Learning Progressions through Diagnostic Assessments
Dr. Gerald Tindal – BRT.UO

About a decade ago, we published a technical report on learning progressions[1]. As we note in that report, learning progressions involve building blocks of (sub)skills that students must master, with their assemblage sequenced, and eventually with increased difficulty and complexity that build into a whole. For example, in mathematics, the early subskills for becoming proficient moves from sets (grouping of objects and one-to-one correspondence) to counting, ordering, and eventually to the use of operations and algorithms to solve complex problems. In reading, the subskills involve phonemes, eventually with letters that build words for decoding (which often rely on inconsistent rules) but eventually lead to smooth and fluent reading (with prosody). In this report, we also note that these progressions are not curriculum maps, primarily because students are likely to vary in their own progressions and the rate in which they move through them, most likely in a nonlinear way.

Standards Based Progressions

In CBMSkills©, specific diagnostic assessments in mathematics, early reading, and reading fluency are presented reflecting learning progressions. In the former two types of assessments (mathematics and early reading), the Common Core State Standards formed the basis in articulating domains. These grade level standards, and this articulation of learning progressions, is highly informative for developing specific interventions. In learning progressions, the tasks are connected, with each one leading to another, though the progression itself may be individualized. This form of assessment can be viewed as a 'response to intervention' much the same way as easyCBM© but learning progressions represent more discrete skills rather than a compilation of skills used to monitor long term progress, which relies on comparability of outcomes over extended periods of time (e.g., weeks and months). With CBMSkill©, students can also practice tasks to not only show improvement, but eventually to show proficiency.

In the late 2000s, the Common Core State Standards (CCSS) were developed and promulgated by the Council of Chief State School Officers. This organization had convened content experts from across the country to develop consistent achievement standards for states to adopt. Their reasoning was that reading and mathematics skills and learning progressions across the grades should not really differ from state to state: Reading is reading is reading whether you are from Louisiana or Oregon. Furthermore, a united and coherent set of standards would save individual states from convening their own expert panels and save state education funds. Although this movement lasted for a while, eventually states began to adapt their own standards, often looking suspiciously similar but with local variations that were thought to be important.

We recently went through the various state standards and aligned them with the original CCSS standards and then aligned with easyCBM© measures. As we wrote in the abstract of this

[1] Saez, L., Lei, C. F., & Tindal, G. (2015). *Learning Progressions: Tools for Assessment and Instruction for All Learners*. University of Oregon: Behavioral Research and Teaching. Technical Report 2101.

technical report[2]: "First, a team of researchers gathered the status of state standard information for mathematics and English language arts (ELA) standards across grades K-8 for all 50 U.S. states. Three main groups were identified: CCSS Adopted (20 – ELA & Math), CCSS Revised (24 – ELA, 28 – Math) and State Unique (6 – ELA, 2 Math). Next, the team analyzed the alignment between the standards and the easyCBM© literacy measures. Finally, the team analyzed the alignment between the standards and the easyCBM© mathematics measures" (page 1). This technical report describes the process used in the alignment study and provides the results of the analysis.

The important take away for CBMSkills© and its diagnostic measures used to document learning progressions is (a) that many (20) states had directly adopted the CCSS, (b) many states (24) had slightly revised the CCSS, and (c) only six states adopted unique standards. Using categories of exact match, partial match, deviation, and no match, the results indicated considerable content match between our measures and the standards, whether adopted, revised, or unique. In extending easyCBM© to our progressions, therefore, we relied on the CCSS with confidence in the learning progressions from grade to grade. On that note: The CCSS may not be precisely located in their grade placement with the likelihood that the skills and therefore states have adapted them. In our learning progressions, we have placed them in rough grade levels, but have built the interface to allow teachers flexibility in mixing and matching tasks in any combination deemed appropriate.

One final caveat: With the CCSS as well as state-adapted standards, many of the specific progressions are multi-dimensional and process oriented. For example, in Grade 4, a fraction standard states "Decompose a fraction into a sum of fractions with the same denominator *in more than one way,* recording each decomposition by an equation. *Justify* decompositions, e.g., by using a visual fraction model. Examples: 3/8 = 1/8 + 1/8 + 1/8; 3/8 = 1/8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8". As a learning progression, this emphasis on alternate expressions and process forces the item to have a bi-variate skill which we did not adopt in our system.

Learning Progressions

<u>Type of Student Response</u>. To document students' learning progressions and refine the diagnostic power of this process, teachers need to consider whether students respond by (a) *producing* the answer to the target item/problem OR (b) *selecting* an option from an array of possibilities, often restricted to three options. The focus on either type of response is the diagnostic analysis of misrules when students' responses are incorrect.

- In the former, production responses, students are presented a problem and construct their response. The beauty of this type is a variety of misrules can be detected, though teachers need to classify them.
- In the latter, selection responses, students are presented a problem and the options presented that typically include a correct option, a near distractor, and a far distractor. The beauty of this type is that that teachers can quickly classify them with near and far distractors representing partial or no skill, respectively.

---

[2] Saez, L., Whitney, M., Swanson, D., & Alonzo, J. (2021). *The Alignment between easyCBM© Mathematics and Literacy Assessments and State and National Standards*. University of Oregon: Behavioral Research and Teaching. Technical Report 2101.

CBMSkills© has both types of distractors: (a) the mathematics tasks tasks/items have a predominance of production problems, (b) early reading has only selection tasks, and (c) oral reading fluency is only a production response. As a footnote, the advantage accorded selection responses had been the ease of getting immediate results. In CBMSkills©, however, immediate results can be obtained, irrespective of whether students produced or selected the response.

Focus of Assessment. The big idea behind identification of learning problems is that teachers can target their teaching to very specific skills. This system can become part of a response to intervention (RTI) in which students who are risk of learning problems on global, skills-based assessments, can then take specific, skills-based tasks, so teachers can use the outcomes diagnostically. In most RTI systems, general outcomes-based tasks are used normatively, ranking students from low to high on global measures (displaying individual difference). This system is efficient but begs the question of what is causing a student to have a low performance but allows teachers to intervene to make an individual difference. With a learning progression approach, teachers can map out a series of skills and then have students take individual tasks/items. This map, however, needs to be distinguished from a curriculum and instructional strategy used to remediate. The problem space of skill deficits, however, is at least constrained so teachers can proceed on both fronts.

Because learning progressions are student-specific, this process can only proceed only if (a) the assessment used are individually administered, (b) the domain of items representing the skill is sufficient, and (c) mastery is considered on a continuum.

- Given the task analysis of progressions, a multitude of specific skills need to be articulated and so teachers can guide students to take various items and tasks. To avoid fatigue, however, these tasks must be brief and results immediately attainable. In CBMSkills©, we use skill sets with 10 items presented. In mathematics, items can also be read aloud in any of 13 languages, so that learning can progress without being hindered by unnecessary skills.
- Furthermore, the domain of each skill needs to be exhaustive, with the full range of skills presented. Sometimes, the domain is quite limited (e.g., geometry in early grades may involve a limited range of possibilities). In other skill areas, the domain may be extensive (e.g., consonant-vowel-consonant word types). To achieve full coverage, therefore, alternate forms need to be presented so, eventually, over time, students can respond to the full set.
- In moving through these progressions, mastery needs to be considered in two ways: (a) as none, emergent, partial, and complete, and (b) as a heat map with various skills displayed representing the full set. In CBMSkills©, we depict these four states of mastery with medals (a) participation, bronze, silver, and gold, each of which are presented immediately upon completion of the entire task. The heat map displays the full range of medals concurrently by student and by skill.
- Finally, comparability of items is only possible within a specific domain. In more typical assessments that are general outcomes-based tasks (and used in RTI systems), different forms are scaled for comparability (using Item Response Theory). However, in our tasks within a problem type, items are deemed comparable by using random sampling of all possible options. These random samples can provide comparability over the long run so that teachers can feel confident that improvement is real and not a function of the specific items sampled within a site.

Mathematics Learning Progressions

Although English is not a transparent language, with consistent rules that govern the associations of graphemes and phonemes, mathematics is transparent, and rule governed with a general sequence of skills that can be taught and learned in an orderly fashion. Notice the word 'generally'. Although for many students, the sequence of skill development is orderly (with increasing sophistication and complexity over time and grades), many intersections are available that reflect individual learning progressions. The National Council on Teachers of Mathematics (NCTM) has been the main non-governmental agency to promulgate best practices in these learning progressions.

For example, in the early grades, problems may be presented with sections of a circle (e.g., a pizza) that can be counted and compared. This is a fraction problem in disguise. Another example is the association between a number line and the concepts of less-equal-greater as well as counting by different values. Finally, addition and subtraction operations are obviously related, but students also might associate multiplication as speed addition.

In the following progressions, which are part of the CBMSkills© modules, teachers can easily draw their own developmental progressions for students on an individual basis.

- Objects and counting as representations of numbers or numerals
- Sets with grouping in uneven amounts
- Compare with more or less
- Numbers on a number line
- Count by
- Addition and its opposite of subtraction
- Place value with 1, 2, and 3 digits
- Whole integers and real numbers
- Multiplication (fast addition) and its opposite, division
- Renewed grouping in algebraic relations
- Fractions and proportions along with division,
- Graphing with coordinates along with slope (rise over run)
- Measurement and scaling (in amount as well as distance)
- Money and situated story problems with text versions of operations

Subskill specific areas in elementary grades

- Geometry
- Area and Volume
- Movement from base 10 in imperial system to
- Time (base 12) and AM and PM
- Metric system

The problem, as noted above, is that we have general learning progressions but not individual ones. Therefore, teachers need to be judicious in balancing a coherent lesson (for a group of students) and attending to variation among students (with some already proficient while others are not proficient). With this general approach, several instructional approaches are possible for ensuring students' progress in various skills. Because mathematics is inherently rule-based, unlike reading, several different approaches may be uniquely applied in mathematics.

- Explicit instruction: Students are directly taught not only rules and algorithms but also example outcomes that result from application of rules.
- Cooperative learning: Begun by the Johnsons at the University of Minnesota decades ago, this strategy involves students working together and proactively in solving problems.
- Repeated practice: Ideally, students are directed to engage with items and tasks repeatedly, with two caveats, however. First, feedback should be immediate, and second, the tasks should be comparable and focused on a single skill.
- Manipulatives: Many mathematics concepts can be explained and demonstrated most effectively when presented along with manipulative objects (e.g., stackers, countable and sortable objects, etc.).
- Scaffolds: Support materials can be used to process math problems (e.g., times tables, process steps, etc.).

In summary, mathematics is well suited for learning progressions because of the tidiness of the domains (many similar item types provide immediate comparability that function under the same rule-governed system). Furthermore, the skills are easily graded developmentally, with successive skills build upon each other. Finally, instruction can be more individually based with structured, relevant practice (and feedback) provided.

Early Reading Progressions

Our view of reading progressions is based on the early work of the National Reading Panel (NRP, 2000). We begin with the English language itself, though clearly young students need to know that reading involves graphemes and a process of association that moves from left to right, that reading is comprised of building blocks like sounds, words (which are separated by spaces), and sentences (which are separated by punctuation marks), and the entire skill, holistically involves fluent reading with prosody (this last process is treated in the next section of this blog). In our map of learning progressions in reading, we have developed three phonemic awareness (PA) tasks and seven, word identification (WID) tasks. Although more and different skills areas could be articulated (e.g., rhyming and consonant-vowel-consonant tasks), these 10 skill areas represent the bulk of skills needed to move ahead in reading fluently.

Our Phonemic Awareness skills include the following:

- Isolating Sounds, both beginning and ending
- Blending (onset/rime, initial consonant/rest of word, and phonemes)
- Segmenting (beginning and ending)

Phonemic awareness (PA) is the ability to hear and manipulate individual sounds within words (and is important eventually as children match sounds with letters), while phonological awareness is a broader concept that includes syllable awareness and rhyming. The National Reading Panel (2000) conducted a review of studies on phonemic awareness instruction and found that it improves reading skills, particularly in at-risk children. PA is particularly important in kindergarten and first grade, best fostered with small-group instruction, and most beneficial when one or two skills are addressed. The key skills to teach are segmenting and blending sounds within words. Overall, phonemic awareness instruction is essential for early reading success and should be integrated into literacy instruction in the early years.

Our seven Word Identification (WID) skills are ordered to represent increasing in difficulty from kindergarten (first three listed below) to Grade 2:

- Sight word recognition (from Fry/Dolch lists)
- Vowel sounds (both short and long)
- Consonant blends (initial and final)
- Consonant digraphs (both initial and final)
- Complex vowel team patterns (covering ai, ea, ee, oa, oi, oo, ou, oy, ow, aw, ew/ui/oo)
- "Tricky" Silent & Controlled patterns (covering silent e/b/k/w, le, gh/ph, double consonants, r-controlled)

Phonics instruction teaches students the relationship between letters and sounds in decoding and pronouncing words. *Synthetic* phonics teaches individual sounds and blending, while *analytic* phonics emphasizes larger units of pronunciation. Both approaches have shown effectiveness in teaching phonics. The National Reading Panel (2000) conducted a review of studies on phonics instruction and found that systematic phonics instruction had a positive impact on word recognition and spelling skills in kindergarten and first-grade students. Phonics instruction can benefit struggling readers in higher grades, but its effectiveness depends on concurrently building vocabulary knowledge alongside decoding skills.

Summary and Recommendations: Because of the non-transparency of the English language, these learning progressions also represent a range of misrules that need to be considered. As Arika Okrent writes in a book entitle Highly Irregular,[3] "*No engineer would purposefully design a language to be this disorderly. But language is not the product of engineering. It is the product of evolution, and the faults of English are similar to those that can be found in our bodies. Why do we have an appendix? Why are we so prone to back pain? Why do we love unhealthy food? Some biological adaptations help us at one point but hurt us later. Some changes stick around for no reason at all. The process of evolution does not itself have a goal, but it makes us what we are. Some strengths become weaknesses; some useful parts become useless (pp. 11-12)"*

To illustrate this point, she references *Drop Your Foreign Accent* by Nolst Trenite's that highlight the inconsistencies of English with words that contain 'ough', like dough, enough, though, through, thought, plough, cough, tough, and hiccough. She identifies five vowels (and a 6th with y on occasion) but then, when appearing with various combinations of letters before or after, the count is 12, 16, or even 20 when making phonemes. So, the 21 letters that serve as consonants along with the 5 (or 6) vowels (depending on the swing of y) result in 44 phonemes. Furthermore, in this array, we also have long and short vowels, as well as spoken and silent letters (e.g., night, light, bright).

---

[3] Okrent, Arika. Highly Irregular. Oxford University Press. Kindle Edition.

The problem sets in learning progressions, therefore, need to include a sufficient range of items that teachers can use any of several instructional strategies proven to be evidence-based. And consequently, instructional strategies, may differ from mathematics, if only because of the irregularity of the language and the lack of consistent rules.

- Model-lead-test: Teachers model the appropriate response, ask students to respond in kind, and then over time, present the item without the model.
- Far and near examples: In direct instruction, minimum differences between two items are presented to exemplify how they are different and maximum differences between two items are presented to exemplify how they are the same.
- Mnemonics: Associations are presented through songs and rhymes, acronyms, chunking, etc. to increase student recall.
- Strategy instruction: A clear procedure is used to learn content with steps outlined and rehearsed.
- Scaffolds: Items can include hints and prompts when first presented and then gradually removed.
- Guided and repeated practice is an important part of improvement, but it needs to occur with guidance and feedback.

Fluency Instruction and Progressions

Fluency refers to the ability to read text accurately, quickly, and with proper expression. It is important for students to read words accurately, process text at a sufficient speed for comprehension, and use appropriate pausing and emphasis to convey meaning. Research has shown that fluency instruction improves reading achievement in many ways. It enhances oral reading fluency, decoding skills, word recognition, and silent-reading comprehension. Fluency instruction is important for both low-achieving readers and typical readers.

Successful fluency instruction involves oral reading, repetition of texts, and guidance or feedback. Students need to read aloud and practice texts repeatedly to improve accuracy, speed, and expression. Ideally, fluency instruction is applied to a wide range of texts, including expository and literary materials. A key to improvement in fluency is that guided instruction and practice is provided, rather than simply having students reading independently. Having a teacher, partner, or listener who can provide feedback and assistance may be useful to ensure reading practice is guided. Paired reading, where students take turns reading to each other, is an effective technique. Automatic speech recognition system can also support fluency practice. In the end, fluency instruction can be quite simple, but teachers should keep progress records to monitor improvement. Ultimately, teachers have flexibility in determining the number of times students should reread a text, either until they meet a criterion of success or after several repetitions. In this next section, we provide standards for making such decisions.

Learning progressions of fluency has a 40+ year record of research.

- In 1982, the first study on oral reading fluency was published in *Exceptional Children*[4] that launched four decades of research on this construct and the publication of hundreds of peer-reviewed articles. In this initial research, the goal was to identify simple measures of reading

[4] Deno, S.L.; Mirkin, P. K., & Chiang, B. (1982). Identifying valid measures of reading. *Exceptional Children*. *49*(1), p.36-47

that could be administered frequently so teachers could monitor progress and skill growth. In this initial study, fluency (not accuracy) was the main measure and was defined as the number of words read correctly per minute.

- Although this initial research and publication marked the beginning of 40 years of research on reading fluency, the first study done was from Starch (1915): "In every branch of instruction in the public schools, we need a definite standard of attainment to be reached at the end of each grade. If we had such standards and if we had adequate means of precisely measuring efficiency, it would be possible for a qualified person to go into a schoolroom and measure the attainment in any or all subjects and determine on the basis of his measurements whether the pupils are up to the standard, whether they are deficient, and in what specific respect" (p. 14, Starch, 1915). His data on oral reading fluency were published as words/second for each of grades 1 through 8 (though we report only to Grade 5 below).

This line of inquiry on oral reading fluency then went silent for many decades.

- In 1992, Hasbrouck and Tindal[5] published the first norms with curriculum-based measures used in several districts in the Midwest, following the systemic introduction of CBM in Pine County Educational Cooperative.

- In 2005, Hasbrouck and Tindal[6] published a compilation of average performances from thousands of students across grades 1 through 8 (though we report only to Grade 5 below). These data, however, were more granular in their values and further articulated according to fall, winter, and spring seasons this last season is reported in the table), as well as at various percentile ranks.

- In 2017, these same authors[7] updated the normative data with a larger and more descriptive data set from three assessment systems widely deployed across the United States with hundreds of thousands of students: Aimsweb©, Dibels©, and easyCBM©. Again, only Grades 1-5 are presented.

- Finally, in 2018, the National Assessment of Educational Progress (NAEP) reported values from their second administration of oral reading fluency. Given that this assessment is only administered in Grades 4, 8, and 12, only the earliest grade can be used in comparison to these prior publications.

---

[5] Hasbrouck, J. & Tindal, G. (1992). Curriculum-based oral reading fluency norms for students in Grades 2 through 5. *Teaching Exceptional Children*, *24*(3), 41-24.

[6] Hasbrouck, J. & Tindal, G. (2005). *Oral Reading Fluency: 90 Years of Measurement*. University of Oregon, Behavioral Research and Teaching: Technical Report 33.

[7] Hasbrouck, J. & Tindal, G. (2017). *An Update to Compiled ORF Norms*. University of Oregon, Behavioral Research and Teaching, Technical Report No.1702.

Source	GR 1	GR 2	GR 3	GR 4	GR 5
1915 Starch publication	90	108	126	144	168
1992 publication		94	114	118	128
2005 BRT Tech Report 2006 Publication	59	89	107	125	138
2017 BRT Tech Report	60	100	112	133	146
2018 NAEP				120	

In summary, fluent reading is the goal, with students reading at an appropriate rate and inflection to reflect the author's meaning. It is not fast reading but accurate reading with meaning and with prosody. In this process and with these progressions, teachers can now provide students the right kind of intervention support to prepare them for later learning of content. Fluency is the coin of the realm in learning to read so students can then read to learn.

Summary

In conclusion, we developed CBMskills to provide teachers diagnostic assessments that could be organized into learning progressions. With many different skills in mathematics and reading, teachers can assemble them in any order they deem appropriate for individual students. And because the tasks are taken on a computer, with the students independently responding (rather than being administered by the teacher), this flexibility truly allows individualization. We have 12 tasks in each of grades Kindergarten through Fifth. In early reading, we have three essential tasks reflecting phonemic awareness and 7 tasks reflecting word identification. Finally, for oral reading fluency, we have 17 passages in each of Grades One through Five. Students can take these tasks until they reach proficiency, which we have organized into three levels reflected in medals: Bronze (70% through 79%), Silver (80% to 89%), and Gold (90% and above).