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The Structure of Children's Ability Perceptions and Achievement Values: Age, Gender, and Domain Differences

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Various achievement motivation theorists argue that individuals' achievement self-perceptions play a key mediating role in their achievement behavior (e.g., Bandura, 1986; Eccles et al., 1983; Weiner, 1979). One key achievement self-perception serving this mediating role is individuals' perceptions of their ability. Many studies now have assessed the nature of ability perceptions and how they develop, and several of these studies have shown that children's perceptions of ability predict their achievement performance (Stipek & Mac Iver, 1989 provide detailed discussion of this work). Theorists taking an expectancy - value perspective on achievement motivation and behavior have shown that children's valuing of different tasks is another important predictor of children's achievement behavior and choice of achievement activities to pursue (e.g., Eccles et al., 1983; Meece, Wigfield, & Eccles, 1990). In a study involving 5th through 12th grade children, Eccles and Wigfield (1991) found that children's perceptions of ability and subjective valuing of mathematics formed quite distinct factors, indicating that children differentiated between these two kinds of beliefs. The ability perception and task values factors correlated positively with one another.

The major purpose of the present study was to look at the early development of children's perceptions of ability and achievement values by examining whether the factor structure of these beliefs differs across age. Studies of change in the factor structure of children's beliefs attempt to determine whether children's beliefs become more differentiated as they get older and so test the long-held assumption in certain developmental theories that different characteristics change from a global to a more differentiated state (e.g., Werner, 1957). Harter (1983) proposed that the self-system develops in this fashion. Studies looking at the structure of children's perceptions of ability have clearly shown that even during the early elementary school years children distinguish different domains of competence, such as academic, social, physical, and other kinds of competence (e.g., Harter,1982; Marsh & Hocevar, 1985). Wigfield et al. (1990) found (using exploratory factor analytic techniques) that children as young as first graders distinguished between ability perceptions and subjective values within several activity domains (math, reading, and sports activities); these beliefs formed separate factors. These distinctions were tested more explicitly in the present study by using confirmatory factor analysis (CFA) to examine the factor structure of children's ability perceptions and achievement values.

A second purpose of this study is to examine whether there are gender differences in the factor structure of children's beliefs. Many different studies have found mean differences in boys' and girls' achievement-related self-perceptions, and that these differences tend to reflect prevailing sex-role stereotypes about different activities. For instance, boys tend to have higher perceptions of ability in math and sports than do girls, whereas girls' perceptions of social activities and reading/English tend to be higher than those of boys (e.g., Eccles et al., 1989; Eccles et al., 1991; Harter, 1982; Marsh, 1989; Wigfield et al., in press). No study has examined the factor structure of boys' and girls' ability perceptions and values to determine if there are gender differences in the structure of boys' and girls' beliefs. Finally, because in this study children's ability perceptions and subjective achievement values were measured in several activity domains, a third purpose of the study was to examine models in those different domains. The domains chosen were math, reading, and sports, since those domains are common to children's experiences.

Different models of the structure of children's perceptions of ability and achievement values in different activity domains were tested using confirmatory factor analysis (CFA). CFA allows the researcher to specify and test different theoretically-based models of the structure of children's beliefs (see Joreskog & Sorbom, 1984; Marsh & Hocevar, 1985) and provides statistical indices to evaluate the fit of the different models. Since Eccles et al.'s (1983) expectancy - value model provides the basis for the factor models specified in this study, CFA techniques are ideal for this study. The theoretical significance of the CFA analyses done in the present study are: 1) providing explicit tests of the distinctions between expectancy-related beliefs and values beliefs that are made in expectancy - value theory, and 2) allowing for the

comparison of the structure of perceptions of ability and subjective values for different groups of children, such as younger and older children, or boys and girls.

Participants include 865 first (N = 284), second (N =320), and fourth grade (N = 261) children attending 10 elementary schools in four school districts. The children are from lower middle class to middle class backgrounds, and over 95% are white. Children completed questionnaires tapping their beliefs about activities in several different activity domains. The specific beliefs assessed included children's perceptions of their own ability for each activity, their expectancies for current and future success in each activity, their sense of efficacy about learning new things in each domain, the difficulty of the activity, their subjective task values for these activities (including perceptions of how interesting/fun each activity is, how important being good at the activity is to the child, and how useful the child though the activity is now) the difficulty of each activity, and other constructs. These items were asked in the math, reading, and sports activity domains. The items have excellent psychometric properties (see Eccles et al., 1983; Eccles et al., 1991).

Factor Structure of Children's Beliefs

For each domain (math, reading, sports) three models were specified: 1) a null model (see Bentler & Bonett, 1980; Marsh, Balla, & MacDonald, 1988) that specified no relations among the observed measures; this model is used as a comparison to the target models; 2) a one-factor model in which the factor loading matrix contained all the items loading on one factor; and 3) a two-factor model in which the factor loading matrix consisted of the ability-related items loading on one factor and the values items loading on a second factor.

Since there is as yet no one best-accepted index of goodness-of-fit for CFA (see Marsh et al., 1988), several of the most commonly-used fit indices (chi-square, chi-square divided by degrees of freedom, Joreskog and Sorbom's Goodness of Fit Index [GFI], and the Tucker-Lewis Index [TLI]) were examined to evaluate model fit. These various goodness of fit indices for the different models are presented in Table 1. As can be seen in the table, the indices show that in general the one factor models do not fit the data extremely well. In contrast, the two factor models fit the data quite well. Most of the chi-square to degrees of freedom ratios are around 2.0, and nearly all of the GFIs and TLIs exceed .90, which indicates good model fit. In terms of the fit within the different domains, for the first and second graders the two factor models for math and reading fit very well, whereas for the second graders the model for sports fits somewhat less well. For the fourth graders the math model fits better than either reading or sports models, though each of these latter two models fit reasonably well.

Age Differences in Factor Structure

Three tests were done to compare the factor structure across age: a test of the invariance of factor pattern (or number of factors), invariance of the factor loadings, and invariance of the covariance matrix. These tests are progressively more rigorous tests of invariance across groups (see Joreskog & Sorbom, 1984). The tests were done by comparing pairs of groups to one another; e.g., first graders versus second graders, first graders versus fourth graders, and so on. The various fit indices for the grade-by-grade comparisons in the different domains are presented in Table 2. Looking at the table, the factor patterns appear to be invariant across the groups. All the GFI values exceed .90. Chi-square divided by their degrees of freedom for these tests produce values indicating reasonable fit across groups. The factor loadings also appear to be invariant, since those fit indices are similar to the ones for the factor pattern tests.

The case for covariance invariance is less clear, especially for the comparisons of the first and fourth graders. The GFI values are low for these tests, and the chi-square values are large, particularly in comparison to those of the factor pattern and loading tests. It appears, however, that the matrices for the first and second graders are invariant, since those fit indices are better.

Gender Differences in Factor Structure

At this time the analysis of gender differences in factor structure have not been completed. Analyses done to date have assessed the invariance of the covariance matrices for boys and girls (the most rigorous test). These analyses show that the covariance matrices for boys and girls appear to be invariant in the math and reading domains, but not the sports domain. Analyses comparing whether the number of factors are the same and if the loadings are invariant will be conducted.

Discussion

Results of this study have important theoretical implications for models of achievement motivation, and developmental theory more generally. They indicate that even at first grade children clearly distinguish between perceptions of ability for different activities and the value they attach to those activities. They also indicate that these beliefs do not become more differentiated later in elementary school; hence the differentiation occurs very early on, even before children have had a great deal of

experience with the activities in school. They also indicate that the structure of boy's and girls' achievement beliefs is quite similar during the elementary school years. Results thus confirm distinctions made in expectancy - value theory, and so provide support for Eccles et al.'s (1983) model of achievement choice.

Implications of results for children' choice of achievement activities to pursue will be presented. For instance, previous work (e.g., Eccles et al., 1983; Meece et al., 1990) has shown that during late elementary school and secondary school children's perceptions of ability predict their subsequent performance in mathematics, whereas their subjective values predict both their intentions and actual decisions to continue taking mathematics. For younger children, it also is likely that perceptions of ability will predict their performance at different activities. However, rather than predicting choice of activities younger children's subjective values may predict their enthusiasm for pursuing those activities, since younger children may have less choice of which activities they do, especially in school. We will suggest that even during the very early elementary school years it is important to understand both children's perceptions of ability and subjective values in order to gauge their motivation to pursue tasks in different activity domains.

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Table 1

Goodness-of-Fit Indices for the One and Two Factor Models

Domain	One Factor				Two Factor			
	Chi-Sq	Chi-Sq/ df	GFI[a]	TLI[b]	Chi-Sq	Chi-Sq/ df	GFI	TLI
Math								
First	157.07	4.49	.89	.62	73.31	2.16	.95	.87
Second	182.35	5.21	.88	.70	43.49	1.28	.97	.98
Fourth	205.26	5.86	.84	.75	73.45	2.16	.94	.94
Reading								
First	123.48	3.53	.90	.68	36.40	1.07	.97	.99
Second	241.63	6.90	.84	.69	61.82	1.82	.96	.96
Fourth	273.37	7.82	.79	.73	121.05	3.56	.91	.90
Sports								
First	110.01	3.14	.91	.87	71.42	2.10	.94	.93
Second	247.06	7.06	.86	.76	131.54	3.87	.92	.89
Fourth	210.06	6.00	.86	.82	123.17	3.62	.90	.90

Note. df for the one-factor models is 35, for the two factor models 34. The null models (used to compute the Tucker-Lewis indices) all had 45 df. For math the chi-square values for the null models are: first grade, 446.35; second grade, 678.52; fourth grade, 93.59. For reading: first grade, 401.19, second grade, 888.72; fourth grade 1175.75. For sports: first grade, 799.68; second grade, 1180.45; fourth grade, 1275.68. [a]GFI = Joreskog and Sorbom's Goodness-of-Fit Index. [b]TLI = Tucker-Lewis Index.

Table 2

Chi-Square and Goodness-of-Fit Indices for the Age Group Comparison Tests

Domain	Covariance Invariance		Pattern Invariance		Loading Invariance	
Math	Chi-Sq	GFI	Chi-Sq	GFI	Chi-Sq	GFI
1st vs. 2nd	140.69	.95	116.80	.97	131.30	.97
1st vs. 4th	353.14	.76	147.76	.94	154.45	.94
2nd vs. 4th	170.60	.90	116.95	.94	129.75	.94
Reading						
1st vs 2nd	114.02	.96	98.27	.96	101.93	.96
1st vs. 4th	325.04	.82	157.45	.91	161.83	.91
2nd. vs. 4th	165.63	.91	182.93	.91	187.49	.91
Sports						
1st vs. 2nd	172.38	.94	202.96	.92	220.60	.91
1st vs. 4th	462.98	.72	194.59	.90	217.81	.90
2nd. vs. 4th	214.15	.88	254.71	.90	271.15	.89

Note. df for the covariance invariance tests are 55, for the pattern invariance tests 68, and the loading invariance tests 76.