



Considerations for STEM Education from PreK through Grade 3

A SELECTION OF DRK-12 RESOURCES

- ① The *Ongoing Assessment Project for Additive Reasoning* includes tools and resources for teachers in grades Pre-K-2, specifically on the topics of **number, addition and subtraction**. These tools and resources include professional development, a bank of formative assessment items, and learning progressions for analyzing evidence in student work. For more information, visit the [project website](#).

- ② *Project M²: Mentoring Young Mathematicians* project developed K–2 **geometry and measurement** units that engage students as mathematicians. [Visit this site](#) to see how teachers engaged students in mathematical discussions and writing. Project M² publications about engaging students in mathematics:
 - Casa, T. M., Firmender, J. M., Gavin, M. K., & Carroll, S. R. (2017). Kindergarteners' achievement on geometry and measurement units that incorporate a gifted education approach. *Gifted Child Quarterly*, 61(1), 52–72.
 - Gavin, M. K., & Casa, T. M. (2013). Nurturing young student mathematicians. *Gifted Education International*, 29(3), 140–153.
 - Gavin, M. K., Casa, T. M., Adelson, J. L., & Firmender, J. M. (2013). The impact of advanced geometry and measurement units on the achievement of grade 2 students. *Journal for Research in Mathematics Education*, (44)3, 478–509.
 - Gavin, M. K., Casa, T. M., Firmender, J. M., & Carroll, S. R. (2013). The impact of advanced geometry and measurement curriculum units on the mathematics achievement of first-grade students. *Gifted Child Quarterly*, 57(2), 71–84.
 - Gavin, M. K., Firmender, J. M., & Casa, T. M. (2013). Recognizing and nurturing math talent in children. *Parenting for High Potential*, 3(2), 22–26.

- ③ Practitioner-focused publications from projects, [Project M²](#) and [A Task Force on Conceptualizing Elementary Mathematical Writing: Implications for Mathematics Education Stakeholders](#) to support **students' oral and written mathematical discourse**:
 - Firmender, J. M., Casa, T. M., & Colonnese, M. W. (2017). Write on: Reasoning through mathematical writing. *Teaching Children Mathematics*, 24(2), 84–92.
 - Firmender, J. M., Dilley, A., Amspaugh, C. A., Field, K., Lemay, S., & Casa, T. M. (2017). Beyond *doing* mathematics: Engaging talented students in mathematically creative writing. *Gifted Child Today*, 40(4), 205–211. doi: 10.1177/1076217517722180
 - Casa, T. M., Evans, K., Firmender, J. M., & Colonnese, M. W. (2017). Why should students write in math class? *Educational Leadership* (Disciplinary Literacy theme), 74(5). Available at <http://www.ascd.org/publications/educational-leadership/feb17/vol74/num05/Why-Should-Students-Write-in-Math-Class.aspx>



- Casa, T. M., Firmender, J. M., Cahill, J., Cardetti, F., Choppin, J. M., Cohen, J., Zawodniak, R. (2016). *Types of and purposes for elementary mathematical writing: Task force recommendations*. Retrieved from <http://mathwriting.education.uconn.edu>
 - Casa, T. M. (2014). Supporting writing with the student mathematician discourse framework. In K. Karp (Ed.), *Annual perspectives in mathematics education 2014: Using research to improve instruction* (pp. 107–117). Reston, VA: National Council of Teachers of Mathematics.
 - Casa, T. M. (2013). Capturing thinking on the talk frame. *Teaching Children Mathematics*, 19(8), 516–523.
 - Williams, M. M., & Casa, T. M. (2011 December/2012 January). Connecting class talk with individual student writing. *Teaching Children Mathematics*, 18(5), 314–321.
 - Dorl, J., Casa, T. M., & LaBella, E. (in press). Developing expressive mathematical language in your students. *Young Children*.
- ④ Promising Practices for Engaging Families in STEM Learning project explores **how families, schools, and communities can join together to promote student success in STEM**. [Access a related publication](#).
- ⑤ Information and examples of all three components of **mathematics learning trajectories**: the goal (understanding the mathematical content), the developmental progression (children’s patterns and levels of thinking) and correlated instructional activities:
- Clements, D. H., & Sarama, J. (Producer). (2018). *Learning and teaching with learning trajectories (LT²)*. [Internet-based application]. Retrieved from <http://LearningTrajectories.org>
 - Clements, D. H., & Sarama, J. (2014). *Learning and teaching early math: The learning trajectories approach* (2nd ed.). New York, NY: Routledge.
- ⑥ Publications that explore teaching and learning of **early algebraic concepts** in preK–3:
- Stephens, A. C., & Blanton, M. (2017). Algebraic reasoning in kindergarten – Grade 2. In M. Battista (Ed.), *Reasoning and sense making in elementary grades: Grades K–5*. Reston, VA: National Council of Teachers of Mathematics.
 - Blanton, M., Levi, L., Crites, T., & Dougherty, B. (2011). *Developing essential understanding of algebraic thinking for teaching mathematics in grades 3–5*. Essential Understanding Series. Reston, VA: National Council of Teachers of Mathematics.
 - Blanton, M. (2008). *Algebra and the elementary classroom: Transforming thinking, transforming practice*. Invited book. Portsmouth, NH: Heinemann Publishers.
- ⑦ Components of an **integrated early science and literacy** model that can be implemented in all K–3 classrooms:
- Romance, N. R., & Vitale, M. R. (2017). *Expanding learning opportunities in science and literacy for early elementary learners: Impact of an instructional model on achievement outcomes*. Paper presented at the Annual Conference of the National Association for Research in Science Teaching, Atlanta, GA.
 - Vitale, M. R., & Romance, N. R. (2012). Using in-depth science instruction to accelerate student achievement in science and reading comprehension in grades 1–2. *International Journal of Science and Mathematics Education*, 10, 457–472.

- Romance, N. R., & Vitale, M. R. (2012). Expanding the role of K–5 science instruction in educational reform: Implications of an interdisciplinary model for integrating reading within science. *School Science and Mathematics*, 112, 506–515.
- Romance, N. R., & Vitale, M. R. (2012). Interdisciplinary perspectives linking science and literacy in grades K–5: Implications for policy and practice. In B. J. Fraser, K. G. Tobin, & C. J. McRobbie (Eds.), *Second international handbook of science education (Part two)* (pp. 1351–1374). New York, NY: Springer.
- Romance, N. R., & Vitale, M. R. (2012). Science IDEAS: A research-based K–5 interdisciplinary instructional model linking science and literacy. *Science Educator*, 21, 1–12.
- Romance, N. R., & Vitale, M. R. (2011). *Interdisciplinary perspectives for linking science and literacy: Implications from multi-year studies across grades K–5*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.