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Task Persistence: A Potential Mediator of the Income-Achievement Gap

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With more than 1 in 5 American children living in a household below the poverty line, and an additional 12% hovering just above that cutoff, the income–achievement gap is a pressing national issue.[1] Among fourth-grade children who are eligible for free or reduced-price lunch, 80% score below proficient on the reading component of the National Assessment of Educational Progress. This compares with 49% of children who are not eligible for lunch subsidies.[2] Upon arrival at kindergarten, low-income American children lag significantly behind their more affluent counterparts on standardized math and reading tests, and the gaps persist or even widen as they matriculate.[3]

Although these trends and statistics are fairly straightforward, gaining insight into *how* and *why* childhood poverty leads to such formidable achievement gaps is far more complex. The purpose of this study is to examine the role of one possible mechanism – task persistence – as a mediating factor in the relationship between childhood poverty and educational outcomes. As depicted in Figure 1, we hypothesize that longer periods childhood poverty are associated with diminished task persistence. Persistence, in turn, is related to educational outcomes. Although the work on each of these bivariate relationships is limited, to our knowledge no one has investigated the full path pictured in Figure 1. Additionally, this study adds to the current literature by assessing less commonly measured educational “achievement” variables. Rather than focus on test scores, we examine arguably broader metrics of achievement – perceived academic competence and educational attainment.

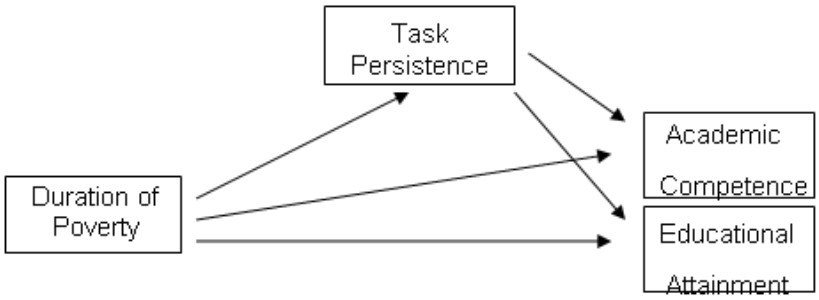

Figure 1. Theoretical model of task persistence mediating duration of poverty and educational outcomes.

Theoretical Framework

Our focus on task persistence as a hypothesized mediator of the robust link between childhood poverty and poor academic achievement is derived from learned helplessness theory. Learned helplessness is a condition in which an individual becomes unable or unwilling to act upon the environment because of the belief that his or her behavior and the outcome are independent of each other.[4] Research into learned helplessness has indicated that a variety of organisms, including humans, experience helplessness when exposed to uncontrollable events in the environment.[4]

As an example, Cohen and colleagues investigated the effect of community noise levels on schoolchildren. Children attending schools in relatively low-noise neighborhoods were more likely than their peers attending schools near an airport (uncontrollable noise) to solve a jigsaw puzzle correctly. Furthermore, among those children who failed to solve the puzzle, more than four times as many noise-exposed children as children who were not exposed to airport noise did so because they simply gave up before the end of the testing period.[5] Longitudinal analyses also showed that these effects extended into the next school grade.[6]

We hypothesize that the environments of impoverished children can undermine task persistence in a manner consistent with learned helplessness theory.

Relationship Between Poverty and Environmental Control

To date, most work examining mediating mechanisms between income and academic outcomes has focused on parental investment. Parents of lower socioeconomic status (SES) talk less to their children and use less varied language, read less often to their children, have fewer books in the

home, have fewer age-appropriate toys and games, and are less likely to take their children to the library.[7-12] However, the ecological context of childhood poverty and low SES consists of more than a dearth of cognitive stimulation. Unfortunately, the environment of childhood disadvantage includes exposure to a wider array, and higher intensity, of adverse psychosocial and physical stressors, such as family conflict and dissolution, residential instability, exposure to violence, fewer daily routines and structure, and elevated exposure to toxins (eg, lead), along with substandard housing and diminished neighborhood quality.[13-16] The environment of many impoverished children can reasonably be characterized as chaotic, consisting of a plethora of uncontrollable and often unpredictable psychosocial and physical stressors. Thus, family poverty may be one of the most pervasive uncontrollable states for children in modern society. As such, it could reasonably be expected to lead to behavioral disruptions as postulated by learned helplessness theory.

Relationship Between Poverty and Persistence

A handful of studies suggest that children of lower SES are less persistent on tasks. Evans and Stecker showed that lower-income 9-year-olds were less persistent when solving challenging, age-appropriate puzzles and subsequently in a prospective, longitudinal analysis when they were age 13.[17] Brown extended these findings to preschool children.[18] Using a concept acquisition task, Bresnahan and Blum reported an interaction between SES and degree of random reinforcement on a concept formation protocol.[19] Children were told that their objective was to choose the correct combination of colored backgrounds and shapes from two options across multiple trials. They were rewarded with a penny for each correct choice involving the concept of “triangle,” which was acquired through their own trial-and-error learning. Low-SES first graders who experienced reinforcement for correct performance on a series of trials before the concept acquisition phase performed significantly worse than their high-SES counterparts in the same condition. However, after exposure to random reinforcement trials wherein rewards were received independently of performance, the results of high- and low-SES children on the concept formation phase converged. The authors concluded that poor performance by low-SES children could be attributed to their chaotic reinforcement histories.[19]

Economic disadvantage also predicts lower perceptions of control. In their study of sixth through eighth graders, Battle and Rotter found that children of high SES were significantly more likely than those of low SES

to have an internal locus of control.[20] Similarly, Bandura et al reported an inverse association between familial SES and the self-efficacy of 11- to 15-year-old children in achievement situations.[21]

Relationship Between Persistence and Academic Outcomes

Behavioral deficits in the form of lack of persistence have been directly linked to academic outcomes.[4,22-25] Third through fifth graders with a lower level of control beliefs demonstrate lower levels of achievement and evidence less task persistence in the classroom.[26] Children who report feelings of a low level of control are less able to cope when they encounter difficulties in achievement situations.[27] Similarly, compared with their more mastery-oriented peers, children who believe they have a low level of ability show greater deficits in tasks requiring continued effort and manifest poorer academic performance. Moreover, poorer academic performance was shown both concurrently and prospectively 2 years later.[28] Compared with their more skilled peers, poor readers evidence more behaviors indicative of learned helplessness, including less persistence and greater decrements in expectancy of success following failure.[29] Lastly, when controlling for childhood SES and IQ, task persistence at age 13 is related to school grades at age 16.[30]

The current study extends the work on poverty, task persistence, and achievement by looking at longitudinal relationships among poverty, task persistence, and two largely unexamined academic outcomes – academic competence and educational attainment.

Academic competence is defined as one's knowledge and perceptions about his or her academic ability.[31] Self-concepts of academic competence are formed through environmental experiences, particularly reinforcements and feedback from others.[32] According to Bong and Skaalvik, "Children with different self-beliefs demonstrate different levels of cognitive, social, and emotional engagement in school" (page 2).[31] In fact, perceived academic competency predicts higher levels of interest in academic material, higher school grades, and higher scores on standardized tests.[33,34] Thus, although perceived academic competence is fairly well explored in the educational literature, this variable has been largely overlooked in connection with childhood poverty.

Educational attainment is defined here as the amount of schooling attained. The duration of time a child has spent in poverty is related to years of schooling attained, likelihood of high school graduation, and adult earnings.[35] In 2009, students who fell in the bottom 20% of all family incomes were five times more likely than their high-income counterparts (ie, those in the top 20% of all family incomes) to drop out of high school.[36]

This educational outcome can shape development over the life course and arguably into future generations.[35]

Summary and Hypothesis

Previous literature has documented a troublesome gap in educational outcomes for children across different socioeconomic strata. Children from lower-SES homes are more likely than their more affluent peers to receive poor grades and low scores on achievement tests, and to drop out of high school.[37-41] Prior research indicates that a portion of the income–achievement gap in low-income households is due to diminished parental investments. Although parental investment is essential to academic development, it is not the only critical ingredient. Another salient component of achievement is persistence on tasks. To test the effect of task persistence on academic outcomes, we used multiple waves of longitudinal data. We hypothesized that task persistence during childhood mediates the relationship between duration of childhood poverty and educational outcomes measured at two age periods – academic competence at age 17 and educational attainment at age 23.

Because chronic poverty operates within a complex ecological web of multiple risk factors, it is unlikely that poverty alone drives the extensively documented income–achievement gap. Thus, our objective is not to present a causal explanation for the income–achievement gap but rather to explore a theoretically plausible behavioral process – task persistence – that may provide additional insight into the abundant correlational evidence for the link between poverty and a low level of achievement.

Methods

Participants

The participants in this study were part of a longitudinal study of rural poverty and human development from early childhood into adulthood (see the 2003 article of Evans for full details).[42] The original sample was recruited through public schools, New York State Cooperative Extension programs, and antipoverty programs in rural areas of upstate New York. Only one child per household participated in the study. Low-income families were intentionally oversampled. Longitudinal data were collected over four time points: age 9 years (mean = 9.17, standard deviation [SD] = 1.15); age 13 years (mean = 13.38, SD = 1.01); age 17 years (mean = 17.48, SD = 1.01); and age 23 years (mean = 23.49, SD = 1.0). At wave 1, a total of 341 participants were enrolled in the study. The sample analyzed here consisted of 206 subjects (48% female) with complete information on

poverty, task persistence, academic competence, and educational attainment.

Procedures and Measures

Poverty. Duration of childhood poverty was defined as the proportion of months from birth through age 9 years that the participant had lived at or below the poverty line (income-to-needs ratio ≤ 1, where 1 = the United States Census Bureau annually adjusted poverty line). Poverty was operationalized in this way because the duration of childhood deprivation, rather than the timing of exposure to poverty, appears to be particularly critical for affecting cognitive achievement.[43,44]

Task persistence. Task persistence was evaluated at ages 9, 13, and 17 years with a standard behavioral protocol[45] adapted for children.[46,47] At age 9, participants were given 10 minutes to draw links between familiar pictures without doubling back or lifting their pencil. Children could work on the puzzle until it was solved or until they felt unable to solve it. At that point, they could move on to the second puzzle. Children were informed that once they had moved on to the second puzzle, they could not return to the first puzzle. Participants received the first test puzzle after the experimenter ensured that they comprehended the task. Unbeknownst to the children, this first problem was unsolvable. The second puzzle was solvable. Time spent working on the first unsolvable problem was the measure of persistence.

The same general procedure was followed at ages 13 and 17. At age 13, the children were shown a picture of a tangram and instructed to reproduce the illustration with multiple plastic pieces that fit into a rectangular frame. A total of 15 minutes was available for the two test puzzles. At age 17, the subjects were instructed that their task was to trace over a complex geometric line drawing without lifting their pencil or going over any line twice. A total of 15 minutes was allotted for completion of the task. Subjects were unaware that the first puzzle was unsolvable.

Multiple studies have shown that this protocol is sensitive to experimental manipulations of the controllability of stressor exposure.[4,45,47] Moreover, both cross-sectional and longitudinal studies of chronic exposure to uncontrollable stressors reveal parallel effects on persistence on unsolvable puzzles.[4,6,13]

To calculate task persistence, we first divided each child's score in minutes by the amount of time allotted for a particular task. Thus, a score of 1.0 indicated persistence for the full period. Following this conversion, the task persistence scores were log transformed because of skewness. The task persistence variable was calculated as a child’s average

persistence across the applicable waves to capture persistence over time. When academic competence was used as the outcome at age 17, task persistence over time was the mean of waves 1 and 2. When educational attainment was used as the outcome at age 23, task persistence over time was the mean of waves 1, 2, and 3.

Academic competence. Academic competence was evaluated with the Scholastic Competence Subscale of the Harter Self-Perception Profile for Adolescents.[48] The assessment was administered during wave 3 of data collection, when the average age of the children was 17.5 years. This subscale captures adolescents' perception of their competence and ability regarding how well they are doing in school and how intelligent they feel relative to their peers. The following is a sample item on the scholastic competence measure: "Some teenagers are pretty slow in finishing their school work BUT other teenagers can do their school work more quickly." Adolescents were asked to decide which kind of teenager they were (ie, a teenager who is slow in finishing work or a teenager who finishes work more quickly) and then asked whether this description was "sort of true" or "really true" of them. Possible responses ranged from 1 to 4. A composite measure was created by averaging the responses to all questions on the scale.

This measure had good reliability ($\alpha = 0.85$), comparable with that of original psychometric work. Scores on the Harter Scholastic Competence Subscale predict grades and also correlate with teacher ratings and achievement test scores.[49]

Educational attainment. At age 23, subjects were asked about their current level of educational attainment, which was coded as follows: 1, high school dropout; 2, GED, regular high school; 3, business, secretarial, vocational, technical, or trade school; 4, dropped out of college; 5, currently enrolled in junior/community college (2 years); 6, graduated from junior/community college (2 years); 7, graduated from nursing school; 8, currently enrolled in a 4-year college; 9, graduated from a 4-year college; 10, graduate or professional school. Various alternative coding metrics were also considered but had little effect on the results.

Results

Table 1 provides descriptive statistics for the variables of interest. The average child in this sample had spent nearly half of his or her early childhood (ages 0–9) in poverty. Additionally, 19% of the sample had graduated from a 4-year college or attended postgraduate school at wave 4. The modal level of education obtained was "dropped out of college." As mentioned previously, the sample was largely white (>92%). Data were

available for 341 participants in wave 1, whereas for waves 1 through 4, data were available for 206 participants. A *t* test confirmed that those who remained in the study at age 23 had spent less of their early childhood in poverty (mean = .43) than had those who did not remain in the study (mean = .60) at wave 4; $t(279) = 2.42$, $P < .05$. Bivariate relationships between the variables of interest are displayed in Table 2.

Table 1. Descriptive Statistics for the Three Waves of Data Collection

Variable	Mean (SD)
Proportion of life spent in poverty (birth – wave 1)	0.46 (0.49)
Task persistence (average proportion waves 1 and 2)	0.52 (0.24)
Task persistence (average proportion waves 1, 2, and 3)	0.49 (0.23)
Academic competence	2.87 (0.70)

SD, standard deviation.

Table 2. Bivariate Correlations of the Variables

Variable	1	2	3	4	5
1. Duration of poverty					
2. Task persistence, waves 1 and 2	–.183*	–			
3. Task persistence, waves 1, 2, and 3	–.243*	.912*	–		
4. Academic competence	–.167**	.137**	.176*	–	
5. Educational attainment	–.407*	.224*	.322*	.305*	–

* Correlation is significant at the .01 level (2-tailed).
** Correlation is significant at the .05 level (2-tailed).

As mentioned previously, because of skew, the task persistence variables were log transformed before entry into regression models. To assess the hypothesized relationship between childhood poverty and perceived academic competence, academic competence was regressed onto duration of early childhood spent in poverty. Figure 2 depicts academic competence at age 17 as a function of the proportion of life lived in poverty from birth to age 9. Note that these results are for descriptive purposes only; all inferential analyses maintained the continuous measure of proportion of life spent in poverty from birth to age 9. As suggested by Figure 2, the proportion of early childhood spent living in poverty significantly predicted academic competence at age 17; $b = –2.56$, $P < .05$.

To evaluate the hypothesized role of task persistence as a mediator, we used the product of the coefficients approach. This is possible, given that the product of the predictor and the mediator is equal to the difference between the total and the direct effect. We then tested the significance of this product term with bootstrapping, a nonparametric sampling method that through repeated simulations derives an estimate of the significance of the indirect effect with generated confidence intervals.[50] As indicated in Table 3, the proportion of reduction in the beta weight for academic competence from row 1 to row 3 when controlling for task persistence is 92%. The 95% confidence interval for the indirect effect on academic competence (–.08 to –.001) indicates that the covariance between the duration of poverty and academic competence was significantly attenuated.[50] There is a significant indirect effect of poverty early in life on perceived academic competence vis-à-vis task persistence

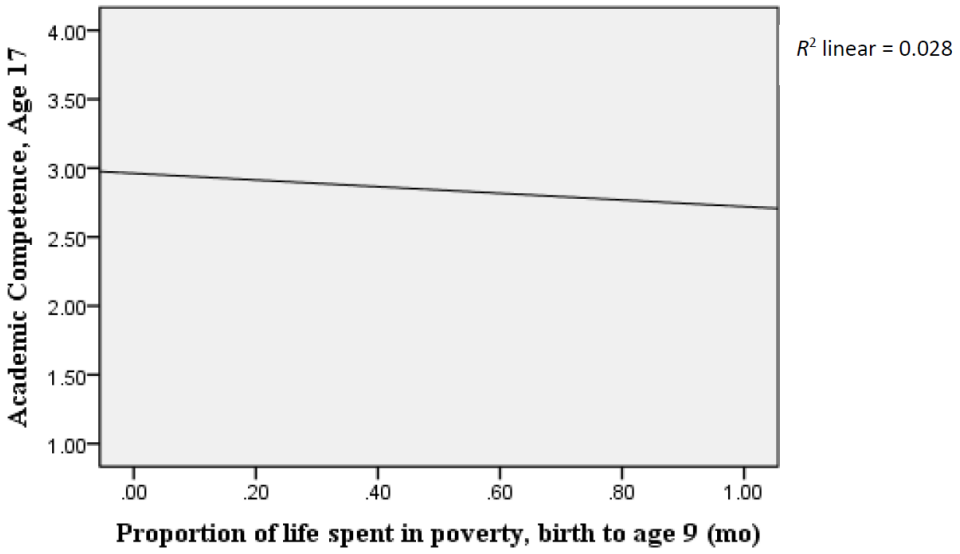

Figure 2. The proportion of early childhood spent living in poverty significantly predicts academic competence at age 17; $b = –2.56$, $P < .05$.

Table 3. Longitudinal Mediational Analysis of Academic Competence in Adolescents (Age 17) and Proportion of Early Childhood Spent Living in Poverty (Birth to Age 9), Statistically Controlling for Task Persistence Over Time (Ages 9 and 13).

	Academic Competence			
Predictor	**Total R^2**	**$F\Delta R^2$**	***df***	***b* (SE)**
Proportion of early childhood spent living in poverty (birth to age 9 years)	.03	6.53*	1227	–2.56* (.01)
Task persistence (mean of ages 9 and 13)	.03	5.10*	1207	.41* (.21)
Proportion of early childhood spent living in poverty	.02	4.10*	1206	–.20* (.10)

controlled for task persistence (mean of ages 9 and 13)							

R^2, coefficient of determination; *F*Δ*R2,* change in R^2*; df*, degrees of freedom; *b*, regression coefficient (beta); SE, standard error.* *P* < .05.

To assess the mediational role of task persistence in educational attainment, educational attainment was regressed onto duration of early childhood spent in poverty. Figure 3 depicts educational attainment at age 23 as a function of proportion of life lived in poverty from birth to age 9. Table 4 shows parallel results for educational attainment at age 23 and early childhood poverty; *b* = –2.23*, P* < .001. As reported in Table 4, the proportion of reduction in the beta weight for educational attainment from row 1 to row 3 when controlling for task persistence is 24%. The 95% confidence interval for the indirect effect of educational attainment (–.85 to –.28) indicates that the covariance between duration of poverty and educational attainment was significantly attenuated.[50]

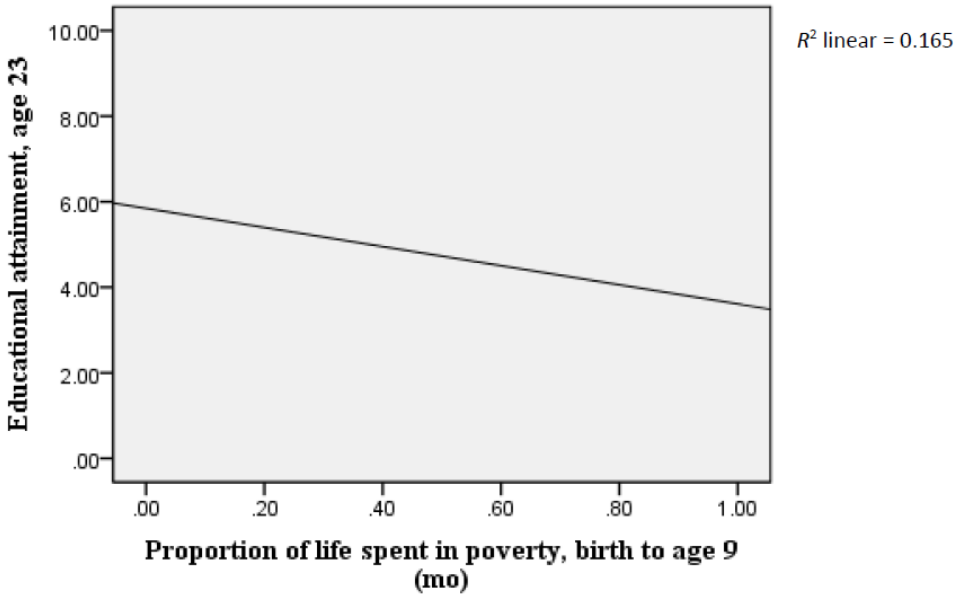

Figure 3. The proportion of early childhood spent living in poverty significantly predicts educational attainment at age 23; $b = –2.23$, $P < .001$.

Table 4. Longitudinal Meditational Analysis of Educational Attainment in Young Adulthood (Age 23) and Proportion of Early Childhood Spent Living in Poverty (Birth to Age 9 Years), Statistically Controlling for Task Persistence Over Time (Ages 9 to 17 years)

	Educational Attainment			
Predictor	**Total R^2**	**$F\Delta R^2$**	***df***	***b* (SE)**
Proportion of early childhood spent living in poverty (birth to age 9)	.17	43.79*	1221	–2.23* (.34)
Task persistence (mean of ages 9, 13, and 17 years)	.16	40.87*	1218	3.41* (.71)
Proportion of early childhood spent living in poverty, controlling for task persistence (mean of ages 9, 13, and 17 years)	.09	24.57*	1217	–1.70* (.34)

R^2, coefficient of determination; $F\Delta R2$, change in R^2; *df*, degrees of freedom; *b*, regression coefficient (beta); SE, standard error.
* $P < .05$

Discussion

Using longitudinal data, we found that average task persistence at ages 9 and 13 statistically mediated the relation between duration of childhood poverty and academic competence at age 17. Furthermore, average task persistence at ages 9, 13, and 17 mediated the association between duration of childhood poverty and educational attainment at age 23. Thus, one of the pathways linking childhood poverty to academic outcomes in late adolescence and early adulthood may be task persistence.

The current study builds upon and extends a well-established area of research regarding the effect of economic inequalities on academic outcomes. Over the past several decades, family income has been

identified as one of the strongest predictors of school achievement and dropout rates.[37-41] Through the use of multiple methods and a longitudinal design, the current study provides evidence that task persistence is a potential pathway underlying the pervasive income–achievement gap. To our knowledge, the present study provides the only data directly testing the model depicted in Figure 1, indicating that diminished task persistence is a mechanism that helps account for the association between poverty and poor educational outcomes.

This research is in line with other research exploring noncognitive determinants of success. In particular, self-regulatory abilities in childhood have become a fertile area for understanding school achievement and later success in life.[51-54] Children who are capable of controlling their behavior and delaying gratification tend to be more cognitively competent, socially skilled, and able to cope with frustration.[53]

Unfortunately, the current research does not allow us to identify precisely how poverty undermines persistence. However, it is possible to speculate. Past research suggests that family income indirectly affects children's efficacy through parental efficacy.[21] Environmental chaos is another possible mechanism through which low family SES exerts its influence over children's control beliefs and perseverance.[17] Impoverished children experience more uncontrollable, negative environmental stimuli than do their higher-income peers, effectively decreasing their opportunities to practice self-regulatory skills and gain a sense of mastery over their environment.[16,55-57] This is in line with learned helplessness theory, which states that individuals become unable or unwilling to act upon the environment when they believe that their behavior and the outcome are independent.[4]

These findings raise several follow-up questions. First, do these same relationships exist at different points in time? For example, does income in the first few years of life affect task persistence at age 6? Some researchers have suggested that such deficits are not evidenced until a child has a sufficient understanding of the self, as in the middle school years.[28] Regardless of the timing of the onset of these behaviors, Grant et al assert that although infants and young children likely do not engage in cognitive appraisal, they can nevertheless be subjected to negative events, such as abuse, neglect, or maternal separation.[56] Thus, stressor effects can occur independently of cognitive appraisal in childhood and even into adolescence. Most likely, the timing and duration of such stressor effects influence the likelihood that one's persistence will be undermined. Research suggests that with regard to the timing of poverty, early poverty has more detrimental effects on educational achievement and attainment

than does poverty experienced later in childhood.[58,59] However, a lack of task persistence may be particularly detrimental in the transition to middle school, when more autonomous learning is required.

It is important to note that we used the federal poverty threshold to draw the sample and calculate "duration of childhood in poverty" for this study. Although this cutoff is in line with the national definition of poverty, it is a conservative threshold that admittedly underestimates financial struggle among American families. Many families whose income hovers above the poverty line still experience considerable economic stress.[60]

Limitations

Although the longitudinal design of the current study allows a robust test of statistical mediation, we caution against drawing causal conclusions. Our objective was to explore a theoretically plausible behavioral process – task persistence – to provide additional insight into the abundant correlational evidence for the link between poverty and a low level of achievement. Short of random assignment to households varying in poverty status, there is always the possibility that other variables, such as family background, may account for some of the income–achievement gap. Nevertheless, when we incorporate low level of parental education, single-parent status, teenage motherhood, and maternal mental illness into the present regression models, the significant associations between duration of early childhood poverty and the various outcomes remain significant.

As previously mentioned, the exact mechanisms by which poverty influences task persistence are only speculative at this time. Poverty is a distal condition that increases the likelihood of other, more proximal correlates of risk (eg, food insecurity, parental separation, neglect).[61] Research on adverse childhood experiences suggests that exposure to multiple adverse risks alters brain structure and function as well as stress-related neurological systems.[62] Most likely, the pathway through which poverty exerts its effects on task persistence is multifaceted, such that several mediators are at play. For example, childhood poverty may increase the likelihood of exposure to adverse experiences, which increases the incidence of uncontrollable events and ultimately undermines persistence. Evans has shown that cumulative risk exposure among children of elementary school age predicts greater helplessness, along with deficits in executive functioning.[42]

We recognize that these other potential mechanisms of influence are unexamined. One plausible mediating mechanism is executive functioning, which contributes to school readiness[63] and is known to be undermined by poverty.[64,65] Unfortunately, executive functioning was not

assessed over the course of the study. The same holds true for intelligence. Future research might incorporate a larger model whereby the differential effects of various explanatory variables such as these could be examined.

Although the data are longitudinal, there is insufficient information on children's prior academic achievement at ages 9 and 13 to control for prior academic performance. Thus, it is possible that there is a reciprocal influence, with poorer academic performance actually weakening task persistence. Similarly, we did not have data on earlier levels of academic competence. Perceived academic competence and task persistence likely interact in a joint fashion.[66]

Additionally, perceived academic competence is likely conflated with self-esteem and/or self-confidence. Although feelings of competence are indeed important to success, a more complete picture could be gleaned by also having the actual grades or test scores of these children. A supplementary measure of teacher-reported achievement or grades would help tease these apart.

Lastly, the study participants were largely white and came from rural areas of upstate New York. These characteristics limit the generalizability of the findings because the experiences and effects of disadvantage are by no means homogeneous across groups. Whereas rural families of low SES tend to lack health care and job opportunities, urban families in inner cities must contend with high crime rates and violence plus the insidious effects of racism. The multilayered relationships between SES, geographical location, and ethnicity are likely quite complex. On the other hand, it is worth noting the absence of data from samples such as this one – white, rural, low- and middle-income children and youth.

Implications and Future Directions

Improving educational attainment among our nation's students is imperative. High school dropouts face bleak futures; they are less likely find a job and earn a living wage, more likely to be poor, and at increased risk for a variety of adverse health outcomes.[67] Additionally, they are more likely to rely on public assistance, engage in crime, and generate other social costs borne by taxpayers.[68] The effects of low educational attainment do not apply only to high school dropouts, however. Bailey and Dynarski found that among a cohort born between 1979 and 1982, 54% in the highest income quartile completed college, compared with only 9% in the lowest income quartile.[69] This is particularly concerning because one

of the most effective ways to raise people out of the cycle of poverty is through higher education.[70]

Current educational reform tends to focus on increased testing and accountability, and on standardized curricula.[71] However, if task persistence is a mediator of the income–education gap, these types of reforms are unlikely to drastically improve academic outcomes for poor students. Instead, reform might focus on improving the daily lives of impoverished children, which, compared with the lives of their nonpoor peers, are more likely to be plagued by unresponsive parenting, chaotic living conditions, family instability, and exposure to a host of chronic stressors that are uncontrollable.[13]

Additionally, the type of learning environment may moderate the association between childhood poverty and poor academic outcomes. The degree to which a learning environment is competitive or supportive can affect a variety of educational outcomes.[72-74] For example, Ludtke and colleagues found that mathematics self-concepts (perceived competence) tended to be higher in learning environments that focused on individual students' progress rather than on social comparison.[75] Given the current focus in American schools, and particularly the poorly performing schools where most impoverished children matriculate, the modal experience of poor children likely emphasizes test performance rather than individual progress. The effects of academic self-concept on overall self-esteem (rather than vice versa) tend to increase in meritocratic learning environments because achievement is strongly tied to effort rather than to other factors (ie, luck, circumstance). These findings suggest that the interaction of learning environment with poverty status warrants further investigation.

Similarly, teacher perceptions of students' family backgrounds, and the subsequent expectations they hold for students, may be worthy of future study. Teachers in schools with pupils of lower SES and lower achievement more often underestimate their students' abilities, even after holding students' social and academic backgrounds constant.[76] The classic work of Rosenthal and Jacobson on the Pygmalion effect found that higher teacher expectations led to better student performance.[77] Together with these findings, it is possible that teachers' perceptions of their students, as well as expectations that result from these perceptions, can influence or interact with children's task persistence. For example, if a poor child is not expected to do well, a teacher may unconsciously undermine persistence by providing tasks that are too easy or stepping in too soon to offer help.

Finally, because persistence is a behavior that is learned through interaction with the environment, it is crucial to consider ways in which this behavior may be increased. Extensive work has found that attribution training can significantly improve children's persistence on tasks. Attribution training involves providing children with several instances of success as well as imbuing them with a sense that personal effort and a successful outcome are linked (as opposed to believing that personal action and outcomes are not contingent). Children who undergo this form of training persist longer and are more likely to improve their performance, even after instances of failure, than are matched peers who do not undergo attribution training.[78]

Future studies might explore what psychological processes and pathways underlie the relatively consistent links uncovered in several studies between poverty and task persistence. Parenting variables likely play a sizable role, particularly sensitivity and encouragement of self-direction and autonomy.[9,79-82] Chaos in a child's microsetting may also contribute by increasing unpredictability and uncontrollability. Evans and colleagues found that chaos, defined by high levels of noise and crowding, minimal routine, and a general sense of unpredictability in daily living, mediated the relationship between income and persistence on a puzzle task.[17] In addition to parenting and chaos, it is possible that neighborhood or school resources play a role. Living in neighborhoods with a high proportion of nonworking adults and being isolated from jobs or mainstream culture diminish youth self-efficacy.[83] Furthermore, persistent conditions of unemployment in one's community can lead to feelings of self-doubt and futility.[84] Finally, as mentioned previously, there are likely factors within the school itself that influence children's motivation. Teacher quality, measured as the amount of teacher experience and in-field preparation, is disproportionally lower in the low-income schools that impoverished children are likely to attend.[85]

Summary and Conclusion

To our knowledge, this is the first empirical examination of the mediating role of task persistence in the well-documented income–achievement gap. We have built upon prior work showing that duration of poverty is negatively linked with task persistence and two educational outcomes – academic competence and educational attainment. Using longitudinal data, we provide multi-methodological evidence that an important mechanism for the income–achievement gap is task persistence. This evidence adds to current research on noncognitive predictors of academic achievement.

Nobel Laureate James Heckman notes that skill formation trajectories are initiated in the early family environment and driven by a combination of cognitive and socioemotional factors, particularly motivation, persistence, and tenacity.[3] Acquisition of these skills in early childhood begets additional skills years later. Unfortunately, the children who are not armed with these advantages at an early age will likely lag their peers later in life. The result is an intergenerational cycle of poverty and underachievement that is not only detrimental to individuals and families but also costly to society as a whole.

References

1. United States Census Bureau. 2014 current population survey annual social and economic supplement research files. http://www.census.gov/newsroom/press-releases/2015/cb15-tps04.html. Published January 13, 2015. Accessed November 5, 2016.

2. Kids Count Data Center. Fourth graders who scored below proficient reading level by family income. http://datacenter.kidscount.org/data/bar/5125-fourth-graders-who-scored-below-proficient-reading-level-by-family-income?loc=21&loct=2#2/21/false/573/1171,1172/11558. Published 2015. Accessed November 5, 2016.

3. Heckman JJ. Skill formation and the economics of investing in disadvantaged children. *Science.* 2006;312:1900-1902.

4. Peterson C, Maier SF, Seligman MEP. *Learned Helplessness: A Theory for the Age of Personal Control*. New York, NY: Oxford University Press; 1993.

5. Cohen S, Evans GW, Krantz D, Stokols D. Physiological, motivational, and cognitive effects of aircraft noise on children: moving from the laboratory to the field. *Am Psychol.* 1980;35(3):231-243.

6. Cohen S, Evans GW, Stokols D, Krantz DS. *Behavior, Health, and Environmental Stress*. New York, NY: Plenum; 1986.

7. Duncan GJ, Brooks-Gunn J, Klebanov P. Economic deprivation and early childhood development. *Child Dev.* 1994;65 (2 Spec No):296-318.

8. Hoff E, Laursen B, Tardiff. Socioeconomic status and parenting. In: Bornstein MH, ed. *Handbook of Parenting.* 2nd ed. Mahwah, NJ: Erlbaum; 2002:231-252.

9. Bradley RH, Corwyn RF, McAdoo HP, Coll CG. The home environments of children in the United States part I: variations by age, ethnicity, and poverty status. *Child Dev.* 2001;72(6):1844-1867.

10. Linver MR, Brooks-Gunn J, Kohen D. Family processes in pathways from income to young children's development. *Dev Psychol.* 2002;38(5):719-734.

11. Power C, Jefferis B, Manor O, Hertzman C. The influence of birth weight and socioeconomic position on cognitive development: does the early home and learning environment modify their effects? *J Pediatr.* 2006;148(1):54-61.

12. Smith JR, Brooks-Gunn J, Klebanov PK. Consequences of living in poverty for young children's cognitive and verbal ability and early school achievement. In: Duncan GJ, Brooks-Gunn J, eds. *Consequences of Growing Up Poor*. New York, NY: Russell Sage Foundation; 1997:132-189.

13. Evans GW, Stecker R. The motivational consequences of environmental stress. *J Environ Psychol.* 2004;24:143-165.

14. Evans GW, Eckenrode J, Marcynyszyn LA. Poverty and chaos. In: Evans GW, Wachs TD, eds. *Chaos and Its Influence on Children's Development*. Washington, DC: American Psychological Association; 2010:225-238.

15. Sherman A. *Wasting America's Future.* Boston, MA: Beacon; 1994.

16. Taylor SE, Repetti RL, Seeman TE. Health psychology: what is an unhealthy environment and how does it get under the skin? *Annu Rev Psychol.* 1997;48:411-447.

17. Evans GW, Gonnella C, Marcynyszyn LA, Gentile L, Salpekar N. The role of chaos in poverty and children's socioemotional adjustment. *Psychol Sci.* 2005;16(7):560-565.

18. Brown ED. Persistence in the face of academic challenge for economically disadvantaged children. *J Early Childhood Res.* 2009;7:175-186.

19. Bresnahan JL, Blum WL. Chaotic reinforcement: a socioeconomic leveler. *Dev Psychol.* 1971;4(1):89-92.

20. Battle ES, Rotter JB. Children's feelings of personal control as related to social class and ethnic group. *J Pers.* 1963;31:482-490.

21. Bandura A, Barbaranelli C, Caprara GV, Pastorelli C. Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Dev.* 2001;*72*(1):187-206.

22. Bandura A. *Self-Efficacy: The Exercise of Control.* New York, NY: Freeman; 1997.

23. Seligman MEP. *Helplessness: On Depression, Development, and Death*. San Francisco, CA: Freeman; 1975.

24. Shapiro DH, Astin J. *Control Theory.* New York, NY: Wiley; 1998.

25. Dweck CS, Elliott E. Achievement motivation. In: Mussen P, ed. *Handbook of Child Psychology*. Vol 4. New York, NY: Wiley; 1983:643-691.

26. Nolen-Hoeksema S, Girgus JS, Seligman MEP. Learned helplessness in children: a longitudinal study of depression, achievement, and explanatory style. *J Pers Social Psychol.* 1986;51(2):435-442.

27. Licht BG, Dweck CS. Determinants of academic achievement: the interaction of children's achievement orientations with skill area. *Dev Psychol.* 1984;20(4):628-636.

28. Fincham FD, Hokoda A, Sanders R Jr. Learned helplessness, test anxiety, and academic achievement: a longitudinal analysis. *Child Dev.* 1989;60(1):138-145.

29. Butkowsky IS, Willows DM. Cognitive-motivational characteristics of children varying in reading ability: evidence for learned helplessness in poor readers. *J Educ Psychol.* 1980;72(3):408-422.

30. Andersson H, Bergman LR. The role of task persistence in young adolescence for successful educational and occupational attainment in middle adulthood. *Dev Psychol.* 2011;47(4):950-960.

31. Bong M, Skaalvik EM. Academic self-concept and self-efficacy: how different are they really*? Educ Psychol Rev.* 2003;15(1):1-40.

32. Shavelson RJ, Hubner JJ, Stanton GC. Self-concept: validation of construct interpretations. *Rev Educ Ress* 1976;46(3):407-441.

33. Marsh HW, Trautwein U, Ludtke O, Koller O, Baumert J. Academic self-concept, interest, grades, and standardized test scores: reciprocal effects models of causal ordering. *Child Dev.* 2005;76(2):397-416.

34. Valentine JC, DuBois DL, Cooper H. The relation between self-beliefs and academic achievement: a meta-analytic review. *Educ Psychol.* 2004;39(2):111-133.

35. Teachman JD, Paasch KM, Day RD, Carver KP. Poverty during adolescence and subsequent educational attainment. In: Duncan GJ, Brooks-Gunn J, eds. *Consequences of Growing Up Poor*. New York, NY: Russell Sage Foundation; 1997:382-418.

36. Chapman C, Laird J, Ifill N, Kewal Ramani A. Trends in high school dropout and completion rates in the United States: 1972-2009. National Center for Education Statistics. http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2012006. Published October 13, 2011. Accessed November 5, 2016.

37. Duncan GJ, Murnane RJ, eds. *Whither Opportunity*? New York, NY: Russell Sage Foundation; 2011.

38. McLoyd VC. Socioeconomic disadvantage and child development. *Am Psychol.* 1998;53(2):185-204.

39. Putnam R. *Our Kids: The American Dream in Crisis.* New York, NY: Simon & Schuster; 2015.

40. Sirin SR. Socioeconomic status and academic achievement: a meta-analytic review. *Rev Educ Res.* 2005;75(3):417-453.

41. Bradley RH, Corwyn, RF. Socioeconomic status and child development. *Annu Rev. Psychol.* 2002;53:371-399.

42. Evans GW. A multi-methodological analysis of cumulative risk and allostatic load among rural children. *Dev Psychol.* 2003;39:924-933.

43. Korenman S, Miller JE, Sjaastad JE. Long-term poverty and child development: evidence from the NLSY. *Child Youth Serv Rev.* 1995;17:127-155.

44. National Institute of Child Health and Human Development Early Child Care Research Network. Duration and developmental timing of poverty and children's cognitive and social development. *Child Dev.* 2005;76(4):795-810.

45. Glass D, Singer J. *Urban Stress: Experiments on Noise and Social Stressors*. New York, NY: Academic Press; 1972.

46. Bullinger M, Hygge S, Evans GW, Meis M, von Mackensen S. The psychological costs of aircraft noise among children. *Zentralbl Hyg Umweltmedizin.* 1999;202(2-4):127-138.

47. Cohen S. Aftereffects of stress on human performance and social behavior: a review of research and theory*. Psychol Bull.* 1980;88(1):82-108.

48. Harter S. *Manual for the Self-Perception Profile for Adolescents*. Denver, CO: University of Denver; 1988.

49. Harter S. The perceived competence scale for children. *Child Dev.* 1982;53(1):87-97.

50. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods.* 2008;40(3);879-891.

51. Blair C. School readiness. Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *Am Psychol.* 2002;57(2):111-127.

52. Blair C. Stress and the development of self-regulation in context. *Child Dev Perspect.* 2010;4(3):181-188.

53. Mischel W, Shoda Y, Rodriguez MI. Delay of gratification in children. *Science.* 1989;244(4907):933-938.

54. Raver C. Emotions matter: making the case for the role of young children's emotional development for early school readiness. *Social Policy Rep.* 2002;16(3):3-19.

55. Evans GW. The environment of childhood poverty. *Am Psychol.* 2004;59(2):77-92.

56. Grant KE, Compas BE, Stuhlmacher AF, Thurm AE, McMahon SD, Halpert JA. Stressors and child and adolescent psychopathology: moving from markers to mechanisms of risk. *Psychol Bull.* 2003;129(3):447-466.

57. Repetti RL, Taylor SE, Seeman TE. Risk families: family social environments and the mental and physical health of offspring. *Psychol Bull.* 2002;128(2):330-366.

58. Duncan GJ, Yeung WJ, Brooks-Gunn J, Smith JR. How much does childhood poverty affect the life chances of children? *Am Sociol Rev.* 1998;63(3):406-423.

59. Votruba-Drzal E. Economic disparities in middle childhood development: does income matter? *Dev Psychol.* 2006;42(6*)*:1154-1167*.*

60. Gould E, Cooke T, Kimball W. What families need to get by: EPI's 2015 family budget calculator. Issue Brief No. 403. Economic Policy Institute. http://www.epi.org/publication/what-families-need-to-get-by-epis-2015-family-budget-calculator/. Published August 26, 2015. Accessed November 5, 2016.

61. Evans GW, Li DP, Whipple SS. Cumulative risk and child development.
Psychol Bull. 2013;139(6):1342-1396.

62. Anda RF, Felitti VJ, Bremner JD, et al. The enduring effects of abuse and related adverse experiences in childhood: a convergence of evidence from neurobiology and epidemiology. *Eur Arch Psychiatry Clin Neurosci.* 2006;256(3):174-186.

63. Blair C, Raver CC. School readiness and self-regulation: a developmental psychobiological approach. *Annu Rev Psychol.* 2015;66:711-731.

64. Blair C, Raver CC. Child development in the context of adversity: experiential canalization of brain and behavior. *Am Psychol.* 2012;67(4):309-318.

65. Evans GW, Kim P. Childhood poverty, chronic stress, self-regulation and coping. *Child Devel Perspect.* 2013;7(1):43-48.

66. Dweck CS. Motivational processes affect learning. *Am Psychol.* 1986;41(10):1040-1048.

67. Rumberger RW. *Dropping Out: Why Students Drop Out of High School and What Can Be Done About It*. Cambridge, MA: Harvard University Press; 2011.

68. Belfield C, Levin HM. *The Price We Pay: Economic and Social Consequences of Inadequate Education*. Washington, DC: Brookings Institution Press; 2007.

69. Bailey MJ, Dynarski SM. *Gains and Gaps: Changing Inequality in U.S. College Entry and Completion* (NBER Working Paper No. 17633). Cambridge, MA: National Bureau of Economic Research; 2011.

70. Douglas-Hall A, Chau M. Parents' low education leads to low income, despite full-time employment. National Center for Children in Poverty, Columbia University, Mailman School of Public Health. http://www.nccp.org/publications/pub_786.html. Published November 2007. Accessed November 5, 2016.

71. Ladd HF. Education and poverty: confronting the evidence. *J Policy Analysis Manage.* 2012;31(2):203-227.

72. Ames C. Classrooms: goals, structures, and student motivation. *J Educ Psychol.* 1992;84:261-271.

73. Anderman EM. School effects on psychological outcomes during adolescence. *J Educ Psychol.* 2002;94(4):795.

74. Pintrich PR. A motivational science perspective on the role of student motivation in learning and teaching contexts. *J Educ Psychol.* 2003;95(4):667-686.

75. Ludtke O, Koller O, Marsh HW, Trautwein U. Teacher frame of reference and the big-fish-little-pond effect. *Contemp Educ Psychol.* 2005;30:263–285.

76. Ready DD, Wright DL. Accuracy and inaccuracy in teachers' perceptions of young children's cognitive abilities: the role of child background and classroom context. *Am Educ Res J.* 2011;48(2):335-360.

77. Rosenthal R, Jacobson L. *Pygmalion in the Classroom: Teacher Expectation and Pupils' Intellectual Development.* New York, NY: Holt, Rinehart, & Winston; 1968.

78. Dweck CS. *Mindset.* New York, NY: Ballantine Books; 2007.

79. Conger RD, Donnellan MB. An interactionist perspective on the socioeconomic
context of human development. *Annu Rev Psychol.* 2007;58:175-199.

80. Gecas V. The social psychology of self-efficacy. *Annu Rev Sociol.* 1989;15:291-316.

81. Kohn ML. *Social Class and Conformity*. Chicago, IL: University of Chicago Press; 1977.

82. Luster T, Rhoades K, Haas B. The relation between parental values and parenting
behavior: a test of the Kohn hypothesis. *J Marriage Fam.* 1989;51:139-147.

83. Wilson WJ. Public policy research and 'the truly disadvantaged.' In: Jencks C, Peterson PB, eds. *The Urban Underclass*. Brookings Institution Press; 1991:460-482.

84. McLeod JD, Nonnemaker JM. Social stratification and inequality. In: Aneshensel CS, Phelan JC, eds. *Handbook of the Sociology of Mental Health.* New York, NY: Kluwer; 1999:321-344.

85. Peske HG, Haycock K. *Teaching inequality: how poor and minority students are shortchanged on teacher quality*. Education Trust. http://edtrust.org/wp-content/uploads/2013/10/TQReportJune2006.pdf. Published June 2006. Accessed November 5, 2016.