

## Influence of Gender Stereotypes on Parent and Child Mathematics Attitudes

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This study tested the hypothesis that parents' gender stereotypes about mathematical ability interact with the sex of their child to directly influence their beliefs about the child's mathematical ability and likelihood of future success in mathematics and to indirectly influence the child's self-perceptions and mathematics performance. Approximately 400 parents and their 6th- to 11th-grade children responded to questionnaires concerning their beliefs about the child's mathematics achievement and their stereotypes about males' and females' relative abilities in mathematics. Path analyses revealed that parents' gender stereotypes have no direct effect on children's self-perceptions. Instead, parents' stereotypes interact with the sex of their child to directly influence the parents' beliefs about the child's abilities. In turn, parents' beliefs about their child directly influence their child's self-perceptions, and both the parents' stereotypes and the child's self-perceptions influence the child's performance.

A growing body of literature has established the importance of parents' beliefs in influencing their children's achievement attitudes and academic performance. Parents' beliefs and expectations have been related to the child's performance history (Parsons, Adler, & Kaczala, 1982; Entwisle & Baker, 1983; Entwisle & Hayduk, 1978, 1981), performance on cognitive tasks (McGillicuddy-De Lisi, 1985), and self-perceptions of ability and achievement expectancies (Hess, Holloway, Dickson, & Price, 1984; Parsons et al., 1982; Stevenson & Newman, 1986). Parents' beliefs about children's abilities have been found to have an even greater influence on children's achievement attitudes than does previous performance (Parsons et al., 1982; Phillips, 1987).

Parents' beliefs appear to play a particularly important role in the area of mathematics achievement, in which sex differences in attitudes are greater than performance differences (for review of research, Chipman, Brush, & Wilson, 1985). Compared to parents of boys, parents of girls are less likely to buy mathematics-related toys and games (Astin, 1974), are more likely to report that mathematics is less important than other subjects (Parsons et al., 1982), and are more likely to attribute good mathematics performance to training and effort than to ability (Holloway & Hess, 1985; Parsons et al., 1982). These findings from the existing literature clearly indicate that parents hold sex-differentiated beliefs about mathematics ability. The purpose of this study was to extend current research by evaluating the influence of parents' gender stereotypes on their own beliefs and on those of their children. Specifically, parents' gender stereotypes about mathematical ability were

expected to interact with the sex of their child to directly influence the parents' beliefs about their child's abilities and future expectancies for success and to indirectly influence the child's self-perceptions of mathematical ability, future expectancies, and performance in mathematics.

Research to date has not linked parents' gender stereotypes to their beliefs about their children's abilities, although evidence for the existence of such beliefs exists. Studies have suggested that parents and other adults hold general beliefs about the appropriateness of certain behaviors for each sex (Connor & Serbin, 1977; Fagot, 1973, 1974; Jacobs & Eccles, 1985; Perloff, 1977). These more general gender beliefs or stereotypes are likely to influence parents' judgments about the child's abilities (Eccles [Parsons], 1984; Eccles [Parsons] et al., 1983; Jacobs & Eccles, 1985).

An examination of the social psychological research on stereotyping lends support to the hypothesis that parents' gender stereotypes about the relative abilities of males and females will have an impact on their beliefs about their child's abilities. Early work by Allport (1954; Allport & Postman, 1945) demonstrated that people used stereotypes even when the actual image violated their expectancy. Other researchers have reported similar findings indicating that, even in the presence of information about specific individuals, general beliefs have a significant impact (Amir, 1969; Darley & Gross, 1983; Landy & Sigall, 1974). Although more recent research indicates that the strength of this effect is related to the availability of information about the particular person (see Locksley, Borgida, Brekke, & Hepburn, 1980; Locksley, Hepburn, & Ortiz, 1982), the finding that stereotypes affect judgments about specific individuals remains well supported. This may be particularly important for parents because the stereotypes they hold may influence the ways in which they interpret their children's behavior, leading them to give messages consistent with the stereotype.

Eccles and her colleagues (see Eccles [Parsons], 1984; Eccles [Parsons] et al., 1983; Parsons et al., 1982) have described a model of parental influence in which parents play an "expectancy socializer" role. Eccles and her colleagues suggested

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that parents convey their expectations for their child by giving messages concerning their beliefs about the child's abilities and that the messages differ depending on the sex of the child. In the general model proposed by Eccles (Parsons) et al. (1983), cultural factors, such as stereotypes, are expected to influence parents' beliefs about their child's abilities. However, Parsons et al. (1982) did not include cultural variables in their test of the model, focusing instead on parents' specific beliefs about their children's abilities. The focus on beliefs about a specific child is consistent with most of the research on the influence of parental beliefs (see Miller, 1988, for review).

The present study adds to previous research on the expectancy socializer model (Eccles [Parsons] et al., 1983) in two ways: by including the influence of parents' gender stereotypes about mathematical ability as an additional influence on their specific beliefs about their child and by including a performance outcome in addition to attitudinal outcomes. The specific beliefs examined were parents' perceptions of their child's mathematical ability and parents' expectations for their child's future success in mathematics. On the basis of previous research and the general model proposed by Eccles, the influence of gender stereotypes on children's self-perceptions was expected to be (a) indirect and (b) gender specific.

Support for the indirect influence of stereotypes is found in work by Dew (1985) showing that stereotypes directly affected subjects' memories of a target person, which then influenced the subjects' evaluations of the person. More evidence for this idea is found in an investigation of the impact of media-reported research on parents' mathematical ability beliefs by Jacobs and Eccles (1985). These authors found that parents whose gender stereotypes for mathematical ability had been confirmed by reading a media report about mathematical abilities were more likely to change their beliefs about their own children's mathematical abilities than were parents who had not read the report.

Evidence for the sex-specific influence of gender stereotypes is found in previous research indicating that parents' beliefs depend on the sex of their child (Parsons et al., 1982; Jacobs & Eccles, 1985). This suggests that it is the interaction of stereotype and child sex that influences parents' specific beliefs about their child's mathematical abilities rather than the stereotype alone. For example, if parents hold stereotypic beliefs that males are better than females in mathematics, then they are likely to allow their stereotype to lower their perception of their daughter's mathematical ability. If parents have a son, the stereotype is likely to raise their perception of his ability. Therefore, a test of the effects of parents' gender stereotypes is really a test of the effects of the interaction of stereotypes and child sex on parents' specific beliefs about the child.

Additional influences on parents' and children's specific beliefs may be (a) the child's previous performance in mathematics and (b) the child's year in school. Phillips (1987) and Parsons et al. (1982) found that previous performance affected both parents' and children's perceptions, although parents' beliefs remained a stronger influence on children in both studies. Other researchers also have documented the influence of previous mathematics performance on perceptions of abil-

ities (Eccles [Parsons] et al., 1983; Yarborough & Johnson, 1978). In addition, a number of studies have demonstrated a negative relationship between increasing age and beliefs about mathematical abilities. Nicholls (1978) found that children's perceptions of their abilities become more accurate (and more negative) after the age of 9 years, and other researchers have found that children's perceptions of their abilities become more negative with increasing age (Eccles [Parsons] et al., 1983; Entwisle & Hayduk, 1978; Stipek & Hoffman, 1980). Stevenson and Newman (1986) found that mothers' beliefs were more highly correlated with the performance of their child in fifth grade than with the performance of their child in second grade, in part because of lowered assessments of abilities. The impact of year in school may result from changes in the information that is available concerning the child's ability. As children get older, more information on which to base ability judgments becomes available (e.g., ability grouping is used in some subjects, grading practices become stricter, and advanced classes become optional). These changes are likely to influence parents' and children's beliefs about the child's abilities.

The present study included 6th- through 11th-grade children and their parents. Although the cross-sectional design precluded the assessment of changes in parents' beliefs about an individual child, the beliefs of parents of children from a broad age range were expected to differ if changes in available information and in child's developmental level inform parents' stereotypes and ability judgments.

In summary, I investigated the influence of parents' gender stereotypes on their specific beliefs about their child's abilities and on the child's beliefs and performance by examining four hypotheses based on earlier research with the Eccles model (Eccles [Parsons] et al., 1983; Eccles & Jacobs, 1986; Parsons et al., 1982) and the literature reviewed above. First, parents' gender stereotypes were expected to interact with the sex of their child to influence the parents' specific beliefs about the child. Specifically, stronger stereotypes favoring males were expected to be related to more positive beliefs held by parents of sons than the beliefs held by parents of daughters. Second, the interaction of child's sex and gender stereotypes was expected to indirectly influence children by directly affecting parents' specific beliefs about their child, which would then affect the child's self-perceptions, which would in turn affect the child's performance in mathematics. Third, the child's year in school was expected to directly affect parents' and children's specific ability beliefs and future expectancies, with beliefs becoming more negative at higher grade levels. Finally, previous performance in mathematics was expected to directly influence parents' and children's specific beliefs.

## Method

### *Subjects*

This study was part of a larger, 2-year study of 6th- through 11th-grade children. Mathematics classrooms at each grade level were chosen randomly from among classrooms in which teachers volunteered to participate. It should be noted that students of all levels of mathematical ability were included. The 11th-grade sample was less

heterogeneous than Grades 6–10 because in 11th grade mathematics became an elective for many students. Therefore, students with lower mathematical abilities may have stopped taking mathematics when given the opportunity. The classrooms were located in two school districts in primarily White, middle-class suburbs, outside of a large midwestern city. Only students whose mothers participated were included in the present study. The number of participants at each grade level is shown in Table 1.

Approximately equal numbers of girls and boys participated (girls composed 51.4% of the sample and boys composed 48.6%) The parent sample consisted of 424 mothers and 390 fathers of these students. Most fathers were employed as professionals (79%), and most mothers worked as homemakers (35%), professionals (25%), or in clerical positions (18%).

## Measures

*Student and parent questionnaires.* The questionnaires contained a variety of questions regarding children's beliefs and attitudes about mathematics. The items used in this study were a subset of the total asked in the larger study. The analyses presented in this study were based on two scales for students and parents originally developed by Parsons et al. (1980) and reported by Parsons et al. (1982). The items and alphas for each scale are presented in Table 2.

The first scale measured students' perceptions of their own mathematics abilities, and the second scale measured students' expectancies for future success in mathematics. All scale items were designed with 7-point Likert response formats. Parents responded to scales containing questions designed to parallel items on the student questionnaire. One scale contained questions about parents' perceptions of their child's mathematical ability. The other scale included items about parents' expectations for their child's future success in mathematics. All scales were scored so that high scores were consistent with the label of the scale.

Parents also answered one stereotype item, using a 5-point Likert response scale (see Table 2). This item assessed respondents' general beliefs about males' and females' relative mathematical abilities and is referred to as the parents' gender stereotype throughout the analyses and discussion. The scoring for this item was reversed so that higher numbers indicated stereotypes in favor of males. A single-item indicator such as this has the disadvantage of being less reliable than a multiple-item index. However, the impact of low reliability is underestimation at the effect of a variable (Pedhazur, 1982; Kenny, 1979). Thus, the study provides a conservative test of the effects of stereotypes, and significant relationships involving the variable are likely to be robust.

*School record data.* In all of the analyses, mathematics grades were used as a measure of mathematics performance. Grades were chosen instead of achievement test scores (Pearson product-moment correlation for achievement score and mathematics grade was .55) because the dependent variables of interest were children's and parents' perceptions of ability and these were most likely to be influenced

by grades (parents and children typically had more access to grades than to achievement test scores). In addition, districts differed on the kind of achievement tests used and when they were given. Year-end mathematics grades were collected from school records for the previous year and the year during which data were collected for this study. Schools varied in their grading systems (e.g., number grades ranging from 1–7 or 1–4, letter grades ranging from A–F); however, all grades were coded to reflect a system ranging from *F* (1) for failing to *A+* (14).

## Procedure

Trained field staff administered questionnaires to students in two 30-min sessions during mathematics class. Students answered questions at their own pace without time limits (other than the length of the class period).

The parent questionnaires were mailed to the homes of parents who had agreed to participate. Each parent completed a separate questionnaire and then returned it in an enclosed prepaid mailer. In all, 72% of the mothers and 66% of the fathers of participating students returned questionnaires. Although it is possible that some selection bias existed as a result of this method of data collection, the parent sample was representative of the districts on indicators such as education and occupation when compared to the relevant census data.

## Results

On the basis of the model outlined by Eccles and the research reviewed earlier, I used a path analytic model to test the hypotheses stated above. The same model was used to test the impact of stereotypes on two sets of specific beliefs held by parents; (a) perceptions of their child's mathematical ability and (b) expectations for their child's success in mathematics in the future. Before estimating the model, all cases with implausible response patterns were removed from the original data set (no outliers were found on any of the variables included in the analyses reported in the article). I also conducted preliminary analyses to test the relationships between parent and child sex and the dependent variables using 2 (sex of parents: mothers, fathers)  $\times$  2 (sex of children: girls, boys) analyses of variance (ANOVAs). Mothers had significantly higher perceptions of their children's abilities than did fathers,  $F(1, 720) = 6.98, p < .01, MS_e = 108.27$ . No significant differences were found for future expectancies. I conducted a similar analysis to compare mothers' and fathers' gender stereotypes for mathematics. No significant differences between mothers' and fathers' beliefs were found; however, parents of girls held more stereotyped beliefs (favoring males) than did parents of boys,  $F(1, 725) = 5.99, p < .05, MS_e = .40$ . The interaction of parent and child sex was not significant. Means and standard deviations for these variables are presented in Tables 3 and 4. It should be noted that 92% of parents' responses fell within the middle range (scores of 2 to 4) on the response scale for the stereotype question (only 2% believed that females were much more talented than males, and only 6% believed that males were much more talented than females).

Table 1  
Number of Participants at Each Grade Level

Parents	Grade						Total
	6	7	8	9	10	11	
Mothers	60	69	72	84	72	67	424
Fathers	53	67	68	77	63	62	390
Total	113	136	140	161	135	129	814

Note. Only students whose mothers participated in the study were included in the analyses.

Table 2  
Cronbach's Alpha for Parent and Child Scales

Scale/item	Response rating scale anchors	$\alpha$
Child's self-perceptions of math ability		.80
How good at math are you?	<i>Not at all good</i> (1), <i>Very good</i> (7)	
If you were to order all of the students in your math class from the worst to the best, where would you put yourself?	<i>At the bottom</i> (1), <i>At the top</i> (7)	
In comparison to most of your other academic subjects, how good are you in math?	<i>Much worse in math</i> (1), <i>Much better in math</i> (7)	
Child's future expectancy for success in math		.81
How well do you think you'll do in your mathematics course next year?	<i>Not at all well</i> (1), <i>Very well</i> (7)	
How successful do you think you'd be in a career which required mathematical ability?	<i>Not at all successful</i> (1), <i>Very successful</i> (7)	
How well do you think you will do in advanced high school math courses? (like algebra or calculus)	<i>Not at all well</i> (1), <i>Very well</i> (7)	
Parent's perceptions of child's math ability		.61 for M, .58 for F
My child is:	<i>Not at all good at math</i> (1), <i>Very good at math</i> (7)	
In comparison with other academic subjects, my child is:	<i>Much worse in math</i> (1), <i>Much better in math</i> (7)	
Parent's future expectancy for child		.66 for M, .83 for F
How well do you think your child would do in first year algebra?	<i>Not at all well</i> (1), <i>Very well</i> (7)	
How well do you think your child would do in an advanced math course like calculus?	<i>Not at all well</i> (1), <i>Very well</i> (7)	
Parent's stereotyping of mathematical ability		(single item)
In general, how do you believe males and females compare in their mathematical aptitude or ability?	<i>Males are much more talented in math than females</i> (1), <i>Females are much more talented in math than males</i> (5)	

Note. M = Mothers; F = fathers.

### Description of the Model

I chose recursive path analysis for the analyses because it permits the estimation of both direct and indirect relationships among variables (Duncan, 1966). The prediction variables included the interaction of parent's stereotype and child sex, previous year's mathematics grade, year in school, sex of child, and parent's stereotype. The interaction term was the variable of major interest in this study because parents' gender-stereotyped beliefs were expected to affect sons and daughters differently. The belief that boys are better at mathematics

was expected to lead to more favorable views about sons and less favorable views about daughters. Accordingly, a significant path between the interaction term and parent or child beliefs would indicate that the influence of parents' stereotypes about gender differences in mathematical ability is moderated by the sex of their child (see Baron & Kenny, 1986, for a discussion of moderator variables). For the interaction term to be meaningful, it was necessary to include sex of child and parent stereotypes as separate variables. No effects of the interactions between other exogenous variables were hypothesized. However, to ensure that the model was not specified

Table 3  
Means and Standard Deviations for Parent Variables

Measure	Mothers				Fathers			
	Daughters		Sons		Daughters		Sons	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Parent's perceptions of child's math ability	55.12	11.19	54.79	10.25	51.42	9.86	52.11	10.18
Parent's future expectancies for child	55.12	13.09	56.25	12.07	55.23	11.91	55.02	11.12
Parent's stereotyping of mathematical ability	2.71	0.56	2.60	0.69	2.73	0.63	2.60	0.64

Table 4  
Means and Standard Deviations for Child Variables

Measure	Daughters		Sons	
	M	SD	M	SD
Child's self-perceptions of math ability	4.77	1.10	5.08	1.15
Child's future expectancy for success in math	4.81	1.04	5.22	0.94
Mathematics grade Year 0	10.56	2.28	9.99	2.37
Mathematics grade Year 1	10.07	2.35	9.69	2.62

Note. Mathematics grade Year 0 = the year previous to the year the study was conducted; mathematics grade Year 1 = the year during which the study was conducted.

incorrectly, preliminary analyses included the interactions of sex and mathematics grade with year in school. No significant paths were found for any of the dependent variables; therefore, they were not included in estimates of the hypothesized model reported in this article.

The previous year's mathematics grade was included as a measure of mathematical ability, and it was expected to predict both parents' and children's perceptions of the child's mathematical ability. Previous mathematics grade was the only child-to-parent influence included in the model. This choice was not a deliberate attempt to ignore all of the other ways in which children affect their parents or the cyclical nature of family relationships. Rather, the model presented in this article was chosen to focus on the influence of parents' stereotypes and on grade differences in parents' influence. However, based on previous research (Yee & Eccles, 1985) indicating that mathematics grades inform parents' beliefs about their children significantly more often than other sources of information, previous mathematics grades were expected to be representative of children's impact on parents' attitudes. To examine the influence of grade level on parent and child beliefs, year in school was included.

In addition to the direct effect of the interaction term on parents' specific beliefs, year in school and previous mathematics grade were expected to directly influence parents' specific beliefs and children's self-perceptions. Although not hypothesized, the analyses also included all other direct effects of stereotype, sex, year in school, and previous mathematics grade on the dependent variables. This ensured that any influence of the hypothesized interaction term was not attributable to those factors.

Sex of child was coded as  $-.5$  for daughters and  $+.5$  for sons. The interaction term was constructed by first standardizing the stereotype variable and then multiplying the sex and stereotype variables together. All other variables (dependent and independent) were standardized before being entered into the regression equation. The reported path coefficients were  $b$  weights rather than beta weights (Kerlinger & Pedhazur, 1973, p. 25), but the two were equivalent in all cases except for sex and the interaction term.

This analysis strategy allowed a straightforward interpretation of the regression weights received by sex, stereotype, and the interaction of sex and stereotype. In regression analysis, variables used to form an interaction may not be interpreted

simply as main effects but when coded properly may be meaningfully interpreted in light of the interaction (see Judd & McClelland, 1989, pp. 286–288, for a discussion of coding for two groups). Because stereotypes were standardized to a mean of zero before forming the interaction variable, sex, stereotypes, and the interaction term were essentially uncorrelated. The coefficient for sex corresponds to the sex difference in standard deviation units at the mean level of stereotyping (holding constant all other variables). On the basis of the same coding strategy, the coefficient for stereotypes may be interpreted as the effect of stereotyping, averaged across sons and daughters. Most important for present purposes is the interpretation of the path coefficient for the interaction term. A positive coefficient indicates that the more parents' stereotypes favor males, the more positive their perceptions of sons relative to daughters will be. Conversely, the less parents' stereotypes favor males, the less positive will be their perceptions of sons in comparison with daughters. The magnitude of the coefficient reflects the amount of change in the sex difference of parents' perceptions per unit of change in stereotyping, both of which are expressed in standard deviation units (Kerlinger & Pedhazur, 1973, pp. 252–253).

I estimated the path coefficients using a series of least squares regressions. The criterion variables at a given level of the model were regressed on the prediction variables from all previous levels. The interaction term was not significant after the first step of each model, so it was not included in Steps 2 and 3. This means that the sex and stereotype terms may be interpreted as main effects in Steps 2 and 3. Because the variables were standardized, the size of the coefficients provides an estimate of the relative strength of the relationships specified by each path. The amount of variance accounted for is listed under each criterion in all figures. Because of concerns about multicollinearity, I performed separate analyses for mothers and fathers. The model for mothers' ability perceptions is presented in Figure 1, and the model for fathers' ability perceptions is presented in Figure 2.

### Ability Perceptions

*Mothers.* The model for ability perceptions clearly upholds the hypothesis that stereotypes interact with sex of child to have a direct effect on mothers' specific ability beliefs (.21) and to have only indirect effects on children's self-perceptions (.08) and later grades (.07).<sup>1</sup> The path coefficient for the interaction term indicates that greater stereotyping was related to lower ability beliefs for daughters and to higher ability beliefs for sons. At the mean level of stereotyping, there was a difference of .29 standard deviation units (indicated by the path coefficient for sex) for sons and daughters. As stereotypes became stronger, the sex difference in parents' perceptions

<sup>1</sup> The indirect effect of A on C, mediated by B, is calculated by multiplying the direct effect of A on B by the direct effect of B on C. If more than one indirect path exists, the effects are added together. For example, the calculation for the indirect effect of the interaction on current grades for mothers is the following:  $(.21 \times .37 \times .36) + (.21 \times .19) = .07$ . See Kenny (1979, pp. 70–73) for more details.

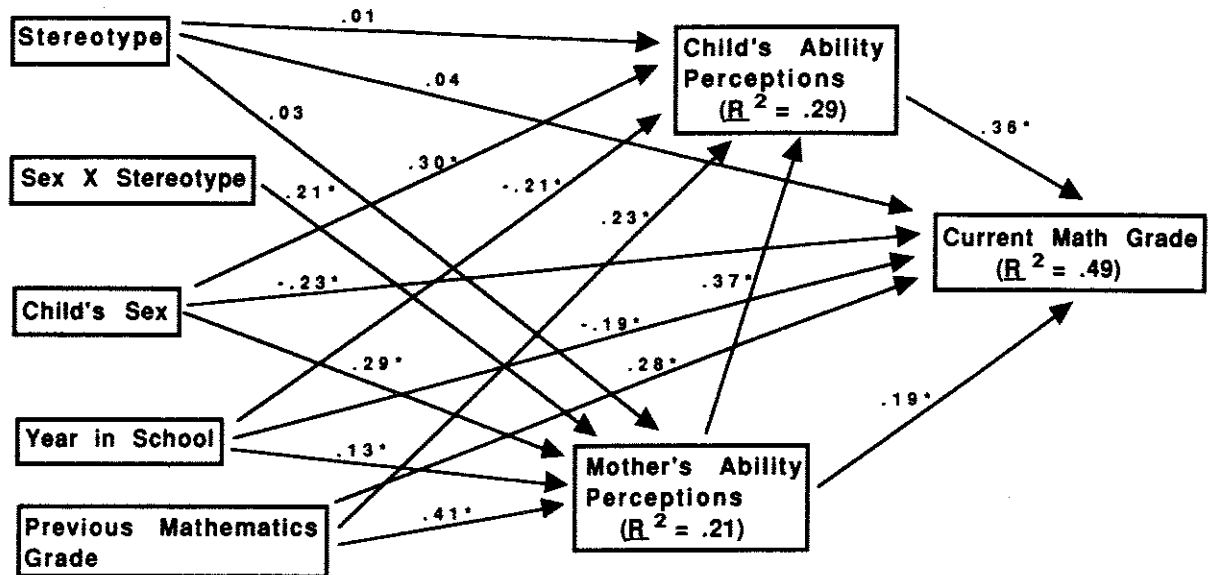


Figure 1. Path analyses of mothers' perceptions of their children's mathematics abilities. (\* $p < .05$ .)

became larger (favoring males); with less stereotyping the difference decreased.<sup>2</sup>

Mothers' ability beliefs about their children were most strongly influenced by the previous year's grades, with the positive coefficient indicating that higher grades were related to higher ability beliefs. Mothers' beliefs, in turn, had a strong influence on the ability beliefs of their children. Children were also influenced by their previous mathematics grades, and their self-perceptions decreased with increasing age. The significant path between sex and children's ability beliefs indicates that boys had higher self-perceptions of ability than did girls. Finally, as hypothesized, children's self-perceptions of ability were predictive of the current year's mathematics grade.<sup>3</sup> In estimating the indirect paths between mothers' perceptions and current grades, an unhypothesized direct path also was found between mothers' beliefs and the current year's mathematics grade, with higher ability perceptions related to higher mathematics grades. The negative path between sex and current mathematics grade indicates that girls had higher grades than boys.

Effects of year in school appeared in the form of direct paths to all three criterion variables. School year had a relatively weak, positive relationship to mothers' specific beliefs in the ability model, indicating that mothers of older children held more favorable beliefs about their children's mathematical abilities than did mothers of younger children. It is important to note that year in school had an influence on children that is opposite to the influence it had on their mothers. The negative path coefficients between year in school and children's ability beliefs indicates that older children's self-perceptions were lower than younger children's. This effect may reflect a general developmental decline or a cohort effect. The increasingly negative self-perceptions of mathematical ability with year in school may be related to the fact that older children were receiving lower grades, as demon-

strated by the negative path coefficients between school year and current mathematics grade.

*Fathers.* In the model for fathers, stereotypes again interacted with sex of child to directly influence fathers' beliefs about their children's mathematical abilities (.28) and to indirectly affect children's self-perceptions (.09) and mathematics grades (.06). The positive path coefficient for the interaction term indicates that, like mothers, fathers with stronger stereotypes had lower ability beliefs for their daughters as compared with ability beliefs for their sons. However, as can be seen by the lack of a significant path coefficient for sex, there was little difference between fathers' ability beliefs for sons and daughters at the mean level of stereotyping. Only with low or high levels of stereotypes would this difference occur. For example, at 2.0 *SD* below the mean for stereotyping, fathers' ability perceptions would differ by .43 *SD*<sup>4</sup> in favor of daughters, and at 2.0 *SD* above the mean, fathers'

<sup>2</sup> For mothers of sons, the standardized coefficient for stereotypes is .135:  $.03 + (.21)(.50)$ , determined by the overall coefficient for stereotypes plus the coefficient for the interaction multiplied by the value assigned to sons on the sex variable. For parents of daughters, the standardized coefficient is  $-.075: .03 + (.21)(-.50)$ .

<sup>3</sup> All of the analyses have been repeated with the grade received at the end of the second year of the study as the outcome variable and with children's beliefs from the second year. The pattern of results remained the same, although the effects were weaker.

<sup>4</sup> This number is calculated as follows: The coefficient for the path between sex and fathers' perceptions is .13, indicating a sex difference of .13 *SD* favoring sons. The coefficient for the path between the interaction term and fathers' perceptions is .28. As explained earlier, this is the amount of change in sex difference for each standard deviation in stereotyping; thus, for 2 *SD* below the mean, the coefficient will be  $.13 - (2 \times .28) = -.43$  (with the minus sign indicating that it favors daughters).

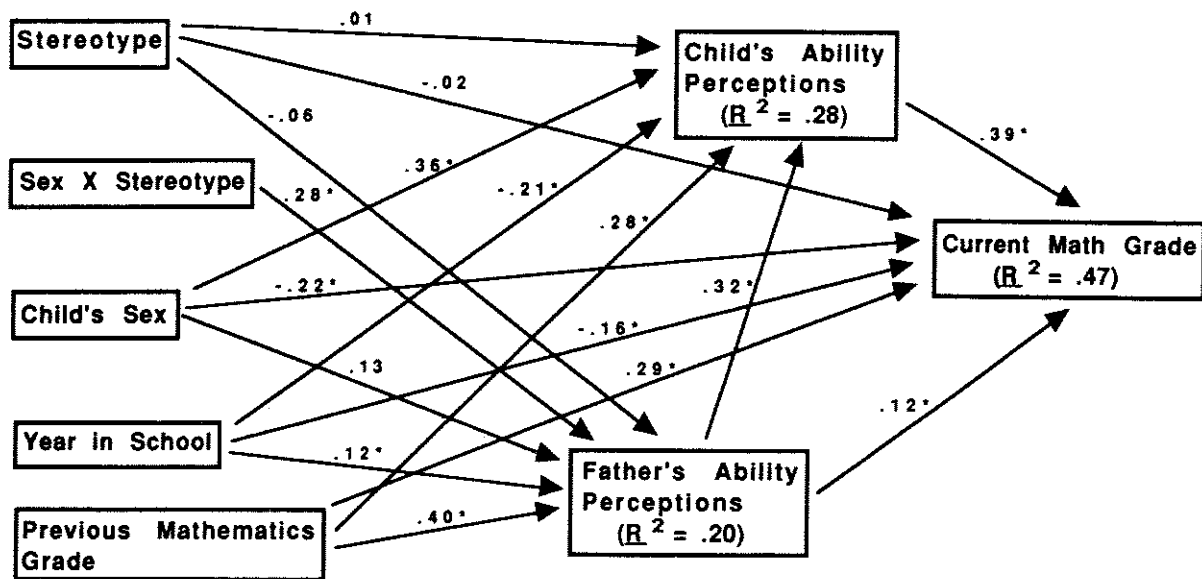


Figure 2. Path analyses of fathers' perceptions of their children's mathematics abilities. (\* $p < .05$ .)

perceptions would differ by .69 *SD* in favor of sons. In contrast, mothers' perceptions would differ by .13 *SD* in favor of daughters at 2 *SD* below the mean for stereotyping and would differ by .71 standard deviations at 2 *SD* above the mean (favoring sons).

Similar to its relationship to mothers' ability beliefs, previous mathematics grade was a strong predictor of fathers' ability beliefs. Fathers' ability beliefs also had a strong direct influence on the child's ability beliefs. As the children in this analysis are a subset of those in the mothers' analysis, similar results were found for the child variables. Previous mathematics grades again had both a direct influence and an indirect influence on children's ability beliefs and their ability beliefs were directly related to current mathematics grades. As in the mothers' analysis, child sex directly affected children's self-perceptions and their current mathematics grades. It is important to note that the coefficient for the path between sex and child beliefs in both models was positive, indicating that boys had higher ability beliefs, but that the coefficient between sex and mathematics grade was negative, indicating that girls actually had higher grades in mathematics.

### Future Expectancies

I used path analyses to estimate the influence of the same independent variables on parents' and children's future expectancies for the child's success in mathematics. The results are depicted in Figure 3 for mothers and in Figure 4 for fathers.

Generally, the models for ability perceptions and future expectancies look very similar. As in the model for ability perceptions, the interaction of sex and stereotypes had a direct influence only on parent expectancies (.18 for mothers and .21 for fathers) and therefore an indirect influence on children's future expectancies (.07 for mothers and .09 for fathers) and their grades (.07 for mothers and .08 for fathers). The

path coefficient for the interaction term indicates that as stereotyping increased, the gap between parents' expectancies for their sons' and daughters' future success in mathematics increased. As in the models for ability beliefs, at the mean level of stereotyping, mothers' future expectancies were significantly different for sons and daughters ( $SD = .28$ ), whereas the difference for fathers was not significant at that level.

Most other paths were similar to those found in the models for ability beliefs and are not further discussed here. A few notable exceptions should be mentioned. The direct effects of year in school on parents' and children's beliefs seen for ability beliefs were not seen for future expectancies. Apparently, parents' and children's expectancies for the child's future success in mathematics are not directly linked to the child's year in school, which reflects both the age of the child and the change in the composition of the sample in the later grades (only students who elected to continue in mathematics are in the 11th-grade sample). Another slight difference between these models is that both mothers' and fathers' future expectancies had a larger direct effect on the current mathematics grade than did their ability perceptions, however, children's future expectancies had less of a direct effect than did their self-perceptions of ability.

### Discussion

The hypotheses tested in this study were based on the conceptual model proposed by Eccles (Parsons) et al. (1983) and tested by Parsons et al. (1982). The analyses presented in this study focused on parents' perceptions of their child's mathematics abilities and their expectations for the child's future success in mathematics, with an emphasis on the impact of gender stereotypes on those beliefs. In addition, this study improved on previous tests of Eccles's social expectancy model by including a performance outcome as well as the attitudinal outcome variables.

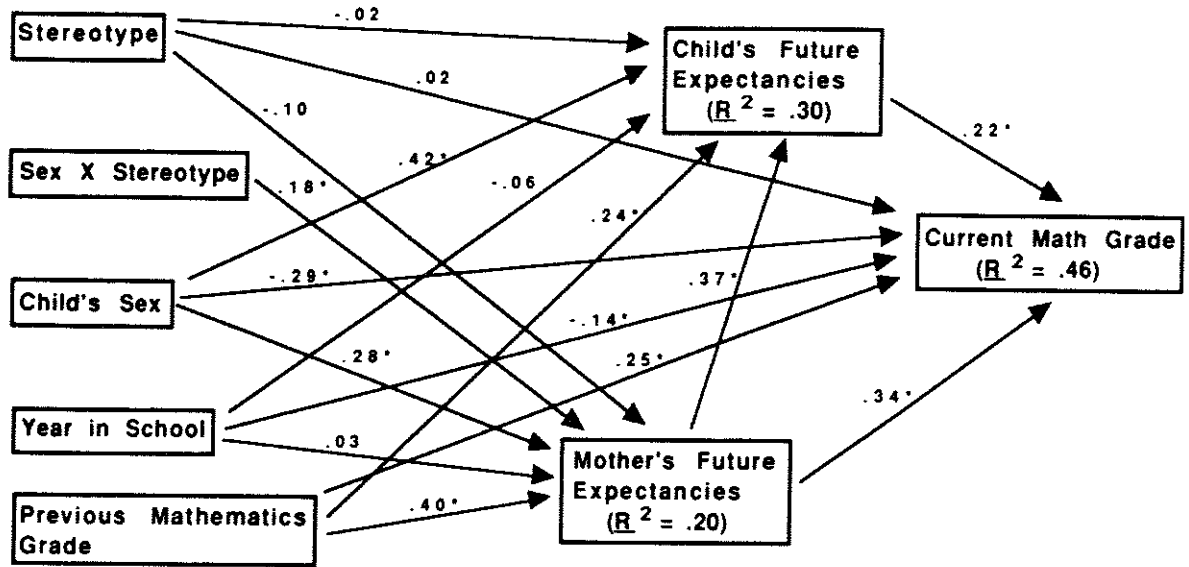


Figure 3. Path analyses of mothers' future expectations for their children's success in mathematics. (\* $p < .05$ .)

Four hypotheses were tested in this study. The first hypothesis, focusing on the gender-specific influence of stereotypes, was clearly supported by the emergence of the Sex  $\times$  Stereotype interaction term as a significant predictor in all four path models. The influence of the child's gender on parents' beliefs about their child's mathematics abilities and future success in mathematics depended on their level of stereotyping; stronger gender stereotypes were related to higher specific beliefs for parents of sons relative to the ability beliefs of parents of daughters. The same was true for future expectations for success in mathematics.

The second hypothesis, concerning the nature of the influence of parents' gender stereotypes on their children, was supported. Parents' gender stereotypes interacted with the sex of their child to have a direct influence on their specific beliefs about the child's mathematical ability and expectancies for the child's future success in mathematics but only an indirect effect on the children's beliefs, which then affected mathematics performance. Because the direct effect of stereotypes was gender specific, the indirect effect of stereotypes on children's perceptions was also dependent on gender. This interpretation is supported by the finding that boys had consis-

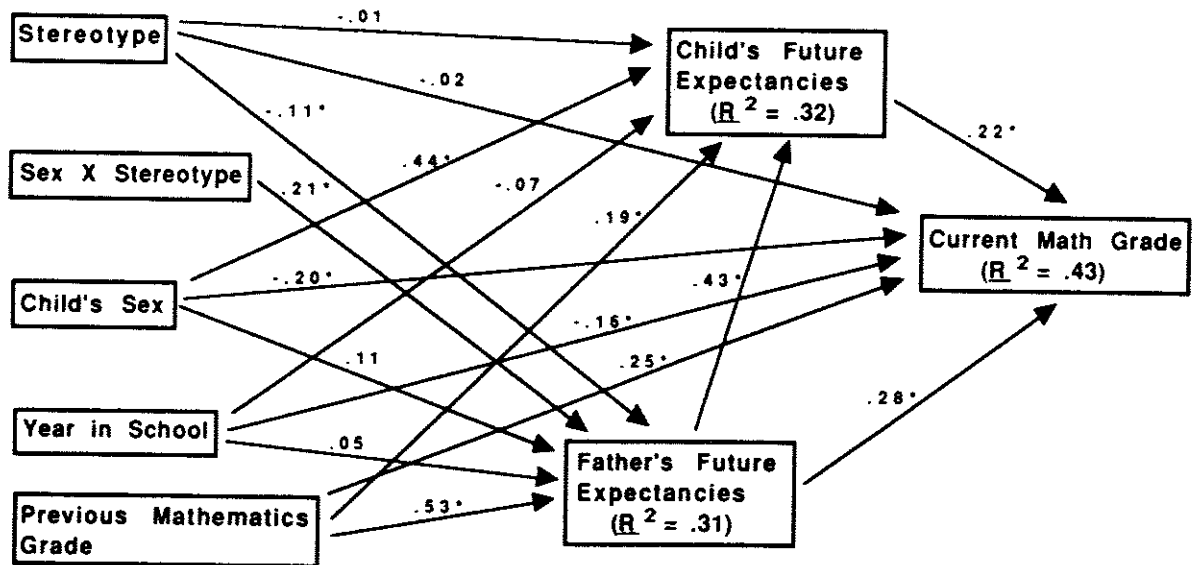


Figure 4. Path analyses of fathers' future expectations for their children's success in mathematics. (\* $p < .05$ .)



tently higher mathematics ability beliefs and future expectancies than did girls, despite the fact that girls had consistently higher grades in mathematics than boys at all grade levels. This incongruity suggests that children are forming their self-perceptions on the basis of more than just their own and their classmates' performance. Gender-differentiated messages from parents and other sources may account, in part, for their non-databased beliefs.

The expected indirect influence of the interaction of stereotypes and sex on children's beliefs that was found suggests that the messages children receive from their parents about gender differences in mathematical ability are subtle rather than blatant, manifesting themselves in parents' specific beliefs about their children. Although the influence of this interaction was indirect and the coefficients were small, the interaction should not be discounted because parents' specific ability beliefs had a strong impact on children's self-perceptions in the findings presented in this study. In fact, parents' specific beliefs had a stronger impact on children's self-perceptions than did children's past performances (similar findings have been documented by Parsons et al., 1982, and Phillips, 1987). Therefore, any information (e.g., gender stereotypes) that alters those specific beliefs has the potential for influencing the child.

One could argue that the stereotypes held by parents are not biased beliefs but accurate reflections of reality. In fact, Campbell (1967) suggested that stereotypes have their basis in "a kernel of truth" about differences between groups. Parents may very well have based their beliefs on a "kernel of truth" found in the differential participation or performance of male and female adults in mathematics in the world around them. However, the parents did not base their beliefs on the mathematics performance of their children because girls outperformed boys in this study. Whether or not the stereotypes were well-founded, this study lends support to previous research indicating that beliefs about a group can affect perceptions about an individual.

The final part of the second hypothesis, the prediction that performance in mathematics would only be indirectly influenced by parents' beliefs, was not upheld. Parents' beliefs had an unexpected direct effect on children's mathematics grades in addition to the expected indirect effect. It is possible that this effect could be explained by the inclusion of other parent beliefs or practices that were not measured in the current study.

The prediction that year in school would be negatively related to parents' and children's specific beliefs, received little support. No significant relationships between year in school and parents' and children's future expectancies were found. Although year in school was directly related to ability perceptions, it was positively related for parents. Parents of older children held more positive beliefs than did parents of younger children; however, this finding may be due to differences in the samples. The younger children represented a more diverse group because children in the lower grades were required to take mathematics. This may mean that, on the average, the younger group had lower abilities than the older group who self-selected into more advanced mathematics classes. Although parents' ability perceptions were more positive for

older children, children's self-perceptions of ability were negatively related to year in school, as hypothesized. This is similar to others' findings of a downward trend in ability perceptions with increasing age (Eccles [Parsons] et al., 1983; Entwisle & Hayduk, 1978; Stipek & Hoffman, 1980). Although this could be interpreted as accuracy on the part of children because mathematics grades often decrease as children get older, the grades typically drop because the courses become more difficult and more selective in junior high and high school and because teachers appear to use more stringent grading practices at higher levels. Parents may interpret this relationship between increasing difficulty and lowered grades differently than do children. Parents may use the fact that their children are still enrolled in mathematics as evidence of their ability. Children may not be aware of the relationship between high ability and continued participation in mathematics, they may not use awareness of the relationship to inform their ability perceptions.

The final hypothesis concerning the relation between previous mathematics grades and parents' and children's beliefs was upheld. The ability perceptions and future expectancies of both parents and children were influenced by previous performance in mathematics. These analyses indicate that, despite the importance of past performance, many other factors play a role in parents' and children's specific beliefs. In addition, the same information may be interpreted differently by parents and children, as suggested in the preceding paragraph.

The research presented in this article suggests the need for more tests of the use of stereotypes and child-specific information in natural settings, with beliefs that are developed from a history of interactions. Although this study highlights the importance of parents' stereotypes, several limitations should be mentioned. The study was limited to a predominantly White, middle-class sample; therefore, the findings and the model may not be generalized to other populations. It is possible that stereotypes have more or less influence on other groups of parents. The study was limited to a focus on the product, or outcome, of parent and child beliefs rather than on the process of parental influence. A closer examination of the ways in which parents convey their beliefs to their children (e.g., time spent, toys and activities purchased, comments made) and how these vary by gender and across grade levels is needed.

On the basis of the findings reported in this article, it seems likely that the ability messages girls and boys receive from their parents depend on the same interaction of information concerning the child's gender and the parents' stereotype that informs parents' specific beliefs. When such messages are conveyed, they may be detrimental to some children. Children of the sex not favored by the stereotype (in this study, female) whose parents hold stereotyped views may receive less favorable messages about their abilities than children of the other sex. This may limit their choices to gender-appropriate domains. The limitations posed by such influences on parents' beliefs are particularly worrisome because they are indirect and parents may be unaware of them. The subtle nature of this effect may allow it to be overlooked, ultimately serving to maintain stereotypes within our culture.

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