachers used to categorize their instructional environment according to task differentiation, grouping practices, evaluation, and student autonomy. From the teacher descriptions, classrooms were organized into two types, high and low opportunity to make comparisons. In the high comparison environment students were permitted more opportunities to observe their peers performance in learning tasks. In both high and low ability comparison classes students ranked their own reading ability and that of their peers. Teachers also provided assessments of student reading ability.

There were differences in students' ability perceptions between classrooms. In the classes with high opportunities for ability comparisons, there was greater agreement among students about students' reading ability and students' personal ratings were closer to those of their peers and their teachers. Rosenholtz and Wilson (1980) took these results as evidence that classroom structures can have an influence on students' perceptions of their peers abilities as well as their own.

Rosenholtz and Rosenholtz (1981), changed the classroom structure designations using the terms "unidimensional" and "multidimensional" to describe classrooms with high and low levels of ability comparison, respectively. In the unidimensional classroom, students' reading ability perceptions were more stratified across "below average," "average," and "above average" ability groups. Compared to the multidimensional class, participants were found to perceive more levels of ability in the unidimensional class.

From the same data, Rosenholtz (1982) found differences in students' social power perceptions in relation to instructional practices. In unidimensional classes, there were higher correlations between students' perceptions of their reading ability and social power. Social power was also found to be perceived as having more levels in the unidimensional classes than in the multidimensional environments.

In another analysis of this data, Rosenholtz and Simpson (1984) found stratification differences between the two classroom structures when academic self-concept was the variable. Students' academic self-concepts were more stratified in that students perceived multiple levels of self-concept in unidimensional classes.

From this group of studies by Rosenholtz and her colleagues, there is support for inferring that the classroom instructional environment has influences on a number of variables including academic self-concept.

Simpson (1981) examined the same variables operating in third grade classrooms, and included mathematics and social studies, while Rosenholtz and Wilson (1980) had focused on reading ability perceptions. In all content domains, the results supported Rosenholtz and Rosenholtz (1981). The third-grade students' perceptions of their ability and that of their peers were more stratified in unidimensional classes. Like their fifth- and sixth-grade counterparts, students' and teachers' ratings were more in accord in the unidimensional classes than in classes with multidimensional structures.

An instrument developed by Marshall and Weinstein (1986) gathered teacher information on classroom environment dimensions including student-teacher relations, motivation strategies, differing task structures, grouping, student autonomy, and evaluation and observation of students. This preliminary instrument was found to be inadequate, perhaps because of its single focus on teachers' perceptions. Marshall and Weinstein (1986) noted that the full model of classroom factors influencing students' personal evaluations and expectations for achievement was not tested.

An improvement to the instrument's validity by Midgley, Feldlaufer, and Eccles (1988) included students' perceptions of classroom structure in their measurement model. Over a two-year study period there were two administrations so that both teachers and students responded to classroom structure instruments before and after

students entered junior high. Students had the perspective of using their elementary classroom structure as a base with which to compare the environment that they were entering. Observers also had the opportunity to collect before and after information.

Moving to high school reduced the role of student contributions to the classroom structure. Students were allowed to make fewer decisions in high school than in their elementary schools and they had fewer opportunities to cooperate or interact with other students. The student perceptions present a different picture of classroom environment from the teachers' intended structures. In high school classes students noticed more social comparisons among themselves and saw fewer opportunities for quality relations with the teacher. The data gathered from before and after entering high school yielded an unexpected finding. Students perceived the high school classes to be less competitive. The differing findings were useful in providing validity evidence for the instruments. Taking more than one measure from each participant group provides a model for collecting classroom environment evidence in future research.

MacIver (1988) also collected data over time on task structure, grading, grouping, and student perception of mathematics ability. Upper-elementary students supplied information on three self-concept items and one mathematics ability item. Teachers supplied information on grades and tasks. In unidimensional classrooms students' were more likely to perceive ability stratas than in multidimensional classrooms. Stratification was also related to teacher reports of increased spread in ability within classes.

In related work, Midgley, Feldlaufer, and Eccles (1989) investigated students' attitudes to mathematics and student-teacher relationships, with a focus on perceived teacher-support. Before students left elementary school they responded to two instruments assessing the perceived value and usefulness of mathematics. Results showed that perceived teacher support influenced both measures. When students moved from elementary classes where teachers provided low levels of support, their perceived intrinsic value of mathematics increased if they perceived that their new teacher in high school provided high levels of support. Conversely, intrinsic value, perceived usefulness and importance of mathematics all decreased for students who moved from elementary teachers providing high support to secondary teachers providing less support.

Reuman (1989) used MacIver's (1988) mathematics self-concept measure when examining relations among social comparisons, ability-grouping practices, and student expectations for mathematics achievement. Student reports of the frequency and importance of interpersonal comparisons were compared to teacher reports of classroom ability groupings. Grouping by ability was found to influence students' selection of a partner who complemented their abilities. That is, a student in a high-ability group would be more likely to select a partner from a low-ability group and vice versa. Grouping by ability within the class had differential effects on students' achievement expectations. Students already low in achievement showed even lower expectations, whereas high-achieving students had their expectations enhanced.

Teachers must provide a balanced environment that enables students to become self-regulated learners while providing students with the support needed to attain this goal (Blumenfeld, 1992). Since students and teachers are partners in learning, an analysis of the environment where the learning occurs should collect information from both sets of participants. Rather than assess the classroom environment, in this dissertation perceptions of the classroom environment according to both the student and teacher were measured by a revised form of an instrument designed by Midgley, Feldlaufer, and Eccles (1989).

CHAPTER 3

METHODS AND PROCEDURES

Sample

Students participating in this study were drawn from 20 grade 8 mathematics classrooms located at four secondary schools in a large metropolitan school district in British Columbia. Of the 530 approached to participate, 518 students agreed to take part in the study. However, due to a teachers' strike one teacher with two classes withdrew from the study (60 students). Another 20 students who transferred to other classes or other schools were deleted from the study. The final study included 438 students (234 females and 204 males) aged 12 to 15 years (mean age = 13). There were 346 students aged 13, 84 aged 14, seven aged 15, and one 12 year old.

The majority of students in the sample identified their country of birth as Canada (250 or 61.3%), 158 (38.7%) identified another country, and 31 did not specify. English was the first language for 152 students (37.3%), while for 255 (62.7%) it was not. There were another 31 students who did not specify their first language. The majority of students usually spoke English at home (264 or 64.9%), while 143 (32.6%) did not. Another 31 students did not respond. The most common ethnic background was Chinese (190 or 46.3%), followed by English or other Caucasian group (79 or 19.3%), East Indian (53 or 12.9%), Vietnamese (15 or 3.7%), and Spanish (12 or 2.9%). Another 61 students (14.9%) identified another ethnic group and 29 did not answer the item. The highest level of mother's education was high school for the majority of students (143 or 41.7%), followed by university (104 or 30.3%), college (69

or 20.1%), and elementary school (27 or 7.9%). There were 96 non-responses to this question. For father's highest level of education, the most frequent response was again high school (130 or 38.2%), followed by university (127 or 37.4%), college (65 or 19.1%), and elementary school (18 or 5.3%). Again there were 99 missing cases. Of 403 students who responded, 247 (61.29) reported a mother who worked outside the home, and for 395 respondents, 371 (93.92%) reported a working father. Table 1 includes a breakdown of mothers' and fathers' occupations.

Five teachers were female and five were male. Information about class size, the number of participating students and their gender are shown in Appendix A.

TABLE 1
Frequencies of Parental Occupations

Parental Occupation	MOTHER f	FATHER f
Professional	55	66
Unskilled Worker	13	66
Skilled Worker	26	65
Manager	19	61
Business Owner	5	34
Clerical	47	21
Salesperson	16	19
Health Care Worker	39	10
Service Industry Worker	36	4

Design

There were a total of 438 students from 19 classes who participated in the main study. Thirty-nine of these students were also interviewed.

The desired interview sample was 38 (one male and one female per class). A total of 108 students were approached for participation in the interview before the final sample of 39 students (20 females and 19 males) was obtained. There were 39 students rather than 38 as two female students wanted to be interviewed together. This is discussed in more detail in Chapter 4.

Description of the Instruments

Teacher-Made Tests

Three mathematics quizzes designed by each classroom teacher representing the work covered in their individual classes over a five month period were used in this study. At the bottom of each quiz, teachers added one question for students to answer before handing in their quizzes, "What do you expect your mark to be on this test ____ out of _____." This question was inserted to give students the opportunity to predict a score based on a subjective estimate of how well they thought they had performed. Actual percentage scores on each mathematics quiz were collected.

First Term Mathematics Achievement

Overall mathematics achievement, as a percent, was calculated at the end of the first semester and was collected for each student. As the data were collected mostly during the first semester, the first term mathematics average was used in lieu of the second term mathematics average.

Academic Self Description Questionnaire (ASDQ-II)

The ASDQ-II (Marsh, 1990a) is composed of 15 subject specific scales and one general scale. The mathematics subscale and the general subscale of the ASDQ-II were used in this study to assess students' mathematics self-concept and their general academic self-concept. The mathematics component included the following items: "Compared to others my age I am good at mathematics," "I get good marks in mathematics," "Work in mathematics classes is easy for me," "I'm hopeless when it comes to mathematics," "I learn things quickly in mathematics," and "I have always done well in mathematics." The general subscale substitutes "most school subjects" for "mathematics". In this instrument respondents select from the following responses: "false", "mostly false", "more false than true", "more true than false", "mostly true", and "true." Internal consistency estimates of reliability for the ASDQ-II range from .88 to .95 for the 16 scales, as Marsh (1990a) reported for a sample of male students (N=524) in grades seven through ten.

Attribution Measure

This measure, developed by Woudzia (1991), is a questionnaire consisting of items pertaining to four attributions (ability, effort, luck, and task difficulty) and "emotional reactions following either a success or failure outcome, as well as students' expectations for future performance" (p. 72). The four attributions in this instrument are the ones most often investigated in attribution research (Weiner, 1986). Only the attribution questions of the instrument were used in this study. A fifth attribution "studying," was added to the instrument after a discussion with participating teachers.

Teachers suspected that students would perceive a difference between the meaning of "trying hard" and "studying." Wording on some items was modified slightly (as shown in Appendix B).

Another enhancement to this instrument was the provision of writing space for an optional open-ended response. Students were given the opportunity to expand on their responses to the attribution measure. The question read as follows:

> **IF YOU ANSWERED "VERY MUCH" OR "QUITE A BIT" TO ONE OF THE ABOVE QUESTIONS USE THE SPACE BELOW TO EXPLAIN THE REASON FOR YOUR CHOICE.**

This addition to the measure was included to ensure that valued attributions were elicited.

After the results of a mathematics quiz were returned to students, they were instructed to look at the mark they had received on their mathematics quiz and then respond to the five attribution items and the open-ended question. If they thought that it was a good mark they were directed to answer questions on page 2. If it was a poor mark they answered questions on the back of page 2. This was similar to the procedure used by Woudzia. For each question in each section (successful or unsuccessful), the students' attention was drawn to the specific attribution by underlining. For example, item 1 for the successful questionnaire read, "How much do you think that your good mark on this test was due to you <u>trying really hard on the test?"</u> Item 1 for the unsuccessful questionnaire read, "How much do you think that your poor mark on this test was due to you <u>not trying hard enough on the test?"</u>

Respondents rated items using a five point rating scale with options of "very much," "quite a bit," "somewhat," "very little," and "not at all."

Perceptions of the Classroom Environment -- Student Measure

A modification of the Midgley, Feldlaufer, and Eccles (1988), the Classroom Environment Measure by Woudzia (1991), consists of a 24-item scale with 6 subscales. The items "measure students' perceptions of competition and social comparisons among classmates, cooperative learning opportunities, student involvement in decision-making, task organization in mathematics, and teacher fairness and friendliness" (Feldlaufer et al., 1991, p. 78). This scale was used to examine whether findings may vary as a function of differences in classroom structure (Rosenholtz & Simpson, 1984).

The six subscales of the measure are: Cooperation/Interaction, Competition, Social Comparison, Teacher/Student Relations, Student Input, and Task Organization. From Feldlaufer's instrument, Woudzia (1991) modified some phrasing on the student input and task organization items to make them first-person plural (e.g.,"We suggest projects or topics to study in mathematics.")

In the original instrument students respond to a five point scale: 'never', 'seldom', 'occasionally', 'frequently', or 'always'. However, after teacher input, this scale was revised to four responses including 'not very often', 'sometimes', 'usually', and 'very often'. After considering each item, students indicated their response by circling one of the answers.

In this study two items were deleted ("The teacher criticizes us if we do poorly," and "The Teacher grades our math work fairly") to gain school district approval. The former item was replaced by "When we do poor work the teacher lets us know it." and "There is reward for students who do well in mathematics." In response to teacher input, two additional items hypothesized to be related to gender were added ("When I ask for help my teacher urges me to try harder" and "When I ask for help my teacher helps me do the problem"). This was based on teachers' perceptions that there might be a difference in the way that teachers provided feedback to boys and girls (NCTM, 1991). The revised scale administered to students had 26 items. The complete environment measure is reproduced in Appendix C.

Perceptions of the Classroom Environment -- Teacher Measure

Items from the Student Classroom Environment Measure were modified for teacher usage, and other items were added (see Appendix D). This instrument assesses teachers' perceptions of task organization, student decision-making involvement, fairness and friendliness of the teacher, and opportunities for cooperative learning. These items are similar to those on the student measure. Not all items from the student version were appropriate for the teacher version. These items only aplied to the student, for example, "I compare my ability to other students in my math class." Therefore, only the items from the Student Classroom Environment Measure which were appropriate for teachers to answer were included. The two gender items added to the student measure were also included in the teacher measure. Five additional items were added. These questions focused on classroom learning activities such as

problem solving, working on projects, learning algorithms, and also the use of learning aids such as calculators and computers.

Student Background Questionnaire

The Student Background questionnaire was used to gather demographic information on socioeconomic status, gender, ethnicity, first language, and parent information about education and occupations (see Appendix E). This questionnaire included nine closed format items and two open format questions. For the closed responses students were required to circle the appropriate response. For the two open-ended items students were required to list the fathers' and mothers' occupation.

Student Interviews

Student interviews were conducted with a subsample of students to corroborate validity of the attribution measure and to provide more specific information on the relation of gender and attributions. The interview schedule (see Appendix F) consisted of 18 scenarios created by matching high and low levels of attributions to ability, task difficulty, effort, luck, and studying with a successful and a failure condition. For example, with ability, there was a high ability successful scenario, a low ability successful scenario, a low ability failure scenario, and a high ability failure scenario. For scenarios involving attribution to luck, only two matches made sense; successful or unsuccessful, hence there were 18 rather than 20 scenarios. An example of a success scenario matched to high difficulty would be "John is in grade eight mathematics. He just wrote a mathematics test. While he was taking the test, he found it very hard. Then when he got the test back, he had passed with a very good mark."

The interview began with an explanation about what the interviewee was to consider. "I am going to describe several learning situations in a classroom. I want you to imagine how the person in each story would respond to the situation. Before I tell you the story I would like to ask you about marks on a test. What would you consider to be a good mark on a test out of 100 _____ and a bad mark out of 100 _____." This item was added after a discussion with teachers about marks. It was expected that a good mark for some students might be considered a poor mark by other students. This question was asked in order to help interpret the interview. Students were told that the scenarios all involved a grade 8 student who had just completed a mathematics test. They were also told that the same scenario would be asked for a boy and for a girl. Each student was also asked what they thought was a good name for a boy and a good name for a girl. These names were used in the scenarios.

After each scenario, students were asked two questions: one calling for an affective response, "How do you think the student would feel?" and another which elicited a causal analysis, "What do you think the student would say when asked why he did so well" or "so poorly?" Questions were reproduced on an answer sheet with some suggested responses (see Appendix G). Students were first told a scenario about a same sex student, and asked questions. This was followed by the same scenario with an opposite sex student. Students rank ordered their responses using a "1" for the option they most thought described the situation. Each interview took about 15 minutes. One male and one female student from each classroom were interviewed.

Procedures

Stage 1

During stage one, four school principals were approached about participating in the research study. After their agreement, a meeting took place between the researcher and the teachers at the schools, and at two schools, the principal. Once teachers agreed to participate, individual meetings were scheduled with each of them to discuss the data collection in more detail.

At these individual meetings, parent consent forms were given to the teacher to hand out to students in the class. A total of 530 parent permission letters were sent home with students. Of this total, 518 were returned with agreement to participate.

Stage 2

During stage two (the beginning of October), the 10 participating teachers administered the mathematics self-concept measure and the student classroom environment measure about 2 to 5 days prior to the first test. The first unit mathematics test was given to students. Teachers included the item, "What do you expect your mark will be on this test?" at the end of the mathematics test. Upon the return of the first unit mathematics test (a test that covers one instructional unit), the attribution measure was administered by the teachers to their participating students. The teacher read the instructions on the first page which told students to proceed to page 2 if they perceived the mark on the mathematics test as a good mark, or page 3 if it was a bad mark. Students completed the six items on the measure. Students were instructed to check one option for each item. No attempts were made to have absent

students complete the attribution measure at a later date. First test grades as a percentage were provided by each teacher.

Stage 3

This period began about mid November. During stage three teachers again added the item about expected grades on the second unit mathematics test. After the second unit mathematics test was returned, teachers again administered the attribution measure. Second test grades were again provided as well as first semester final grade point averages. Teacher classroom environment measures were given to teachers during this period.

Stage 4

This period began mid January. During this stage the mathematics self-concept test and the student classroom environment measure was administered for a second time about 2 to 5 days prior to the mathematics quiz. The student background questionnaire was also administered. Students took the third mathematics quiz and teachers again added the item about expected grade. After the third unit mathematics test was returned, teachers again administered the attribution measure.

Stage 5

This period began at the beginning of February and continued until the end of March. During this final stage, four students (two male and two female) from each classroom were selected by Identification Number (from the background questionnaire) using a computerized random number generator (Peters, 1991). Students were given a letter telling them about the interview and asking for their

permission. In addition, a permission letter was sent home to parents. Two students (one male and one female) were required from each classroom. Four were selected in case either student or parent declined to participate. In two instances, two additional girls had to be randomly selected when the required number was not achieved. This was due to lack of interest, and in one case a male circled "female" on the background questionnaire.

All interviews were conducted by the researcher. Interviews took 15 minutes. In some cases they were conducted at the back of the classroom, or in a separate room.

CHAPTER 4

RESULTS

Overview

This chapter is divided into four sections: a review of the results from the classroom environment measure, results of tests of hypotheses, relationship of achievement and motivational variables with the classroom environment data, and results of student interviews.

Classroom Environment Review

Classroom Environment From The Student Perspective

The Classroom Environment measure (administered twice at time one and at time three) was used to examine factors that may influence student learning in the classroom. As mentioned in Chapter 3, two items were deleted from the original measure and four new items were added. Two items were added to replace the deletion of the item "When we do poor work the teacher lets us know it." Two items perceived to differentiate between genders were added to satisfy teachers' interest. The results for these two items, "When I ask for help my teacher urges me to try harder" and "When I ask for help my teacher helps me do the problem" were examined to determine whether gender differences existed. Independent t-tests were computed between gender means for each item on both administrations. This analysis failed to detect significant gender differences (see Table 2). Consequently, they were omitted from further consideration.

TABLE 2

t - test Results for Gender Items on the Classroom Environment Scale

Environment Item	Sex	ADMINISTRATION ONE n	M	SD	t	df	ADMINISTRATION TWO n	M	SD	t	df
When I ask for help my teacher urges me to try harder.	F	216	2.02	1.07	0.21	397	222	2.05	0.98	0.68	407
	M	183	2.00	1.13			187	2.12	1.05		
When I ask for help my teacher helps me do the problem.	F	221	2.86	1.11	0.43	402	224	2.95	1.09	0.36	410
	M	183	2.91	1.12			188	2.99	1.08		

Factor analysis was performed on the Classroom Environment measure in order to determine whether the items loaded on the original factors specified by the test authors. Principal axis factoring extraction was used followed by Varimax rotation. Factor loadings for each of the 24 items arshown in Table 3 for administration 1 and Table 4 for administration 2.

Eight factors were extracted from the analysis rather than the six proposed by the test authors. The seventh factor consisted of one item on the first administration and two on the second. The item that loaded on factor 7 in both administrations was "We can decide which order to do our mathematics work in." The additional item which turned up on the seventh factor in the second administration was item 10, "We can choose mathematics materials (books, games) to use in class." The former item was also detected as a seventh factor in a study conducted by Woudzia (1991). Woudzia named this factor "Autonomy," a term adopted for this study. The eighth factor consisted of one new item on the first administration, "When we do poor work the teacher lets us know it." In the second administration an additional item loaded on this scale, Item 6, "The teacher

TABLE 3
Factor Loadings on the Eight Factors of the Classroom Environment Scale for the First Administration

Item	Factors 1	2	3	4	5	6	7	8
1	-	.70	-	-	-	-	-	-
2	-	-	-	-	-	.79	-	-
3	.66	-	-	-	-	-	-	-
4	-	-	.57	-	-	-	-	-
5	-	-	-	.69	-	-	-	-
6	-	-	-	-	.81	-	-	-
7	-	.69	-	-	-	-	-	-
8	-	-	-	-	-	.79	-	-
9	.72	-	-	-	-	-	-	-
10	-	-	.44	-	-	-	-	-
11	-	-	-	.82	-	-	-	-
12	-	.74	-	-	-	-	-	-
13	.80	-	-	-	-	-	-	-
14	-	-	-	-	-	-	.66	-
15	-	-	-	.52	-	-	-	-
16	-	-	.70	-	-	-	-	-
17	-	.71	-	-	-	-	-	-
18	.72	-	-	-	-	-	-	-
19	-	.60	-	-	-	-	-	-
22	-	-	.50	-	-	-	-	-
23	.71	-	-	-	-	-	-	-
24	-	-	-	-	.77	-	-	-
25	-	-	.73	-	-	-	-	-
26	-	-	-	-	-	-	-	.83

Note. Items 20 and 21 were not included.
Eigenvalues and percentage explained variance for each factor.
Scales:
1. Social Comparison Items = 3, 9, 13, 18, 23 (1. eigenvalue = 3.18, % = 13.2);
2. Student-Teacher Relations Items = 6, 24 (1. eigenvalue = 1.38, % = 5.7);
3. Student Input Items = 4, 10, 16, 22, 25 (1. eigenvalue = 2.51, % =10.5);
4. Task Organization Items = 5, 11, 15 (1. eigenvalue = 1.67, % = 7.0);
5. Competition Items = 2, 8 (1. eigenvalue = 1.19, % = 5.0);
6. Cooperation Items = 1, 7, 12, 17, 19 (1. eigenvalue = 2.55, % = 10.6);
7. Autonomy Item = 14 (1. eigenvalue = 1.09, % = 4.6);
8. Teacher Feedback Item = 26 (1. eigenvalue = 1.01, % = 4.2).

cares how we feel." This scale was named "Teacher Feedback."

Table 5 includes the items which represent each of the factors from the original scale and the comparative items and factors for the two administrations in this study. As can be seen, four factors were replicated exactly on both test administrations. The Student Input and Student Teacher Relations scales were not replicated. Since two scales were not replicated and two additional factors were extracted, it did not seem reasonable to use the original author's scales. Rather, it was decided to use the scales described by the factor loadings for each administration with one exception. Item 10 was assigned to the Student Input scale, even though it loaded on two factors in one administration of the test, Student Input and Autonomy. Loading on the autonomy factor was a single occurrence, which could well be anomalous. Therefore, for three scales, Student Input, Student Teacher Relations, and Teacher Feedback, there are different items across the two administrations.

Internal Consistency reliability estimates were calculated for values obtained from the first administration for each subscale on the Classroom Environment measure. The reliability coefficients are presented in Table 6. The lowest estimate for the first administration was for the Competition scale (α = .54). The lowest estimate for the second administration was for the Teacher Feedback scale (α = .32). The Social Comparison scale had the highest reliability estimates for both administrations (time one: α = .78 and time three: α = .81).

TABLE 4
Factor Loadings on the Eight Factors of the Classroom Environment
Scale for the Second Administration

Items	Factors 1	2	3	4	5	6	7	8
1	-	.73	-	-	-	-	-	-
2	-	-	-	-	-	.86	-	-
3	.60	-	-	-	-	-	-	-
4	-	-	.54	-	-	-	-	-
5	-	-	-	.71	-	-	-	-
6	-	-	-	-	.81	-	-	.50
7	-	.73	-	-	-	-	-	-
8	-	-	-	-	-	.76	-	-
9	.70	-	-	-	-	-	-	-
10	-	-	.48	-	-	-	.57	-
11	-	-	-	.68	-	-	-	-
12	-	.69	-	-	-	-	-	-
13	.82	-	-	-	-	-	-	-
14	-	-	-	-	-	-	.75	-
15	-	-	-	.71	-	-	-	-
16	-	-	-	-	.76	-	-	-
17	-	.72	-	-	-	-	-	-
18	.76	-	-	-	-	-	-	-
19	-	.69	-	-	-	-	-	-
22	-	-	.66	-	-	-	-	-
23	.77	-	-	-	-	-	-	-
24	-	-	-	-	.59	-	-	-
25	-	-	-	-	.79	-	-	-
26	-	-	-	-	-	-	-	.82

Note. Items 20 and 21 are not included.
Eigenvalues and percentage explained variance for each factor.
Scales:
1. Social Comparison Items = 3, 9, 13, 18, 23 (2. eigenvalue = 3.95, % = 16.5);
2. Student-Teacher Relations Items = 16, 24, 25, (2. eigenvalue = 2.32, % = 9.7);
3. Student Input Items = 4, 10, 22 (2. eigenvalue = 1.36, % = 5.7);
4. Task Organization Items = 5, 11, 15 (2. eigenvalue = 1.43, % = 5.9);
5. Competition Items = 2, 8 (2. eigenvalue = 1.23, % = 5.1);
6. Cooperation Items = 1, 7, 12, 17, 19 (2. eigenvalue = 2.70, % = 11.3);
7. Autonomy Item = 14 (2. eigenvalue = 1.10, % = 4.6);
8. Teacher Feedback Items = 6, 26 (2. eigenvalue = 1.01, % = 4.2).

TABLE 5
Items By Factors of the Original Classroom Environment Instrument and the Modified Instrument on First and Second Administrations

FACTORS	Items on Original Scale	Items on Modified Scale ADMINISTRATION 1	ADMINISTRATION 2
Social Comparison	3, 9, 13, 18, 23	3, 9, 13, 18, 23	3, 9, 13, 18, 23
Student-Teacher Relations	6, 16, 24, 25	6, 24	16, 24, 25
Student Input	4, 10, 14	4, 10, 16, 22, 25	4, 10, 22
Task Organization	5, 11, 15	5, 11, 15	5, 11, 15
Competition	2, 8	2, 8	2, 8
Cooperation	1, 7, 12, 17, 19	1, 7, 12, 17, 19	1, 7, 12, 17, 19
Autonomy*		14	10, 14
Teacher Feedback*		26	6, 26

Note. * Factor not found by the test authors.

The means and standard deviations for each of the eight factors for both test administrations are displayed in Table 7. With the exception of the Student-Teacher Relations scale, there was very little difference between mean scores for the two administration periods.

For the total group the mean score for social comparison was 11 out of 20 indicating that there was a moderate amount of comparison to others. In the first administration period the Student-Teacher Relations scale which included two items had a mean score of 6 out of 8 indicating good relations between student and teacher. In the second administration when the scale included three items, the result was equivocal with a mean score of 6 out of 12. Only one item was common to both administrations. The mean Student Input score was low, approximately

TABLE 6
Subscale Reliabilities of the Classroom Environment Measure

Environment Measure Subscale	Number of Items	ADMINISTRATION 1 Number of Students	α	M	SD	ADMINISTRATION 2 Number of Students	α	M	SD
Cooperation	5	327	.74	10.08	3.49	348	.77	10.77	3.78
Competition	2	327	.54	4.91	1.66	348	.61	4.93	1.76
Social Comparison	5	327	.78	11.68	3.89	348	.81	11.39	3.99
Student-Teacher Relations	2	327	.65	6.24	1.63	348	.64	5.96	1.63
Student Input	5	327	.59	5.61	2.33	348	.50	5.81	2.19
Task Organization	3	327	.59	11.25	1.41	348	.54	11.26	1.29

Note. Items 20 and 21 not included in measure.
Cooperation = Items 1, 7, 12, 17, 19;
Competition = Items 2, 8;
Social Comparison = Items 3, 9, 13, 18, 23;
Student-Teacher Relations = Items 6, 24;
Student Input = Items 4, 10, 16, 22, 25;
Task Organization = Items 5, 11, 15.

6 out of 16 on the first administration and 6 out of 12 on the second administration, indicating that, on average, students do not believe that they have much input into the classroom. The mean of 11 on Task Organization for both administrations suggests that students in the classroom use the same materials and work on the same assignments. A mid-range score on both administrations of the competition component indicates that on average, students did not perceive their classrooms to be highly competitive. A mid-range score on Cooperation for both administrations suggests that classroom work includes a moderate amount of cooperative learning.

TABLE 7
Means and Standard Deviations for Individual Items and Subscales for Eight Factors on the Classroom Environment Scale

Environment Measure Item	INDIVIDUAL ITEM MEANS ADMINISTRATION 1 N = 404 M	SD	ADMINISTRATION 2 N = 416 M	SD
1.	1.75	0.98	1.96	1.09
2.	2.34	0.98	2.36	1.01
3.	2.08	0.96	2.18	0.99
4.	1.40	0.80	1.34	0.76
5.	3.73	0.66	3.80	0.54
6.	2.85	1.00	2.72	1.00
7.	1.62	0.98	1.84	1.02
8.	2.50	1.04	2.54	1.06
9.	2.54	1.09	2.41	1.11
10.	1.26	0.68	1.30	0.70
11.	3.66	0.71	3.63	0.74
12.	2.13	1.15	2.10	1.18
13.	2.48	1.11	2.44	1.09
14.	1.78	1.04	1.87	1.03
15.	3.75	0.65	3.77	0.60
16.	1.23	0.76	1.31	0.78
17.	2.01	0.92	2.31	1.03
18.	2.04	1.02	2.02	0.97
19.	2.68	0.98	2.83	1.00
22.	1.60	1.05	1.61	1.00
23.	2.43	1.10	2.35	1.08
24.	3.36	0.89	3.24	0.90
25.	1.50	0.96	1.66	1.01
26.	2.72	1.06	2.70	1.03

Environment Measure Subscale	SUBSCALE MEANS ADMINISTRATION 1 N = 404 M	SD	ADMINISTRATION TWO N = 416 M	SD
1. Social Comparison	11.54	3.98	11.37	3.93
2. Student-Teacher Relations	6.20	1.61	6.21	1.49
3. Student Input	5.69	2.40	4.24	1.76
4. Task Organization	11.14	1.49	11.21	1.31
5. Competition	4.84	1.67	4.90	1.74
6. Cooperation	10.18	3.42	11.00	3.78
7. Teacher Feedback	2.72	1.06	5.42	1.57
8. Autonomy	1.78	1.03	1.87	1.03

Note. Items 20 and 21 not included in measure.
1. Social Comparison = Items 3, 9, 13, 18, 23 (both administrations);
2. Task Organization = Items 5, 11, 15, (both administrations);
3. Competition = Items 2, 8 (both administrations);
4. Cooperation = Items 1, 7, 12, 17, 19 (both administrations);
5. Autonomy = Item 14 (both administrations);
6. Student-Teacher Relations = Items 6, 24 (administration one) Items 16, 24, 25 (administration two);
7. Student Input = Items 4, 10, 16, 22, 25 (administration one) Items 4, 10, 22 (administration two);
8. Teacher Feedback = Item 26 (administration one) Item 6, 26 (administration two).

TABLE 8
Response Frequencies for the Teacher Environment Measure

Classroom Environment Statement n = 10		Response A	B	C	D
1.	Students work in small groups.	1	6	2	1
2.	Students can suggest projects or topics to study.	8	1	1	0
3.	Most students in the class do the same homework.	0	1	8	1
4.	Students are allowed to move around the class.	5	3	0	2
5.	Students can choose math materials (books, games) to use in the class.	8	2	0	0
6.	All students work on the same math lesson.	0	8	1	1
7.	Students get to pick which students to work with.	2	5	2	1
8.	Students decide which order to do math work.	9	1	0	0
9.	Students all use the same math textbooks and materials in class.	1	1	8	0
10.	Students can talk to each other during math time.	0	1	6	3
11.	Students help each other with their math work.	0	1	5	4
12.	When students ask for help they are encouraged to try harder.	0	3	1	6
13.	When students ask for help they are helped with the problem.	0	0	0	10
14.	There is recognition for students who do well.	1	0	2	7
15.	Students practise skills in solving problems.	0	0	2	8
16.	Students have projects in math class.	1	6	3	0
17.	Students use a calculator to solve math problems.	0	2	2	6
18.	Students use computers in math class.	7	1	2	0
19.	Students memorize facts and formulas.	1	7	2	0

Note. Modal response is underlined.
A = Not very important
B = Somewhat important
C = Important
D = Very important

The relatively high score for the sole item reflecting Teacher Feedback for both administrations suggests that there is frequent guidance from the teacher during learning. Relatively low mean scores on both administrations for Autonomy suggests that students do not feel that they have a great deal of autonomy in the class.

Classroom Environment From The Teacher Perspective

Frequencies were compiled on the Teacher Classroom Environment Measure and are displayed in Table 8. The mode for each item on this table is underscored. All ten teachers rated the item, "When students ask for help they are helped with the problem" as being "very important" in the operation of their classroom. Another item rated as very important by 80% of the teachers was "Students practice their mathematics skills in solving problems." Recognition for students who do well in class was also rated "very important" or "important" by all but one respondent. Teachers also rated the item "Students help each other with their mathematics work" as either "important" or "very important" by most of the respondents. Using a calculator, having students do the same mathematics homework, using the same materials, and encouraging students to try harder when they ask for help were also considered important by teachers. Other items were considered less important by teachers.

Teachers and students had similar responses for Task Organization -- that students use similar materials and usually work on the same assignments. Most teachers gave a relatively low rating to Cooperation items ("somewhat important" or "not very important"). Students' shared the perspective with teachers that there is a moderate amount of cooperative learning. Students' and teachers' responses were in

general agreement that student input was limited. Other student classroom environment items were not asked of the teacher.

Results Of Hypotheses

Descriptive Statistics

Students participating in this study represented many ability levels. The sample of students in this sample comprised 19 classes from four urban schools, each with an enrolment between 1000-2000. The schools were located in multi-ethnic neighbourhoods with a wide range of socioeconomic status.

Classes were not randomly selected. Participation of 10 teachers yielded a broad range of academic program groupings. Students were enrolled in regular, French Immersion, transitional English, or advanced mathematics classes. Students with modified mathematics programs are integrated within the regular program. All classes had their mathematics instruction in English, including students in French Immersion programs. The only students deleted from the study were those who decided that they did not wish to participate. Although academic aptitude was not measured directly, it seems reasonable that the students who agreed to participate represent a full spectrum of heterogeneous ability groups. It also seems reasonable to analyze the student data as a district group rather than compartmentalize the analysis into school and class groups for two reasons. Using class level analysis would create small cell sizes and the analysis would lack power. Conversely, whole group analysis contributes power from the large sample size. Since the goal was to draw inferences

with the widest possible generalizability, it was deemed appropriate to analyze the aggregated data. less important by teachers.

At the outset it should be noted that sample sizes varied for different measures and testing periods. Missing data occurred in several instances for absent students since tests were administered by classroom teachers and makeups were not offered. Some students' expected scores were missing because they did not respond and, on one occasion, the teacher failed to present them with the opportunity to make a prediction. Four classes did not receive the attribution measure at time two as the teacher of these classes did not remember to administer the instruments.

Descriptive data for administration one are shown in Table 9, for administration two in Table 10, and for administration three in Table 11. Student data were separated into two distinct categories: success outcomes and failure outcomes, at each administration period based on the student's judgment of relative success or failure on the mathematics quiz. Failure does not necessarily mean a failing grade *per se* (although it could). The failure category was defined by the student's perception of whether the achievement outcome was a poor mark for her or him according to a personal metric. A similar interpretation of success outcomes was appropriate, that was, success is defined by a student's perception rather than by an external criterion. Attribution data are presented for these two categories of perceived success or failure since the attributions depend on a success/failure judgment. Achievement and self-concept data are presented for the two categories (perceived success and perceived failure) and also for the total group.

TABLE 9

First Measure of Students' Mean Self-Concept, Achievement, and Attribution Scores for the Total Group of Students with Breakdowns by Gender and Perceived Success or Failure

MEASURE		TOTAL SAMPLE n	M	SD	PERCEIVED SUCCESS n	M	SD	PERCEIVED FAILURE n	M	SD
General	Total	406	19.41	5.71	179	20.60	5.40	213	18.62	5.83
Self-	Females	220	19.23	5.64	102	20.03	5.35	112	18.77	5.81
Concept1	Males	186	19.62	5.81	77	21.36	5.40	101	18.47	5.87
Math	Total	408	19.07	6.65	180	21.37	5.89	213	17.32	6.81
Self-	Females	221	17.82	6.77	102	19.91	6.40	112	16.20	6.72
Concept1	Males	187	20.55	6.21	78	23.27	4.52	101	18.56	6.74
Expected	Total	325	79.95	16.79	145	84.63	13.42	174	75.90	18.39
Score1	Females	178	79.07	17.01	80	83.89	14.06	97	75.08	18.32
	Males	147	81.01	16.52	65	85.55	12.63	77	76.93	18.55
Actual	Total	325	71.14	20.39	186	82.38	15.21	220	61.69	19.68
Score1	Females	178	71.89	19.92	106	82.16	16.05	113	62.51	18.49
(%)	Males	147	70.28	20.99	80	86.67	14.11	107	60.82	18.55
1st	Total				186	3.59	1.11	221	3.20	1.22
Effort	Females				106	3.74	1.06	114	3.32	1.24
Attribution	Males				80	3.40	1.14	107	3.07	1.19
1st	Total				185	3.17	1.00	221	3.42	1.31
Ability	Females				105	2.92	1.02	114	3.39	1.28
Attribution	Males				80	3.50	0.89	107	3.46	1.35
1st	Total				185	1.99	1.01	221	3.79	1.25
Luck	Females				105	2.12	1.09	114	3.90	1.22
Attribution	Males				80	1.81	0.87	107	3.67	1.29
1st Task	Total				186	2.96	0.96	221	3.75	1.04
Difficulty	Females				106	2.96	1.00	114	3.64	1.01
Attribution	Males				80	2.95	0.91	107	3.86	1.07
1st	Total				186	3.00	1.25	220	3.26	1.32
Studying	Females				106	3.02	1.26	113	3.28	1.26
Attribution	Males				80	2.97	1.25	107	3.24	1.37

Throughout this dissertation, correlations are reported as tests of the strength of relations and *t* - tests as tests of differences between means. Whenever a result is reported as statistically significant it is based on a probability estimate less than .01. A conservative level of significance was selected because of the numerous tests conducted on the same data set. A less conservative criterion level (i.e., $p < .05$) would introduce an increase in the expectation of Type I errors, the rejection of the null hypothesis due to chance due to the large number of

TABLE 10

Second Measure of Students' Mean Self-Concept, Achievement, and Attribution Scores for the Total Student Sample with Breakdowns by Gender and Perceived Success or Failure.

MEASURE		TOTAL SAMPLE n	M	SD	PERCEIVED SUCCESS n	M	SD	PERCEIVED FAILURE n	M	SD
1st Term	Total	427	72.39	18.26	186	81.65	13.80	221	65.41	18.52
Math	Females	229	74.33	17.89	106	81.82	13.89	114	67.43	18.22
Average	Males	198	70.14	18.46	80	80.02	13.69	107	63.26	18.67
Expected	Total	305	75.73	18.65	124	78.06	17.92	109	72.84	18.24
Score2	Females	164	75.04	18.57	70	77.11	17.67	60	72.30	19.17
	Males	141	76.53	18.77	54	79.30	18.34	49	73.51	17.21
Actual	Total	418	69.95	20.46	169	79.78	15.87	152	62.38	18.20
Score2	Females	225	71.87	19.01	92	80.53	14.37	86	64.06	18.44
(%)	Males	193	67.72	21.87	77	78.88	14.11	66	60.20	17.80
2nd	Total				169	3.52	1.01	152	3.42	1.07
Effort	Females				92	3.10	1.01	86	3.48	1.12
Attribution	Males				77	3.08	0.99	66	3.35	1.00
2nd	Total				169	2.29	1.11	152	3.62	1.22
Ability	Females				92	2.26	1.01	86	3.46	1.19
Attribution	Males				77	2.32	1.23	66	3.82	1.24
2nd	Total				169	3.02	1.07	152	3.78	1.28
Luck	Females				92	2.96	0.95	86	3.83	1.22
Attribution	Males				77	3.10	1.21	66	3.71	1.36
2nd Task	Total				169	2.92	0.93	152	3.69	1.00
Difficulty	Females				92	3.15	0.89	86	3.55	0.93
Attribution	Males				77	2.65	0.97	66	3.88	1.07
2nd	Total				169	3.00	1.14	152	3.35	1.15
Studying	Females				92	3.02	1.04	86	3.51	1.18
Attribution	Males				77	2.97	1.20	66	3.14	1.11

statistical tests performed on the data. One exception to this criterion was for secondary analysis testing the difference between the magnitude of correlations using the Fisher *r*-to-*z* transformation. The critical level for this analysis was set at $\alpha < .05$.

As described in Chapter 3, an open-ended question was provided on the attribution measure. An inspection of the responses to this question failed to yield any new information other than to replicate the attribution set provided on the instrument. Therefore, responses from this question were not examined further.

TABLE 11

Third Measure of Students' Mean Self-Concept, Achievement, and Attribution Scores for the Total Student Sample with Breakdowns by Gender and Perceived Success or Failure.

MEASURE		TOTAL SAMPLE n	TOTAL SAMPLE M	TOTAL SAMPLE SD	PERCEIVED SUCCESS n	PERCEIVED SUCCESS M	PERCEIVED SUCCESS SD	PERCEIVED FAILURE n	PERCEIVED FAILURE M	PERCEIVED FAILURE SD
General Self-Concept2	Total	407	18.71	5.89	164	20.28	5.23	208	17.79	6.07
	Females	221	18.67	5.99	84	20.77	4.80	117	17.50	6.23
	Males	186	18.76	5.79	80	19.76	5.65	91	18.17	5.87
Math Self-Concept2	Total	411	17.87	6.94	166	20.70	5.76	210	15.98	7.16
	Females	223	17.02	7.05	85	20.30	5.70	118	15.08	7.19
	Males	188	18.88	6.68	81	21.12	5.82	92	17.13	7.00
Expected Score3	Total	340	73.00	18.37	152	79.60	15.95	169	67.47	18.99
	Females	186	72.99	17.79	79	79.82	14.44	96	67.74	19.08
	Males	154	73.01	19.11	73	79.37	17.54	73	67.11	19.00
Actual Score3 (%)	Total	405	67.32	22.90	170	80.74	16.91	215	57.81	19.89
	Females	219	68.43	21.83	86	83.13	13.19	121	59.16	19.90
	Males	186	66.02	23.04	84	78.30	19.80	94	56.06	19.85
3rd Effort Attribution	Total				172	3.43	0.97	216	3.25	1.21
	Females				87	3.70	0.92	121	3.26	1.20
	Males				85	3.15	0.94	95	3.23	1.23
3rd Ability Attribution	Total				172	3.03	0.98	216	3.51	1.17
	Females				87	2.84	0.89	121	3.43	1.12
	Males				85	3.22	1.03	95	3.61	1.22
3rd Luck Attribution	Total				172	2.17	0.98	216	3.51	1.17
	Females				87	2.18	0.89	121	3.43	1.12
	Males				85	2.15	1.03	95	3.61	1.22
3rd Task Difficulty Attribution	Total				172	2.81	0.85	216	3.53	1.02
	Females				87	2.64	0.83	121	3.50	0.95
	Males				85	2.98	0.84	95	3.58	1.10
3rd Studying Attribution	Total				172	2.83	1.14	215	3.19	1.20
	Females				87	2.90	1.09	121	3.16	1.16
	Males				85	2.75	1.18	94	3.22	1.25

Also mentioned in Chapter 3, the classroom environment, mathematics self-concept, and general self-concept measures were administered twice, once at the beginning of the study and once at the end of the study. The causal attribution measure was administered three times coinciding with the return of classroom mathematics quizzes, yielding three sets of correlation results. For the purposes of discussing causal attribution patterns across time, data from the mathematics self-concept and classroom environment measures administered at time one have been

correlated with attribution measures administered at time one and also at time two. Data from the self-concept and classroom environment measures administered at the final time are correlated with the attribution measure administered for the third time (final time).

Reliability and Stability

The reliability estimates for the self-concept measures are relatively high. Alpha coefficients calculated for mathematics self-concept (α = .89 for administration one, α = .91 for administration two) and for general academic self-concept (α = .86 for administration one and α = .86 for administration two) provide evidence that the scales are internally consistent. Test-retest reliability statistics (Pearson product moment correlations) for both the mathematics (r = .74, p < .001) and general self-concept measures (r = .69, p < .001) were also high (see Table 12).

TABLE 12
Correlations Among Mathematics, and General Academic Self-Concept Scores, at First and Third Test Administration Times

Measure	Mathematics Self-Concept1	Mathematics Self-Concept2	General Self-Concept1	General Self-Concept2
1. MATHSEF1	-			
2. MATHSEF2	.74**	-		
3. GENSELF1	.69**	.54**	-	
4. GENSELF2	.53**	.62**	.69**	-

Note. N = 391, 1-tailed Significance: * p < .01, ** p < .001

TABLE 13
Correlations Among Attribution Items for Three Administrations Under Success and Failure Conditions

Items		Attributions 1	2	3	4	5
1. Trying Hard	T1	-		**SUCCESS OUTCOMES**		
	T2	-				
	T3	-				
2. Smart in Math	T1	.04	-			
	T2	.15	-			
	T3	.12	-			
3. Good Luck	T1	.12	.03	-		
	T2	.06	.09	-		
	T3	.04	.06	-		
4. Easy Test	T1	-.09	.20*	.13	-	
	T2	.06	.23*	.11	-	
	T3	.14	.17	.05	-	
5. Study a Lot	T1	.47**	.07	.18*	.04	-
	T2	.51**	.05	.17	-.03	-
	T3	.49**	.10	.06	-.04	-
1. Not Trying	T1	-		**FAILURE OUTCOMES**		
	T2	-				
	T3	-				
2. Not Smart	T1	.23**	-			
	T2	.14	-			
	T3	.22**	-			
3. Bad Luck	T1	.20*	.21**	-		
	T2	.21*	.13	-		
	T3	-.01	-.03	-		
4. Hard Test	T1	.11	.35**	.15	-	
	T2	.10	.57**	.25**	-	
	T3	.19*	.34**	-.01	-	
5. Not Studying	T1	.30**	.17*	.12	.08	-
	T2	.26**	.26**	.12	.22*	-
	T3	.38**	.18*	-.03	.24**	-

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$.
N Success: T1 = 188, T2 = 172, T3 = 176.
N Failure: T1 = 227, T2 = 160, T3 = 219.

Intercorrelations of the attribution measures for success and for failure outcomes are presented in Table 13. For the success outcome, studying and effort correlated ($p < .001$) consistently across time which suggests that the two items were seen as similar by students. Task difficulty level correlated with ability ($p < .01$) at time one and at two. At time one, studying correlated with luck ($p < .01$). For the failure outcome, ability and effort correlated ($p < .001$) for times one and three, but not at time two. For the first test, luck correlated with ability ($p < .001$). Luck also correlated with effort at times one and two. Ability correlated with task difficulty ($p < .001$) for all three administration periods. Task difficulty also correlated with luck at time two ($p < .001$) and with effort at time three ($p < .01$). Studying correlated with effort for all three periods of testing ($p < .001$). Studying also correlated with ability for all three periods ($p < .01$ for administration one and three and $p < .001$ for administration two) and with task difficulty level for the second ($p < .01$) and third ($p < .001$) administrations.

Mathematics Self-Concept and Achievement

To test the hypothesis that males would have a higher mean mathematics self-concept score than females a one-tailed independent *t*-test was computed for the scores at the two administrations. Means and standard deviations are provided in Tables 9 and 11. The mean mathematics self-concept scores were significantly higher for males both at time one, ($t(406) = 4.21$, $p < .01$) and at time two, ($t(409) = 2.74$, $p < .01$).

For classroom grades, it was predicted that females would have a higher overall mathematics achievement for the first term than males. Again, a one-tailed independent *t*-test was computed between genders on first term mathematics averages (see Table 10). The prediction was confirmed; females had a significantly higher mathematics average, ($t(425) = 2.38$, $p < .01$).

Another hypothesis was that females' predicted scores for mathematics quizzes would be lower than males' predictions. This hypothesis was not confirmed. One-tailed independent *t*-tests between genders for predicted mathematics scores on each of the three mathematics quizzes did not reveal any significant between-groups differences (administration one, $t(323) = 1.04$, ns; administration two, $t(303) = 0.70$, ns; administration three, $t(338) = 0.01$, ns).

Correlations were used to examine relations between mathematics achievement and mathematics self-concept. It was hypothesized that students with high academic performance in mathematics would have a high prior mathematics self-concept. Students with the low performance were predicted to have low prior mathematics self-concept. Correlations between mathematics self-concept and achievement were computed at time one and at time three (see Table 14). At both times the correlations proved to be statistically significant ($r = .51$ and .56, $p < .001$ for both administrations), supporting the hypothesis.

It was also predicted that the relation between mathematics self-concept and mathematics achievement would be stronger for males than for females. This was

TABLE 14
Correlations of Mathematics Self-Concept with Mathematics Achievement

Measure		Actual Score 1 r	n	ß	Actual Score 3 r	n	ß
Mathematics Self-Concept	Total	.51**	401	.16	.56**	390	.17
	Females	.52**	216	.18	.59**	213	.15
	Males	.52**	185	.16	.53**	177	.19

Note. 1-tailed Significance: p < .01, ** p < .001.

not confirmed from the results of first quiz. An identical correlation (r = .52, p < .001) was found for both gender groups. Neither was the hypothesis confirmed at time three. Although the observed correlation between the third mathematics quiz and the second self-concept measure was higher for females (r = .59, p < .001) than males (r = .53, p < .001), there was not a significance between the correlation coefficients after standardizing using Fisher's z transformation (z_r =.86, p > .05).

Correlations were computed to investigate the hypothesis that there would be a positive relationship between mathematics self-concept and mathematics achievement in both success and failure conditions (see Tables 15 and 17). Four correlations were computed, two each at times one and three. At time one, the first mathematics self-concept was correlated with the first mathematics quiz for both failure and success groups. At time three, the correlations for these two student groups were calculated between the second mathematics self-concept measure and the third mathematics quiz for students who had perceived that they had been successful and for students who had perceived that they had failed. Results supported the hypothesis with significant (p < .001) correlations for each test (r = .44 and .40, for the success

condition; and r = .43 and .52, for the failure condition). These correlations were standardized using Fisher's z transformation to test whether the correlation for the perceived failure group at time three was higher than at time one. The difference was not significant (z_r = 1.46, p > .05).

Correlations between mathematics self-concept and mathematics quizzes were also calculated for males and females within each condition (perceived failure and perceived success) at times one and three. For males and females at both test periods there were positive correlations (p < .001) between mathematics self-concept

TABLE 15

First Administration Correlations of Students' Causal Attribution Scores with Mathematics Self-Concept and Achievement with Breakdowns by Success or Failure

		SUCCESS						FAILURE					
		Math-Concept1			Actual Score1			Math Concept1			Actual Score1		
MEASURE		r	n	ß	r	n	ß	r	n	ß	r	n	ß
Actual Score 1	Total	.44**	180	.18				.43**	212	.15			
	Females	.48**	102	.19				.46**	111	.17			
	Males	.35**	78	.14				.44**	101	.15			
1st Effort Attribution	Total	-.11	179	.02	.04	184	.00	.15	212	.03	.24**	219	.01
	Females	-.11	101	-.02	.03	104	.00	.25*	111	.05	.23*	112	.02
	Males	.01	78	.00	.15	80	.01	.15	101	.03	.28*	107	.02
1st Ability Attribution	Total	.59**	179	.10	.25**	184	.02	.49**	212	.09	.32**	219	.02
	Females	.57**	101	.09	.30*	104	.02	.50**	111	.09	.28*	112	.02
	Males	.51**	78	.10	.11	80	.01	.47**	101	.09	.36**	107	.02
1st Luck Attribution	Total	-.26**	179	-.05	-.09	184	-.01	.00	212	.00	-.06	219	-.00
	Females	-.23	101	-.10	-.05	104	-.00	.14	111	.02	.10	112	.01
	Males	-.24	78	-.05	-.12	80	-.01	-.08	101	-.02	-.20	107	-.01
1st Task Ease /Difficulty Attribution	Total	.26**	179	.04	.22*	184	.01	.46**	212	.07	.27**	219	.01
	Females	.31**	101	.05	.23*	104	.01	.50**	111	.07	.34**	112	.02
	Males	.21	78	.04	.16	80	.01	.39**	101	.06	.22	107	.01
1st Studying Attribution	Total	-.12	179	-.03	-.09	184	-.01	.27**	212	.05	.33**	219	.02
	Females	-.19	101	-.04	-.08	104	-.01	.28*	111	.05	.36**	112	.02
	Males	.01	78	.00	.11	80	-.01	.29*	101	.06	.30**	107	.02

Note. 1-tailed Significance: * p < .01, ** p < .001. Chinese students' results were analyzed students separately to determine the influence on total group results. This analysis is discussed in Chapter 5.

TABLE 16

Second Administration Correlations of Students' Causal Attribution Scores with Mathematics Self-Concept and Achievement with Breakdowns by Success or Failure.

MEASURE		2nd Effort Attribution r	n	β	2nd Ability Attribution r	n	β	2nd Luck Attribution r	n	β	2nd Task Ease/Difficulty Attribution r	n	β	2nd Studying Attribution r	n	β
Success	T	-.09	163	-.01	.51**	163	.09	-.21*	163	-.03	.17	163	.02	-.20*	163	-.03
Math Self-	F	-.07	89	-.01	.54**	89	.08	-.10	89	-.01	.24	89	.03	-.25*	89	-.04
Concept 1	M	-.07	74	-.01	.52**	74	.11	-.33*	74	-.07	.11	74	.02	-.07	74	-.01
Success	T	.10	169	.01	.26**	169	.02	-.00	169	-.00	.33**	169	.00	-.02	169	-.00
Actual	F	.02	92	.00	.33**	92	.02	-.01	92	-.00	.27*	92	.02	.15	92	.01
Score 2	M	.17	77	.01	.20	77	.01	-.01	77	-.00	.39**	77	.02	-.05	77	-.00
Success	T	.03	169	.00	.38**	169	.03	-.00	169	-.00	.11	169	.01	-.02	169	-.00
1st Term	F	-.06	92	-.00	.40**	92	.03	.07	92	.00	.04	92	.00	-.24	92	-.01
Average	M	.11	77	.01	.35**	77	.03	-.06	77	-.00	.19	77	.00	.17	77	.01
Failure	T	.17	145	.03	.51**	145	.09	-.02	145	.00	.40**	145	.06	.13	145	.02
Math Self-	F	.17	82	.03	.45**	82	.08	.09	82	.02	.30*	82	.04	.27*	82	.05
Concept 1	M	.31*	63	.05	.49**	63	.10	-.06	63	-.01	.45**	63	.08	.15	63	.03
Failure	T	.27**	152	.01	.38**	152	.02	.02	152	.00	.31**	152	.02	.35**	152	.02
Actual	F	.18	86	.01	.30*	86	.02	.06	86	.00	.35**	86	.02	.38**	86	.02
Score 2	M	.49**	66	.03	.52**	66	.04	.02	66	.00	.35**	66	.02	.23	66	.01
Failure	T	.15	152	.01	.30**	152	.02	.02	152	.00	.21*	152	.01	.36**	152	.02
1st Term	F	.10	86	.01	.29*	86	.02	.05	86	.00	.26*	86	.01	.46**	86	.03
Average	M	.30*	66	.02	.36*	66	.03	.02	66	.00	.25	66	.02	.14	66	.01

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$. Chinese students' results were analyzed students separately to determine the influence on total group results. This analysis is discussed in Chapter 5.

and mathematics achievement in both success and failure conditions (perceived success group: males r = .35 (time one) and .39 (time three), females = .48 (time one) and .47 (time three); perceived failure group: males = .44 and .54, females = .46 and .52). Fisher z transformations were calculated to investigate whether or not there were differences in correlations between males and females in each administration period and between each gender in the perceived success group and in the perceived failure group. There were no significant Fisher z statistics.

TABLE 17

Third Administration Correlations of Students' Causal Attribution Scores with Mathematics Self-Concept and Achievement with Breakdowns by Success or Failure

		SUCCESS						FAILURE					
		Math-Concept2			Actual Score3			Math Concept2			Actual Score3		
MEASURE		r	n	ß	r	n	ß	r	n	ß	r	n	ß
Actual Score 3	Total	.40**	164	.13				.52**	209	.18			
	Females	.47**	84	.11				.52**	118	.19			
	Males	.39**	80	.20				.54**	91	.18			
3rd Effort Attribution	Total	.13	166	.02	.13	170	.01	.09	209	.02	.26**	214	.02
	Females	.18	85	.03	.10	86	.01	.13	118	.02	.40**	121	.02
	Males	.12	81	.02	.09	84	.00	.01	91	.00	.04	93	.00
3rd Ability Attribution	Total	.49**	166	.08	.33**	170	.02	.48**	209	.08	.31**	214	.02
	Females	.41**	85	.06	.34**	86	.02	.48**	118	.07	.25*	121	.01
	Males	.56**	81	.10	.39**	84	.02	.46**	91	.08	.35**	93	.02
3rd Luck Attribution	Total	-.23*	166	-.04	-.04	170	-.00	-.06	209	-.01	.06	214	.00
	Females	-.06	85	-.01	-.06	86	.00	-.08	118	-.01	.06	121	.00
	Males	-.37**	81	-.07	-.09	84	-.00	-.08	91	-.01	-.01	93	.00
3rd Task Ease /Difficulty Attribution	Total	.05	166	.01	.07	170	.00	.43**	209	.06	.30**	214	.02
	Females	.00	85	.00	.30*	86	.00	.51**	118	.07	.33**	121	.02
	Males	.09	81	.01	-.03	84	-.00	.31*	91	.05	.27*	93	.01
3rd Studying Attribution	Total	-.03	166	-.01	.06	170	.00	.15	209	.02	.34**	214	.02
	Females	.03	85	-.01	.09	86	.01	.18	118	.03	.45**	121	.03
	Males	-.08	81	-.02	.02	84	.00	.11	91	.02	.20	93	.01

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$. Chinese students' results were analyzed students separately to determine the influence on total group results. This analysis is discussed in Chapter 5.

The significance of the result and the consistency on two separate measures provides supportive evidence that mathematics self-concept is directly related to achievement in mathematics. The relation holds for females as well as males, regardless of whether students perceive the achievement outcomes to be successes or failures.

Attributions and Self-Concept

Perceived Success Outcomes

It was predicted that females would tend to attribute success to effort whereas the tendency for males would be to attribute success to ability. This expectation would be demonstrated in perceived success conditions if the mean effort attribution score

was higher for females than males and the mean ability attribution score was higher for males than females. To test this hypothesis an independent one-tailed *t*-test was computed between gender on attributions for the three administrations (see Tables 9 to 11).

For the first administration period there was a significant gender difference in ability attributions. Males who perceived that they had been successful attributed that success to ability more often than females, ($t(183) = 4.04$, $p < .01$). Females perceiving success made attributions to effort, ($t(184) = 2.07$, $p = .02$) and luck, ($t(183) = 2.09$, $p = .02$) more often than males, but these differences were not statistically significant at the .01 level. Differences were not found between genders for the attributions to studying and task difficulty level ($t(184) = .24$, $p > .01$, and $t(184) = .09$, $p > .01$).

These relations changed at time two. For the second administration, studying was the only attribution that differentiated males and females. Females more often attributed success to studying than males, ($t(167) = 2.92$, $p < .01$). There were nonsignificant differences for males and females for effort ($t(167) = 1.40$), ability ($t(167) = 0.12$), task ease ($t(167) = 1.03$), and luck ($t(167) = 0.38$).

Three attributional differences were statistically significant at time three. At the third administration period there were significant gender differences for effort, ability, and task ease attributions under conditions of perceived success. Females more often attributed perceived success experiences to effort ($t(170) = 3.86$, $p < .01$), while males made more attributions to ability ($t(170) = 2.63$, $p < .01$), and to task ease,

($t(170) = 2.60$, $p < .01$). There were no significant differences for the two other attributions.

Perceived Failure Outcomes

It was hypothesized that females would ascribe failure to low ability and task difficulty more often than males, whereas males would ascribe failure to low effort more often than females. This expectation would be represented in the data if the mean scores for ability and task difficulty attributions were lower for females than males, and the mean score for effort attributions was lower for males than females (see Tables 9, 10, and 11). This hypothesis was not supported at time one. At the first administration of tests there were no gender differences with regard to effort (t (219) = 1.48, $p > .01$), ability ($t(219) = .41$, $p > .01$), studying ($t(218) = .23$, $p > .01$), task difficulty ($t(219 = 1.57$, $p > .01$), or luck ($t(219) = 1.37$, $p > .01$).

For the second administration period the mean ability attribution score for females was lower than for males, indicating a tendency for females to more often ascribe failure to low ability ($t(150) = 1.78$, $p = .04$). Lack of studying was more often ascribed to failure for females than males (t (167) = 2.00, $p = .02$). Females more often ascribed failure to task difficulty than males ($t(150) = 2.04$, $p = .02$). However, these differences were not statistically significant at the .01 level. There were no differences for effort ($t(150) = 0.73$, $p > .01$) or luck ($t(150) = 0.54$, $p > .01$). These non-significant results fail to support the expectation that females would make differing attributions for perceived failure outcomes.

At time three, the results again did not support the hypothesis. *t*-tests failed to reveal any statistically significant differences between genders on attributions (effort: $t(214) = .20$, ability: $t\ (214) = 1.13$, studying: $t(213) = .35$, task difficulty: $t(214) = .60$, and luck: $t(214) = .60$).

Internal Attributions

Attributions may be grouped and categorized according to those which are internal, such as effort, studying, and ability, and those that are external, such as luck and task difficulty. It was hypothesized that ability, effort, and studying attributions would correlate positively with mathematics self-concept under both successful and failure conditions. However, it was predicted that the correlation for attributions to effort or studying would be weaker than for ability.

This correlative evidence did not appear for the effort component of the internal dimension. Among students who perceived that they had succeeded, significant positive correlations between self-concept and effort attributions were not found at any of the three administration periods (see Tables 15 to 17). However, among students who perceived they had failed there was a significant positive correlation between effort and mathematics self-concept for females ($r = .25$, $p < .01$) at time one, and for males ($r = .31$, $p < .01$) at time two. There were no other correlations detectably different from zero. Correlations between self-concept and ability attributions did support the hypothesis. Ability attributions correlated positively with self-concept at all three administration times (time one: $r = .59$, time two: $r = .51$, and time three: $r = .49$; $p < .001$ for all administrations), indicating that students who ascribed success to

ability had a higher self-concept. The results were also significant in the failure condition. Ability attributions correlated positively with mathematics self-concept at all three administration times (time one: r = .49; time two: r = .51 and time three: r = .48; $p < .001$). The result was found in both success and failure conditions for males and for females (see Table 15 to 17). Following success the attribution to studying and mathematics self-concept correlated negatively for the second administration for the whole group (r = -.20, $p < .01$) and for females (r = - .25, $p < .01$). This negative correlation indicates that students who ascribed success outcomes to studying tended to have lower self-concepts. There were no other correlations that were detectably different from zero. However, in the failure condition, there was a significant positive correlation with studying for the whole group (r = .27, $p < .001$) and for both genders (males: r = .28; females: r = .29; $p < .01$) at time one. At time two there was a significant positive correlation for females only (r = .27, $p < .01$).

There was an inverse relationship between luck attributions and self-concept for all three administration periods in the success condition. This means that the students who ascribed achievement success to the external cause of luck tended to have a low self-concept in mathematics. Conversely, students who did not make ascriptions to luck tended to exhibit a high mathematics self-concept. There was a significant negative correlation for the whole group (r = -.26, $p < .001$) at time one. At the second and third administration times, there was a significant negative correlation for the total group (time two: r = -.21, $p < .01$; time three: r = -.23, $p < .01$) and for

males (time two: $r = -.33$, $p < .01$; time three: $r = -.37$, $p < .001$). There were no correlations detectably different from zero in the failure condition.

The other attribution to an external cause was task difficulty/ease. With regard to ease of task, there was a statistically significant positive correlation with mathematics self-concept for the total group ($r = .26$, $p < .001$) and for females ($r = .31$, $p < .001$) at the first administration period only. The correlation for males was not significant. However, for the second administration period neither coefficient attained statistical significance. There was a zero correlation for females, and the coefficient for males approached zero at the third administration. Following failure, attributions to task difficulty correlated positively and significantly with mathematics self-concept in all three administration periods for the total group ($p < .001$) and for both males (time one: $p < .01$, time two: $p < .001$, and time three: $p < .01$) and females (time one: $p < .001$, time two: $p < .01$, and time three: $p < .001$) (see Tables 15 to 17).

High vs. Low Self-Concept Females

It was predicted that high self-concept females would be less likely to attribute failure to lack of ability than low self-concept females. The mean score for lack of ability would be higher for high self-concept females than for low self-concept females. To examine this hypothesis, females' mathematics self-concept scores for the two administrations were dichotomized to form high self-concept and low self-concept groups using the median score on the mathematics self-concept measure as an arbitrary cutoff. The median scores were 18 on the first self-concept measure and 16 on the second. The high and low self-concept groups formed from data on the first

administration were also used at time two. This is because the self-concept measure was not administered at time two. A *t*-test was conducted between groups on ability for the three administration periods.

As predicted the mean ability attribution score of the high self-concept group ($M = 4.23$, $SD = 1.26$, $n = 39$) was significantly higher ($t(110) = 5.65$, $p < .01$) than the mean ability attribution score of the low self-concept group ($M = 2.96$, $SD = 0.84$, $n = 73$) for the first administration period.

This was also the case on the second administration. The mean ability attribution score for the high self-concept group ($M = 4.12$, $SD = 0.95$, $n = 34$) was significantly higher ($t(80) = 4.49$, $p < .01$) than the mean ability score of the low self-concept group ($M = 3.04$, $SD = 1.15$, $n = 48$). Again for the third administration the high self-concept group mean ability score ($M = 4.0$, $SD = 1.01$, $n = 45$) was significantly higher ($t(112) = 4.62$, $p < .01$) than the mean ability score of the low self-concept group ($M = 3.06$, $SD = 1.06$, $n = 69$).

Attributions and Achievement

It was predicted that correlations of mathematics achievement with ability and effort or studying attributions would be positive for both success and failure groups. Because of the coding scheme used, a positive correlation represents attributions to high levels of the ability/effort/studying dimensions for successful students, and attributions to low levels of ability/effort/studying dimensions for failing students.

For the total sample of students who perceived they were successful, there were statistically significant positive correlations between obtained test scores and

ability attributions at times one (r = .25, p < .001), two (r = .26, p < .001) and three (r = .33, p < .001) (see Tables 15 to 17). There were no significant positive correlations between effort or studying and obtained test score for any of the three administration periods (p > .01). The evidence was stronger for the students with perceptions of failure. The correlations were positive and significant for test score with effort (time one: r = .24; time two: r = .27; time three: r = .26; p< .001), studying (time one: r = .33; time two: r = .35; time three: r = .34; p < .001), and ability attributions (time one: r= .32; time two: r = .38; time three: r = .31; p < .001) at all three test administration times.

Perceived Success

Only for females in the perceived success group was there a significant positive correlation between mathematics quiz score and ability attributions at time one (r = .30, p < .01) and at time two (r = .33, p < .001). There were no significant correlations between effort or studying and achievement for either gender at the first two administrations. For the third testing period, the ability attribution correlation was again significant for females (r = .34, p < .001). This significant relation was also found for males (r = .39, p < .001). Again correlations between obtained test score and effort or studying attributions were not significant for either gender.

Perceived Failure

There were statistically significant positive correlations for both males and females between mathematics quiz score and attribution to low effort (females: r = .23; males: r = .28; p < .01) and to studying (females: r =.36, males: r = .30; p <

.001) at time one. At time two, there was a significant positive correlation with effort for males only (r = .49, p < .001) and at time three for females only (r = .40, p < .001). Attributions to studying correlated positively and significantly for females only at time two (r = .38, p < .001) and time three (r = .45, p < .001). Both males and females had significant high correlations between attributions to ability and achievement (see Tables 15 to 17). There were no differences between genders for the three administration periods (time one: r_z = .65, p > .05; time two: r_z = 1.59, p > .05; and time three: r_z = .79, p > .05).

Effort and Ability Attributions for Both Outcomes

It was also anticipated that correlations between mathematics achievement and attributions to ability would be higher than between mathematics achievement and effort and studying attributions. For all three administration periods, this was true for the students who perceived their test results as successful. The implication is that these students attributed their success to ability. This conclusion is supported by the fact that the successful students' effort or studying attributions for achievement did not differ from zero for all three administration periods. This is in contrast to the higher correlations between ability attributions and achievement which ranged from .25 to .33, all attaining statistical significance (p < .001).

Among students who perceived that they had failed, there were statistically significant positive correlations for attribution to lack of ability with quiz score and to lack of effort or studying with quiz score for all three administration periods (see Tables 15 to 17). Correlations were standardized using Fisher's z transformation to

test for difference between the attributions to ability and effort or studying with mathematics quiz score. There were no statistically significant differences between effort and ability correlations at any of the three administration periods (first administration: r_z = 1.22, p > .05; second administration: (r_z = 1.09, p > .05; third administration r_z = 0.60, p > .05). There were also no statistically significant differences between studying and ability (first administration: r_z = .11 , p > .05; second administration: r_z = .27, p > .05; and third administration: r_z = .31, p > .05).

Another hypothesis predicted that students with higher academic performance (overall 1st-term grade average) would be more likely to attribute success to ability and effort. This was investigated by examining the correlations between the overall first term mathematics average (at time two) and attributions of students who perceived their second quiz to be a good mark (see Table 16). The statement was supported for ability attributions. For students with success perceptions there were positive correlations between quiz scores and ability attributions (r = .38, p < .001) for both males (r = .40) and females (r = .35). However, there were no correlations detectably different from zero between attributions to effort or studying and mathematics average (p > .01).

Attributions, Self-concept, and Achievement

It was also predicted that for the students who perceived their mark as a success outcome, the positive correlations between mathematics self-concept and internal attributions would be higher than the correlations with mathematics self-

concept and external attributions. As a corollary, these students' achievement scores would have higher correlations with internal attributions than with external attributions.

The corresponding expectation for students who perceived their mark as a failure outcome was that their mathematics self-concept scores would have higher correlations with external attributions than with internal attributions. The same relation to the internal pole of the controllability dimension was also expected for achievement. For students in the success condition the internal attributions would be to high effort, high ability, and/or studying hard. For students in the failure condition, internal attributions would be to low effort, low ability, and not studying hard.

For each student, internal and external scores were calculated by summing values across internal factors (ability, effort, and studying) and external factors (luck, task difficulty/ease) and dividing by the number of scores. Correlations between these external and internal factors were calculated with achievement and self-concept. Correlations for the perceived success and perceived failure groups with breakdowns for males and females are shown in Table 18.

Perceived Success Outcome

There were no correlations that were detectably different from zero between mathematics quiz and internal attributions for students who perceived first quiz results as successful. The expected pattern was not found for mathematics self-concept and internal attributions, nor was it found for external attributions on the first administration. There were no statistically significant differences when gender was considered.

TABLE 18

Correlations of Students' Internal/External Causal Attribution Scores with Mathematics Self-Concept and Achievement with Breakdowns by Success or Failure

		SUCCESS						FAILURE					
		INTERNAL			EXTERNAL			INTERNAL			EXTERNAL		
MEASURE		r	n	β	r	n	β	r	n	β	r	n	β
1st Math	Total	.14	179	.02	-.01	179	-.01	.44**	211	.04	.29**	211	.03
Self-	Females	.10	101	.01	.04	101	-.00	.50**	110	.05	.38**	110	.04
Concept	Males	.20	78	.04	-.01	78	-.00	.43**	101	.04	.18	101	.03
1st Math	Total	.08	179	.00	.09	179	.01	.42**	211	.01	.15	211	.00
Class	Females	.11	101	.00	.12	101	.01	.43**	110	.01	.27*	110	.01
Quiz	Males	.05	78	-.00	.04	78	.00	.42**	101	.01	.03	101	.00
2nd Math	Total	.11	163	.01	-.04	163	-.01	.38**	155	.03	.22*	155	.02
Self-	Females	.10	89	.01	.08	89	-.00	.41**	82	.04	.23	83	.02
Concept	Males	.20	74	.02	-.19	74	-.03	.43**	63	.03	.21	63	.03
2nd Math	Total	.15	163	.01	.23*	163	.01	.47**	155	.02	.18	155	.01
Class	Females	.07	89	.00	.18	89	.01	.41**	82	.01	.21	82	.01
Quiz	Males	.20	74	.02	.25*	74	.01	.56**	63	.02	.22	63	.01
3rd Math	Total	.26**	164	.02	-.10	164	-.02	.34**	208	.02	.23**	208	.02
Self-	Females	.26*	84	.02	-.00	84	-.02	.37**	118	.02	.25*	118	.01
Concept	Males	.27*	80	.03	-.21	80	-.03	.26*	90	.02	.16	90	.01
3rd Math	Total	.25**	164	.01	.02	164	.00	.43**	208	.01	.25**	208	.01
Class	Females	.24	84	.01	.23	84	.02	.52**	118	.02	.26*	118	.01
Quiz	Males	.25	80	.01	.07	80	.00	.28*	90	.01	.19	90	.01

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$. Chinese students' results were analyzed students separately to determine the influence on total group results. This analysis is discussed in Chapter 5.

For the second administration, a significant positive correlation was found between the mathematics quiz and external attributions for the total sample ($r = .23$, $p < .01$) and for males ($r = .25$, $p < .01$), which seems to indicate that males with highself-concept made attributions to external causes. No other correlations were detectably different from zero ($p > .01$). In the third administration, internal attributions were found to have significant positive correlations with both mathematics self-concept ($r = .26$, $p < .001$) and the classroom quiz ($r = .25$, $p < .001$). Students with higher self-concept and/or higher achievement made attributions to internal causes. Correlations between internal causes and mathematics self-concept were also statistically significant for both genders (males: $r = .27$, females: $r = .26$, $p < .01$).

However, there were no significant correlations between internal causes and mathematics quiz for either males or females ($p > .01$).

Perceived Failure Outcome

For the failure group, significant ($p < .001$) correlations were found for internal attributions with both mathematics self-concept and achievement at all three administrations. For all three administration periods (see Table 18), there were also significant correlations between external attributions and self-concept ($p < .01$ at time two, and $p < .001$ at times one and three). External attributions were also related to achievement at times three ($p < .001$). Correlations for external and internal attributions with mathematics self-concept and achievement were standardized using Fisher's z transformations to determine if the correlations were detectably different from one another.

For administration one, the higher correlation between internal causes and mathematics self-concept was not statistically different ($r_z = 1.80$, $p > .01$) than for external causes. The mathematics quiz was found to have a significant positive correlation ($r = .42$, $p < .001$) with internal attributions but not with external attributions ($p > .01$). When gender was considered, there were statistically significant positive correlations between internal causes and both mathematics self-concept (males: $r = .43$; females: $r = .50$; $p < .001$) and mathematics quiz (males: $r = .42$; females: $r = .42$; $p < .001$), for both genders. There was a positive correlation between external attributions and mathematics self-concept for females ($r = .38$, $p < .001$) and the mathematics quiz ($r = .27$, $p < .01$). There were no correlations

detectably different from zero for males ($p > .01$). Correlations between internal attributions and mathematics self-concept were not significantly higher than between external attributions and mathematics self-concept for females ($r_z = 1.02$, $p > .05$). The correlation between internal attributions and mathematics quiz score was higher ($p < .001$) than between external attributions and mathematics quiz score for females ($p < .01$).

For administration two, the correlations between attributions to internal causes and both mathematics self-concept ($r = .38$, $p < .001$) and mathematics achievement ($r = .47$, $p < .001$) were both positive and statistically significant. The pattern of relationship did not differ by gender. Both groups had significant positive correlations ($p < .001$). The correlation for attributions to external causes and mathematics self-concept was significant for the total group ($r = .22$, $p < .01$) but not for males and females separately ($p > .01$). The correlation for attributions to external causes and mathematics achievement was not significant for the total group, males, or females ($p > .01$).

For administration three, the correlations for internal attributions and external attributions (see Table 18) with mathematics self-concept and achievement were all positive and significant ($p < .001$). Correlations for internal attributions were significantly higher than for external attributions for the mathematics quiz ($r_z = 2.09$, $p < .05$), but not for mathematics self-concept ($r_z = 1.22$, $p > .05$). Females had stronger correlations for internal attributions with achievement than males ($r_z = 2.02$, $p < .01$). There were no gender differences between internal attributions and

mathematics self-concept (r_z = .86, p > .01). Females had significant positive correlations for external factors with both mathematics self-concept (p < .01) and mathematics quiz (p < .01), whereas males did not. Females had significantly higher correlations between internal attributions and achievement than between external attributions and achievement (r_z = 2.35, p < .05). However, females' correlation between internal attributions and mathematics self-concept did not differ significantly from the correlation between external attributions and mathematics self-concept (r_z = 1.0, p > .05).

Correlations of Achievement and Motivational Factors With Classroom Environment

Total Group

Table 19 shows the correlations between subscales of the Classroom Environment Measure and achievement and self-concept measures. When the study began (time one) the Classroom Environment Measure was administered, along with the first mathematics quiz and self-concept measure. Correlations were computed among these measures. The Classroom Environment Measure administered at the end of the study (time three) was correlated to the third mathematics quiz and the self-concept measure administered at the same time.

The Social Comparison subscale correlated positively with the first mathematics quiz for the whole group (r = .16, p < .01), the first mathematics self-concept measure for the whole group (r = .13, p < .01), and for males (r = .23, p < .01),

TABLE 19

Correlations of Classroom Environment Scales with Achievement, Self-Concept, and Causal Attributions for the Total Sample

			Social Comparison		Student Teacher Relations		Student Input		Task Organiz-ation		Compet-ition		Cooper-ation		Student Autonomy		Teacher Feedback	
MEASURE	n		r	ß	r	ß	r	ß	r	ß	r	ß	r	ß	r	ß	r	ß
1st Math	312	T	.16*	.15	.14*	.04	-.05	-.09	.05	.08	-.05	.05	.16*	.06	.01	.01	-.06	-.03
Classroom	169	F	.11	.13	.02	.01	-.04	-.13	.04	.01	-.13	-.11	.23*	.24	-.07	-.09	-.05	-.07
Quiz	143	M	.16	.10	.21*	.21	-.01	-.04	.04	-.01	-.02	-.06	.07	.07	.09	.03	-.07	-.09
3rd Math	314	T	.09	.11	-.01	-.01	-.01	-.04	.03	.02	-.04	-.08	.07	.06	-.00	-.02	.09	.09
Classroom	173	F	.04	-.00	.01	-.11	.01	-.04	.01	-.14	-.01	-.07	.18*	.14	.04	-.01	.15	.10
Quiz	141	M	.13	.08	-.02	.04	.03	.07	.06	.05	-.06	-.16	-.06	-.24	.00	.03	.04	.07
Math	312	T	.13*	.04	.05	.06	-.07	-.14	.06	.04	.07	.03	.07	.20	.04	-.16	-.07	-.10
Self-	169	F	.04	.04	.02	.06	-.05	-.15	.08	.04	.01	.03	.16	.20	-.12	-.16	-.09	-.10
Concept 1	143	M	.23*	.21	.01	-.02	.01	-.01	.00	-.01	.12	.05	.00	-.00	.13	.10	-.08	-.05
Math	314	T	.18**	.15	.07	.04	-.03	-.09	.10	.08	.11	.05	.08	.06	.05	.01	.00	-.03
Self-	173	F	.12	-.09	.07	-.11	.02	.09	.09	-.05	.10	.12	.12	-.07	.02	-.04	.05	.09
Concept 2	141	M	.24*	.33	.04	.09	-.10	-.39	.13	.31	.09	.12	.06	.07	.10	.03	-.07	.01
General	324	T	.22**	.13	.12	.09	-.06	-.19	.18**	.15	.04	-.03	.11	.16	.01	-.13	.00	-.00
Self-	181	F	.13	.13	.08	.09	-.03	-.13	.22*	.16	-.03	-.03	.14	.15	-.09	-.13	.02	-.00
Concept 1	143	M	.30**	.28	.07	-.01	.01	.00	.12	.11	.12	.05	.10	.10	.09	.04	-.03	-.03
General	314	T	.31**	.26	.17*	.11	.06	-.09	.16*	.10	.14*	.04	.19**	.12	.14*	.04	.07	-.02
Self-	173	F	.28**	.12	.27**	.29	.09	-.18	.16	-.02	.08	.09	.21*	.02	.13	.00	.20*	.06
Concept 2	141	M	.36**	.15	.04	.03	.01	-.18	.16	.23	.21*	.27	.16	.22	.15	.07	-.06	-.06

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$.

the second mathematics self-concept measure for the whole group ($r = .18$, $p < .001$) and males ($r = .24$, $p < .01$), the first general self-concept measure for the whole group ($r = .22$, $p < .001$) and males ($r = .30$, $p < .001$), and the second general self-concept measure for the whole group ($r = .31$, $p < .001$), for males ($r = .36$, $p < .001$) and for females ($r = .28$, $p < .001$).

The Student-Teacher Relations subscale was positively correlated with the first mathematics quiz for the whole group ($r = .14$, $p < .01$) and males ($r = .21$, $p < .01$) and with the second general self-concept measure for the whole group ($r = .17$, $p < .01$) and females ($r = .27$, $p < .001$). Task organization was related positively to the

first general self-concept measure for the whole group (r = .18, p < .001) and females (r = .22, p < .01) and the second general self-concept measure for the whole group (r = .16, p < .01). The Competition subscale was positively correlated with the second general self-concept measure for the whole group (r = .14, p < .01) and males (r = .21, p < .01). Cooperation was related positively to the first mathematics quiz for the entire group (r = .16, p < .01) and females (r = .23, p < .01), the third mathematics quiz for females (r = .18, p < .01), and the general self-concept measure for the entire group (r = .19, p < .001) and females (r = .21, p < .01). General self-concept at the second administration was related to both student autonomy for the whole group (r = .14, p < .01) and to teacher feedback for females (r = .20, p < .01).

Perceived Success Group

Table 20 includes correlations between the Classroom Environment scales and achievement, self-concept, and causal attributions for students who perceived that they had been successful. Causal attributions for the second administration were correlated with the Classroom Environment Measure administered at time one.

The mathematics quiz at time one correlated with the Social Comparison subscale for the entire group (r = .22, p < .01). There were also correlations between social comparison and first mathematics self-concept measure for the whole group (r = .20, p < .01) and the second self-concept measure for the whole group (r = .30, p < .001) and for males (r = .37, p < .01). This subscale was also positively related to general self-concept at time one for the whole group (r = .26, p < .001) and to general self-concept at time two for the whole group (r = .30, p < .001), males (r =

TABLE 20

Correlations of Classroom Environment Scales with Achievement, Self-Concept, and Causal Attributions for Students With Perceptions of Success

			Social Comparison		Student Teacher Relations		Student Input		Task Organization		Competition		Cooperation		Student Autonomy		Teacher Feedback	
MEASURE	n		r	β	r	β	r	β	r	β	r	β	r	β	r	β	r	β
1st Math	143	T	.22*	.25	.08	.09	-.03	-.01	-.05	.08	-.05	-.09	.22*	.21	-.05	-.07	.03	.05
Classroom	80	F	-.03	-.12	.00	.01	.13	-.03	-.03	.10	-.10	.13	.10	-.09	-.05	-.16	.17	-.14
Quiz	63	M	.21	.16	.09	.12	-.13	-.08	-.09	.01	.06	-.07	.11	.16	.15	-.04	-.11	-.08
Math	143	T	.20*	.16	.08	.01	-.03	.03	.12	.13	.09	.16	.14	.04	.02	-.01	-.05	-.06
Self-	80	F	.03	-.00	.02	.02	.29	.06	-.03	.09	.03	.04	.09	-.05	.03	.10	-.12	-.69
Concept 1	63	M	.26	.11	-.08	.02	-.17	-.10	.21	.03	.40**	.05	-.02	.08	.25	.02	-.10	-.07
General	143	T	.26**	.19	.15	.04	-.03	.01	.29**	.27	.16	.10	.11	.15	.02	-.03	-.04	-.05
Self-	80	F	.24	.19	.16	.00	.10	-.01	.18	.14	.26	.09	.02	-.03	.13	.08	-.18	-.05
Concept 1	63	M	.22	.20	-.07	.05	-.11	-.08	.19	.14	.40**	.01	.01	.10	.16	-.02	-.16	-.02
1st Time	143	T	-.06	-.06	.02	.10	.06	.03	-.09	-.14	.06	.08	-.03	-.07	.09	.07	.09	.11
Effort	80	F	-.21	-.12	-.12	.01	-.03	.03	-.19	-.10	.04	.13	.04	.00	.14	.17	.10	.14
Attribution	63	M	-.01	.03	.15	.21	.09	.09	-.09	-.14	-.04	-.02	.03	-.07	.03	.02	.06	.08
1st Time	143	T	.09	.02	.09	.05	-.04	-.04	.19	.16	.16	.18	.08	.12	-.03	-.08	.02	.01
Ability	80	F	-.12	.03	.06	.06	.28	.08	.12	.18	.16	.02	.07	.26	-.09	-.20	.04	.00
Attribution	63	M	.07	-.12	.02	-.01	-.22	-.25	.15	.08	.31*	.40	.04	.07	.11	.03	-.02	-.04
1st Time	143	T	-.03	.01	.18	-.11	-.05	-.07	.17	-.14	-.09	-.05	.01	-.01	-.17	-.16	.05	.09
Luck	80	F	-.11	.00	-.18	-.06	.07	-.07	-.09	-.24	-.17	-.10	-.03	.01	-.20	-.14	-.10	.04
Attribution	63	M	-.03	.10	-.23	-.22	-.05	-.01	-.06	.00	-.11	-.06	-.03	-.03	-.21	-.25	.15	.25
1st Time	143	T	.21*	.23	.03	-.01	-.05	-.00	.06	.08	-.09	-.12	.18	.19	-.14	-.15	-.09	-.07
Task Ease	80	F	.24	.27	-.05	.11	.16	.00	-.22	-.07	.04	-.23	.11	.29	.02	-.16	-.09	-.04
Attribution	63	M	.14	.10	-.04	-.10	-.08	-.01	.19	.21	.09	.10	-.02	.10	-.16	-.22	-.12	-.05
1st Time	143	T	.06	.10	.08	.10	.02	.04	.01	-.04	-.01	-.04	-.08	-.11	.02	.03	.04	.07
Studying	80	F	.07	.07	-.08	-.00	.07	-.03	-.06	-.02	-.10	-.07	.07	-.13	.13	.08	.08	.08
Attribution	63	M	.10	.12	.19	.22	.06	.10	.04	-.04	.02	-.00	-.06	-.10	-.03	-.03	-.00	.06
2nd Time	137	T	.05	.05	.31**	.30	.09	.15	.14	.11	-.12	-.02	.09	.03	-.04	-.15	.16	.10
Effort	75	F	.04	.09	.26	.33	.17	.61	.27*	.25	-.07	.08	.02	.25	-.01	.01	.22	.38
Attribution	62	M	.09	.19	.40**	.58	.04	.07	.06	.20	-.12	.07	.08	.17	-.06	.10	.07	.28
2nd Time	137	T	.05	.05	.04	.03	-.11	-.17	-.03	-.04	.10	.12	.11	.13	-.01	.01	.16	.11
Ability	75	F	.18	.23	-.06	.11	-.03	.30	-.16	-.04	-.04	.09	.17	.17	-.11	-.21	-.05	.09
Attribution	62	M	-.06	.15	.11	.36	-.18	-.47	.17	.33	.28	.72	.02	-.18	.09	.21	.22	.28
2nd Time	137	T	.08	.06	-.01	.04	.03	-.01	-.18	-.19	.03	.02	.05	.00	.00	.03	.04	.05
Luck	75	F	-.02	-.18	-.06	.35	-.05	.24	-.32*	-.67	-.02	-.08	-.08	-.13	-.25	-.21	-.08	-.02
Attribution	62	M	.18	.17	.08	-.02	.07	.62	-.02	.10	.08	.12	.21	.18	.25	-.40	.12	.30
2nd Time	137	T	.04	.04	-.20	-.15	.09	.10	-.11	-.05	.09	.06	-.09	-.10	-.07	-.07	.06	.10
Task Ease	75	F	.04	-.02	-.18	-.37	-.08	-.05	-.18	-.06	.09	-.00	-.08	-.26	-.16	-.19	.05	-.06
Attribution	62	M	.01	.08	-.18	-.63	.18	.44	.00	.00	.12	-.46	-.09	.08	.01	.01	.04	-.01
2nd Time	137	T	.02	.01	.32**	.29	.11	.13	.10	.05	-.10	.01	.13	.06	.02	-.09	.27**	.22
Studying	75	F	-.01	-.14	.14	-.13	.22	.07	.22	.18	.02	.23	.02	.27	.05	.09	.33*	.43
Attribution	62	M	.11	.10	.53**	.56	.05	.41	.04	.10	-.19	.09	.15	.15	-.00	-.28	.21	.17
3rd Math	135	T	.06	.11	.15	.11	-.02	.04	.32**	.33	-.08	-.19	-.10	-.17	-.04	-.07	-.10	.04
Classroom	70	F	-.01	.08	.14	.25	-.00	.18	.42**	.51	-.04	-.09	-.06	.02	.02	-.12	.15	.23
Quiz	65	M	.14	.08	.20	.04	-.08	.07	.26	.05	-.10	-.16	-.16	-.24	-.05	.03	.04	.07
Math	135	T	.30**	.27	.37**	.35	-.00	-.10	.31**	.23	.09	.02	.03	-.08	.00	-.09	-.03	-.12
Self-	70	F	.26	.35	.35*	.14	.10	-.08	.35*	.15	-.02	-.09	-.00	.14	-.02	-.10	-.05	-.04
Concept2	65	M	.37*	.17	.40**	.09	-.16	-.39	.29	.30	.16	.12	.11	.07	-.01	.03	-.09	.01

TABLE 20 continued

Correlations of Classroom Environment Scales with Achievement, Self-Concept, and Causal Attributions for Students With Perceptions of Success

			Social Comparison		Student Teacher Relations		Student Input		Task Organization		Competition		Cooperation		Student Autonomy		Teacher Feedback	
MEASURE	n		r	β	r	β	r	β	r	β	r	β	r	β	r	β	r	β
General	137	T	.30**	.29	.25*	.25	.04	-.10	.18	.09	.08	-.05	.03	.17	.04	-.05	-.04	-.09
Self-	72	F	.28*	.47	.34*	.12	.14	-.06	.14	.18	.01	-.21	.03	.17	.06	.01	.15	.04
Concept2	65	M	.31*	.15	.16	.03	-.11	-.18	.21	.23	.23	.27	.19	.22	.01	.07	-.16	-.06
3rd Time	135	T	.10	.14	.14	.11	.12	.10	.02	.01	-.02	-.09	-.15	.01	-.02	-.08	.00	.04
Effort	70	F	.13	.13	.31*	.17	.13	-.07	.16	.22	.04	-.14	-.10	.03	-.01	.07	.05	-.21
Attribution	65	M	.05	-.04	.00	.28	.13	.09	-.14	-.21	-.06	-.12	-.16	-.14	.00	.23	.10	.20
3rd Time	135	T	.24*	.22	.12	.06	.15	.21	.01	.04	.07	-.08	-.10	-.25	-.01	-.07	.00	-.03
Ability	70	F	.32*	.22	.33*	.14	.28*	.44	.15	.06	.10	-.24	-.03	-.34	-.09	-.21	.21	-.06
Attribution	65	M	.22	.01	-.08	-.15	-.01	-.21	-.07	-.21	-.01	.21	-.20	-.12	.05	.37	-.15	-.01
3rd Time	135	T	.16	.16	.03	.06	.05	.01	-.23*	-.25	.12	.07	-.17	-.02	-.06	-.06	-.02	.04
Luck	70	F	.22	.10	-.03	-.21	.12	.29	-.05	-.18	.21	.05	-.03	-.08	-.03	-.12	.13	.32
Attribution	65	M	.10	.05	-.08	.02	-.04	.18	-.35*	-.23	.04	.02	-.03	-.41	-.11	-.19	-.10	-.19
3rd Time	135	T	.11	.12	.02	.01	.09	.10	-.10	-.10	.07	.00	-.09	-.11	-.01	-.01	-.01	.04
Task Ease	70	F	.13	.13	.10	-.05	.16	.25	.06	.01	.06	-.18	-.01	-.07	.04	-.06	-.04	.01
Attribution	65	M	.13	.24	-.08	.04	.04	.23	-.20	-.09	.06	-.12	-.12	-.23	-.10	-.17	-.11	.28
3rd Time	135	T	.04	.07	-.05	-.06	.05	.13	-.12	-.05	.02	-.04	-.08	-.12	-.10	-.12	.02	.05
Studying	70	F	.06	.11	.06	-.06	.04	.32	.11	.28	.04	-.16	-.17	-.45	-.04	-.02	.15	.11
Attribution	65	M	.01	-.28	-.15	-.08	.07	.00	-.31*	-.25	-.01	.15	.01	.15	-.14	.27	-.11	.35

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$.

.31, $p < .01$), and females ($r = .28$, $p < .01$). Social comparison was also related to attributions to task ease at time one for the whole group ($r = .21$, $p < .01$) and attributions to ability at time three for the whole group ($r = .24$, $p < .01$) and for females ($r = .32$, $p < .01$).

The Student-Teacher Relations scale correlated positively with the second mathematics self-concept subscale for the entire group ($r = .37$, $p < .001$), females ($r = .35$, $p < .01$), and males ($r = .40$, $p < .001$) and with the second general self-concept subscale for the entire group ($r = .25$, $p < .01$) and females ($r = .34$, $p < .01$). Student-Teacher Relations subscale was also related to attributions to effort at

administration two (whole group: $r = .31$, $p < .001$; males: $r = .40$, $p < .001$), effort at administration three (females: $r = .31$, $p < .01$), and ability at three (females: $r = .33$, $p < .01$). The Student Input scale was also related to ability at time three for females ($r = .28$, $p < .01$).

Task Organization scale was correlated positively with general self-concept at time one for the whole group ($r = .29$, $p < .001$), with mathematics self-concept at time two for the whole group ($r = .31$, $p < .001$) and for females ($r = .35$, $p < .01$). There was also a positive correlation for the third mathematics quiz for the whole group ($r = .32$, $p < .001$) and for females ($r = .42$, $p < .001$). Task organization also correlated negatively with attributions to luck at time two (whole group: $r = -.32$, $p < .01$) and at time three (whole group: $r = -.23$, $p < .01$; males: $r = -.35$, $p < .01$). There was a positive correlation with attributions to effort at time two for females ($r = .27$, $p < .01$) and negative correlation with studying at time three for males ($r = -.31$, $p < .01$).

The Competition subscale had positive correlations for males at time one only with mathematics self-concept ($r = .40$, $p < .001$) and general self-concept ($r = .40$, $p < .001$), and with attributions to ability ($r = .31$, $p < .01$). The Teacher Feedback subscale correlated positively with studying attribution at time two for the whole group ($r = .27$, $p < .001$) and for females ($r = .33$, $p < .01$). There were no correlations detectably different from zero for the Cooperation and Student Autonomy subscales.

TABLE 21

Correlations of Classroom Environment Scales with Achievement, Self-Concept, and Causal Attributions for Students Who Hold Perceptions of Failure

MEASURE	n		Social Comparison r	Social Comparison β	Student Teacher Relations r	Student Teacher Relations β	Student Input r	Student Input β	Task Organization r	Task Organization β	Competition r	Competition β	Cooperation r	Cooperation β	Student Autonomy r	Student Autonomy β	Teacher Feedback r	Teacher Feedback β
1st Math	162	T	.18*	.20	.10	.09	-.03	-.06	.09	.06	-.03	-.07	-.00	-.03	.04	.02	-.03	-.07
Classroom	87	F	.09	.11	-.02	-.02	-.03	-.09	.06	.07	-.04	-.05	.06	.10	-.04	-.04	-.11	-.12
Quiz	75	M	.20	.21	.18	.18	-.06	-.02	.12	.05	-.09	-.07	-.10	.20	.10	.07	.03	.02
Math	160	T	.11	.13	-.02	.01	-.10	-.10	-.01	-.03	.09	.07	-.10	.08	.04	.05	-.04	-.02
Self-	85	F	-.03	.02	.05	.08	-.18	-.16	.04	.00	.19	.18	-.05	.06	-.13	-.14	-.12	-.12
Concept 1	75	M	.24	.27	-.08	-.05	.08	.09	-.06	-.04	.01	-.02	-.12	-.19	.11	.05	-.02	.05
General	160	T	.21*	.23	.06	.04	-.06	-.12	.07	.03	-.02	-.04	.03	.04	-.01	-.02	.04	.01
Self-	85	F	.05	.08	.02	.05	-.15	-.21	.05	.03	.02	-.02	.00	.11	-.09	-.11	-.15	-.04
Concept 1	75	M	.35**	.36	.08	-.00	.07	.08	.10	.10	-.05	-.06	.07	-.03	.07	-.01	.10	.06
1st Time	160	T	.10	.11	.05	.01	-.04	.06	.15	.14	-.24*	-.24	-.03	-.11	-.04	.05	.11	.06
Effort	85	F	.05	.05	.14	.16	.04	.03	.18	.16	-.30*	-.32	-.01	-.08	-.03	-.05	.08	.04
Attribution	75	M	.15	-.17	-.08	.16	.02	-.02	.11	-.11	-.24	.22	-.11	.18	.22	-.21	.18	-.24
1st Time	160	T	-.08	-.07	-.03	-.01	-.06	-.09	-.11	-.13	-.02	.01	.01	.04	.01	.04	.08	.11
Ability	85	F	-.14	-.13	.08	.09	-.02	.01	-.08	-.09	.05	.08	.01	.01	.01	-.01	.03	.04
Attribution	75	M	-.01	-.01	-.10	-.10	-.13	-.20	-.13	-.17	-.07	-.05	.22	.05	.04	.02	.12	.18
1st Time	160	T	-.04	-.03	.04	.10	.02	.09	-.07	-.08	-.02	-.00	-.11	-.17	-.11	-.03	.03	.04
Luck	85	F	.05	.05	.19	.25	.05	.07	-.05	-.10	.06	.05	.02	-.09	.02	-.06	-.03	-.03
Attribution	75	M	-.16	-.10	-.11	-.06	.00	.06	-.08	-.09	-.09	-.06	-.20	-.25	-.20	.03	.10	.17
1st Time	160	T	.01	.06	-.08	-.08	-.11	-.13	-.11	-.10	.02	-.00	-.01	.05	-.14	.02	-.06	-.06
Task	85	F	-.09	-.01	-.05	.02	-.14	-.13	-.11	-.11	.02	-.01	-.08	.01	.02	-.05	-.19	-.19
Difficulty	75	M	.08	.08	-.07	-.11	-.06	-.09	-.14	-.13	.01	.01	.07	.07	-.16	.07	.08	.10
1st Time	160	T	.18*	.22	.03	.04	-.09	-.07	.13	.11	-.08	-.10	-.11	-.11	-.17	-.19	.07	.07
Studying	85	F	.12	.12	.06	.04	.01	.07	.09	.10	-.01	-.00	-.15	-.14	-.18	-.16	-.09	-.08
Attribution	75	M	.19	.25	.07	-.06	-.26	-.24	.14	.08	-.22	-.19	-.08	-.13	-.14	-.15	.25	.26
2nd Time	112	T	-.08	-.08	-.04	-.12	-.16	-.16	.14	.17	.05	.06	-.00	.09	.02	.01	.09	.05
Effort	65	F	-.23	.02	.02	-.06	-.23	-.75	.29	.52	.01	-.01	.10	.78	.11	-.14	.04	-.36
Attribution	47	M	.15	.41	-.16	.16	.02	.11	-.07	.06	.15	-.03	-.15	-.47	-.06	.01	.14	.46
2nd Time	112	T	.11	.12	.01	.02	-.06	-.08	-.01	-.08	-.08	-.09	-.02	-.01	-.10	-.09	.19	.19
Ability	65	F	-.04	.09	.03	.11	.04	-.07	.01	-.30	-.11	-.05	.04	.04	-.15	-.01	.21	.09
Attribution	47	M	.21	.51	-.04	.14	-.16	-.32	-.04	.11	-.04	-.21	.02	-.10	-.14	-.27	.12	.12
2nd Time	112	T	-.02	-.00	.22*	.26	-.03	-.08	-.03	-.14	-.08	-.06	.10	.07	-.07	-.08	-.00	-.01
Luck	65	F	.11	.12	.34*	.24	-.02	.06	.12	-.08	-.18	-.13	.14	.11	-.04	-.25	-.02	.00
Attribution	47	M	-.12	-.22	.08	.66	-.06	-.47	-.25	-.61	.06	.03	.02	-.24	-.05	.18	.06	-.09
2nd Time	112	T	.08	.10	-.04	.03	-.09	-.09	-.13	-.17	.01	-.00	-.08	-.07	.02	.00	.02	.05
Task	65	F	-.03	-.06	.05	.03	-.06	.12	-.07	-.21	-.08	.33	.05	.08	-.11	.00	-.02	.01
Difficulty	47	M	.13	.20	-.07	.30	-.11	-.35	-.23	-.30	.12	-.12	-.21	-.69	.03	.12	.03	.10
2nd Time	112	T	.04	.02	.01	-.00	.12	.13	.04	.01	-.03	-.03	.01	-.05	-.13	-.09	.16	.16
Studying	65	F	-.11	-.12	-.03	.12	.16	-.41	-.05	-.07	-.06	-.07	.02	.59	-.17	-.22	.02	-.15
Attribution	47	M	.12	.01	-.01	-.15	-.08	.04	.15	.08	-.10	-.26	-.13	-.31	-.03	-.02	.41*	.55
3rd Math	164	T	.07	.08	-.05	-.15	-.00	-.04	-.14	-.14	-.04	-.03	.16	.21	-.02	-.06	-.03	.01
Classroom	94	F	-.05	-.00	-.06	-.11	-.05	-.04	-.18	-.14	.06	.14	.25*	-.07	-.04	-.01	.02	.10
Quiz	70	M	.18	.30	-.21	-.11	.07	.01	-.02	-.04	-.01	-.13	.07	-.14	.03	.03	.01	.17

TABLE 21 continued
Correlations of Classroom Environment Scales with Achievement, Self-Concept, and Causal Attributions for Students Who Hold Perceptions of Failure

			Social Comparison		Student Teacher Relations		Student Input		Task Organization		Competition		Cooperation		Student Autonomy		Teacher Feedback	
MEASURE	n		r	B	r	B	r	B	r	B	r	B	r	B	r	B	r	B
Math	164	T	.10	.08	-.12	-.11	-.08	-.09	-.02	-.07	.17	.08	.08	.15	.02	.01	-.06	-.05
Self-	94	F	-.02	-.08	-.09	-.10	-.07	.09	-.08	-.07	.20	.12	.10	-.07	-.10	-.04	-.07	.08
Concept2	70	M	.20	.34	-.22	.11	-.09	-.10	.06	.05	.10	.15	.05	-.04	.15	.11	-.08	-.01
General	164	T	.30**	.23	.09	.04	.06	-.01	.15	.08	.21*	10	.16	.03	.20*	.12	.08	.03
Self-	94	F	.24	.12	.19	.27	.08	-.12	.14	-.01	.14	.10	.21	.02	.12	.05	.13	.16
Concept2	70	M	.39**	.42	-.01	-.03	-.03	.04	.16	.17	.25	.04	.09	-.01	.28*	.09	-.05	-.07
3rd Time	164	T	-.04	.01	.06	.11	-.13	-.15	-.03	-.07	-.02	.02	-.12	-.10	-.09	-.05	.02	.05
Effort	94	F	.04	.14	.07	.00	-.08	-.26	-.05	-.15	.10	.11	.03	.12	.06	-.00	.03	.10
Attribution	70	M	-.23	-.02	.04	.12	-.24	-.17	.03	-.10	-.17	-.04	-.29*	-.29	-.19	-.07	.00	.12
3rd Time	164	T	.02	-.01	-.04	-.05	.00	.04	.04	.04	.07	.07	-.04	-.05	.02	.03	-.06	-.08
Ability	94	F	-.03	-.31	-.01	-.23	.03	.18	.04	.03	.22	.36	-.02	-.11	-.03	.06	.07	.09
Attribution	70	M	.07	.15	-.13	-.12	.04	.14	-.06	.11	-.11	-.28	-.08	-.12	.07	.19	-.15	-.07
3rd Time	164	T	-.17	-.16	-.03	-.04	-.04	-.01	.02	.01	-.04	.02	-.05	-.03	.03	.06	.04	.06
Luck	94	F	-.11	-.18	.04	.35	-.11	-.32	.03	.07	.01	-.04	-.03	.25	-.07	.15	.16	-.09
Attribution	70	M	-.32*	-.31	-.11	-.19	-.01	-.10	.04	.01	-.09	-.35	-.05	.13	.25	.42	-.09	-.01
3rd Time	164	T	.02	-.06	-.00	-.05	.06	.11	.18*	.20	.08	.06	.05	.04	.03	.00	.01	-.06
Task	94	F	.00	-.15	-.01	-.12	.12	.20	.04	.10	.12	.26	.05	.06	-.02	.07	-.08	-.16
Difficulty	70	M	.01	.03	.01	-.19	-.03	-.06	.35*	.25	.00	-.19	.06	-.08	.13	.20	.09	.00
3rd Time	164	T	.08	-.09	.08	.07	.04	.06	-.02	.02	-.04	-.01	-.04	-.01	-.06	-.05	-.05	-.06
Studying	94	F	-.14	-.20	.21	.15	.05	-.01	-.14	-.20	.02	.08	.09	.15	.01	.03	-.15	-.31
Attribution	70	M	-.06	-.03	-.11	-.23	.04	-.05	.13*	.11	-.09	-.10	-.21	-.12	-.14	.02	.05	.30

Note. 1-tailed Significance: * $p < .01$, ** $p < .001$.

Perceived Failure Group

For the students in the perceived failure condition (see Table 21), there were positive correlations between the Social Comparison scale and the first mathematics quiz for the entire group ($r = .18$, $p < .01$), the first general self-concept scale (whole group: $r = .21$, $p < .01$; males: $r = .35$, $p < .001$) and second general self-concept scale (whole group: $r = .30$, $p < .001$); males: $r = .39$, $p < .001$). There were also positive correlations at time three for the whole group with attributions to lack of

studying at time one (r = .18, p < .01) and for males with attributions to poor luck at time three (r = .32, p < .01).

The Student-Teacher Relations subscale correlated positively with attributions to bad luck for the whole group (r = .22, p < .01) and for females at time two (r = .34, p < .01). At time three, task organization correlated positively with task difficulty attributions for the entire group (r = .18, p < .01) and for males (r = .35, p < .01). Competition correlated negatively with attributions to low effort at the first administration for the entire group (r = -.24, p < .01) and for females (r = .30, p < .01). There was also a positive correlation between competition and the second general self-concept for the entire group (r = .21, p < .01).

Cooperation correlated positively with the third mathematics quiz for females (r = .25, p < .01) and negatively with effort attributions at time three for males (r = -.29, p < .01). The Student Autonomy subscale was related positively to the second general self-concept measure for the entire group (r = .20, p < .01) and with males (r = .28, p < .01). Teacher feedback correlated positively with males for attribution to studying at time two (r = .41, p < .01).

Results Of The Interviews

There were 39 students interviewed, 19 males and 20 females. Two students (one male and one female) were selected from each class. In one class, none of the females would agree to an interview. An observation noted was that females from Chinese and East Indian backgrounds were less likely to agree to participate than females from other ethnic backgrounds. In one class two female Chinese students did

agree, on the condition that they were interviewed together. Therefore, the format varied slightly. The students did not talk while responding to the questionnaire. The questions were read and the researcher waited before proceeding to the next question until both subjects were finished with their response.

Students interviewed represented a broad range of achievement. The overall first term mathematics percent ranged from 25 to 95 for the 39 respondents. The mean was 69.50 (*SD* = 16.84) and the median 71.50 for the total group. For females, the mean was 69.90 (*SD* = 17.82) and the median was 70.00. For males, the mean was 69.10 (*SD* = 16.28) and the median was 73.00.

Table 22 includes students' most common responses to the success and failure scenarios for same-sex, and different-sex protagonists. Each student rank-ordered selections. They were not required to respond to every option, only those they thought applicable. The responses shown in this table are only the responses ranked first. Students had the opportunity to supply an option that they valued.

One of the purposes of the interviews was to corroborate the attribution measures. The interview responses would be valid if the supplied set of attributions was given high rankings. Validity evidence would be lacking if student-supplied options were highly ranked. Very few students supplied responses beyond the set presented and, there was little agreement. This pattern validates the attribution measure since students gave precedence to options in the supplied affect set.

The first hypothesis with respect to the interviews was that females in the interview group would experience more shame than males following failure. Males did

TABLE 22

Frequencies for the Two Most Common Student Choices for the Interview Scenarios

	How do you think s/he would feel?				What do you think s/he would say when asked why s/he did so well/poorly?			
	Attribution Same Sex	f	Attribution Other Sex	f	Attribution Same Sex	f	Attribution Other Sex	f
Level of Effort								
Females								
Hi Effort/Success	Happy	18	Happy	17	Tried Hard	11	Tried Hard	9
	Surprised	1	Surprised	2	Studied Hard	6	Studied Hard	5
/Failure	Disappointed	8	Disappointed	6	Not Smart	7	Unlucky	8
	Sad	6	Sad	5	Unlucky	6	Hard Test	6
Lo Effort/Success	Surprised	14	Suprised	11	Lucky	12	Lucky	10
	Happy	4	Happy	7	Easy Test	3	Smart @ Math	4
/Failure	No Surprise	13	No Surprise	8	Did Not Try	11	Did Not Try	8
	Humiliated	3	Humiliated	5	Hard Test	3	Did Not Study	5
Males								
Hi Effort/Success	Happy	13	Happy	17	Tried Hard	10	Luck	9
	Surprised	3	Surprised	2	Easy Test	4	Tried Hard	8
/Failure	Sad	7	Disappointed	7	Hard Test	7	Hard Test	7
	Disappointed	6	Sad	7	Unlucky	5	Not Smart	6
Lo Effort/Success	Surprise	12	Happy	12	Lucky	11	Smart @ Math	9
	Happy	8	Surprised	7	Smart @ Math	5	Easy Test	6
/Failure	No Surprise	10	No Surprise	7	Did Not Try	11	Did Not Try	7
	Sad	4	Disappointed	5	Unlucky	4	Unlucky	5
Ability Level								
Females								
Hi Ability/Success	Happy	13	Happy	10	Smart @ Math	12	Smart @ Math	11
	No Surprise	6	No Surprise	7	Studied Hard	3	Lucky	3
/Failure	Disappointed	7	Disappointed	6	Hard Test	7	Unlucky	11
	Sad	4	Surprised	5	Unlucky	5	Did Not Try	4
Lo Ability/Success	Surprised	13	Suprised	10	Lucky	13	Not Smart	9
	Happy	6	Happy	8	Tried Hard	3	Unlucky	5
/Failure	No Surprise	7	Sad	7	Not Smart	14	Lucky	8
	Sad	6	No Surprise	6	Did Not Try	2	Smart @ Math	5
Males								
Hi Ability/Success	Happy	14	Happy	15	Smart @ Math	17	Smart @ Math	12
	No Surprise	5	No Surprise	3	Studied Hard	2	Lucky	3
/Failure	Disappointed	9	Surprised	8	Unlucky	8	Unlucky	6
	Surprised	8	Disappointed	7	Hard Test	3	Hard Test	4
Lo Ability/Success	Surprised	10	Happy	11	Lucky	9	Lucky	10
	Happy	9	Surprised	8	Tried Hard	4	Tried Hard	3
/Failure	Sad	7	Sad	8	Not Smart	9	Unlucky	7
	No Surprise	6	No Surprise	6	Unlucky	5	Not Smart	4
Luck								
Females								
Luck/Success	Happy	9	Surprised	9	Lucky	13	Lucky	10
	Surprised	9	Happy	8	Tried Hard	3	Tried Hard	3
/Failure	No Surprise	6	No Surprise	7	Not Smart	12	Not Smart	7
	Disappointed	5	Sad	4	Did Not Study	3	Did Not Try	4
Males								
Luck/Success	Surprised	13	Surprised	12	Lucky	16	Lucky	14
	Happy	6	Happy	8	Studied Hard	2	Tried Hard	3
/Failure	No Surprise	9	No Surprise	7	Not Smart	8	Not Smart	6
	Disappointed	5	Sad	6	Unlucky	6	Hard Test	5

TABLE 22 continued

Frequencies for the Two Most Common Student Choices for the Interview Scenarios

	How do you think s/he would feel?				What do you think s/he would say when asked why s/he did so well/poorly?			
	Attribution Same Sex	f	Attribution Other Sex	f	Attribution Same Sex	f	Attribution Other Sex	f
Task Difficulty/Ease								
Females								
Difficult/Success	Surprised	15	Happy	13	Lucky	12	Luck	8
	Happy	4	Surprised	7	Tried Hard	7	Tried Hard	6
Failure	Sad	10	No surprise	7	Hard Test	7	Hard Test	7
	No Surprise	6	Sad	6	Not Smart	5	Not Smart	5
Ease/Success	Happy	9	Happy	12	Easy Test	10	Smart @ Math	7
	No Surprise	8	No Surprise	7	Smart @ Math	5	Easy Test	7
/Failure	Surprised	8	Surprised	8	Unlucky	7	Unlucky	7
	Angry	5	Angry	4	Did Not Study	5	Did Not Study	5
Males								
Difficult/Success	Happy	10	Happy	10	Tried Hard	10	Lucky	7
	Surprised	10	Surprised	8	Lucky	7	Tried Hard	5
Failure	Happy	13	Disappointed	7	Easy Test	13	Hard Test	8
	No Surprise	6	Sad	5	Smart @ Math	3	Not Smart	5
Ease/Success	Disappointed	7	Happy	11	Hard Test	10	Smart @ Math	8
	Surprised	6	No Surprise	8	Did Not Study	4	Easy Test	8
/Failure	Disppointed	8	Disappointed	8	Did Not Try	7	Did Not Try	6
	Sad	6	Sad	3	Unlucky	6	Unlucky	5
Studying								
Females								
Studied Hard/Success	Happy	15	Happy	16	Studied Hard	9	Studied Hard	7
	No Surprise	2	No Surprise	2	Tried Hard	5	Tried Hard	5
/Failure	Disappointed	7	Ashamed	6	Unlucky	6	Unlucky	8
	Sad	6	Sad	4	Not Smart	5	Not Smart	3
Didn't Study/Success	Surprised	11	Happy	10	Lucky	11	Lucky	11
	Happy	7	Surprised	9	Tried Hard	4	Easy Test	3
/Failure	No Surprise	14	Sad	5	Did Not Study	6	Did Not Try	10
	Sad	2	No Surprise	5	Did Not Try	6	Did Not Study	5
Males								
Studied Hard/Success	Happy	14	Happy	15	Studied Hard	9	Tried Hard	8
	No Surprise	3	No Surprise	3	Tried Hard	8	Studied Hard	6
/Failure	Disappointed	8	Sad	7	Hard Test	10	Hard Test	10
	Surprised	3	Surprised	7	Unlucky	8	Unlucky	7
Didn't Study/Success	Surprised	13	Happy	15	Lucky	10	Lucky	7
	Happy	7	Surprised	5	Smart @ Math	5	Easy Test	5
/Failure	No Surprise	12	Sad	6	Did Not Study	10	Did Not Study	8
	Sad	3	Not Surprised	6	Did Not Try	4	Unlucky	4

Note. Females n = 19, Males n = 20

not rank "shame" as their first option for either same-sex or different-sex students. Females ranked "humiliation" first, for a same-sex failure scenario in a low effort situation. From queries made by students during the interviews, it seems likely that students did not discriminate between shame and humiliation. Shame was also ranked

first twice by females for different-sex failure in a low effort situation and failure in a studying hard scenario.

The second hypothesis was that males in the interview group would rate females in the hypothetical situation differently than males. Males would attribute females' success to effort or luck and males success to ability. Females would not differ in their ratings. Males did rate attributions following success and failure situations for same-sex and different-sex scenarios differently for seven of the 16 scenarios. There were variations for four success scenarios and three failure scenarios. When high effort was exerted in a success situation, the response was "easy test" for the same-sex student, but "smart in math" was chosen for different-sex students. The other option selected did not vary between the sexes. For the low effort/success scenario, "smart in math" was indicated for same-sex and "easy test" for different-sexes. The other response provided did not vary between the genders. For the high ability/success scenario, "studied hard" was identified for same-sex students and "lucky" for opposite sex students. The other option was the same for both sexes. For the didn't study hard/success scenario "smart in math" was identified for same-sex and "easy test" for opposite sex. Again the other option was the same for both genders. In the difficult test/failure scenario, "didn't study hard" was chosen for same-sex students and "not smart in math" for opposite-sex students. The other option selected was identical for the two sexes. In the didn't study hard/failure scenario, "didn't try hard" was identified for same-sex students and "unlucky" for opposite sex. The second option selected did not vary between genders. Finally, for the luck/failure

scenario, "unlucky" was the response for males and "difficult test" for females. Again the second option identified did not vary between the genders.

The hypothesis that males rated females differently was supported by responses in seven of 18 scenarios. In two cases males attributed success for males to ability and in one case attributed females' success to luck. Other responses lacked a discernible pattern.

The second part of the hypothesis, that females would not rate males differently from females in regards to attributions, was not supported. Males were rated differently from females in eight cases; four success scenarios and four failure scenarios. In the high ability success scenario females rated females as "studying hard" and males as "lucky". In the low ability/success scenario females were ranked as "trying hard" and males as "smart in math". In the didn't study hard/success scenario, females were rated as "trying hard" and males as having an easy test. In the low effort/success scenario, the cause was attributed to an easy test for females, but for males it was "smart in math". For the high effort/failure scenario, the females' cause was "not smart in math" and males as having a "difficult test". For the low effort/failure scenario, females' failure was ascribed to having a "difficult test" and males' to "not studying hard". In the high ability/failure scenario, it was a "difficult test" for females and "didn't try hard" for males. In the low ability/failure situation, "didn't try hard" was the cause for females and males were seen as "unlucky". In these variations, females tended to attribute females' success or failure to effort or task difficulty. Females attributed

males' success or failure to both external causes, luck and task difficulty and internal causes, ability and effort.

For both females and males there was little variation between ratings of same-sex and different-sex protagonists for how the student would feel about the success or failure situation.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

Overview

In this chapter the results of the dissertation are discussed using the research questions listed in Chapter 1 as a framework. Under each research question there is a summary of findings concerning the hypothesis, a discussion and implications for all subjects, and information is broken down by gender. This gender breakdown is in addition to the research question which focused on differences between females and males. The final section notes limitations of the study and implications for future research.

Relationship of Mathematics Self-concept and Performance

Summary

It was predicted that academic performance in mathematics would correlate with prior mathematics self-concept. A second prediction was that this relationship would hold within both success and failure conditions. These two hypotheses were supported. There were no statistically significant gender differences.

Discussion and Implications

There was a strong positive correlation between mathematics self-concept scores and achievement on the two occasions that measures were taken ($p < .001$). This is consistent with other researchers' findings (Marsh, 1984; Marsh, 1990a; Marsh et al, 1991). Significant positive correlations were found regardless of whether students perceived outcomes as success or failure at each administration period ($p < .001$).

Thus, students with a higher self-concept in mathematics tend to be higher achievers and students with a lower mathematics self-concept tend to have lower achievement. The generalizability of this finding was demonstrated by the strength of the relationship in both success and failure situations for male and female students on the two times that measurements were made. The chronology of events in this study had the self-concept measurement taken prior to the achievement measure. Therefore, the self-concept is essentially the students' mathematics self-concept prior to the learning outcome. The relation between self-concept and achievement was strong. Students' perceptions were relatively accurate in the sense that their higher self-concept indicated an expectation of higher achievement, which was borne out by results. Generally, students who expected to do well were successful.

These findings have an implication for enhancing performance. Since the two variables are substantially correlated, it may not be fruitful to argue which variable is cause and which is effect, enhancements to either of the variables could contribute to an enhancement of the counterpart. In instruction one might hope to improve mathematics achievement through efforts to improve mathematics self-concept, and conversely efforts to improve mathematics achievement may have the effect of a concomitant improvement in mathematics self-concept. In other words, if the two variables are interdependent, then enhancement of one may enhance the other in a cycle of ascending performance.

Relationship of Academic Self-Concept and Causal Attributions

Summary

It was expected that attributions to internal causes (ability, effort, and studying) would correlate positively with mathematics self-concept under both successful and failure conditions. This hypothesis was confirmed in terms of attributions to ability, but not effort or studying. Following success there were no statistically significant gender differences in terms of ability attributions. However after failure, positive correlations were found between attributions to effort and mathematics self-concept for females at time one and for males at time two ($p < .01$). For studying attributions, in one of three administration periods a negative correlation was found following success for the total group and for females. On one other occasion following failure, there was a positive correlation for the total group and both genders. On a second occasion there was a positive correlation for females only.

Of the three possible correlations, the relationship to ability was anticipated to be stronger than the relationship to effort or studying. This was confirmed.

Another expectation was that correlations between mathematics self-concept and internal attributions (combined total for ability, effort, and studying) would be higher than correlations between mathematics self-concept and external attributions (combined total for task difficulty and luck) for successful and unsuccessful students. There was not strong support for this hypothesis after success. Only on one of three occasions was there a significant positive correlation found between internal attributions and mathematics self-concept ($p < .001$) for students. None of the

correlations between mathematics self-concept and external factors were significant ($p > .01$). There were no differences between genders.

In the failure condition, internal attributions were significantly and positively correlated with mathematics self-concept on all three administrations for both genders. There were also significant positive correlations between external attributions and mathematics self-concept on all three administrations for the total group. Data from females contributed greatly to this significant result for the total group. On two out of three occasions the correlations were significant for females, while the correlations for males were not significant at any time. The only time that the correlation between self-concept and internal attributions was significantly higher than the correlation between self-concept and external attributions was at time two. This was the case for the total group and for males and females. There were no significant gender differences at time one, when internal attributions were positively and statistically significantly correlated with self-concept. At time two and three, both genders had significant positive correlations for mathematics self-concept with internal causes. Males' correlation between external attributions and mathematics self-concept was not detectably different from zero. The correlation between internal attributions and mathematics self-concept was not significantly different than the correlation between external attributions and mathematics self-concept for females ($p > .05$).

Discussion and Implications

Ability attributions correlated positively with mathematics self-concept in both success and failure conditions at all three administration times ($p < .001$). This means

that: following success, students with a higher self-concept tended to make attributions to ability; these students selected high ability as the source of their success. Following failure, students with a higher self-concept were not likely to make attributions to ability. Conversely, students with low self-concept scores tended to make attributions to low ability following failure. This result was consistent with other research (Marsh et al, 1984; Marsh, 1984). The findings of the current research constitute strong evidence in understanding the relation between mathematics self-concept and causal attributions because of the study design wherein perceived success and failure events were actual outcomes from students' classroom work. It seems reasonable that students would give greater weight to the importance of an outcome from their own academic learning than an imagined outcome.

Following success, effort attributions did not correlate significantly with mathematics self-concept at any administration period. Although there was a significant correlation once for each gender group following failure, results were not consistent, and no conclusive statement can be made.

There was some evidence of students making studying attributions. On one success occasion attributions to studying correlated negatively with mathematics self-concept for the total group and for females. This indicates that students with lower self-concept thought they had been successful because they studied hard whereas higher self-concept students did not. The results following failure provide some evidence that low self-concept students tended to attribute their failure to lack of studying, but higher self-concept students did not. This occurred on one occasion for

the whole group and for both males and females, and for females only on another occasion.

That attributions to studying and effort following success did not correlate in a consistent and significant way with mathematics self-concept is consistent with the findings of Ames (1978) and Ames and Felker (1979). This agreement is of interest since Ames' measure focused on general self-concept, whereas the current study used a self-concept measure specific to content area. The results for perceived success are not consistent with the findings of Marsh et al. (1984) and Marsh (1984) who found effort attributions to be correlated with mathematics self-concept following both failure and success. One might speculate that the anomalous results for success are due to the race of the students. Separate analysis for Chinese students confirmed the findings noted for the total group, lending partial support to the speculation.

A result of this study consistent with the research of Marsh et al. (1984) and Marsh (1984) was that the correlation between ability attributions and mathematics self-concept was stronger and more stable than the correlation between effort or studying attributions and mathematics self-concept. One may conclude that the relation between mathematics self-concept and ability attributions is stronger than the relation between mathematics self-concept and attributions to effort. This seems reasonable since ability is a stable internal dimension, whereas effort is unstable (Weiner, 1986). Thus, students are aware that their effort fluctuates in different academic situations whereas they construe personal academic ability as a quality they carry relatively unchanged to each learning outcome. The current results based on

real classroom achievement events did not exactly follow those of Marsh's study which employed hypothetical situations. The inconsistent results following failure for effort or studying attributions may be due to definition of the samples since membership in a success/failure group depended on a personal judgment of success/failure according to students' own internal metric rather than a test score.

An implication for classroom instruction is that the relationship between mathematics self-concept and perceptions of mathematics ability is relatively stable among eighth-grade students. Therefore, students with a lower self-concept in mathematics attribute failure to low ability. These are the students for whom attribution retraining has potential. Craven, Marsh, and Debus (1991) had success with an intervention that directed students to attribute failure to lack of effort. The results in the current study show that such students are more likely to focus on ability as cause. Lower self-concept students may benefit in terms of mathematics self-concept if they are given a treatment that includes attributional feedback directing them to attribute failure to effort rather than to ability.

Grouping attributions along a continuum from internal to external did not yield clear results. When factors were combined according to internal or external dimensions, only on one success occasion was the correlation between internal factors and mathematics self-concept significantly higher than the correlation between external factors and mathematics self-concept. There was only one failure occasion where the correlation with internal factors exceeded the correlation with external

factors. Grouping causal attributions according to a simple internal/external dichotomy does not clarify explanations of differences in self-concept.

These results are not in accord with the hypotheses based on previous studies (Marsh et al., 1984; Marsh, 1984). There was no clear evidence that students with higher academic self-concepts attributed academic success to high levels of internal factors, nor was there evidence that students with a lower self-concept attributed failure to low levels of internal factors. In this study internal factors were composed of ability, effort, and studying causes. As previously mentioned, ability appeared as an oft-cited cause by students, but effort and studying did not. Therefore, the hypothesis was supported by attributions to only one of three internal causes when students perceived that they had been successful. Similarly, there was no clear pattern of attributions for higher self-concept students who perceived the assessment outcome as a failure. Students with a lower self-concept tended to attribute failure to both internal and external factors.

Attributions And Achievement

Summary

It was predicted that correlations of mathematics achievement with ability, effort, and studying attributions would be positive for both success and failure groups. For students who perceived that they had been successful, correlations were thrice positive and significant between ability and mathematics quiz score ($p < .001$). There were significant positive correlations for females at all three administrations. Males had a significant positive correlation only at time three. There were no correlations

detectably different from zero for effort or studying and quiz score at any of the three administrations for the total group or for either gender.

Results were clearer for failure. For these students, attributions to effort, studying, and ability were significantly and positively correlated with mathematics achievement at all three administration periods ($p < .001$). Both females' and males' positive correlations between effort and quiz score attained significance twice. For two administrations females' positive correlations between studying and quiz score were significant. This was not the case for males. The positive correlations between ability and quiz score were significant for both genders at all three administration periods.

The hypothesis that correlations between mathematics achievement and attributions to ability would be higher than the correlations between mathematics achievement and effort or studying attributions was confirmed for success situations across all three administrations. For students who perceived test results as unsuccessful, the correlations between ability attributions and achievement did not differ significantly from correlations between effort or studying attributions and achievement ($p > .05$).

It was expected that students with higher academic performance would be more likely to attribute success to the three internal attributions, ability, effort or studying. The hypothesis was upheld for ability attributions for both genders ($p < .001$) but not for effort attributions ($p > .01$) or for studying attributions ($p > .01$).

For both success and failure, the correlations between students' mathematics quiz scores and internal attributions (combined total for ability, effort, and studying)

were expected to be higher than the correlation between quiz scores and external attributions (combined total for luck and task difficulty). After success at time two, a significant positive correlation was found between mathematics quiz scores and external attributions for the total sample and males ($p < .01$). At time three a significant positive correlation was found between internal attributions and classroom quiz scores for the total sample ($p < .001$). Correlations between internal factors and the mathematics quiz were not significant for either gender ($p > .01$). The hypothesis was clearly supported for failure situations.

In the failure condition, there were significant correlations between internal attributions and achievement on all three administrations for both genders. There were significant positive correlations between external attributions and achievement at time three for the total group and for females. At time two females also had a significant positive correlation between external attributions and achievement. As expected in the failure setting, the correlation between achievement and internal attributions was significantly higher than the correlation between achievement and external attributions on all three administrations and for both genders.

Discussion and Implications

There was a tendency for successful students to attribute success to high ability. This tendency was more pronounced for successful females than successful males. Successful students were less likely to ascribe success to effort or studying. The tendency of unsuccessful students was to attribute failure to low ability and also to low effort or studying at all three administrations. This finding agrees partially with

previous research findings (Marsh et al., 1984; and Marsh, 1984) that students tend to make attributions to both effort and ability in success and failure conditions.

Following success, the relationship between ability attributions and achievement was stronger than the relationship between effort or studying attributions and achievement; there were no significant correlations between effort or studying attributions and achievement. That the relationship was stronger for ability and achievement is also consistent with previous findings (Marsh, 1984; Marsh et al., 1984). However, the results differed after failure when there were no detectably significant differences between ability and effort or studying attributions with achievement.

Students with higher academic performance tended to attribute success to ability. This tendency was consistent for all students across the three administrations regardless of gender. Again, this finding is similar to previous results which also found that both ability and effort correlated positively with academic achievement (Marsh, 1984; Marsh et al, 1984). However, in the current study, higher achieving students were unlikely to ascribe success to effort or studying which is similar to the results of Gaeddert (1987) who also failed to find a positive correlation between effort attributions and achievement in success situations. In terms of instruction, it seems reasonable to expect that higher achieving students would tend to exert optimal levels of effort in learning situations. That attributions do not correspond to this intuition is puzzling.

It seems reasonable to expect that successful students would make attributions to high levels of internal causes, such as ability, as well as effort. That they did not

make attributions to high levels of effort is a problem for further investigation. One suggestion that offers a possible explanation is the cultural background of students. One might speculate that the many subjects of Asian descent routinely exert high levels of effort and discount its importance as a cause. There is no evidence, however, to support this cultural stereotype. A single selection of the data was undertaken choosing Chinese students. The intention was to determine if this cultural group had results similar to the total. This was confirmed. It may be that the overall results reflect the influence of Chinese students because they constituted a plurality. However, this influence is unclear without conducting further analysis with explicit comparisons of results by ethnic or language groupings. A more general explanation is that perceptions of high ability are enduring, and students who feel they are "smart in math" may tend to discount the importance of effort in academic success. If subsequent research supports this conclusion, there are implications for attribution retraining since high levels of effort are indeed necessary for academic success even for students with high ability levels. Higher ability students who fail to exert appropriate effort may experience failure (Covington & Omelich, 1985). Attribution retraining thus has potential benefits for all students. Both higher and lower-ability students should be aware that effort and studying are required even for those students who perceive themselves as having high ability within the subject domain.

Negative attributions, such as attributing failure to low ability may hinder student learning (Borkowski, Weyhing, & Carr, 1988). Learning is a cognitive act in which students must engage actively. Retraining would benefit students if the instruction

makes students aware that their negative attributions decrease their motivation to learn by reducing their willingness to work at learning and inhibiting their metacognitive control of the learning activity.

Redirecting causal attributions to effort also benefit self-concept as well as achievement. Lower self-concept students who focus on ability as a cause may feel that higher ability students do not need to expend effort. Coupled with a lower perception of ability, this view may lead students to view effort as the "double-edged sword" (Covington & Omelich, 1979). Attribution retraining which shows the merit of effort for both higher and lower-ability students may reduce the stigma attached to exerting maximum effort.

In this sample, students perceived high ability to be the dominant source of success. The two other internal attributions, effort and studying were not seen as major causes of success. This focus on one internal cause provides partial explanation for the failure to confirm the expectation that attributions to internal causes would be more common in success situations. On only one success occasion was the correlation between mathematics quiz scores and internal attributions greater than the correlation between mathematics quiz scores and external attributions. Thus the success results failed to replicate those of Marsh (1984) and Marsh et al. (1984).

The hypothesis was supported for the failure condition. Under failure, students' achievement was more closely related to internal than external causes. This correspondence held for both genders despite the finding that females also made

significant attributions to external causes on two failure conditions. This is similar to the results of Marsh (1984) and Marsh et al. (1984).

The conclusion relevant to classroom learning is that students took responsibility for failure as represented by their attributions to internal factors. Similarly, students took personal responsibility for academic success.

Gender Patterns

Summary

Mathematics Self-Concept.

One primary hypothesis stated that males' mathematics self-concept scores would be higher than females. This hypothesis was confirmed on the two occasions when self-concept was measured. Based on previous research about gender and self-concept (Byrne & Shavelson, 1987; Tapasak, 1990) a related hypothesis stated that, although males have the higher mathematics self-concept, females' performance in mathematics would be superior. This was also supported. Females' first semester mean mathematics average was significantly higher than males ($p < .01$).

Predicted Achievement.

The achievement hypothesis about females' quiz score predictions was not confirmed. The expectation that female students would predict lower mathematics performance than males was not detected ($p > .01$).

Mathematics Self-Concept and Achievement.

A related extrapolation from previous findings on gender differences in self-concept also failed to be confirmed. The expectation was the relationship between

mathematics self-concept and mathematics achievement would be stronger for males than females. There were strong relationships ($p < .001$) between mathematics achievement and mathematics self-concept within each gender group on both test administrations. Between gender groups there was little difference. An identical correlation ($r = .52$) was found for both genders from the first quiz results, and on the third quiz the correlations did not differ significantly (males: $r = .59$; females: $r = .53$).

Causal Attributions.

It was predicted that gender difference patterns would appear for internal attributions such that females would tend to attribute success to effort whereas the tendency for males would be to attribute success to ability. Results from the three sets of causal attributions provide partial confirmation of the hypothesis. After the first test, males attributed success to ability more often than females ($p < .01$), but there was no significant difference between genders in effort attributions ($p > .01$). At time two, there were no gender differences for ability attributions but females attributed success to studying more often than males ($p < .01$). On the final administration the hypothesis was confirmed. Males attributed success to ability ($p < .01$) more often, while females attributed success to effort ($p < .01$).

Another hypothesis about gender differences in causal attributions stated that females would ascribe failure to low ability and task difficulty more often than males, whereas males would ascribe failure to low effort. This hypothesis was not confirmed at any of the three administrations. No gender differences were significant ($p < .01$) following failure.

Attributions and Self-Concept.

A within-gender hypothesis predicted that higher self-concept females would be less likely to attribute failure to lack of ability than lower self-concept females. This hypothesis was confirmed for all three administrations ($p < .01$).

Interviews.

Within the subgroup of students participating in interviews, it was hypothesized that females would experience more shame than males following failure. This was observed. Females ranked "humiliation" first for a same-sex failure scenario in a low effort situation and "shame" was ranked first for a different-sex failure in a low effort situation and following failure in a studying hard scenario. Males did not rank "shame" as their first option for either same-sex or different-sex characters in the scenarios.

Another hypothesis was that students interviewed would rate females in the hypothetical situation differently than males. Males would attribute females' success to effort or luck while attributing males' success to ability. It was not expected that females would differ in their ratings for same-sex or different-sex characters.

There was no support for the hypothesis about ratings by males. In seven out of 16 scenarios males were found to rate attributions following success and failure situations differently for same-sex and different-sex scenarios. In two cases, male character's success was attributed to ability and in one case a female character's success was attributed to luck. Other responses lacked a discernible pattern.

The second part of the hypothesis, that females would not rate male characters differently from female characters in regards to attributions, was not supported. In

eight cases female students did rate male characters differently from female characters, four success scenarios and four failure scenarios.

Discussion and Implications

Mathematics Self-concept.

The finding that males' self-concept in mathematics is higher than females self-concept even when females' math scores are higher is consistent with recent research (Byrne & Shavelson, 1987; Tapasak, 1990). Neither males nor females gave appropriate weighting to achievement results as a contributor to mathematics self-concept.

A classroom implication arising from these findings is that one may expect that higher levels of achievement in mathematics to be associated with higher levels of mathematics self-concept. That males' mathematics self-concept is higher than females' is a conundrum. The higher achievement found for females should contribute to higher levels of mathematics self-concept. Conversely, the lower achievement for males should have contributed to relatively lower levels of self-concept. That this is not the case is a subject for further investigation. One avenue of investigation might be teachers' gender. In the current study half of the mathematics teachers were females, which means that at the time of the study females had a same-sex role model. One might speculate that this is not a regular occurrence in secondary schools, or even upper elementary classes. It may be that over students' school careers the preponderance of mathematics teachers have been male, reinforcing a concept that mathematics is a domain of males.

Predicted Achievement.

Stipek and Gralinski (1991) found that when students were asked to predict their achievement, females tended to predict lower scores. In the current study females' predictions were similar to males'. A possible explanation for the contradictory findings could be that the sample of students in the current study includes many higher achieving students who have high performance expectations regardless of their gender. Another explanation may be the higher expectations of Asian Students. Separate analysis of Chinese student results found that the results for this subgroup were the same as the total group.

Mathematics Self-Concept and Achievement.

Females and males did not differ in correlations between mathematics self-concept and achievement. Although females did hold a lower mathematics self-concept, the strength of the relationship between self-concept and achievement did not differ significantly from males. Although, neither females nor males had the levels of self-concept expected based on their relative achievement, the difference did not attain statistical significance. Therefore, one may not conclude that there is a gender difference in the relationship between self-concept and achievement in mathematics.

Causal Attributions.

There were gender differences found in attributions made by students to explain the cause of success outcomes, but the pattern lacked consistency. With three opportunities to make causal attributions in this study, there was opportunity to search for temporal stability. On two of three occasions, males attributed success to high

ability whereas females did not. On two occasions females made attributions either to studying or effort whereas males did not. Studying and effort were offered as separate choices because some teachers anticipated different students would perceive these causal attributions differently in temporal terms. The logic went along the lines that students who spend a week studying for a test may not feel that effort during the test was important. The results of this study suggest that it was not necessary to include both terms. It seems that students did not distinguish differences in meaning between these two terms (studying and effort). As mentioned earlier, studying and effort attributions were positively correlated (time one: $r = .47$; time two: $r = .51$; time three: $r = .49$; $p < .001$).

There were no gender differences in attributions following failure. The results after failure correspond to those reported by Ryckman and Peckham (1987a, 1987b), but contradict results from Stipek and Gralinski (1991) and Woudzia (1991). In the latter studies, females were found to ascribe failure to low ability more often than males. These researchers also found that females were less likely to ascribe success to ability than males. The tendency for females was to select effort as the source of their success.

That Woudzia's results were not replicated in the current study has special interest in terms of the generalizability of the findings. One would expect similar results given that the students in both studies were of a similar age, lived in the same city, and followed a vertically integrated mathematics curriculum. And, in both cases, the same procedures were used, that is the same attribution measure followed a

teacher-developed classroom mathematics quiz. One possible distinction between the two samples may be related to students' schools. The students in Woudzia's study were in the seventh-grade, the last year of elementary school while the students in the current study were in the eighth grade, their first year of secondary school. Midgley, Feldlaufer, and Eccles (1988) found students in elementary and secondary schools had differing perceptions of classroom learning structures. Secondary students reported fewer opportunities for quality interactions with the teacher or their classmates, they were not allowed to make as many decisions, and more relative comparisons were made among students. One might speculate that different perceptions of the learning environment may have influenced results.

Attributions and Self-Concept.

Mathematics self-concept may have a stronger relation to causal attributions than to gender. That higher self-concept girls were less likely to attribute failure to lack of ability is consistent with results found by Covington and Omelich (1985). Marsh et al. (1984) and Marsh (1984) also found that higher self-concept females and males are less likely to make attributions to ability following failure. The conclusion is that female students' causal attributions are closer to those of males if both are members of the group with a higher self-concept in mathematics. Thus, it may be inappropriate to base conclusions on the basis of gender alone.

This is a major implication for instruction, that one should not make simple dichotomies of attributions along gender lines. Academic self-concept is also related to achievement. Higher self-concept females made attributions that were more similar to

those of higher self-concept males than to those of lower self-concept females. Another concern is the outcome situation. Effort attributions did not differ between genders following failure. Self-concept was significantly correlated with attributions to ability in both success and failure conditions for females and for males.

Interviews.

Affect was not measured directly in the survey instruments administered in class, but it was a major component of the questions asked during interviews. There is some evidence that females experienced more shame than males in the hypothetical scenarios. Covington and Omelich (1985) also found that females experienced more shame than males following failure. Thus, the evidence from the current study tends to support the hypothesis that females attribute more shame to a failure outcome than males, especially since the males interviewed did not give "shame" a high ranking. However, these gender differences may not be reliable due to vocabulary used in the interview. A few students questioned the interviewer about affect definitions, indicating that they did not understand the meaning of "humiliation." Many of the students who participated in this sample were speakers of English as a second language. If a few lacked a clear definition of some affective terms, it seems reasonable that others may also have been uncertain, but failed to voice their concerns.

Based on findings by Sousa and Leyens (1987) the interview hypothesis predicted that males' tendency would be to attribute a female character's success to effort and luck while attributing a male character's success to ability. In addition the hypothesis predicted that females would not rate causes differently for male and

female characters. There was no support for this hypothesis in the current study with grade eight participants. This difference relative to Sousa and Leyen's could be related to developmental difference between the two samples: participants in Sousa and Leyens' study were adult students in university. Perhaps adults had a longer time to make between-gender observations of performance, while adolescents have only begun to make such comparisons. Another source of differing findings could be cultural. Sousa and Leyen's subjects were Europeans. One might speculate that North Americans' views of performance are less differentiated with respect to gender.

Notes by the researcher from the interviews shed some light on the finding that there was no reliable pattern by gender for subjects' causal ascriptions of events in the scenarios. An observation was made that many of the other-sex judgments made by students seemed to be based on arbitrary assignment, rather than on deeply held perceptions. An example is a statement that "I'll mark it this way because I don't want the girls to have the same ratings."

Attribution Patterns Across Time

Summary

In this section findings that were significantly correlated with attributions for every one of the three administration periods are summarized.

Attributions to ability were positively correlated with mathematics self-concept after success and failure for both males and females. Following success outcomes, none of the correlations between mathematics self-concept and attributions to effort were detectably different from zero. Again, this was true of both males and females.

A pattern noted but not hypothesized was that students' mathematics self-concept was negatively correlated with attributions to luck when they were successful. On two occasions males' mathematics self-concept was also negatively correlated with luck attributions. Another unexpected pattern was that attributions to task difficulty following failure correlated positively and statistically significantly with mathematics self-concept at every administration and for all students and both gender groups.

Classroom achievement as measured by mathematics quiz score was positively correlated with females' attributions to ability following success. This stable relation occurred three times for females, yet only once for males. Attributions to lack of ability, effort, and studying were positively correlated with mathematics quiz scores for all students after failure. The relationship between ability attributions and achievement held for both genders. The relationship between females' attributions to lack of studying and classroom achievement was stable across occasions but effort attributions were less stable. Attributing failure to low effort was correlated with achievement on two occasions for both genders. On two occasions males' attributions to lack of studying were correlated with achievement.

Another clear pattern found, determined by Fisher's r-to-z transformation, was that attributions to ability and mathematics achievement were higher following success than attributions to effort. Perceived ability was more closely related to achievement on all three occasions by both genders.

Another clear pattern was found that, following failure, students' internal attributions (total score for ability, studying, and effort) correlated positively with

mathematics self-concept scores and with mathematics quiz scores at all three assessment times for the total student group and for both genders. However, for the total group, mathematics self-concept was also found to be correlated positively with external attributions (total score for luck and task difficulty) on all three occasions. This stable result was noted for females twice, but not at all for males.

Discussion and Implications

For the purposes of this discussion a stable relationship is defined as one exhibited by significant correlations at each of the three measurement periods during the study. One of the most interesting findings is the stable relationship between ability attribution and mathematics self-concept. That is, both males and females with a higher self-concept attribute their success to ability whereas lower self-concept students do not. In addition, both males and females with a lower self-concept attribute their failure to lack of ability whereas higher self-concept students do not. Thus, students, regardless of gender, tend to focus on ability as a cause, whether or not they are successful. The enduring relationship between attributions to ability provides an understanding of how students conceive their mathematics ability. Higher self-concept students use success results as evidence of personal competence. That lower self-concept students reject the same result as evidence for competence suggests that lower self-concept persons could benefit from attribution retraining which emphasizes their personal contribution to the success event. Conversely, when lower self-concept students fail, they are willing to accept this negative evidence that they lack personal competence. Low levels of self-concept are related to a tendency to

interpret assessment outcomes in unfavourable personal terms. Higher self-concept persons are more resilient. When failure occurs, they may be less likely to attribute low ability as a cause, such that a poor performance has less impact on their personal assessment of competence.

For students with lower self-concept there was a stable relationship with task difficulty. Students, both males and females, tended to perceive the task as being too difficult. That is higher self-concept students did not make failure attributions to task difficulty but lower self-concept students did. Although this finding was not expected, it is consistent with Marsh et al. (1984) and Marsh (1984) who found no negative correlations following failure between mathematics self-concept and attributions to external causes. This finding has implications for attribution retraining. Lower self-concept students who attribute failure to difficult tasks may be less motivated to exert appropriate effort in future assessment situations, especially if a difficult task perception is coupled with one of low ability. Feedback which focuses on effort as a primary cause, coupled with encouragement that describes tasks as attainable, would seem to be an appropriate intervention for lower self-concept students.

These suggestions for lower self-concept students hold regardless of gender. Females who did well attributed their success to high ability whereas females who did poorly did not. Thus higher self-concept females exhibit attribution patterns that resemble those of higher self-concept males. It is not reasonable to make generalizations about the relationship between mathematics self-concept and attributions based solely on gender.

Like mathematics self-concept, achievement was closely related to the internal cause of ability. Following success the correlation between achievement and ability was significantly greater than the correlation between achievement and effort. Also like the relationship with mathematics self-concept, both males' and females' ability attributions had higher correlations with achievement. That higher achieving students perceived success as evidence of high ability, also suggests that for higher achievers, gender results are similar. Higher achieving females may see success as evidence of personal competence just as males do.

Students' attribution patterns differ more by level of achievement or mathematics self-concept than by gender. When students failed, internal causes were significantly correlated with mathematics self-concept and with achievement represented by scores from classroom mathematics quizzes. This indicates that students with lower self-concept made attributions to failure to internal causes whereas higher self-concept students did not. A female student with a lower self-concept was just as likely to focus on an internal cause for failure as a lower self-concept male student. Moreover, students would not focus on internal causes for failure when they had a higher mathematics self-concept, regardless of gender.

One interesting gender difference finding for success outcomes was the negative correlation between attributions to luck and mathematics self-concept. The result was significant for all students and for male students, but not for females. The implication is that male students with a lower mathematics self-concept had a tendency to attribute their success to good fortune.

Correlations Of Achievement And Motivational Factors With Perceptions of the Classroom Environment

There were no hypotheses for correlations between student perceptions of the classroom environment and achievement or motivational factors; rather this analysis was exploratory. Significant correlations were found between classroom environment factors with several other measures: mathematics self-concept, mathematics quiz score, and general academic self-concept. There were eight factors examined within the classroom environment: social comparison, student-teacher relations, student input, task organization, competition, cooperation, student autonomy, and teacher feedback.

These factors were not examined with expected conclusions. Therefore, it is difficult to interpret the results, except in terms of evidence for hypotheses in future research. Few relationships were found to be stable, in the sense that significant correlations were found on both occasions that classroom environment was measured. Single instances of significant correlations do not constitute clear evidence of relationships. The fact that nonsignificant relations were found at another time could well be construed as evidence that no relationship exists. Therefore, the focus of the discussion in this section is on the relationships that were stable, in the sense that correlations were statistically significant for both waves of measurement.

Summary of Overall Results

For the total group, social comparison was positively and significantly correlated with both mathematics self-concept measures and both general self-concept

measures. The relationships indicate that when students frequently compare their performance to that of their classmates, the students are more likely to have higher mathematics and general academic self-concepts. For males, this correlation was significant on the two mathematics self-concept measures and the two general academic self-concept measures. Females' general self-concept was significantly and positively correlated with social comparison only on one occasion. Therefore, the indication from these results is that when the classroom environment engenders a greater degree of social comparison, the tendency for males is to have a higher mathematics and general academic self-concept. One might speculate that the differing results for females could be related to levels of self-concept. Perhaps high self-concept females would have higher mathematics and general academic self-concept in social comparison. Conversely, the greater degree of social comparison could be an inappropriate structure for females with a lower initial self-concept for mathematics specifically, and academic learning in general. It seems reasonable that prior perceptions of low mathematics self-concept in mathematics would be reinforced when more between-student comparisons were made in mathematics classes.

Task organization was positively and significantly related to general self-concept twice for the total sample and for females once. Therefore, in mathematics classes where students work on similar tasks at approximately the same time, students, especially females, have a higher general academic self-concept.

There were significant correlations found between the Cooperation scale and two mathematics quizzes for females only. This indicates that when mathematics

classes include a greater degree of cooperative learning, there is an increased likelihood that females will demonstrate higher achievement.

Summary of Success Outcomes

For the total sample, social comparison correlated positively with both mathematics self-concept measures and both general self-concept measures. Social comparison correlated with mathematics self-concept for males once and with general self-concept for both genders once. Therefore, in classrooms where there was a greater degree of social comparison there were higher scores for mathematics and general self-concept.

Summary of Failure Outcomes

In the perceived failure condition, positive correlations were found between the Social Comparison scale with males' general self-concept on both occasions. This indicates that males' overall academic self-concept remained high after failure in mathematics classes where social comparison occurred.

Discussion and Implications for Perceptions of the Classroom Environment

With the eight factors of the classroom environment scale, a complex set of relations has been described for females, males, and all students with the cluster of motivational variables. Since there were no *a priori* hypotheses, it is difficult to draw gender difference conclusions, especially since few relationships were stable. However, the results do suggest avenues for future research. Student perceptions of classroom environment factors most frequently related to measures of self-concept. Clear connections to mathematics achievement did not appear. Further research

should pursue stability of relationships to self-concept and whether classroom environment has an indirect relation with achievement through self-concept.

Two factors, task organization and cooperation, seemed to be associated with structures that would be construed as better learning environments for females. In the Task Organization grouping, students work on similar tasks and at similar times and in a Cooperative classroom, students help each other in small work groups of their choosing. Whether these structures are indeed conducive to better learning by female students is a fruitful research opportunity.

The Social Comparison environment was shown to be related to males' self-concept, but there did not seem to be a relationship with achievement. Subsequent efforts should attempt to discern how classroom environment is related to motivational variables, and determine which structures are appropriate for females and males of different levels of self-concept.

The reluctance to draw conclusions stems from a concern by the researcher that the scale itself needs greater validity evidence. The factors in the original instrument were not extracted exactly in the current study. Since, different items loaded on factors for the two administrations, the constituent factors need to be replicated to provide evidence of their validity. For example, in the current study, the Student Autonomy scale did not seem to be related in a significant way to motivational variables. It is not clear that student autonomy is a discrete factor. In order to draw conclusions about the environment of mathematics classes for gender differences one

must have greater confidence in the factors of which the Classroom Environment Measure consist.

Limitations Of The Study

The sample of students was relatively large, but stronger evidence would have been produced if the data had been more complete. There were three periods when data was collected. At time two, some data was lost due to forgetful teachers not collecting some data. Students who were absent for one or more of the instruments had missing data for that instrument, since teachers did not subsequently administer instruments to absent students. The total sample is also smaller than proposed, because a teacher strike intervened, which resulted in the loss of two entire classes of subjects.

Another limitation related to the sample occurred when comparisons were made from results at three different administrations. Because of missing data, the sample at each administration consisted of essentially different groups. This problem was considered before the analyses proceeded. A suggested solution was to exclude all subjects who did not have a complete data set. However, this option was rejected and the analyses included all participants since exclusion would have resulted in a smaller sample with a corresponding lack of power.

A Final Remark

The current study was designed to provide a broad view of the relationships among achievement and motivational variables while avoiding the methodological limitations that reduce generalizability. Few studies have included

analysis of these groups of motivational variables. Still fewer have included achievement referents that students value. If we are to draw inferences for learning, it seems that the minimum criterion for including achievement measures would be to include those from classroom learning.

That was done in this study. Grounding the success and failure outcomes in students' personal learning is a more valid frame of reference for understanding their causal implications (Meece, Blumenfeld, & Hoyle, 1988). Thus ecological validity inherent in the study design lends credence to the significant findings noted.

This research yielded some results that differ from other empirical investigations. It was expected that attributions to internal causes of ability and effort would correlate with mathematics self-concept after success and failure. Following success only ability attributions correlated positively with mathematics self-concept. Following failure ability attributions again correlated positively with mathematics self-concept. Effort attributions were found to correlate with mathematics self-concept for one failure event only, which may have been a chance occurrence. Internal attributions were expected to correlate positively with mathematics achievement for males and females after both success and failure. Ability attributions correlated positively with mathematics achievement following success for females on all three occasions, but for males only once. Effort and studying did not correlate following success.

There were other unique findings related to gender differences. Females' predicted mathematics examinations scores were not significantly lower than males' predictions. The hypothesis that females would attribute success to effort or studying

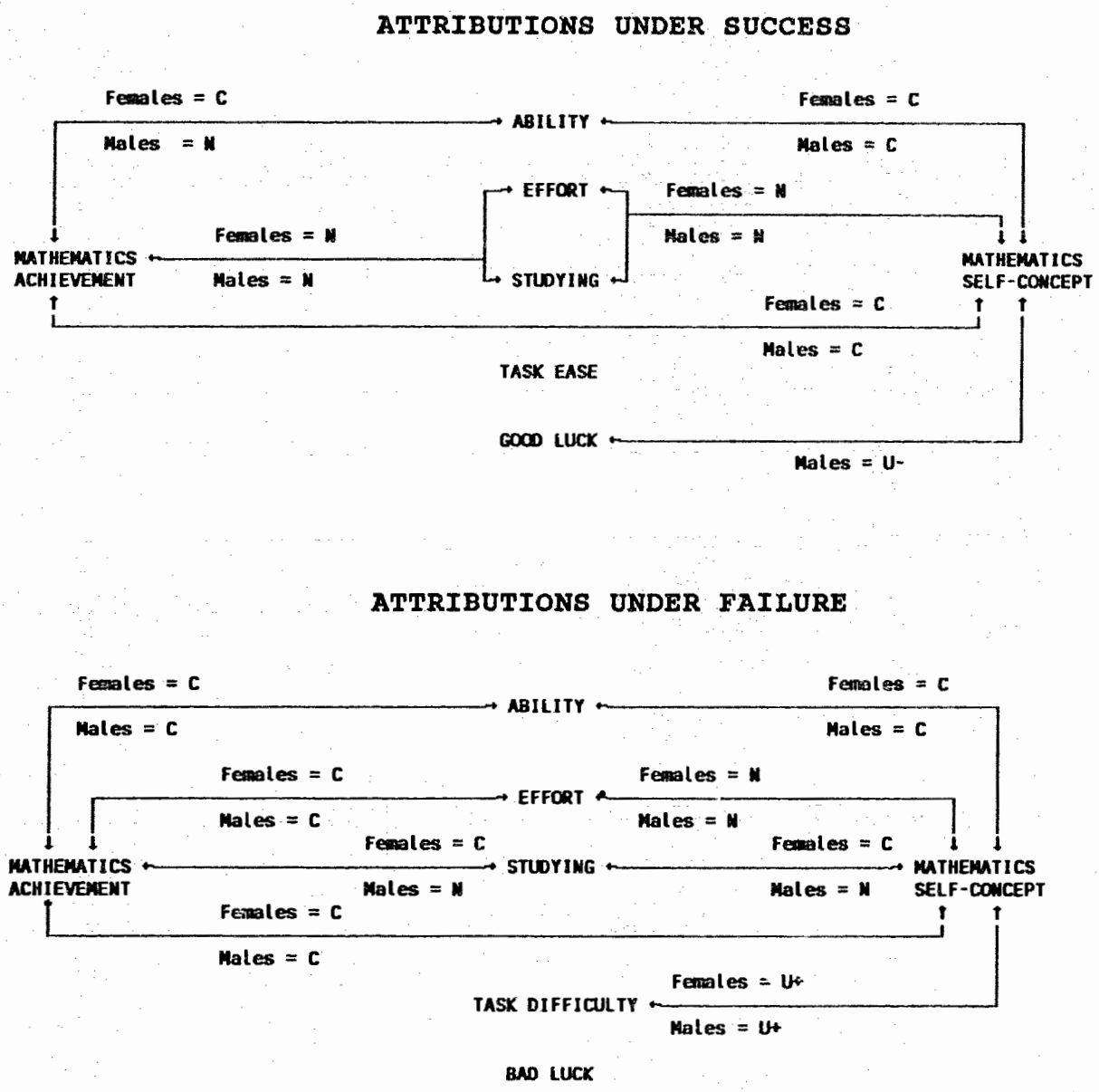
was only confirmed once. Females did not ascribe failure to low ability or task difficulty more often than males on any occasion.

The results of this study highlight similar relationships among achievement and motivational variables for male and female students (see Figure 1). There were expectations that the responses would differ more by gender. Some differences are noted but the present study may be seen as a reference point for future research. There is a need to replicate the work including the constellation of factors: academic mathematics self-concept, causal attributions, academic achievement, within an ecologically valid analysis of learning within the classroom environment. The complexity of learning is such that breakdowns by demographic variables such as gender and culture should be related to motivational factors. Replication will reveal whether gender differences are reliable and provide evidence to influence instruction.

As mentioned in the classroom environment summary, this area offers interesting opportunities for future research, especially relating the factors of the classroom environment to the motivational variables investigated in the current study. The correlations found in this study could form the basis for hypotheses in other studies.

The differences by gender were investigated in this study for the motivational variables. Cultural differences were not. There was some speculation made that the ethnic background of the subjects may have predisposed them to respond in a specific pattern. Separate analysis of results selecting Chinese students only yielded results that were in most instances, congruent with the findings reported for students

FIGURE 1
Diagram of Relations Among Motivational Variables and Achievement for Males and Females.



Note. Legend of Symbols
C = Hypothesis of expected positive correlation confirmed on at least two occasions.
N = Hypothesis of expected positive correlation not confirmed on two occasions.
U+ = Outcome not hypothesized (positive correlation).
U- = Outcome not hypothesized (negative correlation).

overall. Whether race was a determining factor is not clear. Such an investigation was beyond the scope of this study. However, it is a path that should be followed.

As noted earlier, the results for this study have implications for attribution retraining. That the relation between mathematics self-concept and attributions to ability for both success and failure outcomes was positive indicates that students with a low self-concept tend to attribute failure to low ability. These students could benefit from retraining to redirect their attributions for failure to lack of effort. Successful students were more likely to attribute success to ability, especially females. This was not the case for attributions to effort or studying. Attribution retraining to redirect success to effort may also have potential benefits for these successful students.

The fact that following failure, there were no gender differences between attributions to effort, ability, and studying is interesting. Subsequent research should focus on determining whether these results are an anomaly or if attributions do not differ by gender.

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Appendix A

Individual Class Information

INDIVIDUAL CLASS INFORMATION

Teacher	Teacher's Gender	Class Size	Number of Participants	Number of Females	Number of Males
A	Male	28	28	18	10
A		27	27	18	9
B	Male	15	12	6	6
C	Female	28	28	13	15
D	Female	30	28	16	12
D		24	22	10	12
E	Female	23	19	13	6
E		30	27	13	14
F	Male	23	21	9	12
G	Female	27	27	15	12
G		28	27	2	15
H	Female	26	25	16	9
H		23	23	16	7
I	Male	17	15	6	9
I		26	23	14	9
J	Male	25	21	10	11
J		26	24	13	11
J		21	19	6	13
J		25	22	10	12
Total		470	438	234	204

Note. Total number of teachers = 10, total number of classes = 19.

Appendix B

Attribution Measure

ATTRIBUTION MEASURE

DIRECTIONS

LOOK AT THE MARK YOU RECEIVED ON YOUR MATH QUIZ.

IF YOU CONSIDER YOUR MARK A GOOD MARK, PLEASE ANSWER QUESTIONS ON THE NEXT PAGE (PAGE 2).

IF YOU CONSIDER YOUR MARK A POOR MARK, PLEASE ANSWER QUESTIONS ON PAGE 3.

1. How much do you think that your good mark on this test was due to you trying really hard on the test?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

2. How much do you think that your good mark on this test was due to the fact that you're smart in this subject?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

3. How much do you think that your good mark on this test was due to good luck on your part?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

4. How much do you think that your good mark on this test was due to the fact that the test was easy?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

5. How much do you think that your good mark on this test was due to studying a lot?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

6. If you answered "very much" or "quite a bit" to one of the above questions use the space below to explain the reason for your choice?

_____

1. How much do you think that your poor mark on this test was due to you <u>not trying hard enough</u>?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

2. How much do you think that your poor mark on this test was due to you <u>not being smart enough in this subject</u>?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

3. How much do you think that your poor mark was due to the fact that you <u>had bad luck</u> on this test?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

4. How much do you think that your poor mark on this test was due to the fact that the <u>test was too difficult</u>?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

5. How much do you think that your poor mark on this test was due to <u>not studying a lot</u>?

very much _____
quite a bit _____
somewhat _____
very little _____
not at all _____

6. If you answered "very much" or "quite a bit" to one of the above questions use the space below to explain the reason for your choice?

_____

Appendix C

Student Classroom Environment Measure

STUDENT CLASSROOM ENVIRONMENT MEASURE

Please enter your student ID Number in the space provided at the left.

These questions refer only to your Math class. How often do these events occur while you are learning Math?

A = Not Very Often
B = Sometimes
C = Usually
D = Very Often

1. We get to work in small groups when we do math.
2. Some students try to be the first ones to answer math questions the teacher asks.
3. I compare my math ability to other students in my math class.
4. We can suggest projects or topics to study in math.
5. Most students in this class do the same math homework.
6. The teacher cares how we feel.
7. During work time, we can move around the classroom.
8. Some students try to be the first to finish math questions.
9. I like to know how my ability compared to other students in my math class.
10. In this class, we can choose math materials (books, games) to use in class.
11. In this class, all students work on the same math lesson at the same time.
12. We get to pick which students we want to work with in math.
13. Doing better in math than other students in my classroom is important to me.
14. We can decide which order to do our math work in.
15. We use the same math textbooks and materials as other students in this class.
16. The teacher treats boys and girls differently.
17. We can talk to each other during math time.
18. I compare how hard I try in math to how hard other students try in my classroom.
19. We help each other with math work.
20. When I ask for help my teacher urges me to try harder.
21. When I ask for help my teacher helps me do the problem.
22. There is reward for students who do well in math.
23. Trying harder in math than other students in my classroom is important to me.
24. The teacher is friendly to us.
25. Not all students are treated the same.
26. When we do poor work the teacher lets us know it.

Appendix D

Teacher Classroom Environment Measure

TEACHER CLASSROOM ENVIRONMENT MEASURE

How important are the following items to the operation of your classroom?

A = Not Very Important
B = Somewhat Important
C = Important
D = Very important

1. Students work in small groups when they do math.
2. Students suggest projects or topics to study in math.
3. Most students in the class do the same math homework.
4. Students are allowed to move around the classroom during work time.
5. Students can choose math materials (books, games) to use in class.
6. All students work on the same math lesson at the same time.
7. Students get to pick which students they want to work with in math.
8. Students decide which order to their math work in.
9. Students all use the same math textbooks and materials in class.
10. Students can talk to each other during math time.
11. Students help each other with their math work.
12. When students ask for help they are encouraged to try harder.
13. When students ask for help they are helped with the problem.
14. There is recognition for students who do well in math.
15. Students practise their math skills in solving problems.
16. Students have projects in math class.
17. Students use a calculator to solve math problems.
18. Students use computers in math class.
19. Students memorize facts and formulas.

Appendix E

Student Background Questionnaire

STUDENT BACKGROUND QUESTIONNAIRE

STUDENT NUMBER _____

PLEASE CIRCLE THE APPROPRIATE LETTER FOR EACH QUESTION NUMBERED 1 TO 8, and also for Question 10.

1. **Sex:** a. Female b. Male

2. **Country of birth:** a. Canada b. Another country

3. **Was English the first language you learned to speak?**
   a. Yes
   b. No

4. **Do you usually speak English at home?**
   a. Yes
   b. No

5. **What is your ethnic background?**
   a. English or other Caucasian group
   b. Chinese (Cantonese/Mandarin)
   c. East Indian (Gujarati/Hindi/Punjabi/Urdu
   d. Vietnamese
   e. Spanish
   f. Another ethnic group

6. **Please indicate the highest level of education your mother has received?**
   a. Elementary school
   b. High school
   c. College
   d. University

7. **Please indicate the highest level of education your father has received?**
   a. Elementary school
   b. High school
   c. College
   d. University

8. **Does your mother have a job?** a. Yes b. No

9. **What kind of work does your mother do (for e.g., secretary, teacher, or manager)?**

   _____

10. **Does your father have a job?** a. Yes b. No

11. **What kind of work does your father do (for e.g., construction worker, teacher, or manager)?**

    _____

Appendix F

Interviewer Scenario Protocol

INTERVIEWER SCENARIO PROTOCOL

INSTRUCTIONS:

I am going to describe several learning situations in a classroom. I want you to imagine how the person in each story would respond to the situation. Before I tell you the story I would like to ask you about marks on a test. What you would consider to be a good mark out of 100 _____ and a bad mark out of 100 _____.
What girl's name would you like me to use in the story? _____ What boy's name? _____

SUCCESS SITUATION

SCENARIO 1:
John is in Grade 8 math. He just wrote a math test. While he/she was taking the test, he found it very hard. Then when he got the test back, he had passed with a very good mark.

How do you think John would feel?

This probe to be used if response is not forthcoming.

(Do you think he would be happy? sad? surprized? disappointed? proud? anything else?)

What do you think John would say when asked why he did so well?

This probe to be used if response is not forthcoming.

(Do you think he would say that he is lucky? smart? that he tried hard? the test was easy? that he studied hard? anything else?)

What if the person in the story was Mary?

How do you think she would feel?

What do you think she would say when asked why she did so well?

SUCCESS SCENARIO TWO

SCENARIO:
Sandra is in Grade 8 math. Sandra just wrote a math test. While she was taking the test, she found it very easy. Then when she got the test back, she had passed with a very good mark.

FAILURE SCENARIO THREE

SCENARIO:
Bing is in Grade 8 math. He just wrote a math test. While he was taking the test, he found it very hard. Then when he got the test back, he had failed.

How do you think Bing would feel?

This probe to be used if response is not forthcoming.
(Do you think he would be happy? sad? surprized? not surprized? disappointed? ashamed? angry? humiliated? anything else?)

What do you think Bing would say when asked why he did so poorly?

This probe to be used if response is not forthcoming.

(Do you think Bing would say that he is unlucky? not smart in math? the test was too hard? that he did not try hard? that he did not study enough? anything else?)

What if the person in the story was Mary?
How do you think she would feel?
What do you think she would say when asked why she did so poorly?

SCENARIO FOUR

Siu Wan is in Grade 8 math. She found the unit test very easy, and expected a good mark. When she got the test back, she found out that she had failed.

SUCCESS SCENARIO FIVE

Nguyen is in Grade 8 math. He tried very hard when he worked on the unit test. When he got the test back, he had earned a very high mark.

SUCCESS SCENARIO SIX

Rumiko is in Grade 8 math. She just wrote a test. While she was taking the test, she did not try very hard. Then when she got the test back, she had passed with a very good mark.

FAILURE SCENARIO SEVEN

Joanne is in Grade 8 math. She just wrote a math test. While she was taking the test she tried very hard. then when she got the test back, she had failed.

FAILURE SCENARIO EIGHT

Min is in Grade 8 math. He just wrote a test. While taking the test, he did not try very hard. Then when he got the test back, he had failed.

FAILURE SCENARIO NINE

Maizy thinks she is very smart in Grade 8 math. She just wrote a math test. Then when she got the test back, her mark was lower than she usually gets.

SUCCESS SCENARIO TEN

Henry thinks he is very smart in Grade 8 math. He just wrote a math test. Then when he got the test back, his mark was higher than he usually gets.

FAILURE SCENARIO ELEVEN

Maizy thinks she is not smart in Grade 8 math. She just wrote a math test. When she got the test back, her mark was lower than she usually gets.

SUCCESS SCENARIO TWELVE

Maizy thinks she is not smart in Grade 8 math. She just wrote a math test. When she got the test back, her mark was higher than she usually gets.

SUCCESS SCENARIO THIRTEEN

Ingrid is in grade 8 math. She just wrote a math test. She had studied very hard for this test. Then when she got back the test back she found that her mark was higher than she usually gets.

FAILURE SCENARIO FOURTEEN

Arturo is in grade 8 math. He just wrote a test. He had studied very hard for this test. Then when he got back the test back, he found that his mark was lower than he usually gets.

FAILURE SCENARIO FIFTEEN

Arturo is in grade 8 math. He just wrote a test. He knew that he had not studied enough for this test. Then when he got back the test back, he found that his mark was lower than he usually gets.

SUCCESS SCENARIO SIXTEEN

Arturo is in grade 8 math. He just wrote a test. He knew that he had not studied enough for this test. Then when he got back the test back, he found that his mark was higher than he usually gets.

SUCCESS SCENARIO SEVENTEEN

Dieter is in grade 8 math. He just wrote a test. After the class a friend asked him how he had done on the test. Dieter replied, "I really do not know, it will be a fluke if I passed." Then when he got the test back he found that he had passed with a very good mark.

SUCCESS SCENARIO EIGHTEEN

Billy is in grade 8 math. He just wrote a test. After the class a friend asked him how he had done on the test. Billy replied, "I really do not know, it will be a fluke if I passed." Then when he got the test back he found that he had failed.

Appendix G

Answer Sheet for Male Students

ANSWER SHEET FOR MALE STUDENTS

Note. The answer sheet for female students follows the same format with pronouns reversed.

SCENARIO 1:

1. How do you think he would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   PROUD _____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

   LUCKY _____
   SMART IN MATH _____
   TRIED HARD _____
   TEST EASY _____
   STUDIED HARD _____
   ANYTHING ELSE_____

3. How do you think she would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED _____
   PROUD _____
   ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

   LUCKY _____
   SMART IN MATH _____
   TRIED HARD _____
   TEST EASY _____
   STUDIED HARD _____
   ANYTHING ELSE _____

SCENARIO 2:

1. How do you think he would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   PROUD _____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

   LUCKY _____
   SMART IN MATH _____
   TRIED HARD _____
   TEST EASY _____
   STUDIED HARD _____
   ANYTHING ELSE_____

3. How do you think she would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED _____
   PROUD _____
   ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

   LUCKY _____
   SMART IN MATH _____
   TRIED HARD _____
   TEST EASY_____
   STUDIED HARD _____
   ANYTHING ELSE _____

SCENARIO 3:

1. How do you think he would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

SCENARIO 4:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

SCENARIO 5:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
PROUD _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY_____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 6:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
PROUD _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY_____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 7:

1. How do you think he would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?

   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

3. How do you think she would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED _____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?

   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

SCENARIO 8:

1. How do you think he would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?

   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

3. How do you think she would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED _____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?

   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

SCENARIO 9:

1. How do you think he would feel?
   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?
   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

3. How do you think she would feel?
   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED _____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?
   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

SCENARIO 10:

1. How do you think he would feel?

   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   PROUD _____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE _____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 11:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
ASHAMED _____
ANGRY _____
HUMILIATED _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?

UNLUCKY _____
NOT SMART IN MATH _____
TEST DIFFICULT _____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE _____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

SCENARIO 12:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
PROUD _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 13:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE _____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 14:

1. How do you think he would feel?
   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?
   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

3. How do you think she would feel?
   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED _____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?
   UNLUCKY _____
   NOT SMART IN MATH_____
   TEST DIFFICULT_____
   DIDN'T TRY HARD _____
   DIDN'T STUDY HARD _____
   ANYTHING ELSE_____

SCENARIO 15:

1. How do you think he would feel?
   HAPPY _____
   SAD _____
   SURPRIZED _____
   NOT SURPRIZED _____
   DISAPPOINTED_____
   ASHAMED_____
   ANGRY_____
   HUMILIATED_____
   ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?

UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

SCENARIO 16:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
PROUD _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY_____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 17:

1. How do you think he would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
PROUD _____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY _____
STUDIED HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?

HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
PROUD _____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so well?

LUCKY _____
SMART IN MATH _____
TRIED HARD _____
TEST EASY_____
STUDIED HARD _____
ANYTHING ELSE _____

SCENARIO 18:

1. How do you think he would feel?
HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED_____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

2. What do you think he would say when asked why he did so poorly?
UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____

3. How do you think she would feel?
HAPPY _____
SAD _____
SURPRIZED _____
NOT SURPRIZED _____
DISAPPOINTED _____
ASHAMED_____
ANGRY_____
HUMILIATED_____
ANYTHING ELSE _____

4. What do you think she would say when asked why she did so poorly?
UNLUCKY _____
NOT SMART IN MATH_____
TEST DIFFICULT_____
DIDN'T TRY HARD _____
DIDN'T STUDY HARD _____
ANYTHING ELSE_____