Collecting Practice-Based Evidence to Support Teaching and Learning

SUMMARY

Collecting systematic data on student progress is the optimal way to match instructional approaches to individual students as effectively and efficiently as possible. These authors discuss their use of mastery measurement — a method teachers can use to monitor their students' progress with specific skills. In this example, authors describe a process for collecting and analyzing data to monitor student learning and offer specific questions that guide instructional decisions.

Ms. Gardner was asked to work with Alex, a first-grader. The goal was for Alex to master all grade level-appropriate sight words. As she worked with Alex, Ms. Gardner realized that his limited sight word vocabulary was having a negative impact on his reading ability.

As part of the efforts by teachers at Madison High School to prepare students to take the Algebra Regents Examination, Ms. Baker was assigned to work with Carl, a 10th-grade student with a learning disability who was having particular difficulty factoring polynomials, a topic that Carl would encounter on the examination.

To guide their instruction and monitor their students' learning progress, Ms. Gardner and Ms. Baker created assessment probes directly related to learning standards and the skills they needed to teach in order for students to achieve targeted outcomes.

Ms. Gardner's probe involved having Alex read the 41 words on the Dolch sight word list for first grade within one minute. This learning goal was aligned with Grade 1 Literacy Competencies/Fluency: Sight-read automatically grade-level common, high-frequency words (*English Language Arts Core Curriculum: Prekindergarten–Grade 12*, May 2005) as well as Foundation Skills in the *New York State P-12 Common Core Learning Standards for English Language Arts and Literacy*.

Ms. Baker's probe asked Carl to factor 10 polynomials within 15 minutes, (e.g., factor $x^2 + 4x + 3$). This learning

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goal is aligned to the *New York State P-12 Common Core Learning Standards for Mathematics*, which indicate that high school students should learn to work with polynomials, including knowing their structures and how to rewrite them in equivalent forms. These topics are also specified in the Algebra: Seeing Structure of Equations domain of the high school mathematics standards (A-SSE 1-3).

Prior to beginning their instruction, the teachers administered their probes to obtain a baseline measure of their students' skill levels. Ms. Gardner and Ms. Baker used the baseline data to determine the progress expected of each student. They implemented research-based practices designed to foster Alex's sight word reading and Carl's factoring of polynomials. Ms. Gardner used strategies including guiding Alex in creating mental images to connect with a specific sight word, skywriting (i.e., writing the word in the air) and saying words simultaneously, and engaging in a series of memory-based activities presented in a game format. To improve Carl's factoring skills, Ms. Baker initially used index cards to review recognizing perfect squares and finding their square roots. To have Carl assume greater control over his learning and become an active participant in the lessons, Ms. Baker guided him in creating a mnemonic device for remembering when a factor should be negative and when it should be positive, and worked with him to show him how to use the mnemonic strategy consistently.

On a weekly basis, at the end of the instructional sessions, Ms. Gardner and Ms. Baker administered assessment probes, and graphed and analyzed the data to assess student progress and to make adjustments in their teaching. In analyzing the range of data she collected, Ms. Gardner noticed that Alex's error patterns showed that he either added or omitted vowels, so she decided to focus her instruction on vowels and vowel patterns within sight words. To simplify abstract concepts and to give Carl a procedure with explicitly delineated steps he could follow to solve more complicated problems, Ms. Baker showed Carl how to create a table to organize and choose factors to use in his answers, and taught him to use the "slide and divide method" for

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factoring, which she found at *http://mrsgalgebra.pbworks.com* (Search: slide and divide).

Pleased with their success, Ms. Gardner and Ms. Baker shared their results with their students and other professionals. They also reflected on their teaching practices. Ms. Gardner felt that her error analysis was instrumental in guiding her instruction. Ms. Baker thought that using visuals helped her to make abstract concepts more concrete and understandable, and that the mnemonic devices and strategies provided Carl with an organizational framework for factoring polynomials.

Practice-Based Evidence

Throughout their careers, educators encounter students like Alex and Carl, who require the use of a variety of research-based strategies (Salend, 2011). For teachers, this means collecting and examining practice-based evidence to assess whether there is a relationship between their instructional strategies and positive changes in their students' academic, social and behavioral development (Detrich, Keyworth, & States, 2008; Maheady & Jabot, 2011).

One assessment strategy that teachers can use to collect practice-based evidence to monitor their students' learning progress and inform their instruction is curriculum-based assessment (CBA) (Salend, 2009). CBA is a progress-monitoring technique that involves use of ongoing, individualized, direct and brief probes of students' progress and proficiency in mastering content and skills directly related to the curriculum and classroom instruction (Foegen & Morrison, 2010). Because CBA probes are relatively brief, low stakes, used repeatedly, and relate to everyday instructional tasks, CBA is a practical and effective way to collect and analyze data over time to assess students' learning progress across the curriculum. A continuous evaluation of teaching effectiveness is also an integral part of CBA. Thus, teachers also examine the data collected to inform their teaching and make any necessary adjustments that will foster their students' learning.

Educators typically use two forms of CBA: curriculum-based measurement (CBM) and mastery measurement (MM) (IRIS Center for Training Enhancements, 2004). CBM involves the use of valid and reliable assessment probes related to multiple skills across the curriculum to systematically identify, compare, and predict student progress based on norms for growth rates across the curriculum (e.g., reading, writing, mathematics) and at various grade levels. Whereas CBM is implemented more systematically as an integral part of the response-to-intervention

(RtI) process, MM is used more informally by teachers to monitor their students' mastery of specific skills currently being taught.

Guidelines for Implementing Mastery Measurement

Using examples related to Ms. Gardner and Ms. Baker, this article presents an application and adaptation of a MM model previously presented by Salend (2009; 2011) to collect and reflect on practice-based evidence regarding the effectiveness of their interventions. While teachers like Ms. Baker and Ms. Gardner used MM to assess their students' learning progress and determine the efficacy of their teaching practices, these guidelines are used more systematically as part of norm-based CBM. The steps in implementing MM involve:

1. Identifying and defining the meaningful school-related tasks and learning objectives to be assessed.

Teachers begin the MM process by examining their curriculum and learning standards to determine the meaningful critical thinking, problem-solving, academic, or performance skills their students need to learn. In the case of students with disabilities, teachers also consult their students' Individualized Education Programs (IEPs) and Section 504 Accommodation Plans. The identified skills are stated as instructional objectives. For example, Ms. Gardner's objective targeted Alex's reading of sight words which were related to the school's literacy standards, and Ms. Baker's objective focused on Carl's ability to factor polynomials, which addressed the state's math learning standards and was an important topic assessed on the Algebra Regents exam.

2. Creating an assessment probe.

Teachers then develop an assessment probe that relates ***directly*** to their instructional objective. In creating the probe, teachers specify: (a) the number and types of items, making sure that the presentation and response modes of the items are consistent with the instructional objective; (b) the sample duration, which refers to the amount of time students will have to complete the assessment probe; (c) the conditions associated with the probe, such as what the teacher says and does, and the materials and resources students will be allowed to use to complete the probe; and (d) the criteria used to score the probe, including the response time for specific items and the acceptable level of precision. For example, Ms. Gardner's probe involved a typed worksheet that contained the 41 words of the Dolch first-grade word list. The words were typed into three columns and Alex was told that he had one minute to read the words aloud from top to bottom in a clear and calm voice. Alex was

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Teachers develop an assessment probe that relates ***directly*** to their instructional objective.

informed that if he came across a word he did not know he should say "skip" and move to the next word. Words were counted as correct when Alex read the word correctly, or when he self-corrected the word within three seconds. Words were counted as incorrect when Alex pronounced the word incorrectly or said "skip."

3. Administering the assessment probe to establish a baseline.

Teachers administer the probe to obtain a ***baseline***, a measure of students' performance on the assessment probe prior to commencing instruction. A baseline provides a level that allows educators to judge the subsequent effectiveness of their instruction.

4. Determining an aimline.

Teachers use the baseline data and the instructional objective to determine an ***aimline***, a dotted diagonal line on a graph that provides an estimate of a student's expected rate of progress from the baseline measures to the expected levels of mastery (see Figures 1 and 2). The aimline is individually determined based on the student's baseline data and learning strengths and challenges as well as the levels of mastery the student is expected to attain and the length of time devoted to instruction. It provides teachers and students with a visual way to determine learning progress and to judge the effectiveness of the instructional program.

5. Designing and delivering varied, research-based, motivating, acceptable, and differentiated instruction.

As Ms. Gardner and Ms. Baker did, teachers use the baseline data and the aimline as reference points to plan and implement varied, research-based, motivating, acceptable, and differentiated instructional strategies. Possible research-based interventions to consider can be identified by:

(a) observing and speaking with other professionals;

(b) attending professional development activities, conferences, and teacher education courses;

(c) participating in face-to-face and online professional learning communities; and

(d) consulting professional journals, books, websites, listservs, wikis and blogs (Huber, 2010).

In choosing research-based interventions, teachers examine the extent to which the research matches the characteristics of their students (e.g., specific disability characteristics, age, gender, socio-economic, cultural and language background), their classrooms (e.g., technology, materials,

scheduling and staffing requirements, group sizes), and the required instructional intensity (e.g., preparation required for implementation) (Jitendra, Burgess, & Gajria, 2011). Teachers also consider acceptability, the extent to which an instructional strategy is viewed by teachers and students as feasible to use, motivating, fair, appropriate for the setting, and consistent with their teaching style and philosophy.

6. Administering the assessment probe following instruction and graphing the data.

Following instruction, teachers administer the assessment probe and graph the data. In graphing the number, percentage, or rate of the correct responses, they use the following guidelines:

- Place the assessment probe skill on the vertical axis.
- Place the teaching sessions in consecutive order on the horizontal axis.
- Raise the zero point above the horizontal axis because it can be hard to see a point if it is directly on the axis.
- Label baseline and intervention phases and use solid vertical lines to separate them.
- Give the graph a title.

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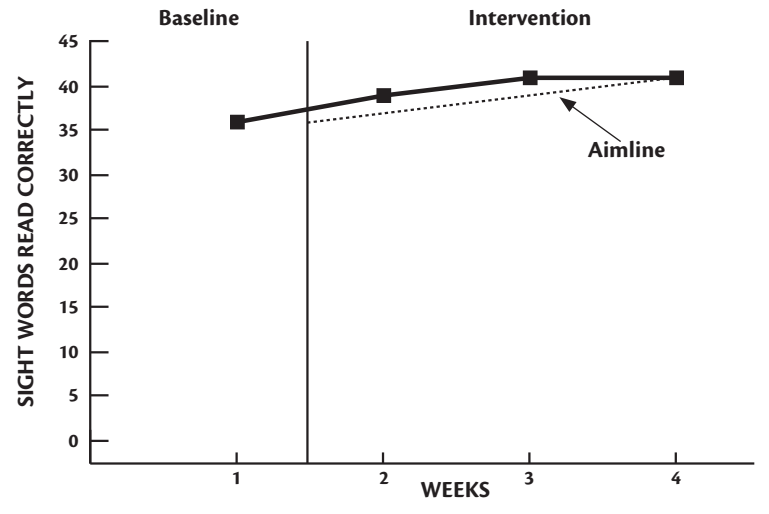
Figure 1

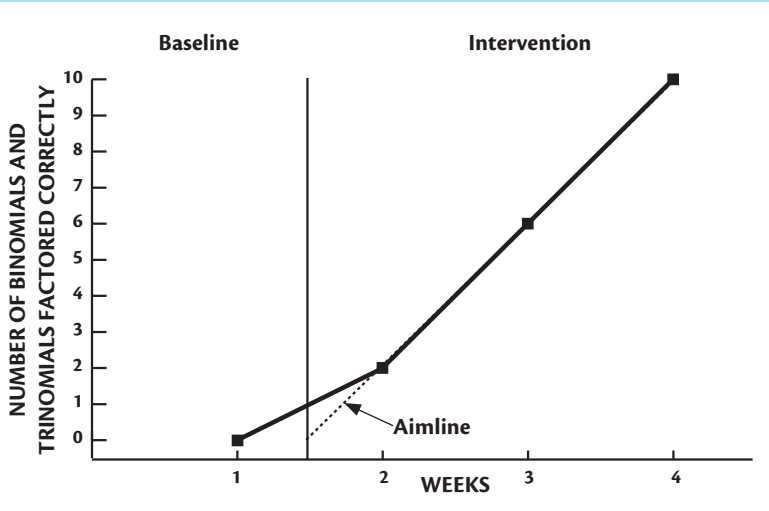
Alex's Sight Word Reading Progress



Ms. Gardner's graph is presented in Figure 1; Ms. Baker's graph is presented in Figure 2.

Figure 2

Carl's Progress on Factoring Polynomials



Students can be asked to offer their opinions about the interventions. Did they like the approach? Was there anything about it that they didn't like?

7. Examining the data to assess student learning progress and inform instruction.

Like Ms. Gardner and Ms. Baker, teachers examine the graph and the data by comparing it to the student's aimline to assess whether the student is making adequate learning progress. Teachers also use the data to make adjustments in their teaching practices. In examining the data, teachers determine whether the student:

- is making adequate progress and therefore instruction should be continued until mastery is established;
- has achieved mastery and is ready for more challenging instructional objectives; or
- is not progressing and therefore adjustments should be instituted related to the level of difficulty of the instructional objective and/or the teaching strategies being delivered.

Teachers also examine students' responses to identify areas of difficulty and ineffective patterns in the ways students approach a task and use this information to plan instruction to correct error patterns. As mentioned earlier, Ms. Gardner's error analysis showed that Alex added or omitted vowels, which caused her to target her instruction on vowels and vowel patterns within sight words. Ms. Baker's data analysis led her to provide Carl with more challenging instruction and to teach him a strategy for solving more complicated problems.

8. Soliciting feedback from students.

Although interventions may foster student learning, they may also have other consequences that need to be examined. For example, an intervention may make a student feel embarrassed or different from her or his classmates (Salend, 2009). Therefore, teachers can solicit feedback from students to view the interventions from their perspective and to understand the consequences associated with their use (Maheady & Gard, 2010). Students can be asked to offer their opinions about the interventions. Did they like the approach? Was there anything about it that they didn't like? For example, when asked which activity he enjoyed the best and why, Alex said, "Skywriting — because I like it and I'm really good at it."

9. Reflecting on the efficacy of the instructional strategies.

Teachers reflect on the data to assess and compare the efficacy of instructional interventions and make decisions about their instructional practices and students' educational programs. They reflect on:

- **Product:** What did my students learn?

- **Process:** How did my students learn it?
- **Reasons:** Were my instructional strategies successful? If so, why? If not, why not?
- **Impact on Students:** Was the intervention effective for all of my students? Some of my students? My students with disabilities? My students who are English language learners? Why? Why not?
- **Unanticipated Consequences:** Were there unanticipated consequences for my students (positive or negative) associated with using the intervention(s)? How about for me (e.g., too time-consuming in comparison to benefit for students)?
- **Improvements:** What steps can I take to enhance the implementation, effectiveness, and acceptability of my instructional strategies? What additional resources do I need and/or preparation tasks do I (or my students) need to do so my instructional strategies can be more effective and efficient?
- **Future:** What are future goals and possible strategies for use with my students?

10. Communicating the results.

Teachers use their graphs and reflections to share information about their students' learning progress with others. For students with disabilities, data can be used to document mastery of specialized goals listed on their IEPs. Teachers also can share their data and graphs with students, families, administrators, and colleagues to demonstrate their use of effective practices that support student learning.

Was the intervention effective for all of my students? Some of my students? My students with disabilities? My students who are English language learners?

Summary

Highly effective educators continually use assessment data to monitor student learning progress, and to plan and differentiate their instruction (New York State United Teachers, 2011). Curriculum-based assessment is one method for collecting evidence and reflecting on practice. In this way, educators are better able to identify and show their use of highly effective interventions that support their students' learning.

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