Changes in Children's Self and Task Beliefs from Childhood Through Adolescence:
Role of Gender and Parents' Beliefs

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Abstract

This study extends previous research by documenting developmental trends in children's motivation from childhood through adolescence. Hierarchical Linear Modeling was used to describe changes in children's motivation in math and sports from the beginning of elementary school to the end of high school. Six separate growth models were tested: 1) math competence, 2) math interest, 3) math importance, 4) sports competence, 5) sports interest, and 6) sports importance. Differences in growth trajectories by gender and parents' ratings of children's ability were explored. Across all six models, children's self-perceptions declined from first to twelfth grade. Gender differences in self and task beliefs were found. However, the gender gap between boys and girls' competence and value beliefs did not increase with age, as predicted by socialization theories. In addition, parents' ratings of children's ability helped to explain both mean level differences and variations in the rate of change in children's beliefs over time, with the effect being strongest in the sports competence model.
Introduction

The development of children's beliefs has been a subject of great interest in the psychological literature because of the link between these beliefs and motivation and achievement-related outcomes (see Eccles, Wigfield & Schiefele, 1998 for review). Individuals competence-related beliefs (i.e., operationalized as judgments about one's ability to accomplish certain tasks, expectations for one's future performance, and self-efficacy) have received a great deal of research attention. This construct has been linked to effort, persistence, cognitive engagement and achievement, even after controlling for previous performance (Bandura, 1994; Eccles et al., 1983; Eccles et al., 1998, Schunk, 1991).

Motivational researchers have also examined the line between children's task values and achievement-related outcomes, though much less attention has been devoted to this construct. Eccles and her colleagues (Eccles et al., 1983) have developed the most extensive theory of task value. They divide task value into four distinct components: interest, attainment value, utility value/importance, and cost (see Eccles et al., 1983; Wigfield & Eccles, 1992). Researchers have found that task values predict current and future activity choice across a variety of domains (Eccles & Harold, 1991; Feather, 1988; Meece, Wigfield & Eccles, 1990).

A major emphasis in the motivational literature has been on how these constructs develop in children (see Eccles et al., 1998). For example, there has been a great deal of research on age-related changes in children's competence perceptions. Researchers have consistently documented that children's competence beliefs decline across the elementary and middle school years in a variety of domains (Dweck & Elliot, 1983; Eccles, Midgley & Adler, 1989; Marsh, 1989; Stipek & MacIver, 1989; Wigfield et al., 1997). The majority of this work has been based on cross-sectional and short-term longitudinal designs. There is a need for longitudinal research
on the development of children's beliefs that spans larger age ranges. In addition, there may be
differences in the developmental pattern of changes in competence beliefs by domain. Some
researchers have reported declines in children's perceptions of physical abilities (e.g., Marsh,
1989; Marsh, Barnes, Cairns & Tidman, 1984), while others have not found age differences in
perceptions in the upper elementary school years (Eccles, Wigfield, Harold & Blumenfeld,
1993). Research that examines motivational trajectories in multiple domains is needed.

As compared with the work on the development of competence beliefs, there has been
less research on age differences in children's value perceptions. In one such study, Wigfield and
his colleagues (1997) found that mean levels of elementary children's ratings of the importance
of mathematics, reading, music, and sports declined over time, though their interest in sports and
mathematics remained relatively stable. Using data from other samples, Eccles and her
colleagues have documented that children's ratings of the importance of math and interest in
math decline across the transition to junior high school (Eccles, Midgley & Adler, 1984;
Wigfield et al., 1991). However, no prior work has examined longitudinal changes in children's
perceptions of importance and interest from childhood to adolescence. Moreover, from current
research it is not clear whether children's interest and importance follow similar developmental
trajectories over time. Since interest and importance are distinct components of value (see
Eccles, 1983), it is probable that the growth curves for these constructs will differ.

The evidence to date suggests that, on average, children's competence and value beliefs
decline over time. However, the majority of this research has examined mean level changes in
children's motivation. This analytic strategy fails to account for individual differences in
developmental trajectories. For instance, some children's beliefs remain relatively stable over
time, others show the gradual decline that has been documented in the prior literature, and still
other children's ratings of their ability and interest may actually increase over time. An important question is what individual and socialization factors can help to explain differences in individuals' trajectories over time. In this study, we explore how two such factors, gender and parents' ratings of children's ability, can help to account for variations in children's beliefs over time. We examine this question in two separate domains (math and sports).

Traditionally, math and sports have been considered male-typed domains. Therefore, it is important to consider whether boys and girls have different motivation trajectories in these domains over time. In cross-sectional and short-term longitudinal studies, boys rate their ability and expectations for success high than girls in math and sports (Eccles et al., 1993; Marsh & Yeung, 1998; Wigfield et al., 1997). Exactly when these gender differences emerge and how they change over time has received less attention. Scholars have argued that the emergence and changes in gender differences over time are a product of differential socialization experiences (see Eccles, 1987; Maccoby, 1966). According to a socialization perspective, gender differences should start small and get larger with age. For instance, several researchers have suggested that gender differences should decrease over the elementary school years and then increase with the onset of puberty (Hill & Lynch, 1983).

The empirical evidence of gender differences is mixed. In the math domain, Eccles and her colleagues found that gender differences are not evident until the late elementary school years. However, in more recent work, they have found evidence of gender differences as early as first grade (Eccles et al., 1993). Other scholars have documented that gender differences emerge early and remain stable over time (Marsh, 1993; Wigfield et al., 1997). Thus, from the available research it is not clear when these gender differences emerge and whether they become larger over time.
Further, parents' beliefs about their children's ability may help to explain individual differences in motivational development over time. A positive link between parents' expectations and children's motivation and performance has been well established in the literature (e.g., Alexander & Entwisle, 1988; Majoribanks, 1979; Parsons et al., 1982). More recently, scholars have tested the link between parents' beliefs and children's motivation in specific domains. For instance, mothers' ratings of adolescents' ability has been found to be a significant predictor of adolescents' estimates of their ability and interest in math, even after controlling for performance differences (Eccles, 1993; Jacobs, 1992; Jacobs & Eccles, 1992). However, less research has examined the longitudinal effect of parents' ratings of ability on children's motivation at earlier ages. For instance, it is probable that children who receive positive feedback from their parents in the early grades get a psychological boost, which helps them to maintain high motivation over time. Furthermore, although there is an extensive literature on parent socialization in math, the research examining the link between parents' beliefs and children's athletic motivation is limited (Brustad, 1992; Woolger & Power, 1993). In this study, we fill these gaps by examining the effect of mothers' and fathers' ratings of children's ability in elementary school on children's self and task beliefs in math and sports from childhood to adolescence.

We use hierarchical linear modeling techniques to chart changes in children's self and task perceptions in math and sports from the beginning of elementary school to the end of high school. This study expands the literature by using a more sophisticated analytic technique to examine data spanning a larger age range than has been explored in previous research (see also, Jacobs, Hyatt, Eccles, Osgood & Wigfield, under review). Our analysis strategy contrasts with much of the previous research that has relied on path analytic techniques (e.g., Marsh & Yeung,
1998) and repeated measures MANOVA (e.g., Wigfield et al., 1997). Path analytic techniques do not take full advantage of repeated measurements (Bryk & Raudenbush, 1987), while repeated measures ANOVA models are less flexible in dealing with missing data. HLM growth models permit the inclusion of all respondents, even if they do not provide data for the full set of observations. Skinner and colleagues (1998) used a similar analytic strategy to examine longitudinal changes in perceived control during middle childhood and early adolescence.

The prior literature on the development of children's beliefs, gender differences, and parent socialization were used as a guide to develop the following predictions. Children's perceptions of competence, interest, and importance will decline over time; the gender gap in children's beliefs will increase in adolescence because of differential socialization processes and gender-role intensification; and parents' beliefs would be positively related to children's self and task beliefs over time. Thus, when parents have high ratings of children's ability in the domain, we expected children's declines to be less dramatic.

Method

Participants

The present study is part of the Childhood and Beyond Study (CAB), a longitudinal study of the development of children's self-perceptions, task values, and activity choices (Eccles, Wigfield & Blumenfeld, 1984). Children were initially recruited through their school districts; seventy-five percent of children agreed to participate. Children attended 10 elementary schools in four middle class school districts in the suburbs of a large Midwestern city. The final longitudinal sample used in the analyses in this paper include approximately 514 children (the sample size varies slightly across the growth models because of small variations in missing data)\(^1\).
The sample is approximately equally divided by gender (50% male and 50% female). The average family income in the sample in 1990 was $50,000. The sample is primarily European-American (95%), with a small minority population of African-Americans, Native Americans, Asians, and Hispanics. The majority of the families are two-parent intact families\(^2\). Attrition in the sample was due mainly to children moving out of the school districts. Every effort was made to re-locate children each year. In previous analysis of the attrition patterns in this sample, Wigfield and his colleagues (1997) compared the mean scores for children's self and task perceptions in the cross-sectional and longitudinal samples. None of these comparisons were significant at any measurement point. These results suggest that attrition did not affect the results reported in this article.

**Design**

A cohort sequential design was employed (see Figure 1 for outline of data collection). The study began when children were in the first, second, and fourth grade. These three cohorts of students were followed for three subsequent years. After a three-year gap in data collection, these children were followed for three more years. By year 6, these children were in grades nine, ten, and twelve. Thus, the combined cross-sequential sample provides information on children from Grades 1 to Grade 12.

**Measures**

**Child Measures**

Each spring, children completed questionnaires measuring their competence and value beliefs in math and sports, as well as other constructs. These items were modified from an earlier questionnaires developed by Eccles and her colleagues to assess children and adolescents beliefs about mathematics, English, sports, and social activities. These items have strong
psychometric properties (see in Eccles, Adler & Meece, 1984; Eccles & Wigfield, 1995; Eccles et al., 1993). The current study included children younger than participants in previous studies, and therefore great care was taken to ensure that children understood the constructs being assessed. For instance, the items were pilot tested on 100 children, and illustrations were added to the scales to foster children's understanding of how to use them (see Eccles et al., 1993 for more detailed discussion).

Scale construction

Based on factor analytic and theoretical considerations (see Eccles et al., 1993 for more details), scales were developed for the competence beliefs and subjective value constructs in math and sports at each measurement point. The reliabilities for the competence beliefs scales ranged from .76 to .93. For subjective task values, separate scales were created for interest and importance in each domain. For interest, the reliabilities ranged from .73 to .95 in math and sports. For importance, the internal consistency was low in Year 1 (.36 for math and .58 for sports), but ranged from .61 to .92 at the other waves of data collection. The lack of internal consistency at the earlier ages may have occurred because young children have a more difficult time determining which activities are useful and/or important to them.

A concern is that the lower reliability in the task values scales would result in less difference between students at the earlier waves, which would consequently inflate differences at later waves. Because of this potential problem, the interest and importance growth models were run using information from third to twelfth grades, excluding the measurements points with lower reliability. In contrast, the competence models were run using all six waves of data, resulting in information from first to twelfth grade.

The specific items used are presented in the Appendix.
Parent measures

During the first three years mothers and fathers were given self-administered questionnaires assessing among other things, their perceptions of their children’s abilities in math and sports\(^4\). The items were as follows: How good is your child in [domain]? (1=not at all good, 7=very good); How well do you think your child will do in [domain] next year? (1=not at all well, 7=very well); In comparison to other children, how difficult is [domain] for child? (1=very difficult, 7=very easy); Compared to other children, how much innate ability or talent does this child have in [domain]? (1=much less, 7=much more); In comparison to other children, how would you evaluate this child’s performance in math? [1=much worse, 7=much less]. These scales have strong psychometric properties (alpha=.93 to .95).

Control

Differences in children’s math and sports ability are one factor that may help to explain individual differences in both the level and slope associated with children’s competence and value beliefs. In order to get an independent estimate of the relation of gender and parents expectations, we included measures of children’s aptitude in all analyses. Teachers’ ratings of children’s math ability were used as the control for children’s math ability\(^5\). Each year of the study, each teacher rated the ability of each child in math, using the following questions:

Compared to other children, how much innate ability or talent does this child have in math? (1=much less than other children, 7=much more than other children) and How well do you expect this child to do next year in math (1=very poorly, and 7=very well)? These items had strong psychometric properties (alphas = .83-.89). Teachers ratings of children’s competence have good concurrent and long-term predictive validity in terms of children’s performance on cognitive tests and grades in school (e.g., Stevenson, Parker, Wilkinson, Hegion & Fish, 1976).
Children were also given the Bruininks-Oseretsky Test for Motor Proficiency (1978) to estimate their sports aptitude at the first measurement point (kindergarten, first, and third grade). Children were tested on their large motor skills: (1) running, (2) jumping and clapping, (3) broad jumping, (4) catching a ball, and (5) throwing a ball, and their fine motor skills: (1) tapping their feet, (2) drawing lines, and (3) copying circles. This test has been widely used to assess the proficiency of individuals' motor performance (Hattie & Edwards, 1987). 6

Analysis Plans

Hierarchical Linear Modeling (Bryk & Raudenbush, 1992) was used to model changes in children's self and task perceptions in math and sports over time. Six separate growth models were estimated: (1) math competence, (2) math interest, (3) math importance, (4) sports competence, (5) sports interest, and (6) sports importance. HLM is an appropriate technique for studying individual change because repeated measures can be considered as nested within individuals and can be represented as a two level hierarchical model. At Level-1, each person's development is modeled as a unique growth trajectory. At Level-2 the growth parameters of these trajectories become the outcome variables, which are then modeled as a function of some person-level characteristics (Bryk & Raudenbush, 1992).

HLM provides a powerful and flexible framework for plotting individual change over time in a cohort sequential design. Both the number and the spacing of the observations may vary (Bryk & Raudenbush, 1992). In addition, HLM allows for random missing observations at level 1, as it occurs in CAB data by design.

Testing for grade by cohort interactions

Because of the multiple cohort nature of this design, it was first necessary to test for grade by cohort interactions. This is necessary in any accelerated longitudinal design in order to
rule out the possibility of attributing differential change within cohorts as developmental effects (Raudenbush & Chan, 1993; Miyazaki & Raudenbush, 1999). If there are no differences by cohort, it is possible to formulate a single common developmental curve across all cohorts. Following the suggestion in Miyazaki & Raudenbush (1999) to test the plausibility of a single underlying developmental trajectory, a full cohort based hierarchical model was formulated. At level-1, each person's development was conceived as a polynomial function of grade and random error. At level-2 these growth parameters were allowed to vary as a function of cohort. In the second step, we formulated a competing reduced model that was based on the assumption that all cohorts followed a single underlying age trajectory. The likelihood ratio test was used to test the reduced model against the full model. This is possible because the reduced model is a special case of the linear model. A similar strategy was used to test the plausibility of a single underlying trajectory across all of the growth models.

Comparing the full and reduced models revealed a significant change in model deviance for all growth models, except math interest. This finding indicates that the model attributing differences to cohort membership fit the data better than the model assuming that all cohorts followed a single underlying age trajectory. Therefore, in order aggregate data across waves and assume a common underlying model, it was necessary to control for cohort membership. Two separate dummies representing cohort membership were included in all analyses. The first dummy variable compares the youngest cohort to the two oldest cohorts; the second dummy variable compares the two oldest cohorts.

The level-1 model

At level 1, the observed status at time \( t \) for individual \( i \) is a function of a growth trajectory and random error (Bryk & Raudenbush, 1992).
\[ Y_{ti} = \pi_{0i} + \pi_{1i}(a_{ti} - a_{0i}) + \pi_{2i}(a_{ti} - a_{0i})^2 + \epsilon_{ti}. \]

\( Y_{ti} \) is the ratings of self or task perceptions for the person \( i \) at time \( t \).

\( (a_{ti} - a_{0i}) \) represents the linear component of the growth curve

\( (a_{ti} - a_{0i})^2 \) represents the quadratic component of the growth curve

\( \epsilon_{ti} \) is independent and normally distributed with a mean of zero and a constant variance.

For purposes of these analyses, the intercept term \( (\pi_{0i}) \) was centered at the midpoint of the data. Thus, we chose a location where an otherwise meaningless parameter can be interpreted in relation to a relevant age in the study (Bryk & Raudenbush, 1992). The coefficients \( \pi_{1i} \) and \( \pi_{2i} \) summarize change over time; with \( \pi_{1i} \) equal to linear rate of change, and \( \pi_{2i} \) expressing nonlinear curvature in the trajectory over time.

For all six models, likelihood tests were used to examine whether the addition of a quadratic term \( (\pi_{2i}) \) would significantly improve the model fit. A linear function best fit the data for math competence and sports interest growth models. In the other four growth models, the quadratic term was significant and therefore was included in the analyses.

The level-2 model

We tested whether the level-1 model growth trajectories varied across individuals. A level-2 model was formulated to account for variation in both the intercept and the linear term. The constant (intercept) and slope (linear) term serve as outcomes measures in the level-2 equations. The explanatory variables for the level-2 equation are variables that do not change over time.

A similar set of predictors was included in all six of the growth models, which allowed for the comparison of effects across outcomes. In all models, gender and parents’ beliefs were included as predictors of both the intercept and slope\(^9\). Separate growth models were run using
mothers and fathers ratings of children’s ability. Since the results were similar, only the findings for mothers are presented in this article.¹⁰

Children’s aptitude was included as a control in the growth models to insure that our findings concerning differences in the pattern of change are not the function of initial differences in ability. Finally, dummies representing cohort membership were included as controls for both the intercept and the slope. Only those dummies that were significant were included in the final models. Though we present the coefficients for aptitude and cohort status in our tables, we will not discuss them in our presentation of the results.

Results

The HLM results for the six growth models are presented in Tables 1-6. In addition, we plotted the curves derived from the HLM analyses by gender and mothers’ perceptions of ability. The growth curve models are outlined in Figures 2-7. The trajectories for boys and girls were plotted separately for the math and sports competence models.¹¹ In addition, we plotted the trajectories for children who had mothers with high perceptions of their competence (1 standard deviation above the mean) and children who had mothers with low perceptions of their competence (1 standard deviation below the mean) for the math and sports competence models.¹² Finally, the importance and interest models were plotted on the same graph to illustrate differences in the developmental trajectories for these constructs.¹³

Competence Models

Math

The results of the growth model for math competence are presented in Table 1. There was a significant decline in children’s perceptions of their math competencies from first to
twelfth grade. Both gender and mothers' ratings of children's math ability accounted for variance in the intercept term. Moreover, gender was a predictor of changes in children's competencies over time. Males believed that they were more competent in math at the beginning of elementary school than girls (see Figure 2). However, girls' perceptions of their math ability declined at a slower rate than boys. We had hypothesized that the gender gap would get larger in the later grades, but instead we found that the gender gap got smaller over time.

The growth models for math competencies by mothers' ratings of ability are presented in Figure 3. Mothers' beliefs were a significant predictor of the intercept and a marginally significant predictor of the slope. Children who had mothers who held high perceptions of their math abilities (1 standard deviation above the mean) had higher ratings of their ability in the early year than children with mothers who held low perceptions of their math abilities (1 standard deviation below the mean). After controlling for aptitude differences, this gap increased slightly over time.

Sports

As shown in Figures 4 and 5, sports competence beliefs are highest in the first grade. The decline in beliefs actually got larger (i.e. accelerated) over time, as indicated by the negative linear term in conjunction with the negative quadratic function. This accelerated decline began during middle school. Prior research led us to expect that males would have higher sports competence beliefs than females. As can be seen in Figure 4, males did report higher beliefs at first grade than did females. However, we did not find gender differences in the rate of change over time. Thus, the gap between males and females remained the same over time, instead of increasing as we had hypothesized.
The growth models by mothers' perceptions of ability are presented in Figure 5. Children who have mothers with high perceptions of their sports ability (1 standard deviation above the mean) had higher perceptions of their competence in the early years than children who have mothers with low perceptions of their sports ability (1 standard deviation below the mean). Further, mothers' ratings of children's ability helped to explain variations in the rate of change. Children with mothers who had high ratings of their sports competence had much less dramatic declines over time, after controlling for aptitude differences.

Task Value Models

Math

The results of the HLM analyses for children's perceptions of math interest are presented in Table 3. Overall, participants reported a decline in their math interest over time. As shown in Figure 6, this decline in math interest was largest in the early grades and levels off at the later grades. Although there was significant variation between individuals in math interest in both the intercept and linear terms, gender did not account for this variation. Thus, both boys and girls math interest trajectories were similar. In addition, mothers' ratings of children's ability was not a predictor of either the intercept or slope term. These findings indicate that other factors are accounting for individual differences in the mean level and changes in math interest over time.

Further, participants reported a decline in the importance of mathematics from first through twelfth grade, though the pattern was different than the growth curve for interest. In addition to a negative linear term, there was a positive quadratic function, which indicated a deceleration in the rate of decline over time. The plot of the growth curve shows a slight increase in children's self-reports of math importance at the beginning of tenth grade (see Figure
6. Similar to the findings for math interest, gender and mothers’ ratings of ability were not significant predictors of either the intercept or slope (see Table 4).

**Sports**

The results of the growth curve analysis for children’s interest in sports are outlined in Table 5. Overall there was a slight decline in children’s perceptions of sports interest from first to twelfth grade for the whole sample (see Figure 7). As hypothesized, males started out with higher ratings of how much they liked sports than females. However, the interest gap between males and females remained the same over time, rather than increasing as we had predicted. In addition, mothers’ ratings of children’s ability was a significant predictor of the intercept but was not related to changes in children’s interest over time.

Table 6 presents the results for the growth curve analysis for children’s perceptions of sports importance. Overall, there was a decrease in children’s perceptions of the importance of sports over time. The decline in task beliefs got larger over time, as indicated by the negative linear term in conjunction with the negative quadratic function. As shown in Figure 7, students begin to perceive sports as less important to them at the end of elementary school, this decline continues through high school.

Further, girls report that athletics is less useful than boys. However, the gender gap in perceptions of the importance of sports does not increase over time as hypothesized. In addition, mothers’ ratings of ability were a significant predictor of the intercept term and a marginally significant predictor of the slope. Thus, children with mothers who believed they had high athletic ability reported than sports was more important in their lives than children whose mothers had less favorable beliefs; this gap gets slightly larger over time.

**Discussion**
This study had several purposes: (1) document changes in children's competence, perceptions of importance, and interest from childhood through adolescence in two separate domains, (2) describe gender differences in trajectories across these two domains, and (3) examine the effect of parents' beliefs on children's motivational trajectories in math and sports over time. This study extends the literature by describing changes in children's competence and value beliefs in math and sports from the early grades throughout the high school years.

All six HLM growth models demonstrated declines in children's self and task perceptions from the beginning of elementary school to the end of high school. These findings support previous research over shorter periods of time and declines at the point of transition to junior high or middle school (Eccles et al., 1993; Marsh, 1989). The results of this study indicate that the downward trajectories continue beyond the elementary school years into the middle and high school years. It is important to create school and activity contexts where children can feel good about their ability, can experience some enjoyment, and can see the potential value of the activity. Unfortunately, schools are often not structured to support children's competencies and interests (Newman, 1992).

In addition to the linear effects, there were some interesting changes in the developmental pattern. For example, children's perceptions of the importance of mathematics increased slightly at tenth grade. This may reflect children's recognition of the increasing importance of mathematics in high school for future educational and occupational pursuits, which is currently being stressed in many high schools. Mathematics has been termed a critical filter (Sells, 1980) that can help determine individual's future educational and occupational options.

The increase in perceptions of the importance of mathematics occurs at the same time that children's interest in math continues to decline. This finding supports Eccles' contention
that interest and importance are distinct components of value and that developmental changes in these constructs should not necessarily follow the same pattern (see Eccles et al., 1983). Interestingly, we documented that children perceive that math is important to their future, but at the same time they do not like participating in this activity. This pattern was reversed for sports. We found that children continue to report relatively high interest in sports, despite seeing it as increasingly less useful in their lives. One possible explanation for the different developmental patterns in math and sports is that declines in interest and importance are the result of differences in the nature of academic and nonacademic activities.

Another interesting finding is the accelerated rate of decline in children's perceptions of athletic competence during middle school. Developmental changes in early adolescence may help to explain the decline. The onset of puberty results in physical changes that can alter an individual's performance in athletics. In addition, as early adolescents spend more time with their friends and in other activities, it is likely they will have less time to develop their athletic skills. Another possible explanation lies in the changes in the context of sports teams in middle school. During elementary school, children play on a variety of sports teams (e.g., Branta, Painter & Kiger, 1987; Gould, 1987). In contrast, in middle school sports teams become more selective and competitive. This means that more children are competing for fewer slots, and individuals who had participated in the younger grades may no longer be chosen. Finally, the increased competition should provide children more opportunities to engage in social comparison, which in turn may cause them to lower their ratings of their ability.

The second purpose of this study was to document gender differences in motivational trajectories. The findings regarding gender differences in rates of change in math and sports beliefs over time were surprising. Gender-intensification (e.g., Hill & Lynch, 1983) and gender
socialization theories (e.g., Eccles, 1987; Maccoby, 1966) led us to hypothesize that the gender gap would increase in adolescence. However, the results of the growth longitudinal data presented here do not indicate an increase in the gender gap at this period. In fact, we found that the gender gap either decreases (math competence) or does not change (sports competence, sports interest, and sports importance). Instead, the gender gap was largest in the early grades. These findings suggest that boys and girls are entering school with differing beliefs and interests, but that their experiences in school and out of school help to lessen these motivational differences.

There are two possible explanations for the findings regarding gender differences in the rate of change. First, boys may be overestimating their ratings of their ability in the early years and calibrate these beliefs over time. Girls are more mature than boys at the beginning of school, and consequently may have already begun a shift to a more realistic self-appraisal earlier by first grade (see Parsons & Ruble, 1977). Second, this finding may reflect changes in socialization over the past decade. There have been several interventions aimed at increasing girls motivation in math, science, and sports over the past decade (Clevell et al., 1992). These results suggest that these changes are having a positive effect on girls. Moreover, Title 9 has increased the number of opportunities for girls to participate in athletic activities. The results for the sports growth models may reflect greater opportunities and changing cultural views about gender and athletics.

Further, the lack of gender differences in children’s perceptions of math interest and importance in this sample was somewhat surprising. Previous research has documented that girls express less interest in math and have lower perceptions of the usefulness of math than do boys (e.g., Brush, 1980; Eccles, 1984). However, the absence of gender differences does not mean
that girls have high value for math. Unfortunately, both boys and girls in this sample exhibited large declines in their perceptions of math interest from elementary school to high school. This decline is troubling because of the strong relation between perceptions of value and future educational and occupational plans (Armstrong, 1985; Eccles, Adler & Meece, 1984; Updegraaff et al., 1996).

An interesting question for future research is what factors explain intra-individual and inter-individual differences in interest. The hierarchical linear models in math and sports highlight an interesting intra-individual difference. Children self-reported sports interest was much higher than their self-reported interest in mathematics. Why do children report higher interest in sports than they report in math? How does the context of these domains help to explain these differences? There is some evidence that children lose interest in mathematics because of how it is taught in school (Eccles, 1989). An important area of future work is to examine out of school contexts to better understand why children report higher interest in sports activities than they report for school subjects. Such information might be used to create school contexts that better match children’s interests.

Finally, parents’ beliefs in elementary were positively related to mean differences in math competence, sports competence, sports interest, and sports importance, as well as differences in the rate of change in the sports competence model. In both math and sports, children appear to be incorporating their parents’ evaluations into their own self-judgments about their competencies and interests during these early school years. Since children’s aptitude was controlled for in analyses, these effects are independent of actual ability differences.

Interestingly, parents’ beliefs were more predictive in the sports domain than in the math domain. This finding highlights the important role that parents play in socializing children’s
athletic motivation, an understudied area of research (Brustad, 1992). The larger effect of parents in the sports domain may reflect differences in parents' level of involvement in math and sports. Eccles and her colleagues have documented that parents spend more time doing sports with their kids. In contrast, they report spending almost no time on math activities (Eccles et al., in preparation). As a consequence, there is more of an opportunity for parents to influence their children's motivation in sports than in math.

These results indicate that parents do give children a psychological boost in the sports domain. When parents have high perceptions of their children's athletic abilities in elementary school, children feel better about their competencies which may in turn influence how they approach future sports situations. On the other hand, if parents give children negative feedback about their competencies in athletics, children lower their ratings of their ability. This may in turn color how they interpret future experiences in athletics.

The results of this study should be interpreted in light of the following limitations. First, this sample is drawn primarily from middle class European-American families who have substantial access to opportunities and resources. There is a need for future research to examine whether similar declines hold in more diverse samples. Second, we used teachers' ratings as our measure of children's mathematics aptitude. Although it is probable that teachers can provide biased estimates, overall the evidence indicates that teachers are good raters of children's ability (Jussim, Eccles, & Madon, 1996). Nonetheless, in future work it will be important to include other measures of mathematic ability. Finally, HLM assumes that level-2 variables do not change over time. It is possible that changes in parents' beliefs may influence children's motivation over time. In future research, it will be important to test whether there is differences
in trajectories for parents who hold stable beliefs over time as compared to parents whose expectations change over time.

In conclusion, the results of this study illustrate declines in children's motivational beliefs from first to twelfth grade. These results extend the extent literature on the development of children's competence and values beliefs, as well as providing new information on how gender and parents' beliefs influence children's motivation over time.
References


Footnotes

1 The sample for this analysis includes all children who have corresponding information collected from their parents.

2 At the third measurement point (children in third, fourth, and sixth grade), 90% of the families were two parent intact families.

3 The results of the importance and interest growth models from 3rd to 12th grade were similar to the results when the growth models were run from 1st to 12th grade. This result indicates that it is appropriate to project these results backward to the first grade.

4 The first wave of information collected from mothers and fathers were used in analyses.

5 Because of missing information from teachers at some measurement points, we used all available information collected from teachers during the first three waves of data collection to create this measure. We felt this was an appropriate analytic technique were teachers beliefs were highly stable over time.

6 Scores on this test provide an indicator of aptitude differences. However, since children were given this test at the beginning of elementary school, it is not possible to know how much these differences are a function of socialization in the first few years of life. In addition, while this is a good indicator of children's motor development in the early grades it is not clear from the available research whether this is a valid measure of motor skills in the later grades.

7 For the full cohort based model, student grade was centered around the median for all three cohorts.

8 The linear component was centered around the middle of sixth grade for the competence models and the middle of seventh grade for the task value models.
Gender-intensification theories led us to expect gender differences in the rate of acceleration. However, gender was not a significant predictor of the quadratic term in any of the growth models. Therefore, we fixed the quadratic term and treated it as constant across individuals to improve the efficacy of the maximum likelihood algorithm.

We created an interaction term for mothers' beliefs by gender and tested whether it was a significant predictor of both the slope and the intercept. For all models, the interaction term was not significant and therefore was dropped from subsequent models.

Each of the graphs for boys and girls, control for children's aptitude and mothers' beliefs. Because we used grand mean centering, the HLM growth curves represent boys and girls of average ability with mothers who have average ratings of ability.

Each of these graphs control for children's aptitude and gender.

Each of these graphs control for children's aptitude and gender.
Appendix: Child Items for Math (comparable items were asked in sports)

Child Math Competence (5 items)
1) How good at math are you? (1=not at all good, 7=very good)
2) If you were to list all of the students in your class from worst to best in math, where would you put yourself? (1=one of the worst, 7=one of the best)
3) Compared to most of your other school subjects, how good are you at math? (1=a lot worse, 7=a lot better)
4) How well do you expect to do in math this year? (1=not at all well, 7=very well)
5) How good would you be at learning something new in math? (1=not at all good, 7=very good)

Child Math Importance
1) In general, how useful is what you learn in math? (1=not at all useful, 7=very useful)
2) For me being good at math is? (1=not at all important, 7=very important)
3) Compared to most of your other activities, how useful is what you learn in math? (1=not at useful, 7=a lot more useful)
4) Compared to most of your other activities, how important is it you to be good at math? (1=not at all important, 7=a lot more important)

Child Math Interest
1) In general, I find working on math activities? (1=very boring, 7=very interesting)
2) How much do you like doing math? (1= a little, 7=a lot)
3) Compared to most of your other activities, how much do you like math? (1=not as much, 7=a lot more)
Figure Captions

Figure 1: Design Childhood and Beyond Study

Figure 2: Changes in children's math competence beliefs by gender

Figure 3: Changes in children's math competence beliefs by mothers' ratings of ability

Figure 4: Changes in children's sport competence beliefs by gender

Figure 5: Changes in children's sport competence beliefs by mothers' ratings of ability

Figure 6: Changes in children's perceptions of math interest and math importance

Figure 7: Changes in children's perceptions of sports interest and sports importance