FLUENCY IS MORE THAN MERE SPEED

In the Kansas College and Career Ready Standards documents for both mathematics and English language arts and literacy, a great deal of emphasis is placed on the idea of fluency. However, many educators—both here in Kansas and across the country—have misinterpreted this concept as being synonymous with speed. In fact, fluency involves far more than mere speed.

Make no mistake about it, fluency is important. Our students need a level of automaticity and fluency that allows them to explore the conceptual understandings of the ideas they encounter. However, a focus on fluency becomes problematic when educators make it the instructional goal rather than fluency being a means to a larger end. Fluency is an ingredient students need to make progress toward achieving the year-end goals as articulated in the *Standards*; however, fluency and speed should not be goals in and of themselves. Below, the idea of fluency is explored in both mathematics and English language arts and literacy.

Fluency in Mathematics

In mathematics the issue is not if *we should target procedural fluency but rather* how we should target it while also targeting conceptual understanding as called for by the Common Core State Standards. Many teachers think procedural fluency is synonymous with "knowing your math facts," but it's more than that, as defined in the National Research Council book, ***Adding It Up: Helping Children Learn Mathematics***: *Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently.* It is useful for us to think about procedural fluency in terms of stamina. Like all of us, students have a finite amount of energy, the more energy they expend following simple procedures, the less energy they will have for problem solving. Likewise, the less energy they have to devote to problem solving, the less likely they are to gain conceptual understanding. Therefore, a lack of procedural fluency can contribute to a lack of conceptual understanding.

Fluency rests on a well-built mathematical foundation with three parts: 1) an understanding of the meaning of the operations and their relationships to each other -- for example, the inverse relationship between multiplication and division; 2) the knowledge of a large repertoire of number relationships, including the addition and multiplication "facts" as well as other relationships, such as how (4 × 5) is related to (4 × 50); and 3) a thorough understanding of the base ten number system, how numbers are structured in this system, and how the place value system of numbers behaves in different operations -- for example, that *24* + *10* = *34* or *24* × *10* = *240*. (Susan Jo Russell) Furthermore, McCallum (2012) states while there are standards that explicitly call for fluency with addition and multiplication facts and with standard algorithms for addition, subtraction, multiplication, and division these are capstone standards, occurring only after adequate groundwork in earlier grades on strategies and algorithms based on place value and the properties of operations.

To be fluent in math refers to knowing how to do a calculation, whereas to know from memory means being able to produce the answer when prompted without having to do a calculation. (McCallum's blog 9/4/12) Fluency demands more of students than does memorization of a single procedure. Jason Zimba states: Too often students memorize the procedures of math without actually understanding the concepts. Additionally, "naked number" memorization, flashcards (whether on computer or not) used to develop fluency, without understanding is NOT enough. Likewise, conceptual understanding without practice is not enough either. Once a student understands the concept, time is necessary to practice the concept to develop fluency. However, this needs to be done in "un-timed" settings, as

fluency is NOT the same thing as speed. Does procedural fluency involve memorizing multiplication tables and other facts? Sure, but it also involves thinking. Students must know *when*, as opposed to just *how*, to use a procedure. Furthermore, they must not only be able to perform procedures accurately, but also flexibly and efficiently.

Suggestions for Teaching Fluency in Mathematics

One reason students do not always choose the most efficient method is that they do not really choose any method. They just apply an algorithm without thinking. They know how to use procedures but not always when to use them. They perform procedures accurately but not always flexibly or efficiently. In other words, they lack procedural fluency. This brings us back to the Common Core challenge of helping students develop procedural fluency while also helping them develop conceptual understanding. And here are a few suggestions for meeting this challenge:

- Model for students (and/or allow them to discover on their own and from each other) multiple solution strategies (example: comparing fractions).
- Establish connections between new topics such as proportions (and cross-multiplying) and previous topics such as equivalent fractions.
- Build procedural understanding through conceptual understanding whenever possible (example: adding and subtracting integers).

Procedural fluency is always AFTER conceptual understanding for the same topic, never as a precursor or instead of developing that understanding. The Kansas College and Career Ready Standards call for a balance in computational fluency and conceptual understanding. In order to foster greater knowledge of and improve performance in mathematics among Kansas students, it is essential that we make those shifts in instruction that define what these standards are all about: 1) focus, 2) coherence, and 3) rigor.

A focused, coherent progression of mathematics learning, with an emphasis on conceptual understanding and fluency, should be the norm in every mathematics classroom in Kansas.

Fluency in English Language Arts and Literacy

There are dedicated and well-meaning teachers who have taken this goal of improving reading rate to heart and focused their instruction on improving students' reading rates through timed readings and other rate-building activities. Students in these classrooms have become faster readers, but their reading comprehension has not improved. Indeed, a new generation of students is appearing in reading clinics at U.S. universities – students who have learned to read fast but are unable to comprehend what they read, and therefore, are poor readers. (Rasinski, 2006)

Fluent reading is comprised of three key elements: *accurate* reading of connected text at a conversational *rate* with appropriate *prosody* (Hudson, Mercer, & Lane, 2000). A fluent reader can maintain this performance for long periods of time, retains the skill after long periods of no practice, and can apply these skills across various texts. A fluent reader is also not easily distracted and reads in an effortless, flowing manner.
Encouraging students to read faster by timing words read per minute or by memorizing "sight word" flash cards might improve a student's reading speed, but it is not enough to increase reading comprehension, a primary focus of the Kansas College and Career Ready Standards. Reading quickly without practice is not recommended either. Students need repeated exposures to new vocabulary words in order to increase word recognition and therefore fluency. The Kansas College and Career Ready Reading Standards in Foundational Skills for Grade 1 state that students should, "read on-level text orally with accuracy, appropriate rate, and expression on successive readings. However, this needs to be done in "un-timed" settings as fluency and speed are not synonymous.

Reasons for Gaps in Fluency

Joseph Torgesen proposes several possible explanations for the difficulties we have experienced in helping especially older children to "close the gap" in reading fluency after they have struggled with learning to read for several years. The most important factor appears to involve the simple fact that the gulf between a fluent reader and a non-fluent reader is so vast by the time students reach late elementary school. These differences in reading practice emerge during the earliest stages of reading instruction (Allington, 1984; Beimiller, 1977-1978), and they become more pronounced as children advance across grades.

Some of these initial gaps may be attributed to reading disabilities, which might result in those children with severe reading disabilities receiving only a small fraction of the total reading practice obtained by children with no reading disabilities (Cunningham & Stanovich, 1998). One of the major results of this lack of reading practice is a limitation in the sheer number of words children with reading disabilities can recognize automatically, or at a single glance (Ehri, 2002; Share & Stanovich, 1995). This limitation of "sight word" vocabulary is a principle characteristic of most children with reading disabilities after the initial phases of learning to read (Rashotte, MacPhee, & Torgesen, 2001, Torgesen, Alexander, et al., 2001; Wise, Ring, & Olson, 1999), and it arises because children must read specific words accurately a number of times before those words become part of their sight vocabulary (Reitsma, 1983; Share & Stanovich, 1995). As Ehri (2002) points out, "sight words include any words that readers have practiced reading sufficiently often to be read from memory."

Inefficiency in identifying single words is the most important factor in accounting for individual differences in reading fluency in samples of children with reading disabilities. When these findings are combined with the fact that the number of less frequent words (words children are less likely to have encountered before in text) increases rapidly after about third grade (Adams, 1990), it is easy to see why it is so difficult for children who have had fewer exposures (and thus, are less likely to have as robust a sight word vocabulary as those who have had more exposures to high-frequency words) have difficulty closing the reading fluency gap and catching up to their non-struggling peers.

Suggestions for Teaching Fluency in English Language Arts and Literacy

As indicated above, instruction focused on repeatedly exposing students to high-frequency words in the context of appropriately-leveled texts should replace simple memorization of sight words and "drilled" instruction. Likewise, regular practice and repeated readings of passages in which students will encounter high-frequency words should replace tests of speed. Through repeated recognition of these high-frequency words in authentic, cross-curricular contexts, and through practicing repeated readings of texts in untimed settings, students will more readily comprehend texts and in the process of doing so, will gain fluency.

The Kansas College and Career Ready Standards call for movement beyond a focus on fluency to a focus on comprehension. In order to foster greater knowledge of and improve performance in English language arts among Kansas students, it is essential that we make those shifts in instruction that define what these standards are all about: 1) focus, 2) coherence, and 3) rigor.

A focused, coherent progression of English language arts learning, with an emphasis on comprehension, should be the norm in every classroom in Kansas.

References

McCallum, William. (July 2012). The Common Core State Standards in Mathematics. ICME 12, Seoul, Korea. http://math.arizona.edu/~wmc/Research/2012_07_12_ICME_McCallum.pdf

National Research Council. (2002) *Helping Children Learn Mathematics* . Washington, DC: The National Academies Press.

Torgesen, J.K., Hudson, R.F.(2006) *Reading Fluency: Critical Issues for Struggling Readers*
Florida Center for Reading Research at Florida State University

Rasinski,T.(April 2006), Reading fluency instruction: Moving beyond accuracy, automaticity and prosody, The Reading Teacher, Vol. 59, No. 7, pgs. 704-706

Russell, Susan Jo. (May, 2000). Developing Computational Fluency with Whole Numbers in the Elementary Grades. In Ferrucci, Beverly J. and Heid, M. Kathleen (eds). Millenium Focus Issue: Perspectives on Principles and Standards. *The New England Math Journal*. Volume XXXII, Number 2. Keene, NH: Association of Teachers of Mathematics in New England. Pages 40-54.

Spear-Swerling, L. (2006). Developing Auto-matic Recall of Addition and Subtraction Facts.
http://www.ldonline.org/spearswerling/9655

For more information, please contact:

Career, Standards, & Assessment Services Kansas State
Department of Education 785-296-3142