Evidence-Based vs. Best Available Evidence: Approaching Instruction for Youth with Learning Disabilities

Joseph Calvin Gagnon, Ph.D.
University of Florida
jgagnon@coe.ufl.edu

Faculty Page: https://education.ufl.edu/faculty/Gagnon-joseph/
ORCID ID: https://orcid.org/0000-0003-3266-5843
Google Scholar: https://scholar.google.com/citations?user=E91DESMh1=en
Researchgate: https://www.researchgate.net/profile/Joseph_Gagnon

Agenda

- Framework For Implementing Evidence-Based Instructional Practice: Response to Intervention (RTI)
- RTI Implementation: Finland
- Evidence-Based Practice (EBP) vs. Best Available Evidence (BAE)
- High-Leverage Practices
- EBP & BAE Examples
  - Secondary School Mathematics
  - Secondary School Reading

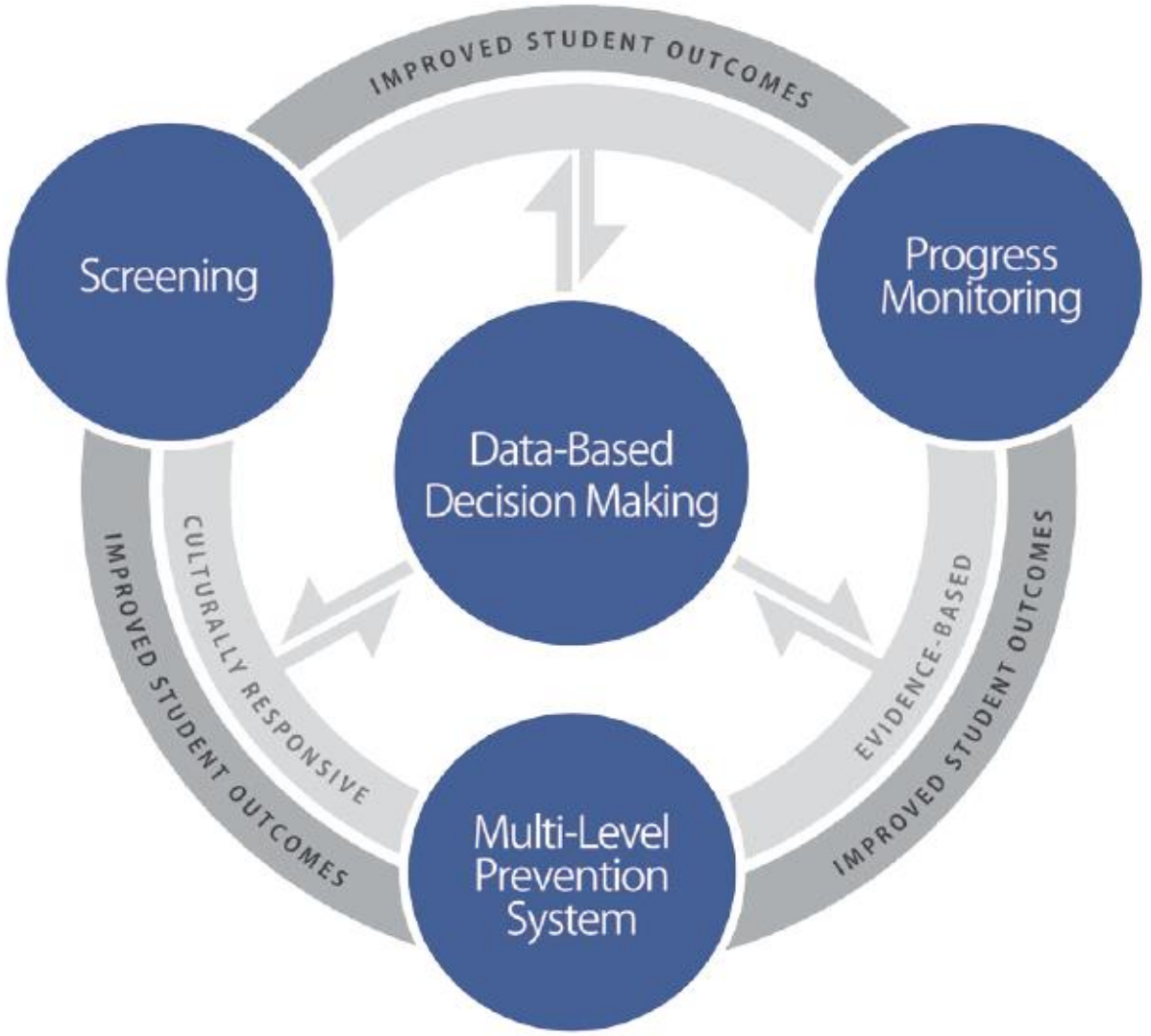
Framework For Implementing Evidence-Based Instructional Practice

- There is an increasing emphasis on evidence-based academic and behavioral interventions.
- What Works Clearinghouse: https://ies.ed.gov/ncee/wwc/
- IRIS Center: https://iris.peabody.vanderbilt.edu/
- The Positive Behavioral Interventions & Supports (PBIS) OSEP Technical Assistance Center: https://www.pbis.org

Framework For Implementing Evidence-Based Instructional Practice

- In Response To Intervention (RTI), “Schools use data to
  - Identify students at risk for poor learning [or behavioral] outcomes
  - Monitor student progress
  - Provide evidence-based interventions
  - Adjust the intensity and nature of those interventions depending on a student’s responsiveness
  - Identify students with learning disabilities and other disabilities” (p. 4). (National Center on Response to Intervention, 2010, October).

Figure 1. Essential Components of a Research-Based Framework



Source: National Center on Response to Intervention, 2010

Multi-Tiered Systems of Support

- Tier I (~80% of students)
  - All youth are provided evidence-based instruction and positive behavioral supports
  - Youth are also screened to identify those with academic and/or behavioral risks

- Tier II (~15% of students)
  - Based on the screening and other data, students with additional need are provided with Tier II supports.
  - Students are provided additional time and evidence-based interventions within small groups.

- Tier III (~5% of students)
  - Students who continue to have difficulties are provided individualized interventions in Tier III.

Researchers have reported positive effects of academic and behavioral interventions at each tier, as well as overall effects of RTI.

(Preston, Wood, & Stecker, 2016)

Multi-Tiered Systems of Support

- However, concerns exist with RTI
  - Need for more clarity concerning moving students between tiers
  - Need more evidence-based interventions
  - Need to improve pre-service training and professional development
  - Need to provide teachers with support to ensure implementation of interventions as intended
  - Need to provide teachers with support to ensure key features of interventions are maintained when needed adaptations are made

(Bineham, Shelby, Pazey, & Yates, 2014)

RTI Implementation: Why Finland?

In 2015 on the Program for International Student Assessment (PISA), average for 15-year-old students:

- Science Literacy: Finland scores 531, compared to 493 in OECD countries and 496 for USA
- Mathematics: Finland scores 511, compared to 490 in OECD countries and 470 for USA.
- Reading: Finland scores 526, compared to 493 in OECD countries, and 497 for USA.

(Organisation for Economic Co-operation and Development (OECD), 2018)

RTI Implementation: Finland

- **Promotes Inclusion**
  - Finland is one of the most equitable countries in terms of education (Pont et al., 2013).
  - Finland provides early and comprehensive support to students from a holistic perspective (Pont et al., 2013).
- **Challenge to Inclusion**
  - The negative impact of socio-economic factors on low achievement has increased in recent years (Pont et al., 2013).
  - Information on exclusionary settings (e.g., child and adolescent psychiatric facilities, juvenile corrections) is limited (Ellila, Sourander, Valimaki, & Piha, 2005).

RTI Implementation: Finland

- **Promotes Inclusion**
  - General support, intensified support, and special support is consistent with multi-tiered systems of support (MTSS) and supports inclusion (Bjorn, Aro, Koponen, Fuchs, & Fuchs, 2018).

- **Challenge to Inclusion**
  - 8% of Finnish students receive full-time special education in segregated classrooms (Sabel et. al., 2011).

  - Some Finnish municipalities do not provide sufficient justification before deciding that a student requires full-time special-needs education (Sabel et. al., 2011).

  - The Finnish MTSS model could benefit from:
    - The systemized use of standardized assessment and evidence-based instruction;
    - Progress monitoring and data-informed decision-making (Bjorn et al., 2018, p. 8).

RTI Implementation: Finland

- **Teacher Training & Qualifications**
  - Highly qualified teachers (Malinen, Vaisanen, & Savolainen, 2012).
  - Pre-service teacher have a number of practice teaching experiences with learners who have special educational needs (SEN)
    - These experiences improve teacher self-efficacy for supporting students in inclusive settings (Malinen et al., 2012).
- **Challenge to Inclusion**
  - Well-developed resource room programs staffed by teachers with an M.A. (Malinen et al., 2013) can lead to the notion that only they have needed skills to support students with SEN (Malinen et al., 2013).

Evidence-Based Practice (EBP) Defined

- EBP means research that involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs; and

- includes research that —
  - employs systematic, empirical methods that draw on observation or experiment;

  - involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn;

  - relies on measurements or observational methods that provide reliable and valid data across evaluators and observers, across multiple measurements and observations, and across studies by the same or different investigators;

(20 USC 7801 Sec. 9101(37)(B)(i-vi))

Evidence-Based Practice (EBP) Defined

- Includes research that —
  - Is evaluated using experimental or quasi-experimental designs
  - ensures that experimental studies are presented in sufficient detail and clarity to allow for replication
  - has been accepted by a peer-reviewed journal

(20 USC 7801 Sec. 9101(37)(B)(i-vi))

Clarity Needed Concerning EBP

- Broadly, ongoing conversations about EBPs are necessary to continually clarify
  - Review procedures
  - Quantity of research needed
  - Indicators of methodological quality
  - Implications of effect magnitude

(Cook, Tankersley, & Landrum, 2009)

  - How do we categorize EBPs and what criteria are used? (Cook & Odom, 2013)

- The lack of experimental research in special education limits the ability to identify EBPs for specific disability populations (Cook & Odom, 2013)

The Need to Rely on BAE

- For secondary students with LD, the following is all of the mathematics intervention research over the last 3 decades:
  - 1988-1995: 20 studies (Maccini & Hughes (1997)
  - 1995-2006 23 studies (Maccini et al., 2007).
  - 2006-2014 15 studies (Myers, Wang, Brownell, & Gagnon, 2015)

- Total: 58 studies and only a handful focused on any given intervention (graduated instructional approaches, strategy instruction, schema-based instruction, peer-mediated instruction, explicit instruction, instructional adaptations, enhanced anchored instruction)

Best Available Evidence (BAE)

- Practitioners need immediate guidance, even if there are no EBP

- In some cases we must rely on the *Best Available Evidence*. Practices that
  - Have *some* evidence
  - Are based on sound theory
  - Have evidence that the technique has proven effective for other students who may have some of the same characteristics

(Cook, Tankersley, Cook, & Landrum, 2008)

High-Leverage Practices (HLP) and EBP

- HLP are a critical set of practices that are essential to improving student learning and behavior. These should be part of pre-service teacher training and
  - Can be learned in coursework
  - Practiced in field experiences

(Ball & Forzani, 2011; McCray, Kamman, Brownell, & Robinson, 2017; McLeskey & Brownell, 2015)

- HLP can be the focus of professional development
- HLP can guide teacher instructional decisions

HLP: Explicit Instruction

- **Note:** Explicit Instruction can integrate problem-based learning that focuses on real-world problems/situations.

- **Review**: Review of previously learned skills, homework, and/or the prerequisite skills

- **Presentation**:
  - Overview of the lesson
  - Teach the new skills at a fast rate
  - Model the procedures via thinking aloud
  - Check for initial student understanding
  - Incorporate examples and teach to a level of mastery prior to advancing in the lesson (Rosenshine and Stevens, 1986; Rosenshine, 1996)

HLP: Explicit Instruction

- **Guided practice**. Teacher directed practice until students reach a level of 80% correct or greater. Include:
  - A high number of factual questions (i.e., requiring specific responses) and process based questions (i.e., requiring explanation of steps).
    - Include individual and group responses to assess student understanding
  - Teacher prompts (e.g., verbal or written cues, anticipating and addressing frequent student errors) are provided to help students perform the task. Prompts are then gradually phased out.
  - Teacher evaluation of student understanding and use of specific corrective feedback

HLP: Explicit Instruction

- **Corrections and feedback:** Corrective feedback is provided immediately to reduce student errors.

- **Independent practice:**
  - Students perform the task while the teacher monitors performance
  - Students should attain a level of 95% correct or greater.
  - Rosenshine (1983) recommends the following:
    - Provide more demonstration and guided practice time, than independent seatwork
    - Providing structured support at the beginning of the independent practice (having the class perform the first two or three problems and checking the work prior to moving on)

HLP: Explicit Instruction

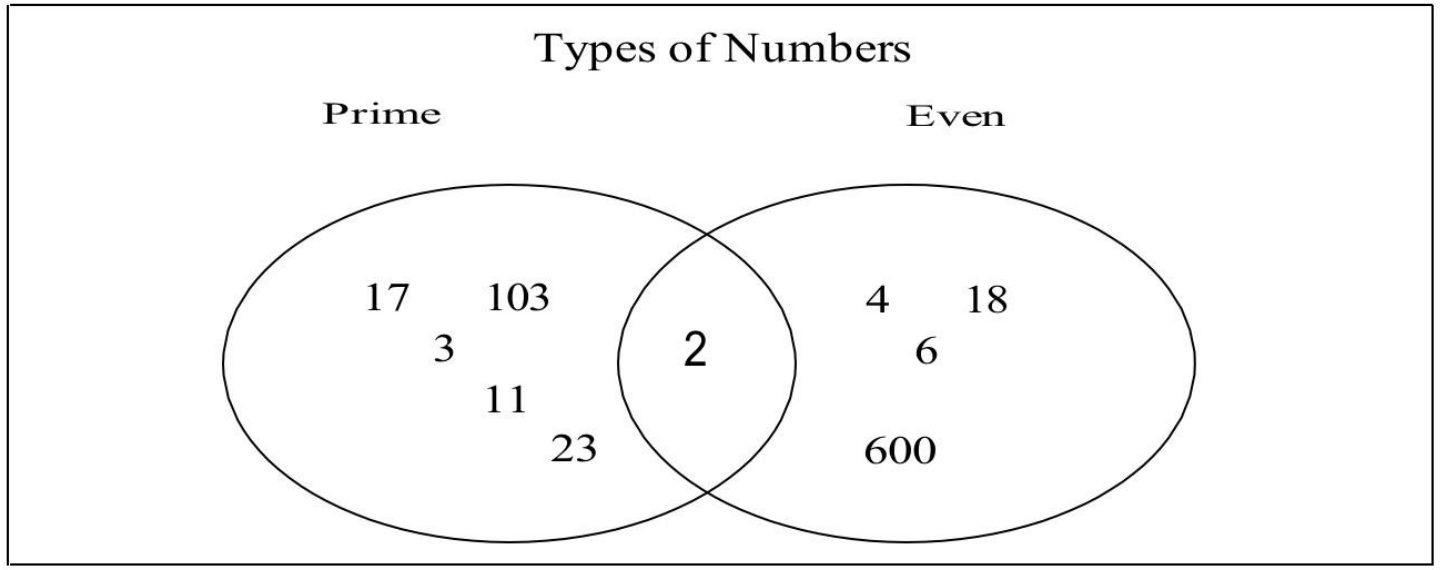
- **Independent practice cont.:**
  - Rosenshine (1983) recommends the following:
    - Circulating among the class and monitoring student work by asking questions, checking answers, and giving brief instructions if needed.
    - For more difficult material, divide instruction tasks involving many steps (e.g., 2 digit multiplication) into segments with multiple instructional and independent segments per period.
      - For example, the teacher can demonstrate the first step in the algorithm, provide student practice and independent practice, and move on to the second step (Rosenshine, 1983)
    - (Homework follows the previous steps)
- **Weekly and monthly reviews**

HLP: Instructional Adaptations, Cognitive & Metacognitive Strategies

- Instructional Adaptations
  - Substitute text (audio reading material)
  - Simplify text
  - Highlight key concepts
  - Content enhancements (e.g., **graphic organizers**, guided notes, mnemonics)

(McLeskey et al., 2017)

Compare and Contrast or Venn Diagram

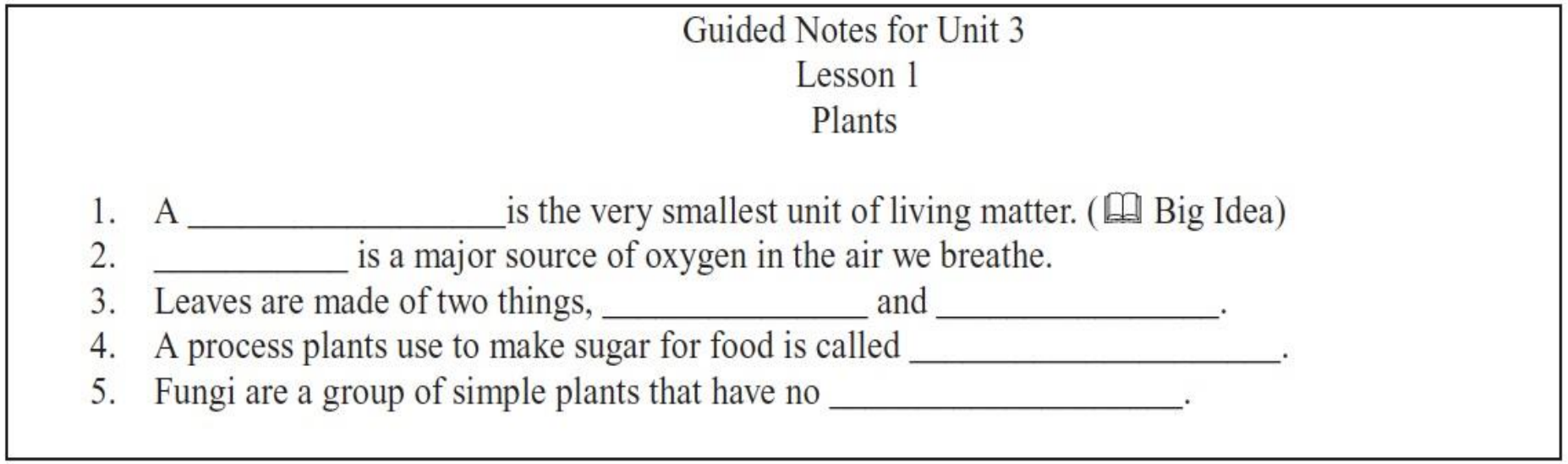


(Maccini & Gagnon, 2005a)

HLP: Instructional Adaptations, Cognitive & Metacognitive Strategies

- Instructional Adaptations
  - Content enhancements (e.g., graphic organizers, **guided notes**, mnemonics)

(McLeskey et al., 2017)



Guided Notes for Unit 3
Lesson 1
Plants

1. A _____is the very smallest unit of living matter. (📖 Big Idea)
2. _____ is a major source of oxygen in the air we breathe.
3. Leaves are made of two things, _____ and _____.
4. A process plants use to make sugar for food is called _____.
5. Fungi are a group of simple plants that have no _____.

Fig. 1. Sample of guided notes for a fifth-grade science lesson.

(Haydon, Mancil, Kroeger, McLeskey, & Lin, 2011)

HLP: Instructional Adaptations, Cognitive & Metacognitive Strategies

- Instructional Adaptations
  - Content enhancements (e.g., graphic organizers, guided notes, **mnemonics**)

(McLeskey et al., 2017)

The steps for STAR include:

(a) **S**earch the word problem;
(b) **T**ranslate the problem;
(c) **A**nswer the problem; and
(d) **R**eview the solution (see Figure 1).

(Maccini & Gagnon, 2005b)

HLP: Instructional Adaptations, Cognitive & Metacognitive Strategies

- Cognitive & Metacognitive Strategies
  - Cognitive strategies for reading (Example of cognitive strategy for mathematics next slide)
    - Making predictions
    - Summarizing
    - Apply grammar rules
    - Making meaning from context
  - Metacognitive strategies
    - Planning and monitoring
    - Self-management and self-regulation (Using Check Sheets of tasks/procedures)

(McLeskey et al., 2017)

Example of EBP & HLP Cognitive Strategy for Mathematics

- Solve it! For solving word problems (Taught via explicit instruction)
  - Read (for understanding)
  - Paraphrase (retell in your own words)
  - Visualize (a picture or diagram)
  - Hypothesize (a plan to solve the problem)
  - Estimate (predict the answer)
  - Compute (do the arithmetic)
  - Check (to make sure everything is correct)

(Montague, Enders, & Dietz, 2011)

HLP: Scaffolding, Flexible Grouping, Promote Student Engagement

- Scaffolding
  - "Scaffolded supports provide temporary assistance to students so they can successfully complete tasks that they cannot yet do independently and with a high rate of success" (McLeskey et al., 2017, p. 78)

- Flexible Grouping
  - Homogeneous and heterogeneous
  - Whole group, small group, student pairs, individualized instruction

- Strategies to Promote Student Engagement
  - Connecting learning to students' lives (e. g., knowing students' academic and cultural backgrounds)
  - Ask questions and offer a variety of ways for students to respond (e.g., choral responding and response cards)
  - Use peer-assisted (e. g., cooperative learning and peer tutoring) learning activities
  - Promote student-regulated (e.g., self-management) strategies
  - Monitor student engagement and provide positive and constructive feedback

(McLeskey et al., 2017)

HLP: Universal Design for Learning (UDL) and Use of Technology

- UDL provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged" (Every Student Succeeds Act of 2015 [ESSA]; Higher Education Opportunity Act, 2008).

- Three main principles of UDL (Center for Applied Special Technology, 2010):
  - *Engagement*: (Examples for mathematics)
    - Include the use of iPad technology (e.g., Yerushalmy, 2005), such as the ShowMe Interactive Whiteboard with hyperlinks to audio files, PhatPad, and iResponse Pro
    - Use culturally relevant and developmentally appropriate examples
    - Use real-world problems

HLP: Universal Design for Learning

- Three main principles of UDL (Center for Applied Special Technology, 2010):
  - *Representation*:
    - Use the National Library of Virtual Manipulatives within a graduated instructional sequence (i.e., concrete-semiconcrete-abstract [CSA]) approach (e.g., Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007). (see http://nlvm.usu.edu/en/nav/vlibrary.html)
    - Highlight components of text, worksheets, and problems
    - Use concrete materials: base-ten blocks, colored chips or tiles, fraction strips, cuisenaire rods, geoboards
  - *Action and expression:*
    - Use strategy cue cards, an audio clip of the strategy steps when students click on hyperlinks, and a Camtasia Studio® video that reviews the step-by-step procedure for problem solving (Maccini & Hughes, 2000; Mulcahy & Krezmien, 2009).
    - Hands on activities
    - Encourage notetaking
    - Allow for for varied approaches for students to show mastery (e.g., group presentations, demonstrations, development of projects)

HLP: Tiered Instruction, Teach for Generalization

- Tiered Instruction and Support
  - As previously noted in discussion of RTI

- Teach for Generalization
  - Effective teachers use specific techniques to teach students to generalize and maintain newly acquired knowledge and skills.
    - Using numerous examples in designing and delivering instruction requires students to apply what they have learned in other settings.
    - Systematically using schedules of reinforcement
    - Providing frequent material reviews
    - Teaching skills that are reinforced by the natural environment beyond the classroom.

(McLeskey et al., 2017)

EBP & BAE for Teaching Secondary Mathematics to Students with LD

Secondary Mathematics EBP & BAE: Cognitive and Meta-Cognitive Strategies

- Teach self-monitoring strategies to help students with problem solving activities
- Incorporate strategy steps into problem solving instruction (e.g., read the problem, represent the problem)
- Graph student progress to make instructional decisions or to show progress
- Give orientation or advance organizer for a new lesson
- Incorporate memory strategies (e.g., first-letter mnemonics)
- instruction emphasizes developing student's ability to problem-solve, justify, conjecture

Secondary Mathematics EBP & BAE: Alternative Delivery

- Encourage the practice of basic mathematics skills/algorithms via computer-assisted instruction
- Embed mathematics in real-world tasks
- Provide cooperative learning activities
- Provide opportunities for peer tutoring sessions
- Include web-based learning environments into mathematics instruction
- Teachers plan in intentional ways that ensure lessons connect both from a content and student learning perspective

Example of EBP for Alternative Delivery Mathematics Instruction

- Enhanced Anchored Instruction (EAI): Uses a combination of multimedia-based problems delivered on CD/DVD (called anchors) and related hands-on projects (e.g., designing, building, and riding on hover-crafts, skateboard ramps)

- Unlike most school-based traditional problems (e.g., word problems), each anchored problem consists of several subproblems embedded in a realistic and motivating context

- Students usually take five to ten 60-min class periods to solve those problems

- Recent versions of EAI has integrated explicit instruction via videos and opportunities to practice mathematics skills by clicking on hyperlinks

(Gagnon & Bottge, 2006)

Secondary Mathematics EBP & BAE: Behavioral Strategies

- **Provide explicit instruction**
- Teach students to discriminate between similar strategies or concepts
- Provide graduated instruction
- Scaffold instruction (gradually fade teacher assistance);
- Incorporate prompt cards or structured worksheets
- Teach both problem representation and problem solution during problem solving instruction
- Separate confusing concepts/terms when introducing mathematics concepts
- Teach procedural mathematics to build on and extend conceptual understanding
- Collect and use formative student performance data to make instructional decisions

Secondary English/Reading EBP & BAE : Comprehension

- Graphic and semantic organizers
- Have students ask and answer questions as they read
- Teach students to monitor their understanding while they read and apply fix-up strategies when their comprehension break down
- Explicitly teach students to identify the text structure of a passage
- Teach students how to summarize what they have read

Secondary English/Reading EBP & BAE : Comprehension

- Teach students how to write in response to reading
- Actively involve students in reading complex texts of different types (such as by partner reading, echo reading, cloze reading, scaffolded silent reading, etc.)
- Explicitly teach students to analyze the use of language in complex texts
- Activate or build students' background knowledge before reading
- Directly teach students to infer information while they read (e.g., make predictions, make connections between ideas within the text, make connections to other texts, draw conclusions, determine the author's purpose, etc.)

Secondary English/Reading EBP & BAE: Word Identification, Fluency

- **Word Identification**
  - Provide systematic phonics instruction (purposefully progressing from easier to more difficult decoding skills)
  - Directly teach spelling skills or patterns aligned to the phonics lessons
  - Teach students to break apart and read multi-syllable words
- **Fluency**
  - Offer students models of prosodic reading (Prosody: The timing, phrasing, emphasis, and intonation that speakers use to help convey aspects of meaning and to make their speech lively.)
  - Provide opportunities for students to practice fluency with repeated oral reading

Secondary English/Reading: Vocabulary

- Directly teach key vocabulary words before reading
- Provide students more than definitional information about words
- Teach students how to use word learning strategies (e.g., context clues, morphology, word categorization, etc.)
- Ensure students have multiple exposures to words in different contexts
- Provide students opportunities to use new words in discussion and in writing
- Use graphic and semantic organizers to support vocabulary learning


GOOD LUCK
45
M.P.H.

References Part 1/2

Bineham, S. C., Shelby, L., Pazey, B. L., & Yates, J. R. (2014). Response to intervention: Perspectives of general and special education professionals. *Journal of School Leadership, 24*, 230-252.

Bjorn, P. M., Aro, M., Koponen, T., Fuchs, L. S., & Fuchs, D. (2018). Response-to-intervention in Finland and the United States: Mathematics learning support as an example. *Frontiers in Psychology, 9*, Article 800, 1-10.

Ball, D. L., & Forzani, F. M. (2011, Summer). Building a common core for learning to teach and connecting professional learning to practice. *American Educator, 17-21*, 38-39.

Bottge, B. A., Rueda, E., Grant, T. S., Stephens, A. C., & Laroque, P. T. (2010). Anchoring problem-solving and computation instruction in context-rich learning environments. *Exceptional Children, 76*, 417–437.

Center for Applied Special Technology. (2010). *Universal design for learning guidelines*. Retrieved from http://www.udlcenter.org/aboutudl/udlguidelines

Cook, B. G., & Odom, S. L. (2013). Evidence-based practices and implementation science in special education. *Exceptional Children, 79*, 135 144.

Cook, B. G., Tankersley, M., Cook, L., & Landrum, T. J. (2008). Evidence-based practices in special education: Some practical considerations. *Intervention in School and Clinic, 44*, 69 75.

Cook, B. G., Tankersley, M., & Harjusola-Webb, S. (2008). Evidence-based special education and professional wisdom: Putting it all together. *Intervention in School and Clinic, 44*, 105 111.

Cook, B. G., Tankersley, M., & Landrum, T. J. (2009). Determining evidenced-based practices in special education. *Exceptional Children, 75*, 365-383.

Every Student Succeeds Act of 2015, Pub. L. No. 114-95 § 114 Stat. 1177 (2015-2016).

Haydon, T., Mancil, G. R., Kroeger, S. D., McLeskey, J., & Lin, W. J. (2011). A review of the effectiveness of guided notes for students who struggle with learning academic content. *Preventing School Failure, 55*, 226-231.

Maccini, P., & Gagnon, J. C. (2005a). *Math graphic organizers for students with disabilities* (pp. 1-10). Washington, DC: The Access Center: Improving Outcomes for all Students K-8.

Maccini, P., & Gagnon, J. C. (2005b). *Math strategy instruction for middle school students with learning disabilities* (pp. 1-9). Washington, DC: The Access Center: Improving Outcomes for all Students K-8.

Maccini, P. & Hughes, C. A. (1997). Mathematics interventions for adolescents with learning disabilities. *Learning Disabilities Research and Practice, 12*, 168-76.

Maccini, P., & Hughes, C. A. (2000). Effects of a problem-solving strategy on the introductory algebra performance of secondary students with learning disabilities. *Learning Disabilities Research & Practice, 15*(1), 10–21.

Maccini, P., Mulcahy, C. A., & Wilson, M. G. (2007). A follow-up of mathematics interventions for secondary students with learning disabilities. *Learning Disabilities Research & Practice, 22*, 58-74.

References Part 2/2

Maccini, P., Strickland, T., Gagnon, J. C., & Malmgren, K. W. (2008). Accessing the general education math curriculum for secondary students with high incidence disabilities. *Focus on Exceptional Children*, *40*(8), 1-32.

Malinen, O., Vaisanen, P., & Savolainen, H. (2012). Teacher education in Finland: A review of a national effort for preparing teachers for the future. *The Curriculum Journal*, *23*, 567-584.

Malinen, O., Savolainen, H., Engelbrecht, P., Xu, J., Nel, M., & Tlale, D. (2013). Exploring teacher self-efficacy for inclusive practices in three diverse countries. *Teaching and Teacher Education, 33*, 34-44.

McCray, E. D., Kamman, M., Brownell, M. T., & Robinson, S. (2017, October). *High-leverage practices and evidence-based practices: A promising pair*. Gainesville, FL: CEEDAR Center.

McLeskey, J., & Brownell, M. (2015). High-leverage practices and teacher preparation in special education (Document No. PR-1). Retrieved from http://ceedar.education.ufl.edu/tools/best-practice-review/

Myers, J. A., Wang, J., Brownell, M. T., & Gagnon, J. C. (2015). Mathematics interventions for students with learning disabilities (LD) in secondary school: A review of the literature. *Learning Disabilities: A Contemporary Journal, 13*, 207-235.

Montague, M., Enders, C., & Dietz, J. (2011). Effects of cognitive strategy instruction on math problem-solving of middle school students with learning disabilities. *Learning Disability Quarterly, 34*, 262-272.

Mulcahy, C., & Krezmien, M. (2009). Effects of a contextualized instructional package on the mathematics performance of secondary students with EBD. *Behavioral Disorders, 34*, 136–150.

National Center on Response to Intervention. (2010, October). *Information Brief: Developing an RTI guidance document*. Washington DC: Author. Retrieved from https://rti4success.org/resource/developing-rti-guidance-document

Organisation for Economic Co-operation and Development (OECD). (2018). PISA 2015: PISA results in focus. Paris, France: Author.

Preston, A. I., Wood, C. L., & Stecker, P. M. (2016). Response to intervention: Where it came from and where it's going. *Preventing School Failure, 60*, 173-182.

Rosenshine, B. (1996). Advances on research on instruction. The Journal of Educational
Research, 88(5), 262268.

Rosenshine, B., & Stevens, R. (1986). Teaching functions. In M.C. Witrock (Ed.), Handbook of research on teaching (3 rd ed., pp. 376391). New York: Macmillan.

Sabel, C., Saxenian, A., Miettinen, R., Kristensen, P. H., Hautamaki, J. (2011, October). *Individualized service provision in the new welfare state: Lessons from special education in Finland*. Helsinki: Sitra.

Santangelo, T., Harris, K. R., & Graham, S. (2008). Using self-regulated strategy development to support students who have "Troubol giting thangs into werds". *Remedial and Special Education, 29*, 78-89.

Spooner, F., Baker, J. N., Harris, A. H., Ahlgrim-Delzell, L., & Browder, D. M. (2007). Effects of training in universal design for learning on lesson plan development. *Remedial and Special Education, 28*, 108–116.

Yerushalmy, M. (2005). Function of interactive visual representations in interactive mathematical textbooks. *International Journal of Computers for Mathematical learning, 10*, 217–249.