

The Causal Relationships between Attribution Styles, Mathematics Self-Efficacy Beliefs, Gender Differences, Goal Setting, and Math Achievement of School Children

M. Shehni Yailagh*

J. Lloyd**

J. Walsh***

Abstract

This study was conducted to investigate the causal relationships between attribution styles, mathematics self-efficacy beliefs, gender differences, goal setting, and math achievement of school children. The subjects were 99 seventh-grade students (56 male and 43 female), from public schools in Sooke, Canada, who were selected randomly to participate in this study. A model was tested, using AMOS software. The scales used consisted of modified Stipek's (1993), Attribution for Performance in Math, Self-Efficacy Scale, the Foundation Skills Assessment tests and Lock and Bryan (1968) modified Students' Grade Goals Rating Scale. The results showed that the model was statistically fit and that student's math self-efficacy was influenced by his/her attribution. A significant relationship was found between self-efficacy and internal attribution. Also, the path between math self-efficacy and goal setting was significant, implying that self-efficacy plays a key role in students' goal setting. In addition, the students' goal setting was a predictor of the math achievement. Actually, those students who set higher goals for themselves in mathematics get better grades in math. The effect of self-efficacy on math achievement was indirect, through goal setting. The significant path between the attribution and math achievement shows that the explanatory styles influence math achievement. In other words, those students who attribute the causes of their success in math to internal factors receive higher grades, and those students who attribute the causes of their failure in math to internal factors get lower grades in mathematics.

Keywords: attribution styles, mathematics self-efficacy beliefs, gender differences, goal setting, math achievement

* Corresponding author: Professor of Shahid Chamran University, Education and Psychology Department, E-mail: mshehniyailagh@yahoo.com.

** University of British Columbia, Canada.

*** University of Victoria, Canada.

Introduction

Different forms of self-beliefs, especially those that tap the notion of subjective competence, have received a great deal of attention during the recent history of human learning and motivation research (Bong & Clark, 1999; Harter, 1990). Investigations on these self-constructs show the importance of one's "perceived" self, as opposed to the "actual" self, in successful functioning and adaptation across many disparate domains (Bandura, 1995). These findings stand in direct contrast to behaviorists' assertion that human learning and motivation are solely products of environmental contingencies (Wylie, 1968). Also studies involving personal beliefs suggest convincingly that individuals with positive views of themselves strive to succeed and overcome even the greatest obstacles in life. Those people with weak or negative self-conceptions seem, on the other hand, to fail to reach their fullest potential and fall short of their expected performance in light of their objective capacity (Bong & Clark, 1999).

In addition, self-efficacy theory postulates that people acquire information to appraise efficacy from their performance accomplishments, vicarious (observational) experiences, forms of persuasion, and physiological indexes (Schunk, 1991). An individual's own performances offer the most reliable guides for assessing efficacy. Successes raise efficacy and failure lowers it, but once a strong sense of efficacy is developed, a failure may not have much impact (Bandura, 1986). Also information acquired from these sources does not automatically influence efficacy; rather, it is cognitively appraised (Bandura, 1986). However, in order for such information to have an impact upon an individual's self-efficacy, this information is selected, interpreted, and subsequently integrated into judgments of personal efficacy. Inherent to this process are the attributions made regarding the causes of efficacy building experiences.

In the last two decades, Seligman (1990) has articulated a "pessimistic" explanatory style whereby people attribute failure to permanent, pervasive, and personal causes. People with this style tend to be especially susceptible to learned helplessness. For instance, attributing failure to inadequate ability is invasive and suggests that failure will continue under similar circumstances in the future. As a result, the helpless individual loses hope and stops trying (Rozell & Gardner, 2000).

Furthermore, Weiner (1979) specifies four primary causes to which most people attribute success or failure: ability, effort, task

difficulty, and luck. He suggested that specific causes people use to explain success and failure reflect at least three dimensions or properties that he labeled stability, locus, and control. How people perceive the likelihood of alternative causal factors influences their emotional reactions to future performance, subsequent achievement behavior, and their actual future performance (Weiner, 1980).

Moreover, Kloosterman (1984a) states that students often differentiate between effort and ability as determinants of school success or failure. He explains that if failure is attributed to low ability, then the student has no reason to believe that he or she will be successful at a later time because ability is perceived as a stable cause of failure. However, effort is an unstable cause of failure, therefore, if it is attributed to lack of effort, a student could expect to be successful if extra effort is put forth (King, 1995). In contrast, mastery orientation is connected with high effort. Mastery oriented students believe that increased effort will lead to success. If these students fail, they attribute this to lack of an adequate amount of effort and not a lack of ability. This often encourages even more effort.

These perceived causes for people's successes and failures influence their self-efficacy, and consequently their actions. Also, attributions influence expectancies of future successes (Schunk, 1991). Assuming that the learning conditions are expected to remain much the same, students who attribute prior successes largely to stable factors (such as high ability or easy task) are apt to hold higher expectancies for success than those who emphasize less stable factors (such as high effort or good luck). In self-efficacy theory, attributions constitute one type of cue that students use to appraise efficacy. Bandura (1986) contends that attribution factors such as the amount of effort expended and judgments of task difficulty influence performance indirectly through self-efficacy. Schunk (1991) believes that students who succeed through high effort are likely to judge themselves less capable than those who succeed with ease. Success on a task judged as easy will not raise self-efficacy as much as success on a difficult task. Efficacy appraisals depend on attribution factors as well as other influences, such as situational circumstances under which performances occur, number and pattern of successes, and persuader credibility (Schunk, 1991). In addition, Schunk (1984b) asserts that attribution variables have significant effects on self-efficacy.

Although perceptions of efficacy may be strong in an individual, altering the attributions of the person may change these efficacy expectations. It is therefore expected that the four sources of efficacy information may have greater impact on students who attribute their successes or failures to internal causes rather than those who attribute their successes or failures to external causes (Matsui, Matsui, & Ohnishi, 1990).

The role which self-efficacy plays in academic motivation can be illustrated by summarizing some relevant research. Brophy (1999) asserts that the person's sense of efficacy or expectations for success connect with related causal attributions for success and failure, emphasis on learning versus performance goals, selection of strategies for accomplishing the task and managing failure and frustration, and so on.

In the connection, Kitsantas and Zimmerman (1998) investigated the effects of performance strategies, goal-setting, and self-evaluative recording on the acquisition of a novel motoric skill with high school girls. It was hypothesized that greater acquisition would occur when (a) an analytic strategy was used instead of imaginal strategy, (b) practice goals were shifted dynamically during learning instead of remaining unchanging or fixed, and (c) self-evaluative recording of strategic performance processes was present rather than absent. Support for all three hypotheses was found.

In addition, several academic self-efficacy researchers (Schunk, 1984a; Schunk & Swartz, 1993) have established the causal role of efficacy beliefs in enhancing student's achievement-related behaviors (Bong & Clark, 1999). Manzo (1999) investigated the causal relationships between explanatory styles, mathematics self-efficacy beliefs, and sources of mathematics self-efficacy information. The results indicate that explanatory style mediates the relationship between sources of mathematics self-efficacy and mathematics self-efficacy. Thus, suggesting that one's efficacy budding experiences have a significant role in the development of one's explanatory style, which in turn influences one's resulting level of self-efficacy (Manzo, 1999).

Furthermore, research investigating the relationship between self-efficacy and causal attributions has demonstrated that increase in self-efficacy is more beneficial for individuals who have an internal locus of control (Chambliss & Murray, 1979a, 1979b). Also, Silver, Mitchell, and Gist (1995) concluded that not only do causal

attributions significantly impact the formation of efficacy beliefs, but that it is how individuals interpret the causes of their performances that is so important. Their investigation with business students indicated that for successful performances, there was a positive relationship between self-efficacy and stable attributions. A non-significant relationship was found between self-efficacy and internal attributions. However, for unsuccessful performances, internal and stable attributions were both found to be significantly related to self-efficacy beliefs (Manzo, 1999). In addition, Shaw, Dzewaltowski, and McElroy (1992) found that individuals who take more responsibility for their failures, experience a decrease in their level of self-efficacy.

Also Mone and Baker (1992) investigated the social-cognitive and attribution theories with goal theory. The results showed that the causal attributions of the students had a significant impact on their test taking self-efficacy. It appears that goal discrepancies and self-efficacy were positively related when stable attributions were made; whereas the relationship between self-efficacy and goal discrepancies was more negatively related when unstable causes were attributed. The impact of casual attributions in the formation of self-efficacy beliefs has further been substantiated.

Silver et al. (1995) studied the causal attributions and self-efficacy, and focused on the role of past performance and attributions as determinants of subsequent self-efficacy beliefs. They found that for successful performance 53% of the variance of post-task self-efficacy was accounted for by both past performance and causal attributions. For unsuccessful performers, past performance and attributions together accounted for 44% of the variance in post-task self-efficacy.

Direct evidence of the effects of explanatory style on computer-related performance is also available. Henry, Martinko, and Pierce (1993) found that more optimistic students earned higher grades in a computer program course. Similarly, Rozell and Gardner (1995) found that optimistic students reported higher computer efficacy and positive affect, and less negative affect. This discussion suggests that people's attribution styles influence their self-efficacy expectations and subsequent performance on computer-related tasks, as well as their performance attributions (Rozell & Gardner, 2000). The consensus from the research is that strong relationships exist between attributions for success and failure and academic performance (Chisholm, 1980; Kloosterman, 1984b).

There is also research to support the relationship between goal setting and self-efficacy, and school achievement (Schunk & Zimmerman, 1997; Schunk, 1991). Studies on goal setting show that goals differ in specificity, difficulty level, and proximity. Goals that are specific, not too difficult, and short-term, usually lead to higher self-efficacy. Vague goals have not been found to activate self-motivation and lead to higher performance. In addition, distant goals are subject to many other influences, while progress can be gauged much more effectively by short-term goals, and goal attainment is validated as they work and observe their progress (King, 1995). Students' achievement goals have been variously described as task versus ego goals, learning versus performance goals, mastery versus performance goals, and learning-focused versus ability-focused goals. Students with learning-focused or mastery goals aim to develop new skills and competencies, whereas students with ability-focused or performance goals try to demonstrate competence or to achieve at high levels of normative ability (Turner, Thorpe, & Meyer, 1998). Students with higher learning-focused or intrinsic goals, especially in elementary school, report higher self-efficacy (Middleton & Midgley, 1997). Also Coutinho and Neuman (2008) believe that mastery-approach and performance-approach goals were positive predictors of self-efficacy. Moreover, Cheng and Chiou (2010) mentioned that students with higher self-efficacy also set higher goals for subsequent achievement tests; those who set higher achievement goals performed better. In other words, goal setting mediated the relation of self-efficacy with subsequent test performance.

Furthermore, Lambert, Moore and Dixon (1999) investigated the relationship between goal-setting strategies and locus of control on on-task behavior. The results indicate that the subjects with a more internal locus of control spent relatively more time on-task under the self-set goal condition while those with a more external locus of control spent more time on-task when the coach set their goals.

Self-efficacy theory suggests an ongoing, reciprocal interaction among mathematics self-efficacy expectations and mathematics anxiety, mathematics achievement, and mathematics-related majors and career choices (Betz & Hackett, 1981). Cooper and Robinson's study investigated the relationships among perceived external support, mathematics background, mathematics anxiety, mathematics performance, and career self-efficacy among male and female students selecting mathematics-related majors. All of the variables listed were

significantly related to mathematics performance. The results of this study provided additional validation for the relationship between mathematics self-efficacy and mathematics performance. Lent and Lopez (1992) investigated the relationships between the four sources of efficacy information and mathematics self-efficacy within a high school sample. It was found that prior performance was the best predictor of self-efficacy, global academic self-concept did not explain unique self-efficacy variation beyond prior performance, and the effects of self-efficacy on the perceived usefulness of mathematics was mediated by students' mathematical/scientific interests (Lent & Lopez, 1992).

Studies of gender and motivation have reported that females hold lower expectations for success and are less likely to attribute success to ability than males (Licht, Stader, & Swenson, 1989). Clance and O'Toole (1988) investigated successful professional women and found that they tended to underestimate their abilities while overestimating those of others.

Additionally, sex-role research has shown that in subjects like mathematics and science, which are typically perceived as masculine, men are viewed as more competent. Success is expected on tasks at which one is more competent, and therefore attributions from successes tend to be of the more stable ability type. If success is attributed to ability then it is more likely that a person will attempt the task in the future (Weiner, Nierenberg, & Goldstein, 1976). Since women are less competent their successes should be less expected (less stable) and are less likely to be attributed to high ability. Therefore, motivation to attempt such tasks in the future is minimized.

There are also some studies that show gender differences in attribution and self-efficacy. Boys generally attribute their successes to ability and their failure to lack of effort, while girls generally attribute their successes to effort and luck, and their failures to a lack of ability (Dweck & Reppucci, 1973). Betz and Hakett (1983) found that gender differences in mathematics self-efficacy were correlated with gender differences in attitudes toward mathematics and choice of mathematics-related majors. In 1984, Betz and Hackett found moderate correlations between mathematics self-efficacy and mathematics performance, and significant gender differences on both variables. Gender was found to mediate mathematics self-efficacy indirectly through (a) socialization influences, and (b) mathematics preparation. Mathematics-related self-efficacy in turn influenced both

mathematics anxiety and mathematics-relatedness of college majors. Females often withdraw from mathematics and science courses after meeting the basic requirements, which limits their opportunities to enter related fields (Kammer & Smith, 1986). Matsui et al. (1990) conducted a study on first year Japanese undergraduates, to investigate Bandura's four sources of self-efficacy information. It was found that mathematics self-efficacy was significantly higher for males than for females (King, 1995).

Gender differences in academic achievement have been the subject of extensive research over the past decades (Fan & Chen, 1997; Kianian, 1996). Recent research in this area indicates that the gap between boys and girls in mathematics achievement is closing. In British Columbia, data from a recent Foundation Skills Assessment shows that girls' achievement in mathematics meets that of boys (Ministry of Education, 1998). Other studies have yielded similar results (Marsh & Yeung, 1998; Byfield, 2000).

In past research, the typical explanation that was given for the traditional gender differences in mathematics performance concerns students' achievement-related beliefs (Stipek & Gralinski, 1991). More specifically, gender differences in achievement have commonly been ascribed to the differing inferences boys and girls make about causes of their performance, and to the differing perceptions they have of their academic ability.

The purpose of this investigation was to determine the causal relationships that exist between attribution styles, mathematics self-efficacy beliefs, gender differences, goal setting, and math achievement of school children, in Victoria, Canada.

The present model (see figure 1) implies that learners obtain information about their math self-efficacy from their attribution styles, and in turn math self-efficacy affects goal setting. It is expected that higher goal setting and attribution style (internal) will lead to high math achievement. Likewise, gender is expected to influence attribution styles and math achievement. The model was supposed to test the following paths:

- 1) Gender differences predict attribution styles.
- 2) Attribution styles predict math self-efficacy.
- 3) Attribution styles predict math achievement.
- 4) Gender differences predict math achievement.
- 5) Self-efficacy predicts goal setting.
- 6) Goal setting predicts math achievement

7) Gender, math self-efficacy, attribution styles, and goal setting, directly or indirectly, predict math achievement.

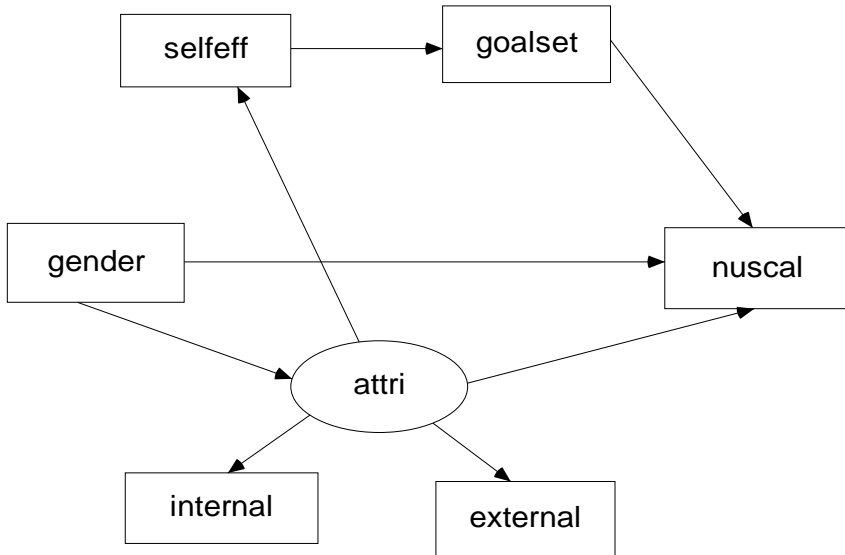


Figure1
The Model of the Causal Relationships between Attribution Styles, Mathematics Self-Efficacy Beliefs, Goal Setting, Gender Differences, and Math Achievement of School Children

selfeff = self-efficacy
goalset = student's goal setting
nuscal = scaled FSA score
attri = attribution for success and failure
internal = attribution of success and failure to internal factors
external = attribution of success and failure to external factors

Method

Sample

The sample consists of seventh-grade students attending public schools in School District # 62 (Sooke, Canada). Data from seventh-grade students were collected from two middle schools. The researchers have received written permission from the superintendent's office allowing them to conduct this study. Approximately 99 students (56 male and 43 female) in seventh-grade were selected randomly, and participated in this study. This sample size ensures that statistical

power will be achieved in subsequent analysis. The region's citizens are mainly middle class and are predominantly Caucasian.

Instruments

Each student in seventh-grade was asked to complete three questionnaires. The first questionnaire (modified from Stipek, 1993) was designed to measure students' attributions for their performance in mathematics. It has two forms: the first form measures the attribution of success in math, and the second measures the attribution of failure in math. The second questionnaire was based on Albert Bandura's research, and more specifically, his guide to constructing self-efficacy scales. The self-efficacy scale is designed to measure students' mathematics self-efficacy. Students will judge their mathematics confidence according to a series of mathematics tasks that are equivalent in form and difficulty to related items the Foundation Skills Assessment (FSA). In other words, students were presented with mathematics items drawn from practice FSA tests. They were not asked to complete the questions, rather they were asked to judge and rate their ability to perform the question. Each self-efficacy scale has nine mathematics questions. The proportion of questions devoted to each type of mathematics (i.e., numbers, patterns and relationships, shape and space, and statistics and probability), is commensurate with the proportion of questions used on the FSA (as described in the Ministry of Education's 2000 FSA Table of Specifications). The questions have been drawn directly from the Ministry of Education's web site, which contains three complete practice Foundation Skills Assessment tests.

Locke and Bryan (in 1968) developed a rating scale (for students) for goal setting, which was adapted from Zimmerman et al.'s (1992) study. Students' Grade Goals rating scale measures a student's expected grade and the grade the student regarded as minimally satisfying. Students' Grade Goals scale was rated in terms of 7 grade levels: 7 = A, 6 = B, 5 = C+, 4 = C, 3 = C-, 2 = D and 1 = F. The two items were combined to a single measure, as recommended by Zimmerman et al. Therefore, the higher numbers indicate higher-grade levels.

Mathematics achievement was measured by collecting data on students' performance on Foundation Skills Assessment test. Foundation Skills Assessment is an assessment test designed and administered by the British Columbia's Ministry of Education to

measure the numeral and reading skills of all fourth-, seventh-, and tenth-grade students in British Columbia. The researchers obtained individual scaled FSA scores for each of the participants.

Once the permission forms were obtained, and the participants had been determined, the researchers administered the attribution, self-efficacy, and goal setting questionnaires. The alpha for math self-efficacy was 0.85, for goal setting was 0.82, for attribution of success in math was 0.37, and for attribution of failure in math was 0.64. The researchers analyzed the data using SPSS and AMOS programs.

Results

The results provide an empirical base for testing the causal relationships between attribution styles, mathematics self-efficacy beliefs, gender differences, goal setting, and math achievement of school children. The mean (and standard deviation) for self-efficacy was 52 (8.18), for goal setting was 11.05 (1.77), for scaled FSA scores was 501.75 (103.69), for attribution for internal factors 16.64 (4.03), and for attribution of external factors was 16.72 (3.67). Also the relationships among the variables are presented in Table 1.

As hypothesized, a significant path connected the latent variable math attribution to the variable math self-efficacy ($\beta = -0.53, p < .05$). The path between self-efficacy and goal setting was also significant ($\beta = 0.32, p < .05$). Standardized regression weight between goal setting and math achievement was $\beta = 0.20 (p < .05)$, implying that goal setting predicts math achievement. The direct path from the variables math attribution and math achievement was $\beta = -0.56 (p < .05)$, indicating a strong causal relationship between the two variables. The direct standardized path between variables gender and latent variable attribution of internal and external factors was $\beta = 0.20 (p > .05)$, indicating that gender is not a good predictor of attribution. Another direct standardized path between gender and math achievement (scaled FSA scores) was $\beta = 0.13$, indicating a non-significant causal relationship between the two variables (see Figure 2). Also squared multiple correlations (R^2) for math achievement was 0.38, indicating that only 38% of the variance of this variable is explained by the variables of the study.

The model was estimated by the method of maximum likelihood. Several indices of fit were used to determine the accuracy of the model. The model is evaluated on the following criteria: (1) X^2 goodness of fit; (2) the root mean square error of approximation

(*RMSEA*); (3) the normed fit index (*NFI*); and (4) the comparative fit index (*CFI*). Also the squared multiple correlations (R^2) associated with predicted variables and evaluation of parameter estimates and error variances associated with variables were presented. The results of the structural model produced a non-significant chi-square ($X^2_{(6)} = 9.65, p < .14$). The solution converged in sixteen iteration. In addition, *RMSEA* was 0.06, *NFI* was 0.99, and *CFI* was 0.99. All of the above indices indicate a good fit. The non-significant X^2 implies that there is no significant discrepancy between the covariance matrix implied by the model and the population covariance matrix. In other words, the model fits the data. Structural path coefficients (or parameter estimates), their respective standard error, and *CR* (critical ratio) are presented in Table 2.

Discussion

The purpose of this study was to investigate the causal relationship between attribution styles, mathematics self-efficacy beliefs, gender differences, goal setting, and math achievement of school children, in Victoria, British Columbia. The proposed model was an expansion of Bandura's social cognitive theory of human functioning, and also to do an exploratory investigation to see the role of sex differences on math achievement. The model was statistically fit and the results show that student's math self-efficacy is influenced by his/her attribution. The significant relationship was found between self-efficacy and internal attributions. This means that those students who attribute their success to internal causes have higher self-efficacy. This finding is consistent with the literature. Some studies show that causal attributions significantly impact the formation of efficacy beliefs (Chambliss & Murray, 1979a, 1979b; Silver, Mitchell, & Gist, 1995).

As expected, the path between math self-efficacy and goal setting was significant, implying that self-efficacy plays a key role in students' goal setting. The research supports the above finding. Schunk and Zimmerman (1997), and Schunk (1991) showed that there is a relationship between goal setting and self-efficacy. Also Middleton and Midgley (1997) assert that students with higher learning-focused or intrinsic goals report higher self-efficacy.

In addition, the students' goal setting was a predictor of the math achievement. Actually, those students who set higher goals for themselves in mathematics get better grades in math. The effect of self-efficacy on math achievement was indirect, through goal setting.

The effects of goal setting on math achievement were also considered meaningful in several studies (Schunk et al., 1997; Schunk, 1991).

The path between the latent variable math attribution and math achievement was almost (borderline) significant. The almost significant path between the two above mentioned variables shows that the explanatory styles influence math achievement. In other words, those students who attribute the causes of their success in math to internal factors receive higher grades, and those students who attribute the causes of their failure in math to internal factors get lower grades in mathematics. This finding was also supported in previous research. Chisholm (1980), and Kloosterman (1984b) assert that strong relationships

Exist between attributions for success and failure and academic performance. Many other studies have found significant relationships between the attribution and school performance (Rozell et al., 2000; Henry et al., 1993; Rozell et al., 1995). But, from this research's result, this needs further investigation.

Table 1
Correlations among Study Variables

Variable	Correlation	Goalset	Self-Eff.	Internal	External	Scaled FSA Score	Gender
Goalset	Pearson Correlation Sig. (2-tailed) N	1.000 . 99					
Self-Eff.	Pearson Correlation Sig. (2-tailed) N	0.403 .001 99	1.000 . 99				
Internal	Pearson Correlation Sig. (2-tailed) N	-0.236 .019 99	-0.303 .002 99	1.000 . 99			
External	Pearson Correlation Sig. (2-tailed) N	-0.260 .009 99	-0.225 .025 99	0.209 .038 99	1.000 . 99		
Scaled FSA Score	Pearson Correlation Sig. (2-tailed) N	0.379 .001 99	0.302 .002 99	-0.329 .001 99	-0.085 .400 99	1.000 . 99	
Gender	Pearson Correlation Sig. (2-tailed) N	0.147 .147 99	-0.123 .226 99	0.109 .285 99	0.016 .876 99	-0.016 .878 99	1.000 . 99

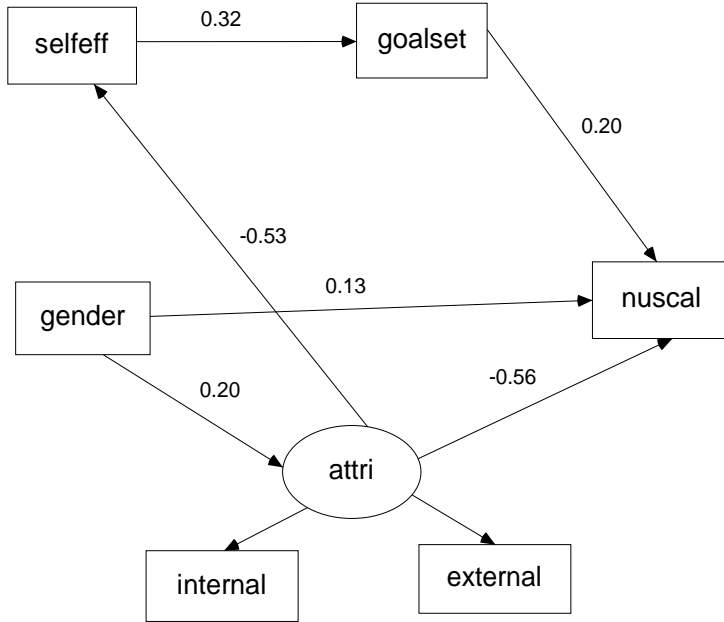


Figure 2
The Model of the Causal Relationships between Attribution Styles, Mathematics Self-Efficacy Beliefs, Goal Setting, Gender Differences, and Math Achievement of School Children

Table 2
Standardized Parameter Estimates, Standard Error, and Critical Ratio of the Paths

Variables	Standardized Parameter Estimate	Standard Error	Critical Ratio*
Goalset <--- selfeff	0.32	0.01	4.23
selfeff <--- attri	-0.53	2.14	-2.01
nuscal <--- attri	-0.56	28.99	-1.84
nuscal <--- gender	0.13	17.68	1.35
attri <--- gender	0.20	0.31	1.30
nuscal <--- goalset	0.20	5.25	2.61
external < --- attri	0.25	-	-
Internal < --- attri	0.44	0.83	2.24

- Critical ratio 1.96 (and more) is significant at $p < .05$.

The unexpected results of the two paths between gender differences and math attribution, and between gender and math achievement might be related to several issues. The first reason for not finding a causal relationship between gender differences and math attribution might be that in fact there was no significant difference between boys and girls in their math attribution of success and failure to internal and external factors, in Victoria, British Columbia. The recent research in this area indicates that the gap between boys and girls in mathematics achievement is closing. In fact, in British Columbia, data from a recent Foundation Skills Assessment shows that girls' achievement in mathematics meets that of boys (Ministry of Education, 1998). Other studies have yielded similar results (Marsh & Yeung, 1998; Byfield, 2000).

In past research, the typical explanation that was given for the traditional gender differences in mathematics performance concerns students' achievement-related beliefs (Stipek & Gralinski, 1991). More specifically, gender differences in achievement have commonly been ascribed to the differing inferences boys and girls make about the causes of their performance, and to the differing perceptions they have of their academic ability. The results of this study show that along the change in the boys' and girls' mathematics performance over the past years, there is a change in their perceptions of the causes of their success and failure in math, in the way that no differences was found in their attributions. The results also indicate that the causal attribution beliefs of boys and girls have been changed from what the literature showed in the past.

The second reason for not finding a significant path between gender differences and math attribution might be the low reliability of attribution of success scale (0.37), and medium reliability of attribution of failure scale (0.64). If a more reliable questionnaire was used the results might have been different.

Finally, the reason for the insignificant path between gender differences and math achievement might be that, in fact, there is no difference in the math achievements of boys and girls. This has been discussed in the previous chapters. Also, in this study the mean (and standard deviation) of math achievement for girls was 503.59 (123.51), and for boys was 500.34 (86.63). This indicates that the

math achievements of girls not only reached the boys but also surpassed them.

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