

# Creating Open-Ended Projects in Middle School Mathematics

## Heather Gramberg Carmody

### Components of an Open-ended Mathematics Project\*

- Extensive mathematical computation
- Algebraic notation
- Written expression
- Visual or graphic representation
- Project proposal
- Peer collaboration
- Evaluation of complexity

### Questions to ask when developing an OMP\*

- What topic is essential to the curriculum? Or, what topic is a cornerstone of the course?
- What are some meaningful and real world applications of this topic?
- What applications are appropriate for students of this age and level of mastery to explore?
- How can I include mathematical computation, algebraic notation, written expression, visual representation, peer collaboration, evaluation of complexity, and opportunities for reflection and revision?
- What choices can I offer in terms of content or product?
- What resources do I need to find for the project? Am I ensuring that all students have equal opportunities for success in terms of required resources?
- What amount of time will students need to produce quality work? How can I structure a timeline that allows for creativity and rigor?
- Are there adequate opportunities for differentiation to accommodate various student needs?
- Does this project encourage a deeper understanding of mathematics than students would otherwise have?

\*Both are from article in 2010 issue of *Mathematics Teaching in the Middle School*.

### References

Carmody, H. G. (2010). Water bottle designs and measures. *Mathematics Teaching in the Middle School*, 16(5), 272-277.

Costa, A. L. (2001). Habits of Mind. In A. L. Costa (Ed.), *Developing Minds: A Resource Book for Teaching Thinking* (pp. 80-86). Alexandria, VA: Association for Supervision and Curriculum Development.

DeBellis, V. A., & Goldin, G. A. (2006). Affect and meta-affect in mathematical problem solving: a representational perspective. *Educational Studies in Mathematics*, 63 (2), 131-147.

Gavin, M.K. and Sheffield, L.J. (2010). Using curriculum to develop mathematical promise in the middle grades. In M. Saul, S. Assouline, and L.J. Sheffield (Eds.), *The Peak in the Middle* (pp. 51-76). Reston, VA: National Council of Teachers of Mathematics.

Greenes, C. and Mode, M. (1999). Empowering teachers to discover, challenge, and support students with mathematical promise. In L.J. Sheffield (Ed.), *Developing mathematically promising students* (pp. 121-132). Reston, VA: National Council of Teachers of Mathematics.

Hadamard, J. (1945). *The psychology of invention in the mathematical field*. Mineola, NY: Dover.

Hirsch, C.R. and Weinhold, M. (1999). Everybody counts- including the mathematically promising. In L.J. Sheffield (Ed.), *Developing mathematically promising students* (pp. 233-241). Reston, VA: National Council of Teachers of Mathematics.

Koshy, V. (2001). *Teaching mathematics to able children*. London: David Fulton Publishers.

Leikin, R. (2009). Bridging research and theory in mathematics education with research and theory in creativity and giftedness. In R. Leikin, A. Berman, & B. Koichu (Eds.), *Creativity in Mathematics and the Education of Gifted Students* (pp. 385-411). Rotterdam, The Netherlands: Sense Publishers.

Mann, E. L. (2006). Creativity: the essence of mathematics, *Journal for the Education of the Gifted*. 30 (2), 236-260.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author.

Renzulli, J. S. (1982). What Makes a Problem Real: Stalking the Illusive Meaning of Qualitative Differences in Gifted Education. *Gifted Child Quarterly*, 26(4), 147-156.

Taylor, P. (2009). Challenge in mathematics learning – where to from here?. In R. Leikin, A. Berman, & B. Koichu (Eds.), *Creativity in Mathematics and the Education of Gifted Students* (pp. 385-411). Rotterdam, The Netherlands: Sense Publishers.

VanTassel-Baska, J., & Stambaugh, T. (2006). *Comprehensive Curriculum for Gifted Learners, 3<sup>rd</sup> Edition*. Boston, MA: Allyn and Bacon.

Warshauer, M., McCabe, T., Sorto, M.A., Strickland, S., Warshauer, H., and White, A. (2010). Equity. In M. Saul, S. Assouline, and L.J. Sheffield (Eds.), *The Peak in the Middle* (pp. 51-76). Reston, VA: National Council of Teachers of Mathematics.

Wheatley, G.H. (1999). Effective learning environments for promising elementary and middle school students. In L.J. Sheffield (Ed.), *Developing mathematically promising students* (pp. 71-80). Reston, VA: National Council of Teachers of Mathematics.

Zemelman, S., Daniels, H. and Hyde, A. (1998) *Best Practice*. Portsmouth, NH: Heinemann.