

The Role of Persistence at Preschool Age in Academic Skills at Kindergarten

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Abstract:

The current study examined the role of preschoolers' motivation, operationalized as persistence, in the formation of language and math skills at kindergarten. The participants were 263 children from diverse ethnic and socio-economic backgrounds. Demographic information, child persistence, and early cognitive-linguistic skills were assessed at age 3; children's academic skills were assessed at kindergarten. Results indicated that preschooler's persistence was related to their academic skills two years later over and above demographic factors and early cognitive-linguistic skills. The findings are discussed in terms of the importance of early childhood motivation for later school achievement.

Keywords: Motivation | Persistence | School readiness | Academic skills | Preschoolers

Article:

Children's early academic skills are often regarded as a key indicator of children's subsequent academic achievement (La Paro and Pianta 2000; Rimm-Kaufman et al. 2000). Duncan et al. (2007) found academic skills at school entry to explain substantially more of the variance in achievement than social-emotional skills or other factors. Low academic performance at the time of school entry often leads to placements in less rigorous education tracks and diminishing interest in learning, particularly among lower income children (Howard et al. 2009; Roeser and Eccles 2000). The achievement gap that tends to increase during the early years of school is known to be associated with demographic and contextual factors (e.g., McLoyd 1998), but the processes prior to school entry which contribute to individual children's success or failure in school have not been thoroughly described. One such process factor that has received relatively little attention is motivation at preschool age. The focus of the present study was to examine the relations between children's motivation at 3 years of age, operationalized as persistence in completing a challenging task, and academic skills in kindergarten, controlling for cognitive-linguistic skills at age 3.

From a viewpoint of current theoretical perspectives on motivation, for example, self-determination theory (Ryan and Deci 2002) or expectancy-value theory (Wigfield and Eccles 2002a), motivation can be described as a source of energy and direction for behavior. As such, motivation predicts child's level of engagement in particular activities and ultimately can affect child's level of performance in these activities, as deeper and longer engagement tends to provide the opportunity to practice existing skills and to acquire new ones (Wigfield et al. 2006). When applied to children's learning, motivation for challenging activities may be particularly important for the development of academic skills as the successful acquisition of knowledge can happen only when children are able to persist in challenging activities (i.e., to engage with tasks and sustain their engagement) long enough for learning to occur.

Empirically, the importance of motivation for academic success has been convincingly established in research involving elementary and secondary school students (for review, see Wigfield and Eccles 2002b). Research evidence indicates that children's motivation can predict a wide range of academically related outcomes, including subsequent academic gains (Furrer and Skinner 2003; Gottfried 1990; Guay et al. 2003), perceived value of school subjects (Wigfield et al. 1997), academic and non-academic self-concepts (Eccles et al. 1989; Gottfried et al. 2006), academic anxiety (Gottfried 1985; Meece et al. 1990), and post-secondary level of education (Gottfried et al. 2005).

A body of literature addressing development of motivation in infancy and toddlerhood has shown the relative stability of motivation across the first years of life and positive relations between motivation and concurrent and subsequent levels of cognitive development (for reviews, see MacTurk and Morgan 1995; Stipek and Greene 2001). Several investigators reported that infants who expressed higher levels of persistence and exploratory behaviors at 6 to 13 months scored higher on developmental scales, such as the Bayley Scales of Infant Development and the McCarthy Scales of Children's Abilities, both concurrently and at 30 months of age (Messer et al. 1986; Yarrow et al. 1982; 1983). Additionally, Jennings et al. (1984) found significant relations between early motivation and later cognitive functioning in girls but not boys. Overall, these studies suggest interconnection between children's early motivation and cognitive development.

A few studies have focused on the relations between child motivation and academic achievement at the time of school entry. Findings from these studies suggest that motivation is positively related to academic achievement concurrently (Walker and MacPhee 2011) and 1 year later (Aunola et al. 2006; Reynolds 1989; Stipek and Ryan 1997). Moreover, Aunola et al. (2006) found reciprocal relations in which high levels of academic performance predicted motivation 6 months later, which in turn predicted subsequent performance.

The longitudinal relationship between motivation at toddlerhood and academic abilities at time of school entry, however, remains largely unexamined. Only two studies found a significant relationship between children's motivation at preschool age and early elementary school success,

controlling for child's initial cognitive abilities (Bridgeman and Shipman 1978; Sigman et al. 1987). In a study of low-income children, Bridgeman and Shipman (1978) found that children's motivation at ages 4 and 5 were positively related to their reading, math, and problem solving abilities at third grade. Similarly, Sigman et al. (1987) reported that children who showed higher levels of task persistence at age 2 had higher levels of cognitive skills at age 5, controlling for children's initial cognitive abilities. As suggested by Stipek and Greene (2001), more research is needed to identify relations between motivation in early childhood and children's academic achievement at and after school entry. The aim of the present study was to identify the relation between persistence in completing a challenging task observed at preschool age and academic skills at kindergarten. We predicted that level of persistence in a challenging task at age 3 was positively related to academic skills at kindergarten over and above demographic factors and child early cognitive-linguistic skills.

Method

Participants

The participants in this study were 263 children and their mothers from two counties in the Southeastern US who took part in a 3-year longitudinal research project. The data for the current report were collected at the first assessment when children were 3 years of age ($M = 42.2$ months, $SD = 2.0$) and at the third assessment when children were 5 years of age ($M = 67.5$ months, $SD = 2.2$) and were attending kindergarten. Mothers were 33 years of age on average ($SD = 5.91$) at the first wave of data collection. Approximately half (51 %) had a 4-year college degree or higher; 74 % of the mothers were living with a partner; and 79 % were currently working outside the home. Average income-to-needs ratio, derived by dividing the total family income by the poverty threshold for that family size, was 2.89 ($SD = 1.73$); approximately 37 % of the sample had an income-to-needs ratio of less than 2.0, indicating low income; 53 % between 2 and 5; and 10 % greater than 5, indicating high income. Sixty-one percent of the mothers self-identified as European American and 39 % as ethnic minority (31 % as African American and 8 % other ethnic backgrounds). The socio-economic and ethnic composition of the sample was representative of the local population (US Census Bureau 2011). Forty eight percent of the children were boys. The retention rate was 87 % of the original sample at age 5. Mothers of participating children at the 5-year visit were more likely to be European American ($\chi^2 = 3.89, p < .05$) and more educated ($t = 2.46, p < .05$) than mothers of non-participating children. Continuously participating children did not differ from non-participating children in terms of gender and persistence at age 3, but had higher PPVT scores at age 3 than did non-participating children ($t = 1.99, p < .05$).

Procedure

Participating families were recruited from preschools and child care centers through letters sent home with the children. Families interested in participating returned contact information to the

research team and were invited for a 2-h laboratory visit. Mothers provided written consent before the start of each session. During the sessions, mothers completed a variety of questionnaires, while children participated in a series of assessments. Families received 40 and 80 for each visit respectively, and children selected a toy after each visit.

Measures

Demographics

Mothers provided demographic information including child gender, maternal ethnicity, level of education, age, marital status, and family income. Ethnicity was coded as 0 (European American) and 1 (ethnic minority), and child gender was coded as 0 (male) and 1 (female).

Child early cognitive-linguistic skills

The Peabody Picture Vocabulary Test—III (PPVT, Dunn and Dunn, 1997), a nationally standardized measure of receptive vocabulary, was administered to children at the 3-year visit. Standard scores were used in the analysis.

Child persistence at age 3

This was assessed through a 4.5-min challenging solitary task that was videotaped for later coding. Children were presented with a wooden shape-sorter in a form of a clock with 12 uniquely shaped slots and 18 wooden pieces of which 12 corresponded to the slots and six were extra, and a clear plastic jar containing the pieces. The objective of the task was to find and put correct pieces into the slots. The child was asked to play with these toys by himself/herself. In pilot work, this task was shown to be challenging but achievable for most 3-year old children, which is precisely the situation that can elicit persistence (MacTurk and Morgan, 1995). *Persistence* was scored as cumulative time (scored in seconds, then recoded into minutes) the child spent trying to put the puzzle together. Non-task oriented activities such as using pieces as building blocks or playing with the hands of the clock were not counted as persistence. Inter-coder reliability for the duration of behavior based on randomly selected 25 % of the videotapes was $r = .96, p < .001$.

Child academic skills at kindergarten

These were assessed during the kindergarten year using the Woodcock–Johnson Psycho-Educational Battery—Revised (WJ; Woodcock and Johnson 1989), a wide-range comprehensive set of individually administered tests for measuring cognitive abilities and achievement. Four subscales—Verbal Comprehension, Letter–Word Identification, Concept Formation, and Applied Problems—were administered during the visit. A mean of standard scores for Verbal Comprehension and Letter–Word Identification ($r = .44, p < .000$) comprise *WJ Language Skills* score, and a mean of standard scores for Concept Formation and Applied Problems ($r = .58, p < .000$) comprise *WJ Math Skills* score.

Results

Preliminary analyses

Descriptive statistics and correlations among study variables are presented in Table 1. Missing values analysis indicated small amount of missing data (5.8 % overall), ranging from 0 to 13.5 % on individual variables and was attributed largely to attrition. In the path analysis using Mplus 6.11 (Muthen and Muthen2010), missing data were addressed by using full information maximum likelihood techniques. Maternal ethnicity, maternal education, and child PPVT scores at age 3 were included as covariates in the analysis as they were correlated with one or both WJ composites at kindergarten (see Table 1). Child gender was also included as a covariate as it related to the PPVT scores at age 3.

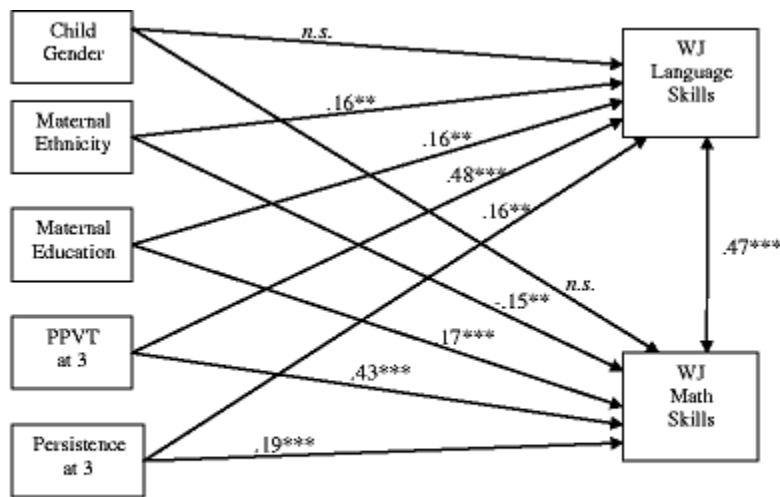
Table 1. Descriptive information and correlations among study variables

Variable	1	2	3	4	5	6	M(SD)	Range
1. Gender	–							
2. Minority Status	.02	–						
3. Maternal Education (years)	–.07	–.17**	–				15.5 (3.2)	10–21
4. PPVT at 3 year	.16**	–.29***	.29***	–			98.4 (15.1)	53–133
5. Persistence at 3 year (min.)	.08	–.09	.04	.19**	–		2.8 (1.4)	0–4.5
6. WJ Language at Kindergarten	–.12	–.03	.26***	.51** *	.23* **	–	110.5 (13.5)	76–176
7. WJ Math at Kindergarten	–.01	–.32***	.31***	.54** *	.29* **	.61** *	103.4 (12.5)	61–146

Minority status is coded as 1; Girl is coded as 1
 ** $p < .01$; *** $p < .001$.

Path analysis models

Mplus 6.11 was used to conduct path analysis to test the study hypothesis about the association between child's persistence at age 3 and WJ Language and Math skills at kindergarten after accounting for the effects of ethnicity, maternal education, child gender, and PPVT scores at age 3. An unconstrained model that estimated the direct paths from all covariates and persistence at age 3 to WJ Language and Math skills composites was fitted to the data. The predictors were allowed to covary to obtain their unique effects on the WJ composites. The residuals of WJ composites were also allowed to covary. The model showed an adequate fit to the data, $\chi^2 = 16.6$, $df = 6$, $p = .01$; comparative fit index (CFI) = .96; root mean square error of approximation (RMSEA) = .08. CFI values near 1.0 and RMSEA values smaller than .08 are considered satisfactory (Bentler 1990; Browne and Cudeck 1993). The results of the model are presented in Fig. 1. The model accounted for a significant portion of variance in both WJ Language skills ($R^2 = .30$, $p < .001$) and WJ Math skills ($R^2 = .37$, $p < .001$). As was hypothesized, persistence in completing a challenging task observed at age 3 was positively and significantly related to academic skills at kindergarten over and above demographic factors and child early cognitive-linguistic skills.



Note: displayed coefficients are standardized; n.s. = not significant.
 ** $p < .01$; *** $p < .001$

Fig. 1 Path analysis model predicting children's academic performance at kindergarten

Discussion

Consistent with theoretical propositions on the role of motivation in achievement and performance (Ryan and Deci 2002; Wigfield and Eccles 2002a; Wigfield et al. 2006) and with the literature on the relations between motivation and subsequent academic success in elementary and secondary school children (e.g., Gottfried 1990; Wigfield and Eccles 2002b), we found that children who were more persistent in completing a challenging task at age 3 showed greater language and math skills at kindergarten than their less persistent peers, after accounting for child early cognitive-linguistic skills and demographic factors. This finding indicates that

very young children's ability to persist in a challenging task may be an important aspect of their developing school readiness.

The results of this study have both applied and basic implications as they emphasize the need to encourage young children's engagement in challenging activities and to help them sustain that engagement. These findings may be of a particular value to parents of young children and early childhood educators, as motivation has been previously found to associate with contextual characteristics. More specifically, support for child's autonomy, provision of structure (such as having rules, routines, and overall predictability at home), and parental emotional and cognitive involvement in children's activities have been identified as particularly salient environmental features that support the development of motivation (Grolnick and Slowiaczek 1994; MacTurk and Morgan 1995). Thus, it may be important to provide parents and early childhood educators with information about the role of motivation in school success and to suggest the specific steps the caregivers can take to encourage the development of their children's motivation.

To date, there is little research available on the role of children's motivation at preschool age in children's later academic achievement. This study reports original findings in children's persistence at age 3 predicting their academic skills 2 years later. Other strengths of the study include the longitudinal design, the large ethnically and economically diverse sample, and the use of standardized tests and observations to assess children's behavior and academic skills, thus reducing reliance on questionnaire data. The limitations of the study include the lack of information about school performance (i.e., teacher assessment, grades) and the lack of follow-up data on these children past kindergarten. Thus, the question about the role of persistence at preschool age in children's long-term academic performance remains under-investigated (Stipek and Greene 2001).

The current report highlights the potential importance of motivation in preschoolers' later academic achievement and the need for more research into the development of motivation in early childhood. Longitudinal studies are especially needed to investigate long-term relations between early motivation and academic success, including possible developmental trajectories that may begin in early childhood. Additionally, the results of this study suggest that young children's level of persistence is not related to ethnicity, maternal education, or child gender. These findings suggest that more research is needed to address the questions about the origins of motivation, such as: what are the individual characteristics of a child that are associated with motivation; what types of child-rearing strategies could help young children to develop higher levels of motivation and to engage in challenging activities; and do certain types of child-rearing strategies work better for children with specific individual characteristics, but not for others? In other words, more research is needed to investigate individual and contextual precursors of the development of motivation, particularly among children at higher risk for poor academic outcomes.

Overall, the current report suggests that persistence in early childhood is an important aspect of child development, which should be supported and encouraged, as it appears to contribute to children's early academic skills.

References

- Aunola, K., Leskinen, E., & Nurmi, J. E. (2006). Developmental dynamics between mathematical performance, task motivation, and teachers' goals during the transitions to primary school. *British Journal of Educational Psychology, 76*, 21–40.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*, 238–246.
- Bridgeman, B., & Shipman, V. C. (1978). Preschool measures of self-esteem and achievement motivation as predictors of grade 3 achievement. *Journal of Educational Psychology, 70*, 17–28.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., et al. (2007). School readiness and later achievement. *Developmental Psychology, 43*, 1428–1446.
- Dunn, L. M., & Dunn, L. (1997). *Peabody picture vocabulary test* (3rd ed.). Circle Pines, MN: American Guidance Service.
- Eccles, J. S., Wigfield, A., Flanagan, C., Miller, C., Reuman, D., & Yee, D. (1989). Self-concepts, domain values, and self-esteem: relations and changes at early adolescence. *Journal of Personality, 57*, 283–310.
- Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology, 95*, 148–162.
- Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high students. *Journal of Educational Psychology, 77*, 631–645.
- Gottfried, A. E. (1990). Academic intrinsic motivation in young elementary school children. *Journal of Educational Psychology, 82*, 525–538.

- Gottfried, A. W., Cook, C. R., Gottfried, A. E., & Morris, P. E. (2005). Educational characteristics of adolescents with gifted academic intrinsic motivation: A longitudinal investigation from school entry through early adulthood. *Gifted Child Quarterly, 49*, 172–186.
- Gottfried, A. W., Gottfried, A. E., & Guerin, D. W. (2006). The Fullerton longitudinal study: a long-term investigation of intellectual and motivational giftedness. *Journal for the Education of the Gifted, 29*, 430–450.
- Grolnick, W. S., & Slowiaczek, M. L. (1994). Parent's Involvement in children's schooling: a multidimensional conceptualization and motivational model. *Child Development, 65*, 237–252.
- Guay, F., Marsh, H. W., & Boivin, M. (2003). Academic self-concept and academic achievement: developmental perspectives on their causal ordering. *Journal of Educational Psychology, 95*, 124–136.
- Howard, T., Dresser, S. G., & Dunklee, D. R. (2009). *Poverty is not a learning disability: equalizing opportunities for low SES students*. Thousand Oaks, CA: Corwin.
- Jennings, K. D., Yarrow, L. J., & Martin, P. (1984). Mastery motivation and cognitive development: a longitudinal study from infancy to three and one half years. *International Journal of Behavioral Development, 7*, 441–461.
- La Paro, K. M., & Pianta, R. C. (2000). Predicting children's competence in the early school years: a meta-analytic review. *Review of Educational Research, 70*, 443–484.
- MacTurk, R. H., & Morgan, G. A. (1995). *Mastery motivation: origins, conceptualizations, and applications*. Norwood, NJ: Ablex.
- McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*, 185–204.
- Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of math anxiety and its influence on young adolescents' course enrollment intentions and performance in mathematics. *Journal of Educational Psychology, 82*, 60–70.
- Messer, D. J., McCarthy, M. E., McQuiston, S., MacTurk, R. H., Yarrow, L. J., & Vietze, P. M. (1986). Relation between mastery behavior in infancy and competence in early childhood. *Developmental Psychology, 22*, 366–372.

Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide*. Los Angeles: Muthen & Muthen.

Reynolds, A. J. (1989). A structural model of first-grade outcomes for an urban, low socioeconomic status, minority population. *Journal of Educational Psychology, 81*, 594–603.

Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teachers' judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly, 15*, 147–166.

Roeser, R. W., & Eccles, J. S. (2000). Schooling and mental health. In A. J. Sameroff, M. Lewis, & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (2nd ed., pp. 135–156). Dordrecht, Netherlands: Kluwer.

Ryan, R. M., & Deci, E. L. (2002). An overview of self-determination theory: an organismic dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3–33). Rochester, NY: University of Rochester Press.

Sigman, M., Cohen, S. E., Beckwith, L., & Topinka, C. (1987). Task persistence in 2-year-old preterm infants in relation to subsequent attentiveness and intelligence. *Infant Behavior and Development, 10*, 295–305.

Stipek, D. J., & Greene, J. K. (2001). Achievement motivation in early childhood: cause for concern or celebration? In S. L. Golbeck (Ed.), *Psychological perspectives on early childhood education* (pp. 64–91). Mahwah, NJ: Erlbaum.

Stipek, D. J., & Ryan, R. H. (1997). Economically disadvantaged preschoolers: ready to learn but further to go. *Developmental Psychology, 33*, 711–723.

US Census Bureau (2011). *North Carolina Quick Facts*. Retrieved December 18, 2012 from <http://quickfacts.census.gov/qfd/states/37000.html>

Walker, A. K., & MacPhee, D. (2011). How home gets to school: parental control strategies predict children's school readiness. *Early Childhood Education Quarterly, 26*, 355–364.

Wigfield, A., & Eccles, J. S. (2002a). The development of competence beliefs, expectancies for success, and achievement values from childhood through adolescence. In A. Wigfield & J. Eccles (Eds.), *Development of achievement motivation* (pp. 92–122). San Diego: Academic.

Wigfield, A., & Eccles, J. S. (2002b). *Development of achievement motivation*. San Diego: Academic.

Wigfield, A., Eccles, J. S., Schiefele, U., Roeser, R. W., & Davis-Kean, P. (2006). Development of achievement motivation. In W. Damon, R. Lerner, & N. Eisenberg (Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (6th ed., pp. 933–1002). New York: Wiley.

Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbretton, A. J. A., & Blumenfeld, P. C. (1997). Changes in children's competence beliefs and subjective task values across the elementary school years: a three-year study. *Journal of Educational Psychology, 89*, 451–469.

Woodcock, R. W. & Johnson, M. B. (1989). *Woodcock–Johnson Test of Achievement (Revised)*. DLM Teaching Resources.

Yarrow, L. J., McQuiston, S., MacTurk, R. H., McCarthy, M. E., Klein, R. P., & Vietze, P. M. (1983). Assessment of mastery motivation during the first year of life: contemporaneous and cross-age relationships. *Developmental Psychology, 19*, 159–171.

Yarrow, L. J., Morgan, G. A., Jennings, K. D., Harmon, R. J., & Gaiter, J. L. (1982). Infants' persistence at tasks: relationships to cognitive functioning and early experience. *Infant Behavior and Development, 5*, 131–141.

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Current themes of research

Development of motivation and achievement attitudes throughout childhood and links with subsequent academic success. Interconnections between child individual characteristics, childhood education experiences, and family factors as predictors of achievement motivation and academic success.

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Current themes of research

Parenting, child care, and children's social and cognitive development. Cognitive development and conscious control of behavior in childhood and across the lifespan.

Most relevant publications in the field of Psychology of Education

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