



▶ Virginia's Statewide Kindergarten Readiness Assessments Predict Third Grade Outcomes

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Importance of Early Skills

Early reading, mathematics, self-regulation, and social skills are strong predictors of long-term outcomes, including academic achievement, school adjustment, high school graduation, and future earnings.ⁱ Despite the importance of these foundational skills, many children struggle to meet grade-level expectations by fourth grade. In 2024, 24% of students scored below basic in mathematics and 40% scored below basic in reading on the National Assessment of Educational Progress (NAEP), indicating that they had not yet demonstrated even partial mastery of the knowledge and skills expected for their grade level. Rates were even higher among children from historically marginalized backgrounds and low-income families.ⁱⁱ Although states have relied on standardized testing beginning in third grade since the No Child Left Behind Act of 2002 to inform policy, address inequities, and support accountability, these assessments occur after several years of formal schooling, limiting opportunities for early intervention. Recent research has found that children’s skills in the fall of kindergarten are highly predictive of reading and mathematics proficiency at the end of third grade.ⁱⁱⁱ Kindergarten entry assessments, administered during the first weeks of school, provide an earlier opportunity to identify students’ strengths and needs and to deliver targeted supports before gaps widen.

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The Virginia Kindergarten Readiness Program

Since 2019, Virginia has used the Virginia Kindergarten Readiness Program (VKRP), a comprehensive assessment system, to assess children’s school readiness skills in the fall and spring of kindergarten.^{iv} VKRP adds measures of mathematics, self-regulation, and social skills to Virginia’s long-standing statewide assessments of literacy skills. VKRP helps Virginia support kindergarten teachers and principals to meet children’s needs and meaningfully engage with families in support of young learners. Earlier studies using Virginia’s statewide literacy screener, PALS-K^a, have shown that children entering kindergarten with stronger literacy skills were more likely to reach reading proficiency in third grade.^v Here, we examine whether kindergarten-entry mathematics, self-regulation, and social skills are associated with third-grade reading and mathematics proficiency.

Current Study

As part of their participation in VKRP, kindergarteners are directly assessed by their teachers or other school staff in the fall using the Virginia Language & Literacy Screener: Kindergarten (VALLS: Kindergarten) and the Early Mathematics Assessment System (EMAS) mathematics assessment.^{vi} Teachers also complete ratings using the Child Behavior Rating Scale (CBRS) of children’s self-regulation (CBRS-SR) and social skills (CBRS-SS).^{vii}

The Virginia Standards of Learning (SOL) establish minimum expectations for what students should know and be able to do. SOL assessments are administered to all Virginia students attending public schools in grades 3-8. The SOL assessments consist of multiple choice items and

^a In 2024-2025, Virginia Literacy Partnerships began implementing the Virginia Language & Literacy Screener: Kindergarten (VALLS: Kindergarten) to replace the PALS-K assessment.

are scored on a scale from 0 to 600. The state has defined cut points for levels of student achievement: basic, proficient, and advanced.^{viii}

Using statewide VKRP data at kindergarten entry from the 2019-2020 school year, we analyzed the relationship between children's mathematics, self-regulation, and social skills and their outcomes on the Virginia SOL reading and mathematics assessments in third grade collected during the 2022-2023 school year. Participants included students who had data on at least one VKRP measure and one SOL assessment (n = 36,587).

Children's Kindergarten Mathematics, Self-Regulation, and Social Skills Predict Mathematics and Reading Proficiency in 3rd Grade

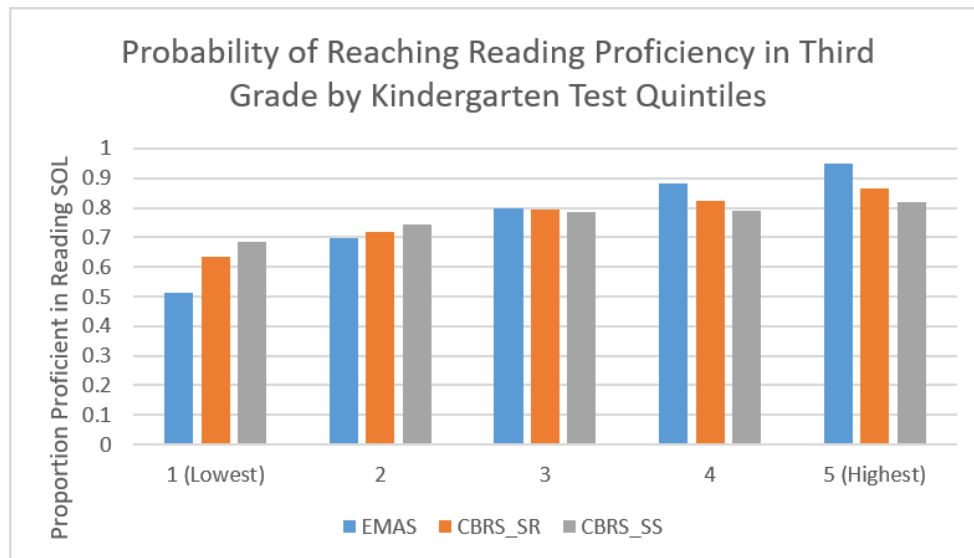
Reading

Kindergarten-entry mathematics, self-regulation, and social skills each uniquely predicted third-grade reading achievement. After accounting for children's background characteristics, kindergarten mathematics skills (EMAS) explained approximately 16% of variation in reading SOL scores, 6% for self-regulation (CBRS-SR), and 2% for social skills (CBRS-SS).

Figure 1 illustrates the relationship between children's kindergarten-entry skills and their likelihood of meeting third grade reading proficiency standards on the SOL. For each readiness measure, the probability of reading proficiency increases as children move from the lowest to the highest kindergarten assessment quintile, indicating that stronger skills at school entry are associated with better later reading outcomes. The steepest gradient is observed for mathematics skills (EMAS). Children in the lowest mathematics quintile had approximately a 50% probability of reaching reading proficiency in third grade, compared with nearly 95% among children in the highest quintile—a difference of more than 40 percentage points. Self-regulation (CBRS-SR) also showed a substantial relationship with later reading achievement, with proficiency rates increasing from about 63% in the lowest quintile to 87% in the highest quintile. Social skills (CBRS-SS) exhibited a more modest but still meaningful pattern, with the probability of reading proficiency rising from approximately 68% among children in the lowest quintile to 82% among those in the highest quintile. Notably, children in the middle quintiles had probabilities of reading proficiency that fell between these extremes, demonstrating a consistent relationship across the full range of kindergarten readiness scores. These findings suggest that mathematics skills, self-regulation, and social skills measured at kindergarten entry are all associated with later reading success, although mathematics skills appear to be the strongest predictor.

Figure 1

Probability of Reaching Reading Proficiency in Third Grade, by EMAS, CBRS-SR, and CBRS-SS Quintiles



Note: Quintiles represent five equal-sized groups based on children's kindergarten-entry scores, with Quintile 1 indicating the lowest scores and Quintile 5 indicating the highest scores. Bars show the predicted probability of meeting third grade reading proficiency standards.

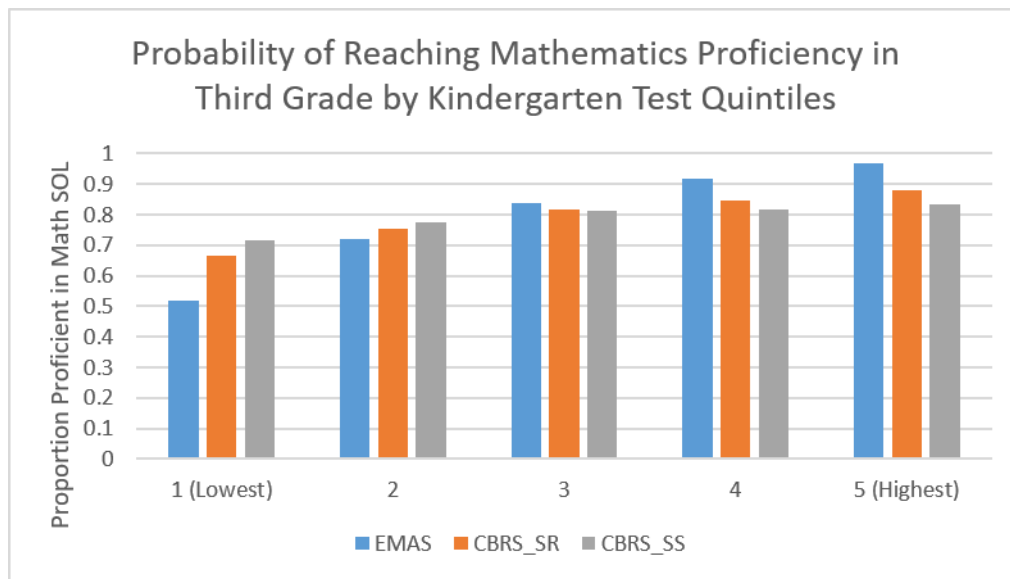
Mathematics

Kindergarten-entry mathematics, self-regulation, and social skills each uniquely predicted third-grade mathematics achievement, even after accounting for children's background characteristics. Mathematics skills emerged as the strongest predictor by a substantial margin, explaining approximately 21% of the variation in mathematics SOL scores. In comparison, self-regulation explained 7% of the variation, while social skills explained 2%. These findings underscore the particularly important role of early mathematics skills in shaping later mathematics achievement, while also demonstrating that self-regulation and social skills contribute independently to students' academic success.

Figure 2 further illustrates the strong relationship between kindergarten readiness and third-grade mathematics proficiency. Children with stronger kindergarten-entry skills were more likely to meet mathematics proficiency standards in third grade, regardless of whether readiness was measured by mathematics skills, self-regulation, or social skills. The strongest relationship was observed for kindergarten mathematics skills (EMAS): children in the highest quintile had nearly a 97% probability of mathematics proficiency, compared with about 50% among children in the lowest quintile. Self-regulation and social skills were also positively associated with later mathematics achievement, although the differences between the highest and lowest quintiles were smaller. These findings suggest that multiple dimensions of kindergarten readiness contribute to later mathematics success, with early mathematics skills showing the strongest association.

Figure 2

Probability of Reaching Mathematics Proficiency in Third Grade, by EMAS, CBRS-SR, and CBRS-SS Quintiles



Note: Quintiles represent five equal-sized groups based on children's kindergarten-entry scores, with Quintile 1 indicating the lowest scores and Quintile 5 indicating the highest scores. Bars show the predicted probability of meeting third grade mathematics proficiency standards.

Implications

Children's mathematics, self-regulation, and social skills readiness skills measured at the beginning of kindergarten provide an early signal of future academic success. The results highlight the value of VKRP as an early identification tool. Because VKRP assessments are administered years before statewide accountability testing begins, educators, school leaders, and families can use these data to identify students who may benefit from additional support and intervention before achievement gaps become more difficult to address.

The findings underscore the importance of supporting multiple domains of school readiness, including not only academic skills but also self-regulation and social competence, as part of efforts to promote long-term student success.

Children's mathematics, self-regulation, and social skills readiness skills measured at the beginning of kindergarten provide an early signal of future academic success.

ⁱ The Annie E. Casey Foundation. (2010, January 1). *Early warning! Why reading by the end of third grade matters*. Retrieved from www.aecf.org/resources/early-warning-why-reading-by-the-end-of-third-grade-matters; Burchinal, M., & Vandell, D. L. (2025). School entry skills and young adult outcomes. *Early Childhood Research Quarterly*, 72, 1–12.; Caemmerer, J. M., & Keith, T. Z. (2015). Longitudinal, reciprocal effects of social skills and achievement from kindergarten to eighth grade. *Journal of School Psychology*, 53(4), 265–281.; Goldhaber, D., Wolff, M., Daly, T. (2020). *Assessing the Accuracy of Elementary School Test Scores as Predictors of Students' High School Outcomes* (CALDER Working Paper No. 235-0821-2). Center for Analysis of Longitudinal Data in Education Research. <https://caldercenter.org/publications/assessing-accuracy-elementary-school-test-scores-predictors-students-high-school/>; Hernandez, D. J. (2011). *Double Jeopardy: How Third-Grade Reading Skills and Poverty Influence High School Graduation*. Annie E. Casey Foundation. <https://www.aecf.org/resources/double-jeopardy>; Ricciardi, C., Manfra, L., Hartman, S., Bleiker, C., Dineheart, L., & Winsler, A. (2021). School readiness skills at age four predict academic achievement through 5th grade. *Early Childhood Research Quarterly*, 57, 110–120.

ⁱⁱ National Assessment of Educational Progress. (2024). *NAEP Report Card*. Retrieved from: https://www.nationsreportcard.gov/reports/mathematics/2024/g4_8/?grade=4

ⁱⁱⁱ Kuhfeld, M., Lewis, K., & Morton, E. (2026). *Behind at the starting line: What kindergarten test scores tell us about reaching proficiency in 3rd grade* [Research brief]. NWEA. https://www.nwea.org/uploads/Behind-the-starting-line-what-kindergarten-test-scores-tell-us-about-reaching-proficiency-in-third-grade_NWEA_researchBrief.pdf

^{iv} Center for Advanced Study of Teaching and Learning, University of Virginia (2025a). VKRP Informational Overview. https://vkrponline.org/wp-content/uploads/sites/3/2026/01/VKRP_2Page_Overview_2025-2026_FINAL508C.pdf; Center for Advanced Study of Teaching and Learning, University of Virginia (2025b). Early Mathematics Assessment System Overview. https://assets.ctfassets.net/1fh9e07vdzgh/khGgNtO1V1qw9B3gOdxgn/77a19ca5ab24368c3af906a613da6e4d/EMAS_Overview_2025.pdf; Center for Advanced Study of Teaching and Learning, University of Virginia (2025c). VKRP Annual Report 2025: Executive Summary. https://vkrponline.org/wp-content/uploads/sites/3/2025/12/2025_VKRP-Executive-Summary-Brief.pdf

^v Herring, W. A., Bassok, D., McGinty, A. S., Miller, L. C., & Wyckoff, J. H. (2022). Racial and socioeconomic disparities in the relationship between children's early literacy skills and third-grade outcomes: Lessons from a kindergarten readiness assessment. *Educational Researcher*, 51(7), 441–450.

^{vi} Center for Advanced Study of Teaching and Learning, University of Virginia (2025b). Early Mathematics Assessment System Overview. https://assets.ctfassets.net/1fh9e07vdzgh/khGgNtO1V1qw9B3gOdxgn/77a19ca5ab24368c3af906a613da6e4d/EMAS_Overview_2025.pdf; Ginsburg, H. P. & Pappas, S. (2016). Invitation to the birthday party: rationale and description. *ZDM Mathematics Education*, 48, 947–960. <https://doi.org/10.1007/s11858-016-0818-4>; Whittaker, J., Vitiello, V., Kutaka, T., DeCoster, J., & Williford, A. (2025, May). *Understanding children's mathematics readiness at school entry: Developing and validating a statewide kindergarten mathematics assessment*. Poster presented at the biennial meeting for the Society for Research in Child Development.

^{vii} Bronson, M. B., Goodson, B. D., Layzer, J. I., & Love, J. M. (1990). *Child Behavior Rating Scale*. Cambridge, MA: Abt Associates.

^{viii} Virginia Department of Education. (2026). *SOL Test Scoring & Performance Reports*. <https://www.doe.virginia.gov/teaching-learning-assessment/student-assessment/virginia-sol-assessment-program/sol-test-scoring-performance-reports>