Using Graphic Organizers to Teach Math

What is the evidence base?

- This is a promising practice for students with disabilities based on one methodologically sound single-subject study across four participants with disabilities and two single-subject studies demonstrating positive effects using methodologically weak designs across six participants with disabilities.

Where is the best place to find out how to do this practice?

The best place to find out how to implement graphic organizers is through the following research to practice lesson plan starters:

- Using Graphic Organizers to Solve Math Word Problems (Strickland & Maccini, 2013)

With who was it implemented?

- Students with
  - Learning disabilities (1 study, n=3)
  - Intellectual disabilities (2 studies, n=7)
  - Other health impairments (1 study, n=2)
- Ages ranged from 11 - 16
- Males (n=5), females (n=5)
- Ethnicity o White (n=6)
  - None reported (n=4)

What is the practice?

Graphic organizers have been defined as “visual and spatial displays that make relationships between related facts and concepts more apparent” (Dexter & Hughes, 2011, p. 52). Other related terms may include visual displays, cognitive mapping, semantic mapping, or semantic feature analysis. Graphic organizers always include some type of visual representation of the concepts and/or facts and relations between them.

In the studies used to establish the evidence base for using graphic organizers to teach math, interventions included using:

- Graphic organizers to teach

    - Word problem solving in algebra, geometry, measurement, and data analysis and probability (Browder, Jiminez, & Trela, 2012)
    - One-step word problems (Sheriff & Boon, 2014)

- Graphic organizers in combination with graduated sequence of instruction to teach
    - Conceptual understanding of quadratic expressions and the ability to transform quadratic expressions between standard- and factored-form (Strickland & Maccini, 2013)

Where has it been implemented?

- Self-contained classroom (2 studies)
- Separate school (1 study)

How does this practice relate to Common Core Standards?

- Math, High School: Algebra, Reasoning with Equations & Inequalities
    - CCSS.MATH.CONTENT.HSA.REI.B.4 – Solve quadratic equations in one variable.
- Math, Grade 7, Geometry
    - CCSS.MATH.CONTENT.7.G.A.2 – Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
- Math, Grade 6, Expressions & Equations
    - CCSS.MATH.CONTENT.6.EE.B.6 – Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

How does this practice relate to the Common Career Technical Core?

- Engineering & Technology Career Pathway
    - Apply the knowledge learned in STEM to solve problems.
- Science & Mathematics Career Pathway (ST-SM)
    - Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
    - Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

References used to establish this evidence base:

Browder, D. M., Jimenez, B. A., & Trela, K. (2012). Grade-aligned math instruction for secondary students with moderate intellectual disability. *Education and Training in Autism and Developmental Disabilities, 47*, 373-388.

Sheriff, K. A., & Boon, R. T. (2014). Effects of computer-based graphic organizers to solve onestep word problems for middle school students with mild intellectual disability: A preliminary study. *Research in Developmental Disabilities, 35*, 1828-1837. doi:10.1016/j.ridd.2014.03.023

Strickland, T. K., & Maccini, P. (2013). Exploration of quadratic expressions through multiple representations for students with mathematics difficulties. *Learning Disabilities: A Multidisciplinary Journal*, *19*, 61-71.

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