

**Social Determinants and Consequences of Children's Non-Cognitive Skills:  
An Exploratory Analysis**

**Amy Hsin**

**Yu Xie**

**Abstract**

We assess the relative role of cognitive and non-cognitive skills in mediating the relationship between family SES and children's academic achievement. We decompose the total effect of family background on children's achievement into: (1) the direct effect of family background, (2) the indirect effect via cognitive skills, and (3) the indirect effect via non-cognitive skills. We analyze the Early Childhood Longitudinal Study-Kindergarten Cohort (i.e. approx. 8,000 children followed from pre-school to 8th grade), with structural equation modeling. The results confirm previous findings that non-cognitive skills are as important as cognitive skills in predicting children's achievement. Surprisingly, unlike cognitive skills, family SES does not influence non-cognitive skills. The results suggest that non-cognitive skills, a critical determinant of children's future attainment, are affected by factors uncorrelated with the commonly understood dimension of vertical social hierarchy. In contrast to cognitive skills, non-cognitive skills may be a more uniquely *individual* determinant of status attainment.

## **Introduction**

A vast literature in social science shows that family background plays a key role in affecting children's outcomes in a predictable fashion: children from advantaged families do better than those from disadvantaged families in almost every domain, i.e., being healthier, more successful academically, and less likely to exhibit deviant behaviors (Case, Lubotsky and Paxson 2002; Bradley and Corwyn 2002; Featherman and Hauser 1978). Cognitive skills are widely cited as a critical causal mechanism through which family background affects attainment outcomes (Duncan et al. 1998; Jencks and Phillips 1998; Guo and Harris 2000). Less is known about the role that "non-cognitive" skills, or non-cognitive traits, play in the intergenerational transmission of status. Whereas several recent studies show that non-cognitive traits are predictive of attainment outcomes ((Duckworth and Seligman 2005; Groves 2005; Heckman, Stixrud et al. 2006; Jackson 2006; Cunha and Heckman 2009), little is known about the social origins of non-cognitive traits and whether they mediate the influence of family background.

We revive the classic Wisconsin model (Sewell, Haller, and Portes 1969) by positing that an important mechanism of family influence on children is not only through affecting children's cognitive skills, but also through affecting their "non-cognitive skills," or non-cognitive traits. We posit that the total effect of family background on children's achievement outcomes can be decomposed into two components: (1) the direct effect of family background on children's achievement and (2) the indirect effect through its influences on children's non-cognitive traits and cognitive abilities. We employ Structural Equation Modelling (SEM) and school-level fixed effects to analyze longitudinal data on children and families from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), which collects detailed information on family background and resources and children's non-cognitive and cognitive traits starting from preschool to 8-th grade.

## **Theory and Method**

The classic Wisconsin model was developed by Sewell and his associates (Hauser, Tsai, and Sewell 1983; Sewell, Haller, and Portes 1969; Sewell and Hauser 1975) to identify causal mechanisms that transmit a family's advantages or disadvantages to the next generation. The key idea is that few individuals benefit directly from parents' material resources (such as a higher purchasing power for consuming goods associated with a higher income) for their own social status. Instead, it is postulated that the main causal mechanisms are social-psychological, especially in terms of educational and occupational aspirations, in addition to cognitive abilities. In its original form, the Wisconsin model posits that all of the family background effects on later educational and occupational achievements are mediated by psychological mechanisms, leaving no role for the direct effect of family background. While we take the Wisconsin model as a good starting point, we do not take the original position and thus allow

for the direct effect of family background. Therefore, the key goal of this study is to decompose the total effect of family background on children’s achievement outcomes into three components: (1) the direct effect of family background on children’ achievement, (2) the indirect effect through its influence on cognitive abilities, and (3) the indirect effect through its influence on children’s non-cognitive traits.

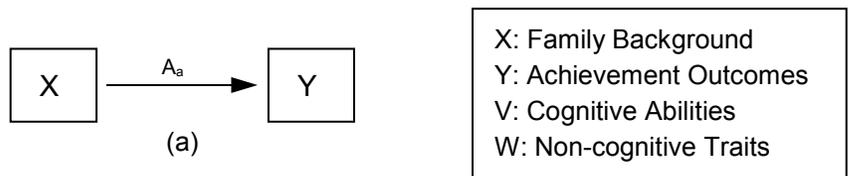
We have multiple measures of children’s non-cognitive trait and therefore, will use SEM to identify the latent constructs that underlie our various measures of non-cognitive traits. Additionally, SEM will be employed to estimate the structural relationship between our observed variables (e.g. SES, cognitive test scores) and latent constructs (i.e. non-cognitive traits). School-level fixed effects are employed within a SEM framework. This approach allows us to eliminate potential biases resulting from both observed and unobserved differences across schools that may also be correlated with attainment outcomes, on one hand, and children’s cognitive and non-cognitive traits, on the other.

For illustrative purposes, we present four simplified models in Figure 1. One simplification is to collapse all family background variables (including parenting values and practices) together (as X). In practice, we will break up different components of family background and examine results with different model specifications.

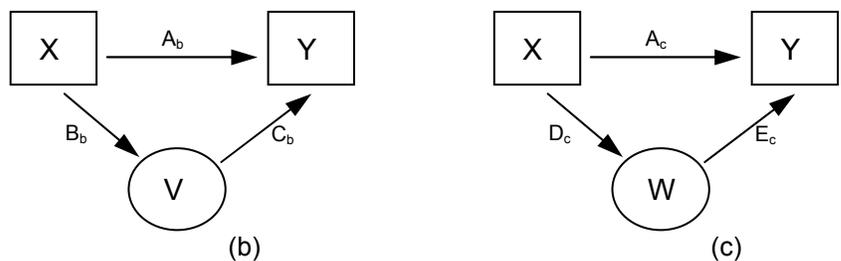
In Model (a), we estimate the total (i.e., reduced-form) effects of family background (X). We expect the results to confirm what is well known in the social stratification literature: family background (X) has large influences on children’s academic success (Y). In Model (b), we introduce measures of cognitive abilities (V) as an intervening mechanism and expect some of the total effects of family background to be mediated by this indirect pathway. As a comparison, we also run a parallel model with non-cognitive traits as an intervening mechanism in Model (c). Due to the potential (likely

Figure 1: Illustration of Total, Direct and Indirect Effects

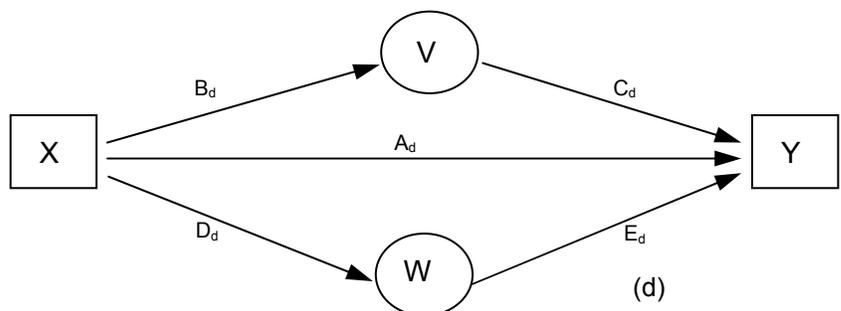
(a) Total Effects of Family Background on Achievement



(b) & (c) Direct and Indirect Effects of Family Background on Achievement via either Cognitive Abilities or Non-Cognitive Skills



(d) Direct and Indirect Effects of Family Background on Achievement via Cognitive Abilities and Non-Cognitive Skills



positive) associations between cognitive abilities and non-cognitive skills, we know that the indirect effects estimated in Models (b) and (c) are biased (likely upwardly). In Model (d), we include cognitive abilities and non-cognitive traits as two parallel intervening mechanisms in a comprehensive model.

For linear models in the traditional form of structural equation models, indirect effects can be obtained directly as the product of two coefficients along an indirect path (Alwin and Hauser 1975). For example, in Model (b), the indirect effect of  $X$  on  $Y$  through  $V$  is simply the product of  $B_b$  and  $C_b$ . However, some models in our analyses will be nonlinear. We will turn to indirect methods of obtaining indirect effects through comparison of multiple models (Xie and Shauman 1998). As in Xie and Shauman (1998) and Thornton, Axinn, and Xie (2007), two methods will be used. The first method is based on the incremental method of adding an intervening factor to the reduced-form model. The second method is based on the reduction method of removing an intervening factor from the full model. In our case, we will compare the reduced-form model (Model (a)), separately, to Models (b) and (c) (for Method 1), and then compare the comprehensive model (Model (d)), separately, to Models (c) and (b) (for Method 2). The two methods provide two alternative ways of assessing the relative importance of the indirect mediating pathway associated with either cognitive abilities or non-cognitive traits. More concretely, the relative sizes of  $A_a - A_b$  versus  $A_a - A_c$ , and the relative sizes of  $A_c - A_d$  and  $A_b - A_d$ , inform us of the relative importance of the indirect pathways associated respectively with cognitive abilities and non-cognitive traits.

## **Data and Measures**

This project analyzes the Early Childhood Longitudinal Study-Kindergarten-Fifth Grade (ECLS-K), which follows a nationally representative cohort of children from kindergarten through 8<sup>th</sup> grade. The ECLS-K is well-suited for the proposed project because it provides repeated assessments of children's achievement and non-cognitive traits, parenting practices and attitudes, and school environment. In-person interviews of parents, direct child assessments and teacher reports were the primary modes of data collection. The ECLS-K employed a stratified, multi-stage area probability sample and oversampled Asian and Pacific Islanders and children whose home language is not English. A baseline sample of 21,260 kindergarteners throughout the country was contacted in 1998-1999. In the Spring of 2000, 2002, 2004 and 2007 children were re-interviewed. This provides assessment for each child at kindergarten, first grade, third grade, fifth grade and eighth grade. Sample weights were created by ECLS-K statisticians in order to account for oversampling of special populations and attrition across waves. We will apply these weights to all our analyses. Our analytic sample will include all children who were included in the baseline and who were followed through to 8-th grade (N=9,000).

**Academic achievement.** Our outcome variable is children's academic achievement. We rely on Academic Ratings Scale (ARS) to capture achievement in the areas of language/literacy and mathematic. These measures are derived from teachers' daily observations of student performance, competency and mastery of reading and mathematics. Teachers rated children's skills, knowledge and behaviors on a 5-point scale from "Not Yet" to "Proficient". We use ARS measured at 8-th grade.

**Cognitive skills.** Cognitive assessments of children's verbal and math ability were administered across the all five waves of data. Cognitive scores are norm-referenced scores which provide estimates of status relative to children's peers and, therefore, provide information on the extent to which individuals or subgroups rank higher or lower than the national average and how much this relative ranking changes over time. The ECLS-K direct assessments of reading and math have demonstrated high reliability and construct validity compared to other national-level and commercial assessment of child cognitive achievement (Pollack et al. 2005). We use the earliest assessment of cognitive skills (i.e. tests taken right before entry into kindergarten) in order to obtain pre-schooling measures of cognitive ability.

**Non-cognitive Traits.** Children's non-cognitive traits are based off of the Social Ratings Scale (SRS), which asked teachers to report on the frequency students exhibited certain skills and behaviors (i.e. 4-point scale ranging from "Never" to "Very often"). Teachers rated individuals as part of a self-administered questionnaire. The SRS asked teachers to rate students along the following dimensions: approaches to learning, self-control, interpersonal skills, externalizing problem behaviors, and internalizing problem behavior. The first three indicators capture positive aspects of non-cognitive traits whereas the last two represent problem behaviors. All measures of non-cognitive traits are taken from pre-kindergarten assessments.

*Approaches to learning* include six items that rate children's attentiveness, task persistence, eagerness to learn, learning independence and organization. *Self-control* includes four items that assess child's ability to control behavior by respecting the property of others, controlling temper, acceptance or peer ideas, and responding appropriately to peer pressure. *Interpersonal Skills* include five items that rate child's ability to form and maintain friendships, getting along with others, comforting and helping other children, expressing feelings in positive ways, and showing sensitivity to others' feelings. *Externalizing Problem Behaviors* scale is derived from five items that rate frequency with which child argues, fights, gets angry, acts impulsively and disturbs ongoing activities. *Internalizing Problem Behavior* scale measures the presence of anxiety, loneliness, low self-esteem, and sadness. The same SRS indicators were collected for all four waves of data. In the current analyses, we average SRS scores across the four waves in our analyses. In future analyses, we hope to explore changes in these measures of non-cognitive traits over time.

**Family background.** Family background variables include household income, maternal education, parenting behaviors, and mother's non-cognitive traits. All family background variables are measured at baseline. We take the log of total family income at baseline. Maternal education is measured in levels ranging from 1 to 9 (i.e. 1 = 8<sup>th</sup> grade or below and 9 = doctorate).

Parenting behaviors include a variety of indicators measuring parents' educational expectations for children's school, cognitive stimulation available in the home environment, disciplinary practices and monitoring of children's activities. Additionally, we also include measures of mother's own non-cognitive traits. Caregivers were given the sample five assessments of non-cognitive traits that children were given (i.e. approaches to learning, self-control, interpersonal skills, externalizing problem behaviors, and internalizing problem behavior).

### **Preliminary Findings**

Means and correlations are presented in Tables 1 and 2, respectively. The correlations show that the variables within the latent construct (i.e. both children's and mother's non-cognitive traits) are related to each other. For children, attitude toward learning has a strong and positive relationship with self-control and interpersonal skills and a more moderate and negative relationship with internalizing and externalizing problem behaviors. In adults, attitude towards learning is positively related to self-control and impulsiveness and negatively correlated to social skills. As expected, our outcome variable, academic achievement, is positively related to our measures of SES (i.e. family income and mother's education), cognitive ability and the positive indicators of non-cognitive traits (e.g. attitude towards learning, self-control and interpersonal skills).

Next we focus on the correlates of children's cognitive and non-cognitive traits. We see that while both family income and mother's education are moderately correlated to children's cognitive ability, they are only weakly related to the five indicators of non-cognitive traits. Mother's non-cognitive traits are also moderate to weak correlates of children's cognitive and non-cognitive traits.

### *Results from Structural Equation Models.*

Figures 2 to 6 present results from structural equation models (SEM). Figure 2 presents estimates from the reduced form model that only examines the relationship between SES and achievement. Figure 3 introduces cognitive ability as a mediator. Figure 4 introduces latent non-cognitive traits as a mediator. Figure 5 includes both cognitive and latent non-cognitive traits. Figure 6 includes latent factors of mother's non-cognitive traits. Because observations are clustered at the school level, all models are estimated using variables that are centered at the 8<sup>th</sup> grade school mean. For example, the average family income for each school was from the sample. Family income for each child in a given school was then subtracted from this school-level mean. This approach is the equivalent of

performing school level fixed effects within a SEM framework. Estimates are derived from comparisons of individuals *within* the same school rather than comparisons of individuals *across* different schools. This process of “de-meaning” allows us to purge estimates of both observable and unobservable school-level characteristics that may bias our results.

Not surprisingly, the results from Figure 2 show a positive and significant relationship between both indicators of SES and children’s verbal achievement. In Figure 3, we see that some of the effects of SES are mediated through verbal abilities. Both family income and mother’s education are predictive of children’s pre-kindergarten verbal abilities, which go on to predict later verbal achievement. In addition to these indirect effects, the direct effect of income and mother’s education remain.

The results in Figure 4 show that, like children’s verbal abilities, latent constructs of children’s non-cognitive traits are highly predictive of achievement outcomes. In contrast to the findings for cognitive abilities, however, SES is only weakly correlated to non-cognitive traits, especially mother’s education. Estimates for the direct effects of income and education in Figure 4 are not significantly different from the reduced form model in Figure 2. These results suggest that while non-cognitive traits may be predictive of future achievement, it does not mediate the effect of SES.

Figure 5 includes both non-cognitive and cognitive traits as potential mediators of SES. The results show that both cognitive and non-cognitive traits positively and significantly relate to achievement outcomes (i.e. the standardized coefficient for the effect of latent non-cognitive traits is 0.22 and the standardized coefficient for the effect of verbal ability is 0.34). SES, however, is more predictive of children’s cognitive abilities than children’s non-cognitive traits. This is especially true of mother’s education. Whereas the mother’s education has a relatively large effect on children’s verbal abilities (0.19), the effect of education on non-cognitive traits is significant but weak (0.05). The results suggest that while cognitive abilities mediate the effect of SES on achievement outcomes (especially the effect of mother’s education on achievement outcomes), non-cognitive traits do not.

Figure 6 introduces parent’s latent non-cognitive traits as another variable predicting children’s non-cognitive trait and verbal ability. The results show that parent’s latent non-cognitive traits positively predict both children’s non-cognitive traits and verbal abilities (i.e. 0.12 and 0.13, respectively). Parents’ own non-cognitive traits are significantly more predictive of children’s non-cognitive traits than SES. The effect of parent’s non-cognitive is twice as large as the effect of either mother’s education or income. In terms of children’s cognitive abilities, however, mother’s education remains the main determinant.

## **Discussion**

The literature in social stratification has long identified family origin as a central stratifying force in shaping individual success and attainment. The Wisconsin model argues that the influence of family resources, such as family income and parental education, on children’s attainment outcomes largely

occur through indirect channels (Hauser, Tsai, and Sewell 1983; Sewell, Haller, and Portes 1969; Sewell and Hauser 1975). One important mediating factor relating family SES and children's academic achievement is children's cognitive skills (Duncan et al. 1998; Jencks and Phillips 1998; Guo and Harris 2000). Less well understood is the role of non-cognitive skills in the intergenerational transmission of social advantage and disadvantage.

The preliminary findings both confirm our existing understanding of the role of family origin and highlight new and interesting results that point to the limitations of family origin in determining individual success. The results confirm that children's cognitive and non-cognitive skills are both important predictors of children's academic achievement. However, unlike children's cognitive skills, non-cognitive skills are largely unexplained by either family income or parent's education. To a degree, parents' own non-cognitive traits explain children's non-cognitive traits but this relationship too is not strong.

The findings suggest that money, resources and status may buy a degree of academic success for children either directly or indirectly via better cognitive skills. Family resources, however, seem to have little influence over qualities, such as motivation, self-control and social skills, that are crucial factors in determining future achievement.

The preliminary results show that non-cognitive skills, a critical determinant of children's future attainment, are affected by factors uncorrelated with the commonly understood dimension of vertical social hierarchy. To the extent that much of stratification research, and research in sociology as a whole, seeks to identify social factors that structure individual achievement, the paper offers some preliminary evidence that social factors may be very limited in predicting a key determinant of individual success. In this sense, the paper identifies non-cognitive skills, in contrast to cognitive skills, as a more uniquely *individual* determinant of status attainment.

**Table 1: Descriptive Statistics for Study Variables**

<b>Variable</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>N</b>
Verbal achievement in 8th grade	3.18	0.96	8969
Verbal ability Pre-K	51.66	9.91	7539
<i>SES</i>			
Log family income	10.55	1.37	8681
Mom's education	4.48	1.81	8556
<i>Children's non-cognitive traits</i>			
Attitude towards learning	3.05	0.65	8103
Self-control	3.13	0.60	7787
Interpersonal skills	3.02	0.61	7717
Internalizing problem behavior	1.51	0.50	7903
Externalizing problem behavior	1.57	0.60	7993
<i>Mother's non-cognitive traits</i>			
Attitude towards learning	3.13	0.47	7825
Self-control	2.86	0.49	7825
Social skills	3.34	0.55	7825
Impulsiveness	1.92	0.65	7785

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1) Verbal achievement (8th grade)	1.00											
2) Verbal ability (Pre-K) SES	0.45	1.00										
3) Log family income	0.22	0.26	1.00									
4) Mom's education	0.32	0.35	0.37	1.00								
<i>Children's personality traits</i>												
5) Attitude towards learning	0.36	0.39	0.12	0.16	1.00							
6) Self-control	0.21	0.19	0.09	0.07	0.66	1.00						
7) Interpersonal skills	0.24	0.23	0.09	0.10	0.69	0.78	1.00					
8) Internalizing problems	-0.15	-0.16	-0.07	-0.06	-0.35	-0.27	-0.33	1.00				
9) Externalizing problems	-0.21	-0.15	-0.07	-0.04	-0.49	-0.68	-0.54	0.24	1.00			
<i>Mother's personality traits</i>												
10) Attitude towards learning	0.19	0.19	0.10	0.19	0.22	0.13	0.16	-0.09	-0.10	1.00		
11) Self-control	0.10	0.09	0.08	0.13	0.12	0.07	0.14	-0.13	<b>-0.02</b>	0.44	1.00	
12) Social skills	-0.18	-0.17	-0.13	-0.14	-0.20	-0.21	-0.19	0.04	0.23	-0.10	<b>-0.03</b>	1.00
13) Impulsiveness	0.12	0.16	0.07	0.10	0.15	0.16	0.16	-0.05	-0.16	0.17	0.15	-0.42

Note: All correlations are significant at the  $p < .001$  level, except for the correlations that are in boldface which are significant at the  $p < .05$  level.

Figure 2. Standardized solutions for reduced form model: SES (family income and mother's education) on children's verbal achievement. Model fit statistics:  $\chi^2 = 476.87$ ;  $df = 2$ ; CFI = 1.00; RMSEA = 0.00; SRMR = 0.00. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

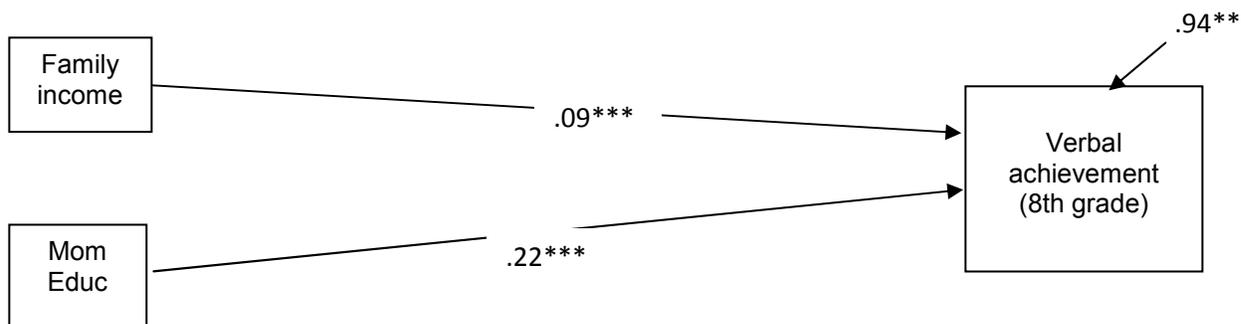


Figure 3. Standardized solutions for model with verbal ability as a mediator. Model fit statistics:  $\chi^2 = 1877.34$ ,  $df = 5$ , CFI = 1.00; RMSEA = 0.00; SRMR = 0.00. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$

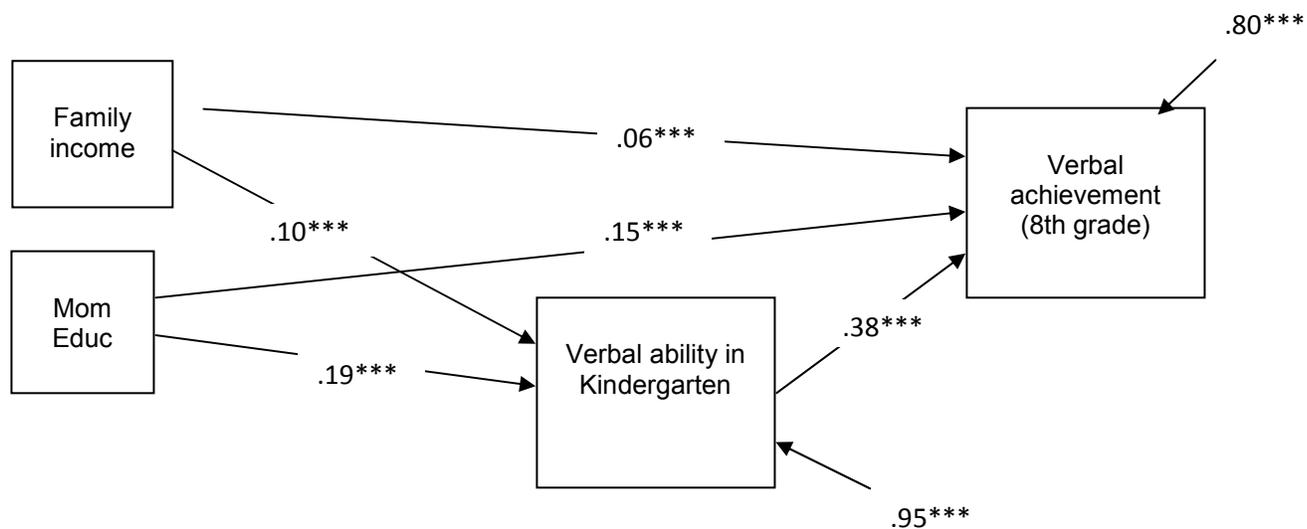


Figure 4. Standardized solutions for model with non-cognitive traits as a mediator. Model fit statistics:  $\chi^2 = 19710.05$ ;  $df = 27$ ;  $CFI = 0.92$ ;  $RMSEA = 0.10$ ;  $SRMR = 0.04$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

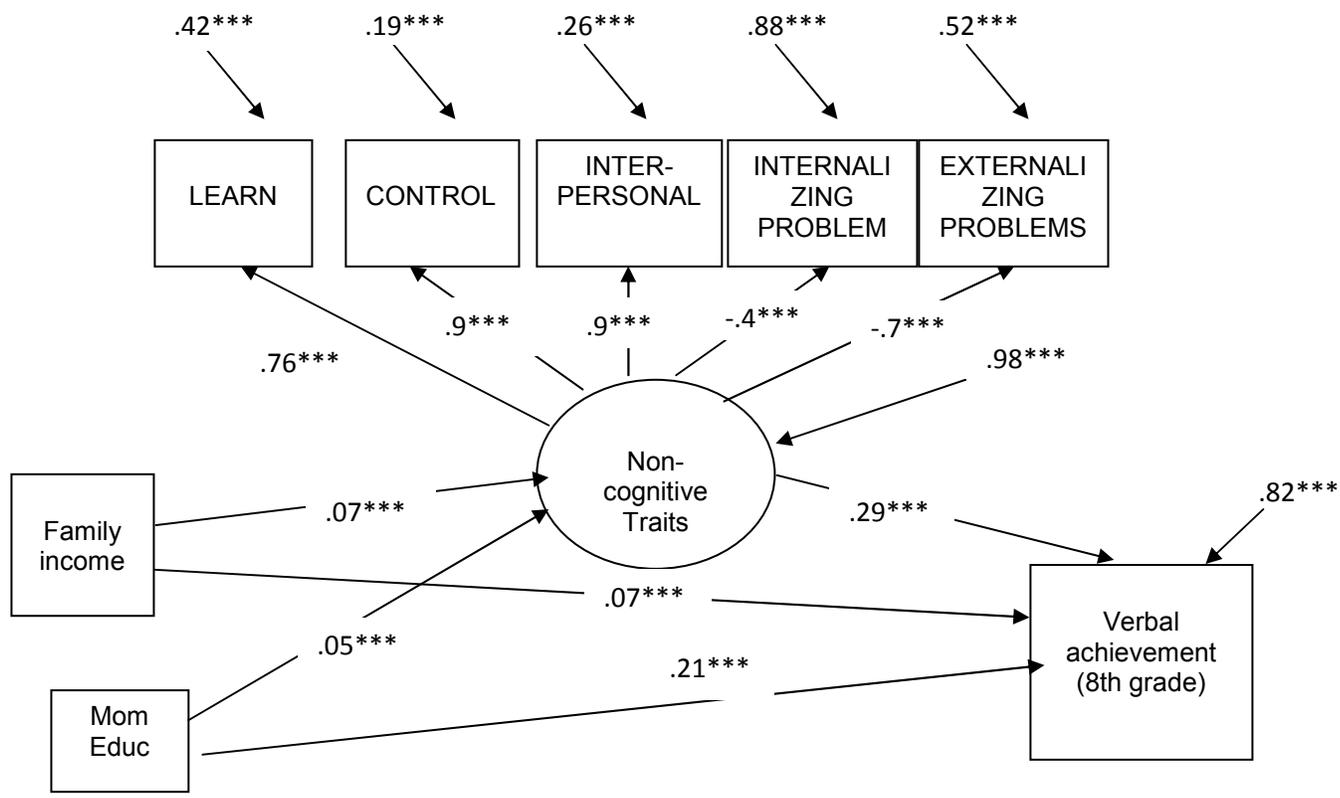


Figure 5. Standardized solutions for model with cognitive ability and non-cognitive traits as mediators. Model fit statistics:  $\chi^2 = 21990.617$ ;  $df = 35$ ; CFI = 0.89; RMSEA = 0.15; SRMR = 0.08. \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

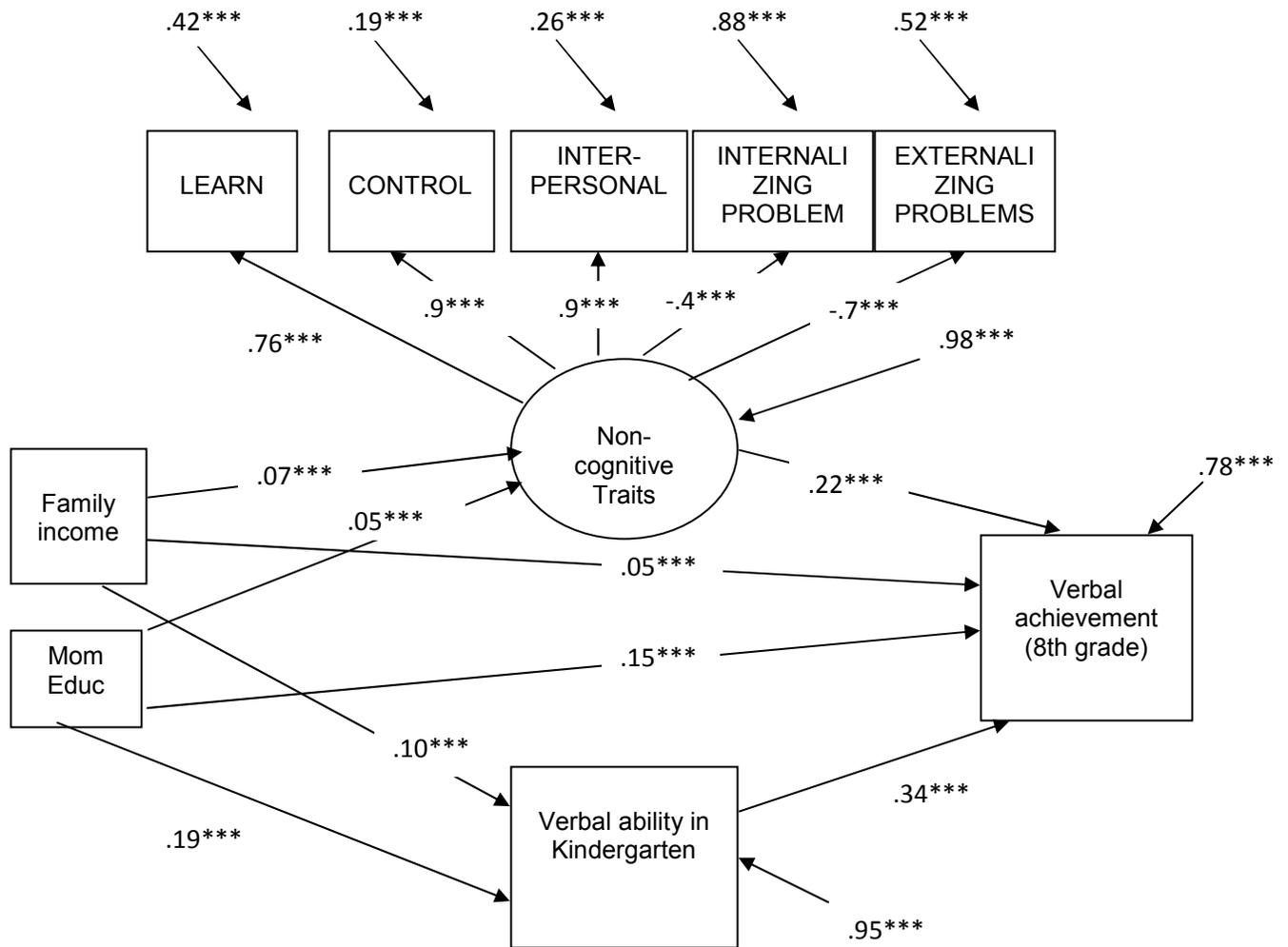


Figure 6. Standardized solutions for model with cognitive ability and non-cognitive traits as mediators and parent's non-cognitive traits. Model fit statistics:  $\chi^2 = 32898.03$ ;  $df = 90$ ;  $CFI = 0.87$ ;  $RMSEA = 0.09$ ;  $SRMR = 0.07$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

