Collecting diagnostic assessment/clinical interview data to individualize targeted mathematics instruction

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Poll Everywhere link: https://pollev.com/gcme

Vocabulary:
Intensive intervention: helps students with severe and persistent learning and behavioral needs, including students with disabilities. **It is a process**, not a specific program or product. The process is driven by data, characterized by increased intensity and individualization, and considers the academic and behavioral needs of the student.

Explicit instruction: A way of teaching where the teacher selects an important objective, specifies the learning outcome, designs **structured instructional experiences**, **explains directly, models the skills being taught, and provides scaffolded practice to help a student achieve mastery** (Kearns, 2018). Explicit instruction was recently identified as a high-leverage practice in special education, and there is a strong evidence base for its use.

Diagnostic interview/assessment: assessing student thinking using formative assessment. It will last approximately 5–15 minutes, depending on a student's age and disability. A brief, one-on-one, formative assessment tool designed to gather detailed information on students' mathematical thinking and reasoning

Clinical interviews: Another term for a diagnostic interview or assessment

Probe – an assessment task – designed to elicit prior understandings and commonly held misunderstandings and misconceptions

Probing questions: Question prompts which help children talk about problem solving (explain, justify, relate)

How should I determine the content covered in intensive intervention?

Screening – the student you are tutoring has already been identified as "at-risk"
Diagnostic assessment/ clinical interview – before and during intervention
Formative assessment – during intervention
Progress monitoring – benchmark assessment
Summative assessment data – after
Error analysis – informal
MA curriculum framework / common core state standards
Cognitive profile / standardized, norm-referenced test results

Probes as a tool for targeting instruction (Fagan, Tobey, & Brodesky, 2016)
Step 1: Establish a math content focus.
Step 2: Develop a plan to collect evidence.
Step 3: Process the results.
Step 4: Plan and implement targeted instruction.
Step 5. Reflect and adjust.

Clinical interviews
Clinical interviews "involve intense interaction with the individual child, an extended dialog between adult and child, careful observation of the child's work with 'concrete' intellectual objects, and flexible questioning tailored to the individual child's distinctive characteristics" (Ginsburg, 1997, p. ix).

- Select calculation examples and word problems of varying degrees of complexity.
- Present each example / problem to the student.
- As the student works, write down everything you hear and observe.
- Ask probing questions:
    - How did you figure it out?
    - Tell me about your thinking. What did you notice? Where did you begin?
    - Tell me what you did out loud.
    - (if student repairs and revises initial solution) Why did you change your mind (answer)?
    - If you had a friend who did not know how to solve this problem, what strategy would you tell him/her to use?
    - Use drawings or pictures or counters to help solve the problem. Show me.

- Good diagnostic interviewers:
    - Have a task/problem ready ahead of time
    - Are neutral in their responses
    - Wait. Silently.
    - Ask probing questions to understand the student's thinking.
    - Use imperatives (show me, tell me) rather than closed questions (yes/no responses)
    - Gather information about a student's thinking (You are not instructing the student. Do not give the student clues!)

Steps as you begin a diagnostic assessment

1. Research misconceptions
2. Read the problem to the student (to ensure reading the problem isn't interfering with math skills)
3. Observe
4. Ask probing questions
5. Have manipulatives on hand

Resources for conducting clinical (diagnostic) interviews

Ginsburg, H. P. (1997). *Entering the child's mind: The clinical interview in psychological research and practice*. New York, NY: Cambridge University Press.

Harbour, K. E., Karp, K. S., & Lingo, A. S. (2017). Inquiry to action: Diagnosing and addressing students' relational thinking about the equal sign. *TEACHING Exceptional Children, 49*(2), 126 – 133. doi: 10.1177/0040059916673310

Lewis, K. E., & Fisher, M. B. (2018). Clinical interviews: Assessing and designing mathematics instruction for students with disabilities. *Intervention in School and Clinic, 53*(5), 283 – 291. doi: 10.1177/1053451217736864

Marolda, M. R., Davidson, P. S., & Boiselle, E. C. (2015). Mathematics Diagnostic and Prescriptive Inventory. Boston: Children's Hospital Learning Disability Program.

Tapper, J. (2012). *Solving for why: Understanding, assessing, and teaching students who struggle with math, grades K–8*. Sausalito, CA: Scholastic, Inc.

Van de Walle, J. A., Karp, K, S. & Bay-Williams, J. M. (2016). *Elementary and middle school mathematics: Teaching developmentally (9th ed.*). Boston: Pearson.

Diagnostic interview strategies and sample probes

- ★ Math Reasoning Inventory: https://www.mathreasoninginventory.com/ (**Does not work in Chrome** – Try Internet Explorer or another browser)
- ★ Education Development Center: http://www2.edc.org/accessmath/resources/probes.asp
- ★ National Center on Intensive Intervention
    - https://intensiveintervention.org/intensive-intervention/diagnostic-data/example-diagnostic-tools
    - https://intensiveintervention.org/sites/default/files/Math-Assess-Supplement_508.pdf
- ★ Georgia Numeracy Project: https://gfletchy.com/wp-content/uploads/2018/11/Numeracy-Assessment-Manual.pdf

Fagan, E. R., Tobey, C. R., & Brodesky, A. R. (2016). Targeting instruction with formative assessment. *Teaching Children Mathematics, 23* (3), 146 – 157. doi: 10.5951/teacchilmath.23.3.0146

Tobey, C. R., & Fagan, E. (2013). *Uncovering student thinking about mathematics of the common core: Grades K – 2: 20 formative assessment probes.* Thousand Oaks, CA: Corwin. https://books.google.com/books?id=ScwhAQAAQBAJ&pg=PT14&lpg=PT14&dq=EDC+assessment+probes+math&source=bl&ots=8Fua1E4sUT&sig=ACfU3U3KFsrWL7SjohQueEwgR_fhpdhWLA&hl=en&sa=X&ved=2ahUKEwiChsiDuNfpAhVPonIEHbIBDE04ChDoATAAegQICRAB#v=onepage&q=EDC%20assessment%20probes%20math&f=false

Tobey, C. R., & Fagan, E. (2014). *Uncovering student thinking about mathematics of the common core: Grades 3 – 5: 20 formative assessment probes.* Thousand Oaks, CA: Corwin. https://books.google.com/books?id=1ZJlAgAAQBAJ&pg=PT14&lpg=PT14&dq=EDC+assessment+probes+math&source=bl&ots=lydw3lJWb3&sig=ACfU3U0Pxe5RtHjqYwWU90GrLlEUN_VDDg&hl=en&sa=X&ved=2ahUKEwju9MS-t9fpAhXOhHIEHfQCDMsQ6AEwEnoECAoQAQ#v=onepage&q=EDC%20assessment%20probes%20math&f=false

Tobey, C. R. & Arline, C. B. (2014a). *Uncovering student thinking about mathematics in the common core: Grades 6 – 8.* Thousand Oaks, CA: Corwin. https://www.google.com/books/edition/Uncovering_Student_Thinking_About_Mathem/LW-4AQAAQBAJ?hl=en&gbpv=1

Tobey, C. R. & Arline, C. B. (2014b). *Uncovering student thinking about mathematics in the common core: High school.* Thousand Oaks, CA: Corwin.

Tobey, C. R & Minton, L. (2011). Uncovering student thinking in mathematics, grades K-5: 25 Formative assessment probes for the elementary classroom. Thousand Oaks, CA: Corwin. https://books.google.com/books?id=Uy52AwAAQBAJ&pg=PR17&lpg=PR17&dq=EDC+assessment+probes+math&source=bl&ots=vxwRT8AW_W&sig=ACfU3U1AuxMkcBcHS0hf1DEJzQtebNmQwA&hl=en&sa=X&ved=2ahUKEwiChsiDuNfpAhVPonIEHbIBDE04ChDoATABegQICxAB#v=onepage&q=EDC%20assessment%20probes%20math&f=false

Links to videos shown during the presentation

First graders (Casey & AnJzanice) add and subtract

Javier - multiplication mental strategies

Monica: 15 × 12 (video does not load in Chrome – use Internet Explorer) Math Reasoning Inventory

Marisa: School Bus Problem (295 students, each bus holds 25 student, how many buses?)

Andres: 3 − 1.9

Zakari

Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L. & Empson, S. B. (2014). *Children's Mathematics: Cognitively Guided Instruction, Second Edition.* Portsmouth, NH: Heinemann.

Sources for finding common misconceptions

Gojak, L. M. & Miles, R. H. (2015). *The common core mathematics companion: The standards decoded, grades K-2: What they say, what they mean, how to teach them.* Thousand Oaks, CA: Corwin.

Gojak, L. M. & Miles, R. H. (2016). *The common core mathematics companion: The standards decoded, grades 3-5: What they say, what they mean, how to teach them.* Thousand Oaks, CA: Corwin.

Miles, R. H. & Williams, L. A. (2016). *The common core mathematics companion: The standards decoded, grades 6-8: What they say, what they mean, how to teach them.* Thousand Oaks, CA: Corwin.

Dillion, F. L., Martin, W.G., Conway, B.S., & Strutchens, M. E. (2018). *The common core mathematics companion: The standards decoded, high school: What they say, what they mean, how to teach them.* Thousand Oaks, CA: Corwin.

Kansas State Department of Education. (2018). 2018 Kansas Mathematics Flip Books. Retrieved from https://community.ksde.org/Default.aspx?tabid=5646

Minnesota STEM Teacher Center. (2018). Frameworks[1] for the Minnesota Science & Mathematics Standards. Retrieved from http://stemtc.scimathmn.org/.

SanGiovanni, J. (2016). *Mine the gap for mathematical understanding, grades K-2: Common holes and misconceptions and what to do about them.* Thousand Oaks, CA: Corwin.

SanGiovanni, J. (2017). *Mine the gap for mathematical understanding, grades 3-5: Common holes and misconceptions and what to do about them.* Thousand Oaks, CA: Corwin.

SanGiovanni, J. & Novak, J. R. (2017). *Mine the gap for mathematical understanding, grades 6-8: Common holes and misconceptions and what to do about them.* Thousand Oaks, CA: Corwin.

Independent work time:

- Choose 1 assessment probe from the approved sources.
- Research misconceptions on the assessment probe concept from the Kansas Flipbooks
- Discuss: state which probe you chose, why you chose this particular probe, the difficulties students may have with this task (misconceptions), what manipulatives you want to have available for the student, and list one probing question you want to ask the student.

Question prompts to help students talk about problem solving (explain, justify, relate)

Ask open-ended questions or use an imperative sentence (command):

- How did you know that?
- How did you do that?
- Tell me what you did out loud.
- How did you figure it out?
- Tell me how you figured it out.

[1] Minnesota has not adopted the Common Core mathematics standards. Search math frameworks by grade and topic. Once you click on a topic, scroll down to misconceptions.

- Show me how you did it.
- What were you thinking?
- (If the child did not use manipulatives, provide one, if appropriate.) Show me how you did it with these?
- What do you predict will happen?
- What patterns do you see?
- How can you solve it a different way?
- What are you thinking?
- How did you figure it out?
- Why did you_____? [write that, draw that, etc.]
- You wrote _____. How did that help you?
- I noticed that you stopped what you were doing just now. What were you thinking?
- Why did you change your mind (answer)?
- I don't know what you mean by that. Show me.
- Draw a picture of that.
- Show me with _____. (cubes, blocks, a number line, etc.)
- You started with this (point) and then went to this (point). Tell me about your thinking.
- Tell me (show me) what _____ means.
- How do you know you are right?
- What do you notice?
- What is another way to show me?

References for question prompts

Clements, D. H., & Sarama, J. (2014). *Learning and Teaching Early Math: The Learning Trajectories Approach (2nd ed.).* Hoboken, NJ: Taylor and Francis.

Tapper, J. (2012). *Solving for Why: Understanding, Assessing, and Teaching Students Who Struggle with Math, Grades K-8*. Sausalito, CA: Math Solutions.

Texas: Algebra Ready (2014). Flexible Interview Guidelines K -2. Retrieved from http://www.txar.org/assessment/flex/MTCK2_FlexInterviewGuidelines.pdf.

Plan and implement targeted instruction: Resources

National Center on Intensive Intervention

Intensive Intervention in Mathematics Course Content from NCII

Provide students worked examples and non-examples

Booth, J.L. (2011). Why Can't Students Get the Concept of Math? *Perspectives on Language and Literacy, 37*(2): 31 – 35.

Provide explicit instruction in **metacognitive strategies** as they relate to mathematics (metacognition refers to the ability to develop strategies for planning an approach to tasks, for organizing the steps of a task to achieve a solution, and for monitoring the results.)

Montague, M. (2007). Self-regulation and mathematics instruction. *Learning Disabilities Research & Practice, 22*(1), 75 – 83.

Montague, M. (2006). Self-regulation strategies for better math performance in middle school. In M. Montague & A. K. Jitendra (Eds.), *Teaching mathematics to middle school students with learning difficulties*. (pp. 89 – 107). New York, NY: Guilford Press.

Montague, M. (2005). Math problem solving for upper elementary students with disabilities. Retrieved from http://165.139.150.129/intervention/Math%20Problem%20Solving%20for%20Primary%20Elementary%20Students%20with%20Disabilties.pdf

Montague, M., & Dietz, S. (2009). Evaluating the evidence base for cognitive strategy instruction and mathematical problem solving. *Exceptional Children, 75*(3), 285 – 302.

Sites for virtual manipulatives

Math Learning Center

Toy Theater

Didax