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Children's Achievement-Related Beliefs: A Longitudinal Analysis

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It is well-known that achievement motivation and achievement-related beliefs play an important role in achievement behaviors such as persistence, choice and performance (Uguroglu & Walberg, 1979). Important achievement-related beliefs include self-concept of ability, achievement expectations, and achievement values. There has been increasing interest in developing models which specify how these beliefs relate to one another and to achievement behavior.

Parsons et al. (1983) developed one such model to predict children's course enrollment decisions and performance in school. The model specifies links between cultural factors, socialization history, achievement beliefs and achievement behavior (see Figure 1). The model is based on traditional expectancy x value theory (e.g., Crandall, 1969), in that children's achievement behavior is said to be determined by the values they place on different tasks as well as on their expectations for success on the task. It is also based on the more recent cognitive approaches to achievement motivation (e.g., Weiner, 1979), since it is assumed that children's interpretations of their achievement outcomes rather than objective success or failure experiences per se determine achievement motivation and behavior. As can be seen in Figure 1, it is proposed that children's self-concepts of ability and achievement goals are determined by children's interpretation of achievement outcomes and by important socialization agents. Children's goals and task beliefs determine task values and expectations, which in turn influence achievement behavior.

The purpose of this paper is to report longitudinal relationships among certain constructs of this model. The data reported here were collected in a longitudinal study which assessed children's beliefs about mathematics, in an attempt to understand why some children continue to take math and others do not. Students completed questionnaires assessing a variety of their achievement-related perceptions, including self-concept of ability and perceived performance in math, expectancies for success in current and future math courses, perceived difficulty and effort needed to do well in math courses, perceived value, interest and importance of mathematics, perceptions of parents' expectations for children's math performance, and intentions to take more math. The questionnaire was carefully designed, and has been tested extensively on large samples of children (Parsons et al., 1980). Each construct is assessed by several items on the questionnaire. The questionnaires were administered to the students twice, once in each of the two years of the study.

Students in the sample were in grades five through twelve, with an approximately equal number of students at each grade. In the analyses reported here, only those students for whom there is complete data at each time of testing were included (N = 498). Longitudinal relationships were assessed using cross-lagged panel correlation

(Campbell, 1963; Kenny, 1975). This procedure tests differences between the correlations of two variables measured at two different times (rx1y2 and rx2y1). If certain assumptions are met, significant differences between the correlations indicate that one of the variables has causal predominance (Kenny, 1975). In the analyses reported here, special care was taken to meet the assumptions, since violating them makes interpretation of the cross-lagged differences problematic (Kenny, 1975; Rogosa, 1980). These assumptions concern the reliability of the measures at the different time points, and whether the causal relationships between two constructs is the same at two different time points (called stationarity). Kenny's program PANAL, used in these analyses, gives the reliability of the measures and provides a test for stationarity. Both of these were considered when interpreting the results to be reported.

The set of variables included in the analyses are listed in Table 1. Four different panel analyses were conducted, one which included the entire sample, one including fifth and sixth graders at year 1, one including seventh through ninth graders at year 1, and one including 10th through 12th graders at year 1. The cross-lagged differences that were significant in each analysis are summarized in Tables 2 through 5.

In the analysis of the overall sample (see Table 2), task difficulty was a strong predictor, in that there were six relationships between task difficulty and other variables (current expectancies in math, interest in math, perceptions of parents' expectancies for children, future expectancies, task concept, and value concept) which produced significant cross-lagged differences, and in each case task difficulty was causally predominant. Most of these relationships were in the .3 to .4 range. Perceived performance in math was another important variable, predicting children's math ability concept, their grades in math, their math interest, math value, and math expectancies. These correlations were in the .4 to .5 range. Perceived performance thus was a stronger predictor variable than self-concept of math ability. Another interesting finding in this analysis was that children's perception of their parents' expectations about them were predicted by several of children's own beliefs. This finding runs counter to the relationship predicted in Parsons et al.'s model (see Figure 1). However, in an earlier test of their model, Parsons et al. (1983) report a similar finding concerning the cross-lagged relationships between children's own beliefs and their perceptions of their parents beliefs about them.

The results for the fifth and sixth grade children, shown in Table 3, generally are weaker than those for the whole sample. The responses of these children also tended to be somewhat less reliable, and the tests for stationarity indicated that some of the causal relationships were changing over time. Thus the results of this analysis should be interpreted with caution (see Kenny, 1975). In this analysis, variables showing evidence of causal predominance were the value-related variables, such as importance of math, value of math, and the cost of doing well in math. Difficulty of math was not as strong a factor in this analysis as in the analysis of the whole sample. So for the youngest group in the study, beliefs about how important math is to them were the strongest predictors. Generaly, these relationships were weaker in this analysis than in the overall analysis.

For the seventh to ninth grade group, task difficulty predicted seven other variables: future expectancies, cost of doing well in math, math interest and importance of math, perceptions of parents'expectations for children, math value concept, and intention to take more math. Most of these relationships were in the .3 to .4 range, and most also were in the direction predicted by Parsons et al.'s model. Unlike the analysis of the fifth and sixth grade children, task value was not as strong a predictor variable. The perceived effort to do well in math predicted several other variables, but most of these relationships were weak. Usefulness of math predicted math interest and math value. Self-concept of ability and perceived performance in math were not strong predictor variables. As in the overall analysis, children's own beliefs predicted their perceptions of their parents' beliefs about them, rather than the reverse.

For the 10th through 12th graders, the self-concept of ability, perceived performance and expectation variables were the strongest predictors of other beliefs concerning math, including intentions to take more mathematics. Most of these relationships were in the .4 to .5 range, which is stronger than many of the relationships in the other analyses. Difficulty of current math was again predictive of other beliefs, but to a lesser extent than in the analysis of the seventh to ninth grade group. In this analysis the relationship between children's own beliefs and their perceptions of their parents' beliefs did not emerge as significant.

These results provide support for many of the links in Parsons et al.'s model, with relationships between several important achievement beliefs and intention to take more math significant. The strongest predictor variables among children's beliefs were perceptions of math difficulty, perceived performance in math, self-concept of math ability, and certain of the values-related variables. However, there were some age differences in which variables were the strongest predictors. Among fifth and sixth graders, values-related variables, such as importance of math and cost of doing well in math, were the strongest predictors. In the seventh to ninth grade group, task difficulty was the strongest predictor, and usefulness of math a relatively strong one. Math ability concept and perceived performance in math were not as strong of predictors. Among the tenth through twelfth grade group, the self-concept of ability, perceived performance and expectancy cluster were the strongest predictor variables. These changes are quite interesting, and could reflect the fact that children's ability concepts become more stable as children get older. Also, as math classes become more difficult in junior high and especially high school, perhaps only children who think they are good at math believe they have a chance of doing well. In elementary school, liking or valuing math may be enough, and so ability-related beliefs take precedence.

The major links in the model not given support concerned children's perceptions of their socializers' expectations and attitudes; those variables did not causally influence any of the other variables, and instead were predicted by children's own beliefs. Perhaps direct assessment of parents' expectations rather than children's perceptions would yield stronger results. Another possibility is that parents' expectations may have a stronger influence on younger children's achievement-related perceptions, and so the relationships between perceived parental attitudes and children's perceptions were relatively low because of the age range of children included in this study.

Generally, though, the analyses reported here provide support for many of the causal links in the model. We are continuing to study these relationships using more sophisticated causal modeling techniques, in order to better test the model presented in Figure 1.

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VARIABLES USED IN THE CROSS-LAGGED PANAL ANALYSES

1. Grade in current math course
2. Perceived difficulty of current math course
3. Expectancy for current math course
4. Expectancy for future math course (s)
5. Self-concept of math ability
6. Perceived performance in math
7. Required effort to do well in math
8. Actual effort in math
9. Cost of doing well in math
10. Interest in math
11. Importance of math
12. Perception of parents' expectation for child's math performance
13. Usefulness of math
14. Task concept of math (combination of difficulty and effort scales)
15. Value of math (combination of interest, importance, usefulness scales)
16. Intention to take more math

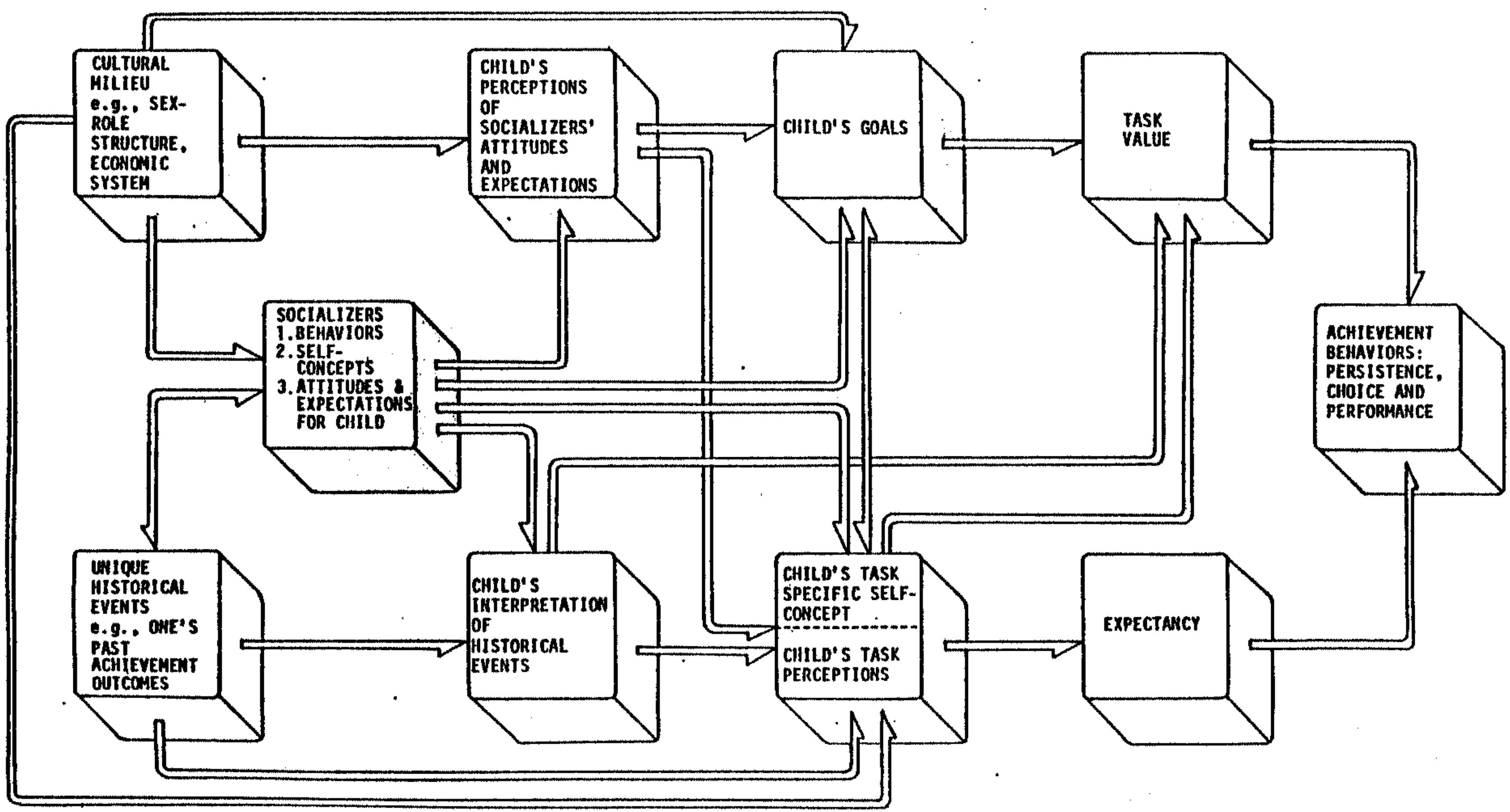
CULTURAL MILIEU e.g., SEX-ROLE STRUCTURE, ECONOMIC SYSTEM
CHILD'S PERCEPTIONS OF SOCIALIZERS' ATTITUDES AND EXPECTATIONS
CHILD'S GOALS
TASK VALUE
SOCIALIZERS 1.BEHAVIORS 2.SELF-CONCEPTS 3.ATTITUDES & EXPECTATIONS FOR CHILD
ACHIEVEMENT BEHAVIORS: PERSISTENCE, CHOICE AND PERFORMANCE
UNIQUE HISTORICAL EVENTS e.g., ONE'S PAST ACHIEVEMENT OUTCOMES
CHILD'S INTERPRETATION OF HISTORICAL EVENTS
CHILD'S TASK SPECIFIC SELF-CONCEPT
CHILD'S TASK PERCEPTIONS
EXPECTANCY

Table 1

Causal Effects From Cross-Lagged Panal Analyses[a]

(Whole Sample, N = 610)

Year One		Year Two
GRADE IN MATH	(+)	FUTURE EXPECTANCIES IN MATH
DIFFICULTY OF CURRENT MATH COURSE	(-)	
CURRENT MATH EXPECTANCIES	(+)	
SELF-CONCEPT OF MATH ABILITY	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	
REQUIRED EFFORT IN MATH	(-)	
COST OF DOING WELL IN MATH	(-)	
INTEREST IN MATH	(+)	
VALUE OF MATH	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	INTEREST IN MATH
CURRENT MATH EXPECTANCIES	(+)	
SELF-CONCEPT OF MATH ABILITY	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	
INTENTION TO TAKE MORE MATH	(+)	
GRADE IN MATH	(+)	INTENTION TO TAKE MORE MATH
DIFFICULTY OF CURRENT MATH COURSE	(-)	
CURRENT MATH EXPECTANCIES	(+)	
REQUIRED EFFORT IN MATH	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	CHILD'S PERCEPTIONS OF PARENTS' EXPECTATIONS FOR HIS/HER MATH PERFORMANCE
SELF-CONCEPT OF MATH ABILITY	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	
REQUIRED EFFORT IN MATH	(+)	
TASK CONCEPT OF MATH	(-)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	VALUE OF MATH
PERCEIVED PERFORMANCE IN MATH	(+)	
CURRENT MATH EXPECTANCIES	(-)	EFFORT IN MATH
REQUIRED EFFORT IN MATH	(+)	
TASK CONCEPT OF MATH	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	SELF-CONCEPT OF MATH ABILITY
PERCEIVED PERFORMANCE IN MATH	(+)	GRADE IN MATH
PERCEIVED PERFORMANCE IN MATH	(-)	COST OF DOING WELL

[a]Effects lead to increase in Year Two variable where there is a plus. Negative sign indicates an effect leading to a decrease in Year Two variables.

Table 2

Causal Effects From Cross-Lagged Panal Analyses[a]

(Fifth and Sixth Graders, N = 160)

Year One		Year Two
COST OF DOING WELL IN MATH IMPORTANCE OF MATH VALUE OF MATH	(-) (+) (+)	FUTURE EXPECTANCIES IN MATH
CURRENT DIFFICULTY	(+)	REQUIRED EFFORT IN MATH
REQUIRED EFFORT IN MATH USEFULNESS OF MATH		
DIFFICULTY OF CURRENT MATH COURSE ACTUAL EFFORT IN MATH	(+) (+)	TASK CONCEPT OF MATH
PERCEIVED PERFORMANCE IN MATH INTENTION TO TAKE MORE MATH	(+)	INTEREST IN MATH

[a]Effects lead to increase in Year Two variable where there is a plus. Negative sign indicates an effect leading to a decrease in Year Two variables.

Table 3

Causal Effects from Cross-Lagged Panal Analyses[a]

(Seventh through Ninth Graders, N = 280)

Year One		Year Two
GRADE IN MATH	(+)	FUTURE EXPECTANCIES IN MATH
DIFFICULTY OF CURRENT MATH COURSE	(-)	
CURRENT MATH EXPECTANCIES	(+)	
SELF-CONCEPT OF MATH ABILITY	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	
REQUIRED EFFORT TO DO WELL	(-)	
COST OF DOING WELL IN MATH	(-)	
TASK CONCEPT IN MATH	(-)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	INTEREST IN MATH
SELF-CONCEPT OF MATH ABILITY	(+)	
USEFULNESS OF MATH	(+)	
VALUE OF MATH	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	INTENTION TO TAKE MORE MATH
CURRENT MATH EXPECTANCIES	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	CHILD'S PERCEPTION OF PARENTS' EXPECTATIONS FOR HIS/HER MATH PERFORMANCE
PERCEIVED PERFORMANCE IN MATH	(+)	
REQUIRED EFFORT IN MATH	(-)	
USEFULNESS OF MATH	(+)	
TASK CONCEPT OF MATH	(-)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	VALUE OF MATH
REQUIRED EFFORT IN MATH	(-)	
USEFULNESS OF MATH	(+)	
TASK CONCEPT OF MATH	(-)	
CURRENT MATH EXPECTANCIES	(+)	SELF-CONCEPT OF MATH ABILITY
PERCEIVED PERFORMANCE IN MATH	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	GRADE IN MATH
PERCEIVED PERFORMANCE IN MATH	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(-)	IMPORTANCE OF MATH
REQUIRED EFFORT IN MATH	(-)	
COST OF DOING WELL IN MATH	(-)	
TASK CONCEPT OF MATH	(-)	

[a]Effects lead to an increase in Year Two variable where there is a plus. Negative sign indicates an effect leading to a decrease in Year Two variables.

Table 4

Causal Effects From Cross-Lagged Panal Analyses[a]

(Tenth through Twelfth Graders, N = 170)

Year One		Year Two
CURRENT MATH EXPECTANCIES	(+)	FUTURE EXPECTANCIES IN MATH
SELF-CONCEPT OF MATH ABILITY	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	
INTEREST IN MATH	(+)	
CURRENT MATH EXPECTANCIES	(+)	INTENTION TO TAKE MORE MATH
FUTURE EXPECTANCIES IN MATH	(+)	
SELF-CONCEPT OF MATH ABILITY	(+)	
PERCEIVED PERFORMANCE IN MATH	(+)	
DIFFICULTY OF CURRENT MATH COURSE	(+)	ACTUAL EFFORT IN MATH
FUTURE EXPECTANCIES IN MATH	(-)	
SELF-CONCEPT OF ABILITY IN MATH	(-)	
REQUIRED EFFORT IN MATH	(+)	
COST OF DOING WELL IN MATH	(+)	
TASK CONCEPT OF MATH	(+)	
CURRENT MATH EXPECTANCIES	(-)	COST OF DOING WELL IN MATH
SELF-CONCEPT OF MATH ABILITY	(-)	
PERCEIVED PERFORMANCE IN MATH	(+)	
USEFULNESS OF MATH	(-)	
DIFFICULTY OF CURRENT MATH COURSE	(+)	TASK CONCEPT OF MATH
FUTURE EXPECTANCIES IN MATH	(-)	
SELF-CONCEPT OF MATH ABILITY	(-)	
REQUIRED EFFORT IN MATH	(+)	

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[a]Effects lead to increase in Year Two variable where there is a plus. Negative sign indicates an effect leading to a decrease in Year Two variables.