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ABSTRACT

This study examines the effectiveness of multiple methods of soliciting attributions. The Attributional Style Questionnaire, specific attributions, and causal dimensions are used to predict the grades and feelings of frustration of college algebra students. The results show that, contrary to current theoretical work, both specific attributions and causal dimensions are equally effective in predicting grades and feelings of frustration. The implications for these multiple methods are discussed. Directions for further research in this area are suggested. (Contains 36 references.) (Author)

Attributional Style as a Predictor of Success in College Mathematics[1]

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ABSTRACT. This study examines the effectiveness of multiple methods of soliciting attributions. The Attributional Style Questionnaire, specific attributions, and causal dimensions are used to predict the grades and feelings of frustration of college algebra students. The results show that, contrary to current theoretical work, both specific attributions and causal dimensions are equally effective in predicting grades and feelings of frustration. The implications for these multiple methods are discussed. Directions for further research in this area are suggested.

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Attributional Style as a Predictor

of Success in College Mathematics

1. Introduction

There have been many efforts to predict academic performance or "success" in mathematics using achievement (MSAT, etc.), previous performance indicators such as GPA, and demographic data (gender, SES, age, etc.), but of more practical interest are predictors which can be manipulated or modified so that the individual has a better chance of academic success. Moreover, landmark reviews of the literature on attitudes toward mathematics have only found "...a low but significant positive correlation..." between attitudes and performance (Aiken, 1976, p. 295; Feierabend, 1960; Aiken, 1970; Dick, 1985). Mathematics education researchers have taken several approaches to attitudinal studies. Some of the principal approaches are as follows: 1) general attitudes toward mathematics were used as predictors (See the studies cited above as well as Harrington, 1960.), 2) specific attitudes such as anxiety, persistence, confidence in learning mathematics, and others (Fennema & Sherman, 1976; Fennema, 1977; Dreger and Aikin, 1957), 3) self-efficacy theory, which is founded in self-concept and self-confidence concepts, were used to predict mathematics performance (Hackett and Betz, 1989, 4) attribution theory was applied to the mathematics learning (A discussion of the theory was published by Weiner, Frieze, Kukla, Reed, Rest, and Rosenbaum in 1971, and mathematics education research was done by Wolleat, Pedro, Becker, and Fennema, 1980, and Kloosterman, 1988), and 5) learned helplessness (LH) was used to construct a general profile of successful and unsuccessful mathematics students (Dweck,

Davidson, Nelson, and Enna in 1978 and Dweck and Reppucci in 1974 applied LH to mathematics performance by way of a mastery/helplessness construct combining attribution theory and LH theory.). Studies using combinations of these approaches to find correlates of performance, achievement, or "success" have shown only limited success (Pedro, Wolleat, Fennema, & Becker , 1981; Elliot & Dweck, 1988; Kloosterman, 1988).

More recently, one of the most successful cognitive predictors of academic achievement has been "attributional style" (Wolleat, Becker, Pedro & Fennema, 1980; Fennema, 1977; Dweck, Davidson, Nelson, and Enna, 1978; Diener and Dweck, 1978; Elliot and Dweck, 1988; Bar-Tal, 1978; Kloosterman, 1984; 1988; Peterson and Villanova, 1988; Peterson and Barrett, 1987). The focus of the research in an achievement oriented academic setting has been the identification of attributional styles and the study of performance of individuals with different styles. Dweck's work suggests that there may be significant differences in the performance and goal orientations of students who are identified as mastery oriented, versus helpless. However, controversy exists about the measurement and predictive power of specific attributions, attributional styles, and underlying causal dimensions. For example, Platt (1988) found that the specific attribution of "ability" for high school success had a positive effect on academic self-concept and the specific attribution for success of "effort" had a positive effect on both academic self-concept and effort in college courses. However, Platt (1988) made no attempt to measure attributional style or underlying causal dimensions. Moreover, Russell (1991) suggested that soliciting specific attributions is not appropriate and that researchers should focus on the underlying causal dimensions which relate to performance.

This review of the literature suggests that there is no consensus about which approach to take and all approaches have met with limited success. Since there may be some merit to all the approaches mentioned above, the current study has two purposes. Firstly, it combines and contrasts attributional style and specific causal attributions and their underlying causal dimensions in an attempt to interpret more accurately the determinants of student performance in college algebra classes. Secondly, it extends the previously cited work by applying the concepts to an older group (college students rather than elementary and high school students) of mathematics students. Before the presentation of the present research, a discussion of the theoretical basis for attribution theory, learned helplessness, and the reformulated learned helplessness model is provided as background for the study.

2. Theoretical Basis for Constructs

2.1. Attribution Theory

Attribution theory, introduced by Heider (1958) and more fully explained by Weiner, Frieze, Kukla, Reed, Rest, and Rosenbaum (1971), posits that perceived causes or causal attributions for success and failure experiences can be classified into four categories based on two underlying causal dimensions. The two by two Causal Attribution Matrix (Weiner et al., 1971) shows the structure of the attributions and causal dimensions.

	Internal	External
Unstable	Effort	Luck/Chance
Stable	Ability	Task Difficulty

The categories of ability, task difficulty, effort, and luck or chance are organized into two "dimensions": locus of causality and stability. Locus of causality is classified as internal or external with the understanding that internal means that the cause is due to something inside of the person, while external refers to an influence outside of the person. The other dimension refers to the stability of a cause; a stable cause is one which is assumed to be consistent or present over time, while an unstable cause can change. Ability is classified as internal/stable, but task difficulty is external/stable because although the characteristics may be stable the reason for success or failure is not something about the individual but rather something about the task (external to the person). For example, if failure to perform on a mathematics test is classified by the student as due to (a lack of) ability, this is an internal/stable cause and is assumed to be an attribute of the individual which is always present when this type of performance is required. Effort is categorized as an internal/unstable cause, and luck or chance is external/unstable since it may vary from time to time and is outside the individual's control.

2.2. Learned Helplessness (LH)

Diener and Dweck (1978) in their mathematics education research, used the terms "mastery-oriented" child and "learned helpless" child. The "mastery-oriented" student is defined as one who persists; whereas,

> On tasks where success was likely, helpless children have shown little enthusiasm, were the last to get started, often asked for help before trying, appeared uncomfortable with praise and gave up easily. When tasks presented a challenge, helpless children tended to become easily discouraged and refused help or stopped working completely (Thomas, 1989, 236).

This pattern is referred to as learned helplessness (Diener & Dweck, 1978). Bassarear (1986) found that in college mathematics courses helpless students show the highest attributions to uncontrollable factors. Attributions for success were predictors for performance in females, but in males confidence in learning mathematics and self-predicted grade were the best predictors for course grade. In a similar study of college mathematics students, Lehmann (1987) found that higher grades were related to a strong mastery orientation, defined as attribution for success to effort or ability and attribution for failure to task difficulty or luck).

2.3. Reformulated Learned Helplessness Model

Combining attribution theory and LH theory, Abramson, Seligman, and Teasdale (1978) posited the reformulated learned helplessness model. They suggested that in addition to the two dimensions discussed above, a third dimension - global/specific - is needed to fully characterize attribution style. A cause is classified as global if it affects many areas of one's life, and is classified as specific if the cause is restricted to a particular setting ("I have trouble with all tests" versus "I do poorly on math tests."). According to this reformulated LH theory, those who attribute failure to internal-stable-global causes have a pessimistic attributional style and are more likely to display symptoms associated with learned helplessness such as not trying when faced with failure. Those who attribute failure to external-unstable-specific causes have an optimistic attributional style and are expected to continue to work in the face of failure.

Little attention has been given to the reformulated LH model in the mathematics education literature. One of the rare instances was a discussion by Gentile and Monaco (1988) of the construct for two hypothetical high school mathematics students. The research

described in here in this article does apply the reformulated LH model to the college mathematics classroom.

In order to operationalize the LH model, the Attributional Style Questionnaire (ASQ) (Peterson, Semmel, von Baeyer, Abramson, Metalsky, & Seligman, 1985) was developed to measure attributional styles along the three dimensions described above: internal/external; stable/unstable; and global/specific. The ASQ is a self-report measure "of patterns of 'explanatory style', which is the tendency to select certain causal explanations for good and bad events" (Tennen & Herzberger, 1985, p. 20). This version of the ASQ is especially appropriate in achievement settings such as the study of mathematics, since it includes attributional style for both success and failure over a series of situations (Tennen & Herzberger, 1985).

Relationships were hypothesized between performance and the three dimensions of attributional style described above. In particular, individuals with a pessimistic attributional style who habitually interpret the causes of failure as internal, stable, and global (It is my fault, it is going to last forever, and it will affect everything I do) are "...more susceptible to helplessness deficits than those with the opposite style" (Seligman & Schulman, 1986, p. 832).

Based on the review above, three methods for examining the effects of attributions on performance in a college algebra course are explored. Firstly, the reformulated learned helplessness model "...in which the pessimistic explanatory style predisposes giving up..." (Seligman & Schulman, 1986) is tested. It is posited that those students with a pessimistic attributional style are predisposed to poor performance or alternatively "just getting by". Thus

it is predicted that students who have a pessimistic attributional style characterized by explanations of failure to internal/stable/global causes will perform poorly on mathematical tasks, operationalized as course grade. Those students with an optimistic attributional style are predicted to be more successful in course performance and to feel less frustrated while working on assignments. Secondly, the current study examines the specific causal attributions (ability, effort, luck, and task difficulty) for course performance and how they are interpreted by the students in an attempt to discover their relationship to course performance and feelings of frustration. Lastly, the interpretation of the specific attributions along the causal dimensions of internal/external, stable/unstable, and global/specific are examined for their relationship to course performance and feelings of frustration.

3. Method

3.1. Subjects

The students enrolled in college algebra at a four-year state college in the southeastern United States were asked to participate in the study. Some students from almost all sections chose not to participate, and other students were absent for the administration of either the first or second questionnaire.

The college algebra course, a five quarter-hour class, is a required course in many majors at the college, and all sections use the same text and syllabus (containing suggested assignments). Each instructor uses his/her own exams, quizzes, and grading, but to insure that the coverage and level of difficulty is similar across sections, a departmental committee reviews copies of all exams and quizzes. Although the students in the study were not all in

the same class, nor did they have the same instructor, it can be assumed that they had roughly the same experience in their college algebra class and that the grades are comparable across sections.

3.2. Materials

Two questionnaires were used in the study. The Attributional Style Questionnaire (ASQ) (Peterson et al., 1985) was administered during the first few days of the term. The ASQ is designed to identify attributional style based upon causal attributions, and the analysis used here is the same as that used by the authors of the scale. Twelve hypothetical events (six with positive outcomes and six with negative outcomes) not related to mathematics but related to daily life events are described. In this self-report instrument respondents are asked to express a major cause for each event and then rate that cause along each of the following scales: internality, stability, and globality. Each "dimension" (internality, stability, and globality) is scored from one to seven with the extremes marked appropriately. The scales are scored so that external, unstable, and specific attributions receive lower scores, and internal, stable, and global attributions receive higher scores. Three summary scores are computed based upon these responses: composite positive (CoPos), the sum of the responses to the positive events across the internal, stable, and global scales (the range is 3 to 21); composite negative (CoNeg), the sum of the responses to the negative events (the range is 3 to 21); and composite positive minus conegative (CPCN) (The range is -18 to 18). A high CoPos score indicates that the respondent attributed positive outcomes to themselves, believed that the circumstances were stable, and that the conditions would hold across situations; whereas a low CoPos indicates attributions of positive outcomes to influences outside of self, not likely

to recur, and specific to the situation. A high CoNeg suggests attribution of negative outcomes to self, likely to be the same over time, and hold across situations; whereas, a low score on this measure indicates attributions to external, unstable, and specific causes. The CPCN provides an indication of the overall orientation of the respondent with a high number indicating a an optimistic attribution style characterized by internal/stable/global attributions (This good event happened because of something about me, it will usually happen, and similar good outcomes will occur in other situations.) for positive and external/unstable/specific attributions for negative outcomes (This bad event happened because of something outside of me, will not happen again, and only happens in this specific situation.). A low CPCN value indicating the opposite reaction to good and bad events. These scores derived from the ASQ were used by the authors (Peterson et al., 1985) of the ASQ as well as in other studies which use the instrument and provide a profile of the attributional style brought to the college algebra class by the students.

The second questionnaire, called the End of Term Questionnaire (ETQ), was administered about two weeks before the end of the term, in order to learn about the specific attributions and attitudes of the students toward the college algebra class which they were about to complete. This instrument, authored by the researchers, contains questions which address three types of constructs. The first, causal attribution (based upon Weiner's 1971 two by two matrix of causal attributions), is measured by asking students to indicate on a scale of one to seven the strength of the explanation for their own performance in the algebra class for each of the four attributions developed by Weiner et al. (1971), i.e. ability, difficulty, effort, and luck. In addition, the students were asked to rate their performance along the causal

dimensions of internal/external, stable/unstable and global/specific. The third construct, frustration, was measured by asking students to recall their feelings while working on algebra assignments and rate these feelings along seven scales (upset/not upset, frustrated/not frustrated, angry/not angry, etc; with the scales scored from 1 to 7). The responses related to these feelings were summed and divided by 7 to form a frustration measure with a range from 1 to 7; a high score indicated a low frustration level.

Two dependent measures were used in this study. The first, course performance, was operationalized as the student's final letter grade in the college algebra course. The second dependent measure was the frustration measure derived from one part of ETQ.

3.3. Procedures and Analysis

The ASQ was administered during the first few days of the term to those college algebra students who agreed to participate in the study. Two weeks before the end of the ten-week quarter the ETQ was given.

As in previous studies using versions of the ASQ (Peterson & Barrett, 1987; Seligman & Schulman, 1986), the CoPos, CoNeg, and CPCN were correlated with performance (student's final grade). The scores on these ASQ based scales were divided on the median of each scale. Those above the median on CoPos and CPCN and those below the median on the CoNeg were characterized as having an optimistic attributional style. A pessimistic style was recognized as a score below the median on the CoPos and CPCN and above the median on the CoNeg. As in previous research (Seligman & Schulman, 1986), difference in means t-tests were used to compare final grades and frustration scores of students classified above and below the median on the CoPos, CoNeg, and CPCN.

Using various items from the End of Term Questionnaire (ETQ), two sets of step-wise regressions were conducted. Final grade was regressed on ability, effort, luck/chance, and task difficulty (as measured by the ETQ items which applied to these "causes" of performance); and final grade was regressed on the causal dimensions of internal/external, stable/unstable, and global/specific (as measured by the items on the ETQ which referenced the classification of "causes" of performance along these scales). In addition, frustration (a summary value obtained from a subset of questions on the ETQ) was regressed on ability, effort, luck/chance, and task difficulty; and frustration was regressed on the causal dimensions of internal/external, stable/unstable, and global/specific.

4. Results

At the beginning of the term, 1218 students were enrolled in 46 sections of college algebra. Of these, 806 agreed to participate in the study and completed the Attributional Style Questionnaire (ASQ). Two weeks before the end of the term 742 students took the End of Term Questionnaire (ETQ).

4.1. Attributional Style Questionnaire

During the first week of classes, the ASQ was given to all students who agreed to participate in the study. There were 806 properly completed questionnaires; subsequently, 124 students dropped the course or received an incomplete in it. In order to determine whether there were significant differences between the students who dropped or received an incomplete in the course (n=124) and those who received a final grade ("A" through "F") (n=682), a difference in means t-test was done on the CoPos, CoNeg, and CPCN scales of the

ASQ. No significant differences were found between the two groups on any of the three ASQ scales (for all cases $p > .10$); therefore, the 682 respondents with grades "A" through "F" do not represent a different sample and subsequently were used in the analysis since final grade was used as a dependent variable.

The reliabilities, measured by Cronbach's (1951) alpha, of the CoNeg, CoPos, and CPCN scores for these subjects were .68, .78, and .74 respectively. These reliabilities are consistent with previous studies (Seligman & Schulman, 1986).

4.1.1. ASQ scales with final grade. A significant correlation was found between the CoNeg score and final grade ($r = -.08$ $p<.05$), but no such significant correlation between CoPos ($r = .03$) or CPCN ($r = .03$) and final grade was found. In order to fully investigate the relationship of CoNeg, CoPos, and CPCN and final grade, exploratory t-tests were performed on the final grades comparing those above and below the median on the ASQ measures (Seligman and Schulman, 1986). The means of the grades (on a point scale with A = 4, B = 3, C = 2, D = 1, and F = 0) for the group above versus below the median CoNeg score were 1.8 and 2.0 respectively. This difference was statistically significant ($t(668) = 2.41$, $p < .05$). Additional t-tests were conducted on the final grades for those students with scores above and below the median on the CoPos and CPCN scale with $t(680) = .84$ ($p > .10$) and $t(655) = -1.11$ ($p > .10$) respectively. Thus, there were differences in performance above and below the median, as measured by final grade, only on the CoNeg scale.

4.1.2. ASQ scales with frustration. The frustration scale had a reliability of .91, as measured by Cronbach's (1951) alpha. The frustration felt while working on course assignments, as reported on the End of Term Questionnaire, was significantly correlated with

the CoNeg scale (r = -.10, p <.01) and CPCN scale (r = .10, p <.01). However there was no correlation with the CoPos scale (r = .04, p > .10). In order to investigate these relationships, t-tests were conducted on all scales for students above and below the median. There was no difference in feelings of frustration for those students above and below the median on the CoNeg scale with means of 4.7 and 4.5 respectively (t(511) = 1.34, p > .10) and the CoPos scale with means of 4.6 and 4.7 respectively (t(512) =-.98, p >.10). However, there was a difference in feelings of frustration on the CPCN scale with means of 4.5 and 4.8 respectively (t(517) = -2.48, p <.05). Thus those students with an optimistic attributional style as measured by the CPCN scale reported experiencing slightly less frustration than those with a pessimistic attributional style.

4.2. End of Term Questionnaire

During the last two weeks of classes, the ETQ was given to all students who agreed to participate in the study. Seven hundred forty-two of these students properly completed the questionnaire, subsequently 10 students dropped the course or received an incomplete. Thus 732 ETQ questionnaires were used in the analysis.

[Insert Table I and Table II about here.]

4.2.1 Attributions and final grade. As indicated in Table I, there were significant correlations between final grade and the attributions to ability and effort. However, there were also significant correlations among the attributions to ability, task difficulty, effort, and luck/chance suggesting interdependence.

In order to control for interdependence among the variables, a step-wise regression was performed regressing the final grade on the specific attributions. As indicated in Table II

regressing the final grade on specific attributions, ability was a reliable predictor of th student's final grade (R^2 = .13, p <.001). In addition attributions to task difficulty were also reliable predictors of the students' final grade (R^2 = .04, p <.001). Attributions to effort were also statistically significant as well, but were not deemed to be practically important due to the low percentage of variance explained (R^2 = .01, p <.001).

[Insert Table III about here.]

4.2.2 Attributions and frustration. The reliability for the frustration scale was .92, as measured by Cronbach's (1951) alpha. As indicated in Table I, there were significant correlations between the degree of frustration felt while working on assignments for the course and attributions to ability, task difficulty, and effort. There were also significant correlations among the attributions to ability, task difficulty, effort, and luck/chance suggesting interdependence. In order to control for the interdependence among the various measures, a step-wise regression was performed regressing frustration on the specific attributions. Table III contains the results of the regression of frustration on specific attributions, ability (R^2 = .07. p <.001), task difficulty (R^2 = .07, p <.001), effort (R^2 = .02, p <.001), and luck/chance (R^2 = .02, p <.001). All of these were statistically significant predictors; however, effort and luck/chance were deemed to be of no practical importance due to the low percentage of variance explained.

4.3. Causal Dimensions

[Insert Table IV, Table V, and Table VI about here.]

Two weeks before the end of the quarter, each student rated his/her selected cause for performance in the course along the causal dimensions of internal/external, stable/unstable,

and global/specific. The correlation matrix with the means and standard deviations for the causal dimensions and the dependent variables is shown in Table IV.

4.3.1. Causal dimensions and final grade. As indicated in Table IV there were significant correlations between final grade and the causal dimensions of stability and globality. However, there were also significant correlations between internality and stability, internality and globality, and stability and globality suggesting interdependence. In order to control for interdependence among the predictors, a step-wise regression was done regressing the final grade on the causal dimensions. As indicated in Table V, stability (R^2 = .09, p<.001) accounted for a significant proportion of variance, suggesting that students believed that their performance would be similar in other math courses. Moreover, globality (R^2 = .03, p <.001) was also a significant predictor of feelings of frustration. However, due to the low percentage of variance explained, globality was deemed to be of little importance.

4.3.2. Causal dimensions and frustration. As indicated in Table IV there were significant correlations between feelings of frustration and internality, stability, and globality (as measured on the ETQ). Significant correlations were found between internality and stability, internality and globality, and stability and globality suggesting interdependence. Controlling for interdependence using step-wise regression an analysis was performed regressing frustration on the causal dimensions. As shown in Table VI globality (R^2 =.05, p < .001) and stability (R^2= .01, p <.001) were significant predictors of feelings of frustration. Internality was not a significant predictor.

5. Conclusions

In past research using the ASQ, the CoNeg has been the most reliable predictor of performance, and in the current research only the ASQ CoNeg scale were correlated with the student's final grade. Students who had an optimistic attributional style performed better in the algebra classes than those with a pessimistic attributional style for negative events as measured by the CoNeg scale. This is consistent with Peterson and Barrett (1987), who found that college freshmen who made internal/stable/global attributions for failure are at risk for poor grades. Thus, those students who tend to explain negative events as external/unstable/specific tend to have better grades than those with pessimistic attributional styles.

There are at least two possible explanations for these results. The first is that an optimistic attributional style predicts and is an antecedent of performance in algebra classes. The second is that an optimistic attributional style may be a consequence of success. This explanation is consistent with knowledge about self-serving biases and is supported by research which has shown that individuals tend to attribute success to themselves and failure to external sources (Kelley and Michela, 1980). However, the fact that the ASQ was given at the beginning of the quarter suggests that attributional style is an antecedent which determines successful performance. Moreover, the fact that the ASQ measures attributional style for general life events versus performance in algebra courses also provides support for the notion that attributional style is an antecedent rather than a consequence of performance in algebra courses.

However, the support for the relationship of attributional style to performance should be viewed with caution since only one of the ASQ scales was able to distinguish differences between attributional styles for students with high versus low grades. Moreover, only one of the ASQ scales (CoNeg) were correlated to grade, and this was a very weak correlation (r= -.08).

The analysis of the relationship of the ASQ scales to frustration showed that students who possessed an optimistic attributional style as measured by the composite CPCN score felt less frustration while working on algebra assignments. One explanation for these findings is that students who have high scores do not feel frustrated. However, a second explanation would suggest that students with an optimistic attributional style experience less frustration and subsequently are able to focus their attention on the course and make better grades. Thus, the study provided evidence that students who tend not to get frustrated and have a positive attributional style do better in algebra courses than students who are easily frustrated and have a pessimistic attributional style.

The ETQ proved to be much more interesting and informative than the ASQ. Attributions to ability for performance in the course accounted for the largest variance in student grades. This indicates that attribution to ability is much more important than the other specific attributions in determining performance. This evidence is consistent with self-efficacy research (Bandura, 1977). Bandura suggested that one's beliefs about their own capabilities was a major determinant of performance. In addition, the analysis indicated that the causal dimension of stability was significantly related to performance and suggests that students who believe the cause for their performance remains relatively stable over time. This result, along

with the fact that ability was also a major contributor to student performance, suggests that the algebra students in this study believed that their ability was relatively stable over time and was a major cause for their performance in the class. This explanation is consistent with Weiner's (Weiner et al., 1971) theory which posits that ability is interpreted as a stable cause for performance.

The analysis of the relationship of the causal dimensions and frustration showed that the causal dimensions of globality and stability account for the largest percentage of variance in frustration. This suggests that frustration carries over from other events in the student's life and does not significantly change over time or situation. Taken together with the results of the regression of the specific causal dimensions, this study indicates that students believe that their ability is a direct determinant of performance, and that feelings of frustration result when the student performs poorly in algebra or similar classes. The results also indicate that the feelings of frustration are likely to persist over time, perhaps producing a circular effect. For example, the student may fall into a cycle of believing that their ability is unchanging thus resulting in poor performance and feelings of frustration in future courses similar to algebra. This may explain the fact that students do not generally improve their performance in subsequent math courses.

Previous research where general attitudes toward mathematics were used as predictors as well as those using anxiety, persistence, confidence in learning mathematics, and self-efficacy theory have met with limited success. Even though the current research is exploratory, the results indicate a promising direction for future theory building and field-

based research using the concepts of attribution theory. Thus far in mathematics education research this area has been rather limited.

6. Future Research

Two areas of future research are indicated by the current study: 1) the development and study of intervention strategies involving beliefs related to ability and the management of frustration, and 2) further development of a model involving mathematics learning, attributional styles, and specific attributions. In the fields of psychology and organizational behavior, various intervention strategies have been suggested in the research literature. Among the strategies which are potentially useful in mathematics education are immunization, discrimination training, attributional training, perceptions of contingency, ego-defense, and modeling (See Martinko and Gardner, 1982, for a description of these strategies and cited research.). Careful research is needed in which mathematics students are diagnosed as "at risk" mathematics students, given various treatments to immunize against inappropriate, destructive attributions, and carefully monitored as they attempt mathematical tasks. The objective is to help the mathematics students develop successful strategies for coping with or avoiding failure.

Finally, the results of the study are important from a theory-building view point. A reliable model for the relationship between mathematics learning, attribution styles, and specific attributions is needed. It is hoped that these constructs will continue to be explored in a number of different settings in order to clarify the complex relationships. With the addition of intervention to the model, research can focus upon diagnosis, intervention, and results.

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Table I
Correlation matrix, means and standard deviations for the Specific Attributions, Final Grade, and Frustration from the End of Term Questionnaire

Variable	Final Grade	Frustration	Ability	Task Diff	Effort	Luck/ Chance
Final Grade		.560***	.364***	-.059	.184***	-.044
Frustration			.257***	-.176***	.186***	-.118**
Ability				.321***	.253***	.032
Task Difficulty					.151***	.064*
Effort						.016
Mean	1.99	4.63	4.87	4.70	5.44	2.34
StDev	1.24	1.39	1.50	1.43	1.53	1.45

*** p <= .01
* p <= .10

Table II
Regression Results: End of Term Questionnaire Final Grade on Specific Attributions

	df	sum of squares	mean square	F
Regression	3	201.51	67.17	52.97****
Residual	729	924.35	1.27	

	Ability	Task Difficulty	Effort	Luck/Chance
Beta	.401****	-.205****	.113**	ns

**** p <= .001
** p <= .05

Table III
Regression Results: End of Term Questionnaire Frustration on Specific Attributions

	df	sum of squares	mean square	F
Regression	3	248.31	62.08	38.63****
Residual	728	1169.79	1.60	

	Ability	Task Difficulty	Effort	Luck/Chance
Beta	.317****	-.294****	.152****	-.113****

**** p <= .001

Table IV
Correlation matrix, means and standard deviations for the Causal Dimensions and Final Grade from the End of Term Questionnaire

Variable	Final Grade	Frus-tration	Internal/ External	Stable/ Unstable	Global
Final Grade		.560***	.018	.298***	.237***
Frustration			.124***	.182***	.213***
Internal/ External				.192***	.202***
Stable/ Unstable					.239***
Mean	1.99	4.63	5.37	4.68	4.50
StDev	1.24	1.39	1.50	1.71	1.82

*** p <= .01

Table V
Regression Results: End of Quarter Questionnaire Final Grade on Causal Dimensions

	df	sum of squares	mean square	F
Regression	2	135.20	67.60	49.73****
Residual	728	989.63	1.36	

	Internal/ External	Stable/ Unstable	Global
Beta	ns	.260****	.175****

**** p <= .001

Table VI
Regression Results: End of Quarter Questionnaire Frustration on Causal Dimensions

	df	sum of squares	mean square	F
Regression	2	88.43	44.22	24.27****
Residual	728	1326.25	1.82	

	Internal/ External	Stable/ Unstable	Global
Beta	ns	.135****	.180****

**** p <= .001