Gender Differences in Children’s Achievement-Related Beliefs and Emotional Responses to Success and Failure in Mathematics

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A sample of 194 3rd graders and 279 junior high school students completed questionnaires measuring achievement-related beliefs before and after they took a regularly scheduled mathematics exam. Girls rated their ability lower, expected to do less well, were less likely than boys to attribute success to high ability and failure to luck, and were more likely to attribute failure to low ability. Girls also reported less pride in their success and a stronger desire to hide their paper after failure and were less likely to believe that success could be achieved through effort. Further associations were observed between attributions and the belief that success could be achieved by effort on one hand and a desire to avoid mathematics tasks and future performance expectations on the other. The results expand our understanding of achievement-related beliefs that might explain gender differences in performance and in future course and occupational choices.

Discrepancies between male students’ and female students’ mathematical achievement have long been a source of concern. By high school boys often outperform girls on achievement tests, especially tests that involve problem solving (Eccles, 1985; Fennema & Sherman, 1977; Hyde, 1981; Hyde, Fennema, & Lamon, 1990; Kimball, 1989). Female students also take fewer advanced math courses than male students and are seriously underrepresented in math and science professions (Eccles & Hoffman, 1984; Elmore & Vasu, 1986; Perl, 1982; Randour, Strasburg, & Lipman-Blumen, 1982).

Theorists have proposed that these gender differences in test performance and choices are caused in part by gender differences in achievement-related beliefs. For example, researchers frequently report that female students have lower perceptions of competence and lower performance expectations than male students in mathematics (Eccles, 1983, 1985; Entwisle & Baker, 1983; Hanna & Sonnenschein, 1985; Mura, Kimball, & Cloutier, 1987; Parsons, Meece, Adler, & Kaczala, 1982; Sherman, 1983; see Meece, Parsons, Kaczala, Goff, & Futterman, 1982, for a review). Related to these differences are gender differences in perceptions of the cause of success and failure in mathematics. Several studies have found that female students are less likely than male students to attribute mathematics success to their own high ability and are more likely to attribute failure in mathematics to low ability (Parsons et al., 1982; Ryckman & Peckham, 1987; Stipek, 1984). Similar gender differences have been found for nonmathematical tasks, but the evidence for self-derogating biases in female students’ attributions is more consistent in mathematics than in other skill areas (Gitelson, Petersen, & Tobin-Richards, 1982; Ryckman & Peckham, 1987; Stipek, 1984).

These achievement-related beliefs are generally assumed to influence choices and behavior that are related to mathematics learning (see Eccles, 1985). However, the mechanisms by which girls’ self-derogating beliefs might inhibit them from participating in math-related activities have not been fully explored. In the present study we examine some implications of the gender differences described above that might contribute to differential performance on achievement tests and different choices regarding mathematical courses and careers.

First, boys’ and girls’ emotional reactions to success and failure may be different. Weiner and other attribution theorists have shown that some emotional responses to achievement outcomes are linked to particular attributions (see Weiner, 1986, for a review). For example, pride and shame are associated with perceptions of internal causes (e.g., effort or stability) and not with perceptions of external causes (e.g., luck, another’s help or interference, task difficulty). If girls are more likely than boys to attribute success to external causes and to attribute failure to internal causes, then they would be expected to feel less pride in their success and more shame in response to failure. (See Eccles, 1983, for a similar proposal.)

Second, gender differences in attributions have implications for boys’ and girls’ future expectations and behavior. Previous research suggests that attributing mathematics success to high ability (which is presumably stable) is associated with expectations for future success and a willingness to approach new mathematics achievement situations. In contrast, attributing failure to low ability is predicted to be associated with low expectations for future success and a desire to avoid future mathematics achievement situations (because failure may not be avoidable; see Weiner, 1986, for a review). Eccles (1983) points out that the “female” attribution bias (attributing failure to low ability and not attributing success to high ability) should, therefore, result in lower future expectations and more avoidance than the “male” attribution bias, regardless of whether past outcomes were positive or negative.
However, ability attributions for failure may not lower future expectations and lead to avoidance behavior for young children. Research on children's reasoning about particular achievement situations by Nicholls and his colleagues (Nicholls, Jagacinski, & Miller, 1986; Nicholls & Miller, 1984) indicates that until early adolescence children do not differentiate ability from effort and do not have a fully developed concept of ability as capacity that limits the effort of effort on performance. A concept of ability as capacity may be a prerequisite of, and probably is associated with, the development of a concept of stable ability that limits the degree to which an individual can achieve success in future achievement situations (referred to by Dweck and Bempechat, 1983, as an "entity" concept of ability). If young children do not assume that ability is stable, failure attributed to ability may not result in lower expectations for future success or a desire to avoid mathematics in the future. Accordingly, gender differences in ability attributions for failure would be expected to promote gender differences in future expectations and avoidance desires for older children but not for younger children.

Another belief that might contribute to gender differences in mathematics concerns the role of effort in success. There is some evidence from studies on learned helplessness that boys stress the role of effort (and related motivational causes) in their explanations of failure more than girls do (Dweck & Reppucci, 1973; see also Parsons et al., 1982). It follows that even if girls believed themselves to be hard workers, they might be less likely than boys to believe that success in mathematics is always achievable through hard work. This belief, like the attribution bias described above, would be expected to engender in some girls relatively low expectations for success and a desire to avoid mathematics performance situations. It may also result in lowered effort in situations in which mathematics cannot be avoided because effort would not be expected to result in success.

However, the belief that success is not always achievable through hard work is probably related to a belief in stable ability that is difficult to change and therefore may not emerge until adolescence. Past research indicates that children of early elementary school age tend to emphasize the role of effort in achievement outcomes. These studies, as do those on children's concept of ability, suggest that younger children, both boys and girls, may be protected from developing low expectations and avoidance desires (Blumenfeld, Pintrich, Meece, & Wessels, 1982). If young children believe that success is always achievable in the long run, they should be able to expect success, even if they do not attribute their past success to high ability. Likewise, they should not be greatly discouraged by failure, even if they attribute failure to low ability.

Although gender differences in attributions have been demonstrated, albeit not consistently (see Sohn, 1982), much less attention has been given to gender differences in the other variables mentioned above. No study has examined gender differences in the belief that success in mathematics is achievable through hard work or the implications of this belief for expectations in mathematics or a desire to avoid mathematics. In this study, we assess gender differences in all of the variables discussed, and we examine the proposed relationships among them.

The hypotheses can be summarized succinctly as follows: Girls, in comparison with boys, are predicted (a) to have lower perceptions of competence in mathematics and lower initial expectations for success; (b) to attribute success less to high ability and to attribute failure more to low ability; (c) to feel less proud of success and to feel more ashamed of failure; (d) to be less likely to believe that success in mathematics can be achieved through hard work; (e) to expect to do less well on a subsequent test (junior high school students only), and (f) to express a stronger desire to avoid mathematics performance situations in the future (junior high school students only). In addition, ability attributions for success are expected to be associated with greater pride, higher expectations for future performance and a desire to approach mathematics achievement opportunities; ability attributions for failure are expected to be associated with greater shame, and in older students, with lower expectations and a desire to avoid future mathematics achievement situations. Finally, external attributions are expected to attenuate pride in success and shame in failure. The belief that success is not always achievable through hard work is expected to be associated with relatively low future expectations and stronger desires to avoid mathematics.

In this study we also examine at what age gender differences in these mathematics achievement-related beliefs and emotions emerge. Most studies of gender differences in attributional tendencies have involved adults, and, to our knowledge, none have involved children in grades earlier than the fifth grade. Third graders and junior high school students were included in the present study because we found, in a pilot study, that third grade was the earliest grade for which attributions could be reliably measured. Previous research has found gender differences in expectations for success and perceived competence in mathematics in children as young as first graders (Entwisle & Baker, 1983; Wigfield et al., 1989). However, we expected gender differences to be weaker among the younger children than among the older children because younger children have had less experience in mathematics achievement contexts.

In this study we assessed children's achievement-related beliefs and emotions in the context of a regularly scheduled mathematics examination that was, according to the teacher, important but not a final exam. A real achievement situation, which had important implications for the children (e.g., contributed to their grade in mathematics), was believed to be necessary to engender real emotional responses. The use of a regularly scheduled examination also precluded the need to create failure experiences for subjects and provided a more ecologically valid test of the hypotheses than an experimental task would allow.

Because perceptions related to a specific examination were assessed, it cannot be assumed that the findings reflect generalized beliefs. However, many examinations were published end-of-chapter or end-of-unit tests that accompanied the mathematics textbook being used. The format of the tests children received was similar over the course of the year and from year to year because textbooks from the same published series were typically used in different grades. Therefore, the results may generalize to typical classroom tests.
Method

Subjects

The sample included 194 third graders (94 girls and 100 boys) and 279 junior high school students (143 girls and 136 boys). Nearly all of the third graders were 8 or 9 years old; most of the junior high school students were 13 and 14 years old. Children came from predominantly middle-class families. Most of the children (71%) were White, 14% were Latino (primarily Mexican American), 10% were Asian American, and 5% were Black. The participating junior high schools were “fed” by the participating elementary schools. The older and younger children, therefore, were drawn from the same population.

All third graders were in age-graded but not ability-tracked classrooms. The participating junior high school classes were all required mathematics courses. Some of the classes were heterogeneous with regard to ability level and others were homogeneous. Care was taken to sample evenly across high-, intermediate-, and low-ability junior high school classes to ensure an equal representation of ability levels equivalent to that of the third-grade sample.

Procedure

Just before a regularly scheduled mathematics test was handed to the students, an experimenter was introduced by the teacher as a professor or student who was studying children’s thoughts and feelings about mathematics tests. The teacher usually remained in the classroom but did not participate in the distribution or collection of questionnaires. The experimenter distributed the pretest questionnaire and explained, with illustrations unrelated to achievement beliefs, how the rating scales worked. Children were encouraged to be honest and were told that their answers would not be shown to their teacher.

The “posttest” questionnaire was distributed 1 to 3 days later, at the same time that the corrected and graded tests were returned to students and before the teacher discussed the test. The grading system was uniform across all classrooms: a scale from A to F, with minuses and pluses. Before students began filling out the questionnaire the experimenter explained the attribution questions, giving examples unrelated to achievement outcomes, until she was satisfied that students understood the scale.

Questionnaire

Pretest. The pretest questionnaire asked students the following: (a) what grade they thought they would get on the test (rated on a 12-point scale ranging from A [1] to F [12], including minuses and pluses); (b) how good they are in math (rated on a 5-point scale ranging from bad [1] to very good [5]); (c) how they thought they would do compared to classmates (rated on a 5-point scale ranging from much worse [1] to much better [5]); and (d) how difficult math was for them (rated on a 5-point scale ranging from very hard [1] to very easy [5]).

Posttest. The posttest questionnaire first asked students what grade they received. The students were then asked how proud and how ashamed they felt on a 5-point scale ranging from not at all (1) to a whole lot (5). Children were also asked how much they felt like “hiding their paper.” This question was assumed to be related to shame but to include also concerns about “saving face” (i.e., avoiding public humiliation).

After students rated their emotions, they were asked a series of attribution questions. Attritions for good outcomes were listed on one page (marked with a green dot) and attributions for bad outcomes were listed on another page (marked with a blue dot). Children were given the following written directions: “If you think you did pretty well on the test, answer the page with a green dot. If you think you didn’t do very well on the test, answer the page with a blue dot.” Instructions for both sets of attribution questions were as follows: “Below is a list of reasons for why some students get the grades they do on tests. Is this an important reason for why you got the grade you did on the test?” A set of reasons was provided, with a 5-point response scale ranging from not a reason (1) to a very important reason (5). The reasons included (a) task difficulty, (b) effort (studied, paid attention), (c) ability, and (d) luck. Reasons were worded to be appropriate to the outcome (e.g., “the test was easy,” “the test was hard”).

Two questions (rated on 5-point scales ranging from strongly disagree [1] to strongly agree [5]) assessed children’s beliefs about whether success in mathematics could be achieved through effort: “Everyone could do well in math if they worked hard,” and “A few kids will never do well in math, even if they try hard.”

Two questions concerned children’s desire to avoid mathematics achievement situations: (a) “Do you wish you could stop taking math?” (rated on a 5-point scale ranging from not at all [1] to a whole lot [5]) and (b) “If you had a choice, would you try to get out of taking the next math test?” (rated on a 5-point scale ranging from definitely not [1] to definitely yes [5]). Finally, students were asked “How will you do on the next math test?” (rated on a 5-point scale, ranging from worse [1] to much better [5] than the present test) and what grade they thought they would get on the next math test.

Results

Pretest

The four questions in the pretest questionnaire that concerned perceptions of competence and expectations for success were strongly correlated with each other (Pearson product-moment correlation coefficients [r's] ranged from .35 to .72, with a mean of .51; every correlation was significant, p < .001). Therefore, four variables were analyzed in a 2 (grade) × 2 (gender) multivariate analysis of variance (MANOVA). The multivariate gender main effect, F(4, 466) = 5.90, p < .001, and grade main effect, F(4, 466) = 23.53, p < .001, were highly significant, but the Gender × Grade interaction, F(4, 466) = 0.30, was not.

The individual analyses of variance revealed a highly significant grade main effect for each of the four variables, with the younger children having a higher mean score in all cases. The grade differences are probably partly based in some reality (e.g., younger children’s grade expectations were higher because they actually received higher grades than older children). However, it is also likely that the grade differences represent...

1 These correlations provide evidence for the reliability of children’s responses to the pretest questions. Additional evidence for reliability comes from significant correlations (p < .001) with the children’s responses to the same question (with minor modifications necessary to make the question meaningful), given after children received their grade: “Circle the grade you probably will really get on the next math test.” (r = .46); “How good are you in math?” (r = .67); “How difficult is math for you?” (r = .73).
a response bias (younger children used the higher end of the scale). Therefore, grade main effects are not discussed.

As can be seen in Table 1, there were significant gender main effects for all four variables. As predicted, in comparison with girls, boys on average rated their competence in mathematics higher, $F(1, 469) = 16.84$, $MS_e = 5.82$, $p < .001$. The absence of significant Grade x Gender interaction effects indicates that, contrary to predictions, these gender differences were not weaker in third grade than in junior high school.

### Posttest

To analyze responses on the posttest questionnaire, subjects were divided into two groups on the basis of their subjective perception of their performance outcome. Subjects placed in the "poor-outcome" group chose the attribution questions for students who "thought they did well"; subjects placed in the "good-outcome" group chose the attribution questions for students who "thought they did well." Subjective perceptions were used to categorize subjects because we assumed that these are a better index of the personal meaning of the outcome than are the grades received and therefore would have more important implications for emotional responses and future motivation.

Girls were somewhat more likely than boys to claim that their outcome was poor (43% vs. 34%, for girls and boys, respectively). The difference, however, is not significant, $\chi^2(1, N = 473) = 3.22$. Furthermore, subjective perceptions were strongly associated with objective grades, and the average grades for boys and girls overall and within each subjective outcome group were not significantly different. An ANOVA with gender, grade, and subjective outcome as the independent variables and actual grade as the dependent variable did not result in a significant main effect for gender, $F(1, 465) = 2.18$, or significant interaction effects for Gender x Grade, $F(1, 465) = 0.92$, or Gender x Outcome, $F(1, 465) = 0.16$. The average grade for children placed in the good-outcome group was 3.06 (about a B+), as compared with a mean of 8.75 (between a C– and a D+) for children placed in the poor-outcome group.

**Attributions.** Children varied considerably with regard to the end of the response scale that they tended to use, with some of the variation being systematically related to age (i.e., younger children used the higher end of the scale). Unlike expectations, perceptions of competence, and other variables measured, each attribution score can be meaningfully conceptualized in terms of the explanatory value of that factor relative to all other causal attributions given. Therefore, an index of children's perceptions of the relative importance of the causes given was created by calculating the difference between each attribution rating and the child's own mean attribution rating. Thus, a positive score for a particular cause meant that the child rated that cause higher than his or her own average rating for causes, and a negative score meant that the child rated the cause lower than his or her average rating for causes.

These transformed attribution scores were subjected separately to 2 (grade) x 2 (gender) x 2 (good vs. poor subjective outcome) ANOVAs. Mean scores, by gender and outcome, are presented in Table 2. Tukey's Studentized range honestly significant difference (HSD) tests were calculated to test the significance level of post hoc mean comparisons in cases in which interaction effects were significant.

For ability attributions the only significant effect containing gender was the Gender x Outcome interaction, $F(1, 465) = 19.34$, $MS_e = 1.29$, $p < .001$. The results are consistent with

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1. Girls claimed that $MS_p < F\left(\frac{\ldots}{5.82}\right)$. Therefore, grade main effects are not discussed.

2. Although the gender main effect for performance was not significant in the Grade x Gender x Outcome ANOVA, it was significant when outcome was eliminated from the analysis, with boys performing better than girls. To make sure that significant gender main effects on other variables could not be explained by this performance difference, they were reexamined with performance as a covariate. All significant gender main effects that were found without performance as a covariate were also found with performance as a covariate.

3. These analyses were also computed with untransformed attribution scores. The same significant effects found with the transformed scores, reported below, were found with untransformed scores, with one exception. The gender main effect for task difficulty was significant with transformed scores but only marginally significant with untransformed scores, $F(1, 465) = 3.70$, $p < .10$.
the hypotheses and many past studies. Boys attributed a good outcome to ability significantly more than did girls, and girls attributed a poor outcome to a lack of ability more than did boys. Boys, but not girls, attributed a good outcome more than a poor outcome to ability. No significant main or interaction effects containing gender were found for effort attributions.

The gender main effect, $F(1, 465) = 7.62, MS_e = 1.10, p < .01$, was significant for task difficulty attributions, but the Gender x Grade and Gender x Outcome interaction effects were not. Boys ($M = .24, SD = 1.09$) claimed that task difficulty was a more important explanation of their outcomes than did girls ($M = .06, SD = 1.06$).

The only significant effect containing gender for luck attributions was the Gender x Outcome interaction, $F(1, 465) = 5.42, MS_e = 1.40, p < .05$. Luck was generally not rated as a very important cause of outcomes. However, boys attributed a poor outcome more to bad luck than did girls and to a greater extent than boys attributed a good outcome to good luck.

Emotions. Gender differences in pride following success and in shame and a desire to hide one's paper following failure were analyzed with $2 \times 2$ ANOVAs, with gender and grade as the two independent variables.

For pride in success, the gender main effect, $F(1, 287) = 6.16, MS_e = 1.75, p < .01$, was significant, but the Gender x Grade Interaction was not, $F(1, 287) = 1.67$. As can be seen in Table 3, boys felt more proud of a good outcome than did girls.

Neither the gender main effect, $F(1, 178) = 1.18$, nor the Gender x Grade interaction, $F(1, 178) = .07$, was significant for the emotion shame following a poor outcome. For “feel like hiding my paper,” the gender main effect, $F(1, 178) = 10.29, MS_e = 2.11, p < .01$, was significant, but the Gender x Grade interaction effect was not, $F(1, 178) = 1.90$. In both grades, girls who believed that they had done poorly claimed to feel more like hiding their paper than did boys who had done poorly.

To determine whether girls’ greater desire to hide their paper was the result of failure rather than the result of a general disposition to be private, the same analysis was done among children who did well. The gender main effect, $F(1, 287) = 0.00$, and the Gender x Grade interaction, $F(1, 287) = 1.05$, were not significant. Among children who did well on the test, girls were no more likely than boys to claim that they wanted to hide their paper.

Success through effort. The two questions assessing children’s perception of the potential role of effort in achieving success were summed to create one variable (the two questions were correlated, $r = -.32, p < .001$). A high score represents the view that success can be achieved by all through hard work, and a low score represents a belief that, for some individuals, success is not achievable through hard work.

A $2$ (gender) $\times 2$ (grade) $\times 2$ (outcome) ANOVA revealed a gender main effect, $F(1, 460) = 14.79, MS_e = 4.05, p < .001$, with girls ($M = 6.84, SD = 2.13$) perceiving effort as less likely to ensure success than did boys ($M = 7.86, SD = 2.02$). Thus, in addition to attributing failure to low ability

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Third Grade</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>($N = 94$)</td>
<td>($N = 100$)</td>
<td>($N = 143$)</td>
<td>($N = 136$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pride in good outcome</td>
<td>3.57</td>
<td>1.48</td>
<td>4.16</td>
<td>1.26</td>
<td>3.40</td>
<td>1.26</td>
<td>3.58</td>
</tr>
<tr>
<td>Shame after poor outcome</td>
<td>2.75</td>
<td>1.53</td>
<td>2.56</td>
<td>1.58</td>
<td>2.28</td>
<td>1.45</td>
<td>1.96</td>
</tr>
<tr>
<td>Desire to hide paper (poor outcome)</td>
<td>3.42</td>
<td>1.63</td>
<td>2.32</td>
<td>1.55</td>
<td>2.31</td>
<td>1.56</td>
<td>1.87</td>
</tr>
<tr>
<td>Desire to hide paper (good outcome)</td>
<td>1.38</td>
<td>0.92</td>
<td>1.31</td>
<td>0.72</td>
<td>1.09</td>
<td>0.38</td>
<td>1.18</td>
</tr>
</tbody>
</table>

Note. Means within an attribution having different subscripts are significantly different from each other.
more than did boys, girls were more likely to believe that effort would not necessarily lead to success. A significant outcome main effect, $F(1, 460) = 10.05, p < .01$, indicated also that children who claimed they had done poorly ($M = 6.80; SD = 2.28$) were less likely to believe that success could be achieved through hard work than were children who claimed they did well ($M = 7.73, SD = 1.95$). In addition, a significant grade main effect, $F(1, 460) = 12.14, p < .001$, was found, with younger children ($M = 7.88, SD = 1.83$) more likely than older children ($M = 7.01, SD = 2.26$) to believe that success can be achieved through hard work. In this case the grade effect cannot be the result of a response bias (e.g., younger children using the higher end of the response scale) because this measure combined two questions; a belief in the effectiveness of hard work was indicated by a high score for one question and a low score for the other question. The Gender x Grade interaction effect was not significant, $F(1, 460) = 1.14$.

**Avoidance wishes and future performance expectations.** The two questions concerning a wish to avoid mathematics and mathematics tests were significantly correlated with each other ($r = .47, p < .001$) for both the third graders and the junior high school students and were therefore combined.

Avoidance, improvement expected, and grade expected scores were analyzed by 2 (gender) x 2 (grade) x 2 (outcome) ANOVAs. A significant grade main effect, $F(1, 465) = 7.59, MS_e = 1.46, p < .01$, revealed that girls were more likely than boys to claim that they would like to avoid mathematics and mathematics tests if they could (see Table 4). The interaction effect was not significant, but the outcome main effect was significant, $F(1, 465) = 57.56, p < .001$, with children who did poorly ($M = 2.91, SD = 1.37$) predicting a higher grade the more children who did well ($M = 1.95, SD = 1.13$). The predicted relationship between external attributions for good outcomes and pride and between ability attributions for poor outcomes and shame were not found.

Only the outcome main effect was significant, $F(1, 465) = 5.26, MS_e = .81, p < .05$, for children’s responses to the question about whether they expected their performance to improve on the next test. Children who had done poorly ($M = 3.76, SD = .93$) claimed to expect more improvement than children who had done well ($M = 3.52, SD = .90$).

With regard to expected grade on the next test, the gender main effect was not significant, $F(1, 465) = 2.54$, but the Gender x Grade interaction effect was significant, $F(1, 465) = 7.05, MS_e = 6.04, p < .01$. Boys had higher expectations than girls in junior high school ($p < .001$) but not in third grade. The outcome main effect was highly significant, $F(1, 465) = 110.59, p < .001$, with children who believed they had done well ($M = 3.27, SD = 2.08$) predicting a higher grade on the next test than children who believed they had done poorly ($M = 6.08, SD = 3.13$).

In summary, the results for the avoidance and future-expectancy questions were not entirely consistent. However, in cases in which significance was found, boys expressed less desire to avoid mathematics and higher expectations for future performance. Also, as predicted, gender differences in expectations were found in junior high school but not in third grade.

**Relationships among attributions, emotions, avoidance desires, and expectations.** Pearson product–moment correlation coefficients were computed (separately for students who did well and did poorly and separately for third graders and junior high school students) between ability attributions and pride, avoidance desires, and expectations for future success. As can be seen from Table 5, the predicted relationships between ability attributions for good outcomes and pride and between ability attributions for poor outcomes and shame were not found.

<table>
<thead>
<tr>
<th>Attribution</th>
<th>Third grade Girls ($N = 94$)</th>
<th>Third grade Boys ($N = 100$)</th>
<th>Junior high Girls ($N = 136$)</th>
<th>Junior high Boys ($N = 136$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Avoid math</td>
<td>2.14</td>
<td>1.35</td>
<td>2.03</td>
<td>1.32</td>
</tr>
<tr>
<td>Improvement expected?</td>
<td>3.68</td>
<td>1.07</td>
<td>3.69</td>
<td>1.01</td>
</tr>
<tr>
<td>Grade expected*</td>
<td>3.50</td>
<td>2.62</td>
<td>3.36*</td>
<td>2.72</td>
</tr>
</tbody>
</table>

* The lower the score, the higher is the grade expected.

Note. Means within an attribution having different subscripts are significantly different from each other.
GENDER DIFFERENCES

Table 5
Pearson Product-Moment Correlation Coefficients Between Ability Attributions and Emotions, Avoidance, and Expectations

<table>
<thead>
<tr>
<th>Emotion/</th>
<th>Did well</th>
<th>Did poorly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3rd grade (N = 143)</td>
<td>Junior high (N = 148)</td>
</tr>
<tr>
<td>Pride in success</td>
<td>.14*</td>
<td>.16*</td>
</tr>
<tr>
<td>Shame in failure</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hide paper</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Avoid math</td>
<td>—27****</td>
<td>—35****</td>
</tr>
<tr>
<td>Improvement expected?</td>
<td>.18**</td>
<td>.12</td>
</tr>
<tr>
<td>Grade expected*</td>
<td>.30***</td>
<td>.38***</td>
</tr>
</tbody>
</table>

* The lower the score, the higher is the grade expected.

**p < .05. ***p < .01. ****p < .001.

Attractively correlated with pride (third grade students, \( r = -.18, p < .05 \); junior high school students, \( r = -.24, p < .01 \)). However, luck attributions for poor outcomes were not associated with attenuated shame (third grade students, \( r = .03 \); junior high school students, \( r = -.05 \)).

As mentioned previously, the gender difference was significant for junior high school students on grades expected on the next test and for all children on the desire to avoid mathematics in the future. Additional analyses were conducted to test the proposal that these gender differences were mediated by ability attributions. Baron and Kenny (1986) suggested regressing the independent variable (gender, in this case) on the outcome variable, with and without the presumed mediator as a covariate. They explained that “perfect mediation holds if the independent variable has no effect when the mediator is controlled” (p. 1177).

Separate path analyses were used to assess the effect of gender both independently and mediated by ability attributions on expected grade (junior high school students only) and avoidance scores (all students). Separate analyses were done for children who claimed to have done poorly and children who claimed to have done well because ability attributions have opposite implications for these two groups (i.e., one group attributed the outcome to low ability and the other group attributed the outcome to high ability). The results, shown in Table 6, support the mediation model in every case except for the effect of gender on avoidance desires among children who did poorly.

As shown in Table 6, beliefs regarding whether success can be achieved through hard work were also associated with future expectations and avoidance desires. Five of the six correlation coefficients that were computed revealed that a tendency to believe that success could be achieved through hard work was positively associated with future expectations and negatively associated with avoidance desires (wishing to be able to stop taking mathematics and to get out of the next test).

We next tested the proposal that gender differences in expected grade on the next test (junior high school students only) and avoidance desires (all subjects) were mediated by the belief that success is achievable through effort. We performed path analyses, which were analogous to those conducted to test ability attributions as a mediator of the same relationships. The results, shown in Figure 1, suggest that this belief mediated, to some degree, avoidance desires, and to a lesser degree, expectations.

Discussion

As predicted, girls’ achievement-related beliefs were generally more negative than boys’ achievement-related beliefs. On average, girls rated their ability lower and expected to do less well on the examination than did boys. Also consistent with previous research, girls attributed failure to low ability more than did boys and success to high ability less.

There was only indirect support for the proposal that attributional biases would result in gender difference in emotional reactions to mathematics achievement outcomes. Girls (who were less likely than boys to attribute success to ability) rated their pride lower than did boys. However, the absence of a significant correlation between ability attributions and pride in success is not consistent with the view that the gender difference in pride was mediated by ability attributions.⁴

Shame reactions to failure on the examination were not associated with low-ability attributions, and poorly performing girls did not claim to feel more ashamed than boys, even though girls were more likely to attribute failure to low ability. It is possible that all children were reluctant to admit shame

⁴ There are several reasons why the attribution–affect relationships in this study might be weaker than those found in previous studies (see Weiner, 1986, for a review). Most previous studies of the relationships between attributions and affects have involved hypothetical vignettes or have involved subjects being asked to think about a situation in which they did well or poorly and then to rate the importance of various causes (see Brown & Weiner, 1984, Experiment 6, for an exception). It is possible that these methodologies tap primarily individuals’ beliefs about attribution–emotion relationships, which may be clearer than the relationships between attributions made and emotions actually experienced. Experimentally induced outcomes have also been used to study attribution–affect linkages. The relationships may be weaker in naturalistic achievement situations than in these experimental situations because outcomes in real achievement situations often have important long-term implications for persons (e.g., their grade in a course). The outcome in natural contexts may be so salient that it overwhelms some of the effect of attributions on emotional responses.
Figure 1. Path analyses. (Least squares regression methods with forced entry were used to estimate the path coefficients. The path analyses are as follows: (a) path model relating gender and low ability attributions to avoidance desires; (b) path model relating gender and high ability attributions to avoidance desires; (c) path model relating gender and low ability attributions to expected grade [junior high school students only]; (d) path model relating gender and high ability attributions to expected grade [junior high school students only]; (e) path model relating gender and belief in success through effort to avoidance desires; and (f) path model relating gender and belief in success through effort to expected grade [junior high school students only]. *p < .05. **p < .01. ***p < .001.)

(means were relatively low for this emotion). It is also possible that even though girls were more likely than boys to attribute failure to low ability, they did not experience more shame because they believed it is culturally acceptable for girls to be less competent in mathematics.

Girls’ claim that they felt more like hiding their paper than boys did not appear to reflect a general disposition toward desiring more privacy, as girls did not report feeling like hiding their paper more than boys after success. The desire to hide one’s paper after failure may be indirect evidence for greater
Table 6

Correlation Coefficients Between (a) the Belief That Success Can Be Achieved Through Effort and (b) Expectancy and Avoidance Measures

<table>
<thead>
<tr>
<th>Expectancy/avoidance measure</th>
<th>3rd grade (N = 194)</th>
<th>Junior high (N = 279)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid math</td>
<td>-.17**</td>
<td>-.32****</td>
</tr>
<tr>
<td>Improvement expected?</td>
<td>.11*</td>
<td>.15****</td>
</tr>
<tr>
<td>Grade expected*</td>
<td>-.17**</td>
<td>-.18****</td>
</tr>
</tbody>
</table>

Note. *The lower the score, the higher is the grade expected. **p < .01. ***p < .001. ****p < .0001.

shame in girls, or it may indicate a greater concern about others' evaluation. This latter interpretation is consistent with previous work suggesting that girls are more concerned about social approval than are boys (see Harter, 1975; Hoffman, 1975; Stein & Bailey, 1975). The possibility that girls are more concerned about public humiliation is worth pursuing in future research because, in combination with relatively low expectations for success, it may contribute to girls' avoidance of mathematics performance situations.

Gender differences in attributions found in this examination also appeared to have implications for future expectancies and avoidance desires, although more so for junior high school students than for third graders. Ability attributions for failure were associated with a desire to avoid mathematics achievement situations and to expect relatively poor performance for the older children but not for the younger children. Furthermore, path analyses were consistent with the proposal that ability attributions mediated junior high school students' expectations for future tests. Both younger and older girls were more likely to attribute failure to low ability than were their male classmates, but the younger children's low-ability attributions apparently did not have the same negative implications for future expectations and avoidance desires that they had for the older children.

Results related to perceptions of success as achievable through effort also suggest that young children are less likely than older children to engage in maladaptive behavior related to mathematics. Although girls at both grade levels were more likely than boys to claim that success was not always achievable by hard work, the younger children (both boys and girls) believed, to a greater extent than did the older children, that anyone could do well if he or she really tried hard.

Thus, although gender differences in attributions and the belief that success can be achieved by effort are manifested by the third grade, the correlational analyses suggest that these beliefs do not dampen future expectations and may not inhibit approach behaviors in young children to the degree that they do in older girls. Therefore, failure would not be expected to discourage third-grade girls as much as it discourages junior high school girls. These findings are consistent with previous research indicating that young children's behavior is not as debilitated by failure as is older children's behavior (Rholes, Blackwell, Jordan, & Walters, 1980).

The data suggest that a distinction may need to be made between expectations assessed before an achievement task and those assessed just after receiving performance feedback. Third-grade girls expected to do less well than third-grade boys before they took a mathematics test, but this gender difference was not evident when children were asked about a future test immediately after they had received performance feedback. We suspect that the initial expectation measure tapped a more generalized expectancy, which was associated with perceptions of competence in mathematics, and that the posttest expectation was based on children's analysis of the performance information that they had just received. The findings suggest that young girls' general dispositions to expect poorer performance in mathematics can be overcome, at least in the short run, by successful performance. In contrast, the older girls continued to expect relatively poor outcomes, even though they had just received performance feedback that was, on average, the same as the performance feedback received by boys.

The data suggest that it is also important to distinguish between the perception that success is caused by effort and the belief that success can be achieved through effort in the long run. Gender differences were not found in children's effort attributions for success. However, girls in the present study were much less likely to claim that anyone can achieve success by trying hard, and the evidence suggests that this belief mediated, to some degree, avoidance desires for children in both age groups and expectations for future success for junior high school students.

The belief that success can be achieved through effort has clearer implications for behavior than does the belief that success was caused by effort. Success attributed by a child to effort can imply that the child believes he or she has the prerequisite ability (otherwise effort would not have paid off). However, as Schunk (1984) pointed out, such an attribution can also reflect a belief that success required extreme effort to compensate for poor ability. In the first case, success attributed to effort should be associated with adaptive approach behaviors; in the second it might be associated with low expectations and avoidance. The question of long-term success through effort concerns a more generalized belief that is unambiguously adaptive and should be associated with relatively high expectations and a willingness to approach mathematics tasks.

It would be useful in future research to include attributions related to effort that are less ambiguous. Clifford (1984) has shown that strategy is a meaningful attribution that has clear, positive implications. Thus, for example, children could be asked to what degree their performance was a consequence of good or poor strategy both in preparation for the test (e.g., practicing the right kinds of problems) and in taking the test (e.g., not spending too much time on the difficult problems, checking answers after finishing).

A third distinction that needs to be made in future research is the distinction between general beliefs for others and beliefs for oneself. Subjects in this study were asked whether everyone can succeed by effort, not whether he or she can succeed with effort. The latter belief would be expected to be more strongly associated with personal expectations and desires to avoid or approach mathematics than the former. The use of the more general measure may explain why the gender difference in the belief that success can be achieved through effort appeared to be a weaker mediator of the relationship between (a) gender...
and (b) avoidance and expectations than did ability attributions.

It is conceivable that some of the gender differences found for this examination reflect differences in self-presentation styles rather than real differences in beliefs. Girls may have wished to appear more modest. This interpretation is suggested by Eccles, Adler, and Meece's (1984) finding that, although girls' statements (e.g., expectancies after failure) suggested lower self-confidence, girls did not evidence greater helplessness, as measured behaviorally. Girls also may have made conservative predictions to protect themselves from disappointment (see Norem & Cantor, 1986). However, it is not likely that modesty or self-protection desires explain all of the gender differences found in this study. First, all responses were given anonymously on written questionnaires. A desire to present oneself as modest or self-confident should not play a strong role in responses on such a questionnaire. Second, needs for both modesty and self-protection seem unlikely explanations for some of the gender differences, such as those found with the desire to avoid mathematics and with the belief that success is not always achievable. Third, the finding that girls were not more likely than boys to want to hide their paper after success is inconsistent with the view that girls were more modest. The present data, however, cannot refute such an interpretation, and research that directly examines self-presentation and self-protection as explanations of gender differences in achievement-related beliefs would be useful.

Overall the results expand our understanding of the motivational variables that may explain females' greater tendency to avoid mathematics courses and occupations. In addition to having more negative beliefs related to their competencies and the likelihood of success, girls took less pride in their success than did boys and after failure experienced either more negative emotion or greater concern about public humiliation than did boys. Girls were also less likely to believe that success can be achieved through effort, and they had stronger desires to avoid mathematics learning situations.

Gender accounted for only about 2%–3% of the variance in most of the achievement-related beliefs measured, 4% of the variance for ability attributions, and 5% of the variance for children's claims about whether they felt like hiding their paper after failure. Gender, therefore, is a small, but nontrivial factor, nontrivial enough to render efforts to improve girls' achievement-related beliefs worthwhile.

All of the gender differences found in this study appeared by the third grade, although the results suggest that the younger girls' more negative beliefs may not affect their behavior as much as such beliefs affect the older girls' behavior. The appearance of negative achievement-related beliefs at an early age suggests that interventions designed to improve girls' mathematics achievement need to begin in early elementary school.

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