Handout 3 to the SD Board of Education

Sharon Vestal, President, South Dakota Council of Teachers of Mathematics

1. The data in Tables 1 and 2 on page 2 was gathered from the following websites, https://edgate.com/standards/us-comparisons and https://www.nationsreportcard.gov/
   - *For the 4th grade math results, Table 1shows the top twelve scoring states in the U.S. Of those twelve, seven have state math standards that match the Common Core Math standards by at least 74%.*
   - *For the 8th grade math results, Table 2 shows the top ten scoring states, and seven of those ten have math standards that match the Common Core by at least 80%.*
   - **Notice that South Dakota appears on both lists. Our students perform well when compared to students across the nation. Why, then, were our current standards so drastically rewritten? When comparing the proposed standards to the current standards, it is very difficult to see a clear connection between the two.**

Table 1:Top Twelve Ranked States in the 2024 4th Grade Math NAEP Assessment & Information about their Math Standards

Ranking	State	% of Standards matches Common Core Math	Year Current Standards Adopted	Average Score	% At or above basic	% At or above proficient
1	Massachusetts	> 80	2017	246	82	51
2	Florida	22.9	Feb-20	243	82	45
2	Wyoming	77.7	2023, emended 2025	243	83	46
4	New Hampshire	> 80	2010	242	81	43
4	Utah	> 80	2016	242	79	45
6	North Dakota	26.4	2023	241	81	43
6	Minnesota	11.2	2025	241	78	45
6	Texas	20.1	2015	241	79	43
9	Indiana	50	2023	240	79	43
9	New Jersey	> 80	2023	240	77	44
9	South Dakota	> 80	2018	240	79	42
9	Tennessee	74.9	2021	240	78	42

Table 2: Top Ten Ranked States in the 2024 8th Grade Math NAEP Assessment & Information about their Math Standards

Ranking	State	% of Standards matches Common Core Math	Year Current Standards Adopted	Average Score	% At or above basic	% At or above proficient
1	Massachusetts	>80	2017	283	68	37
1	Wisconsin	>80	2021	283	69	37
3	Minnesota	11.2	2025	282	71	34
3	Utah	>80	2016	282	70	35
3	New Jersey	>80	2023	282	65	37
6	South Dakota	>80	2018	281	71	33
7	Nebraska	20.9	2022	280	69	32
7	North Dakota	26.4	2023	280	71	29
7	New Hampshire	>80	2010	280	69	32
10	Montana	>80	2011	279	68	32

2. List of Math Education Research that Math Advisory Group was given for their first meeting on February 19, 2025.
   - National Research Council. 2001. *Adding It Up: Helping Children Learn Mathematics*. Washington, D.C.: The National Academies Press. https://doi.org/10.17226/9822
   - National Research Council. 2005. *How Students Learn: History, Mathematics, and Science in the Classroom*. Washington, D.C.: The National Academies Press. https://doi.org/10.17226/10126
   - U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse. March 2021. *Assisting Students Struggling with Mathematics: Intervention in the Elementary Grades*.
   - U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse. May 2012, October 2018. *Improving Mathematical Problem Solving in Grades 4–8*.
   - South Dakota Literacy Framework: *https://doe.sd.gov/literacy/Framework.aspx*
   - Delaware Math Framework: Retrieved from https://education.delaware.gov/educators/academic-support/standards-and-instruction/digital-de/instructional-resources/k-12-math-framework/
   - Kentucky Roadmap to Implementing High Quality Mathematics Instruction: Retrieved from https://www.education.ky.gov/curriculum/standards/kyacadstand/Documents/Overview_Roadmap_to_Implementing_High_Quality_Mathematics_Instruction.pdf
   - North Dakota: Math in ND Curricular Resource Guidance (draft in development)
   - Utah Math Framework and Vision: Retrieved from https://schools.utah.gov/curr/mathematics/index

Some questions that arise from this literature list:
   - Why was no literature from the National Council of Teachers of Mathematics (NCTM) or the National Council of Supervisors of Mathematics (NCSM) included? NCTM, founded in 1920, is the world's largest mathematics education organization, and its mission is to advocate for high-quality mathematics teaching and learning for every student. NCSM is the premier mathematics leadership organization.
   - At the February 2025 meeting, the Advisory Group examined frameworks from Delaware, Kentucky, North Dakota, and Utah. Yet in June, the group reviewed Math Standards from Arkansas, South Carolina, North Dakota, and the Archimedes Standards from Hillsdale College. Why were these two sets of states not the same?

3. At the November meeting, Dr. Graves said that the current standards are "incomprehensible" to some, https://southdakotasearchlight.com/2025/11/10/math-educators-push-state-board-to-keep-current-standards-in-place/.
   - In a recent conversation with Dr. Graves, I shared information about how many math classes future elementary teachers take. At a public Board of Regents university, they must take a general education math course, two content courses covering elementary math concepts, and a math methods course focusing on pedagogy. If future elementary teachers are unprepared, this reflects on university preparation programs—unless teachers are entering through alternative certification.

   - Who are the parents who find the standards "incomprehensible"? Was a survey conducted,

or is this anecdotal evidence? Where is the data?

4. In 2025, the SD EPSCoR REACH Committee put together the South Dakota Science & Technology Plan 2030. This plan can be found at https://sdbor.edu/wp-content/uploads/2025/09/SD-ST-Plan-Report_RTI_FINAL_03_11_25-2.pdf. The plan calls for investment in research and commercialization to drive economic growth and to educate a highly prepared STEM workforce. One strategy states that South Dakota must "grow our own" STEM talent. Success in STEM requires strong critical thinking and problem-solving skills. In fact, the Board of Education's public hearing announcement identifies this as a core purpose of the Mathematics Standards.

SOUTH DAKOTA BOARD OF EDUCATION STANDARDS
NOTICE OF PUBLIC HEARING REGARDING ACADEMIC CONTENT STANDARDS

A public hearing will be held at the Ramkota Hotel, 1400 8th Ave NW, Aberdeen, South Dakota, at 9:00 a.m. Central Time, October 15, 2025, to consider the adoption and implementation of the following: Health Education content standards and Mathematics content standards. This is the first of four public hearings regarding these standards.

Health Education: The goal of the Health Education standards is to equip students with skills they need to obtain, interpret, and understand basic health information and services, and use this knowledge to enhance their own health and the health of others.

Mathematics: The goal of the Mathematics standards is to develop mathematically proficient students who can problem-solve, think critically, communicate, and reason.

   - The proposed standards remove rigor and key vocabulary needed to support the development of future South Dakota problem solvers. These proposed standards will not help us grow our own STEM talent.

5. Recently, an opinion article in The 74, "Test Results Reveal a Deeper Issue in Math – And It's not the Math Itself," noted that gaps in early mathematical knowledge can lead to long-term challenges. https://www.the74million.org/article/test-results-reveal-a-deeper-issue-in-math-and-its-not-the-math-itself/. The article points out that effective math learning requires both conceptual understanding and procedural fluency.
   - This led me to a Carnegie Learning blog on conceptual understanding: https://www.carnegielearning.com/blog/conceptual-understanding. The blog states that mathematical rigor requires three components: conceptual understanding (the why), procedural fluency (the how), and real-world application. Our current math standards were designed around this principle. The proposed standards, however, resemble a checklist and lack the rigor needed to support student success.

Current 1st Grade Standard

B. Understand Place Value

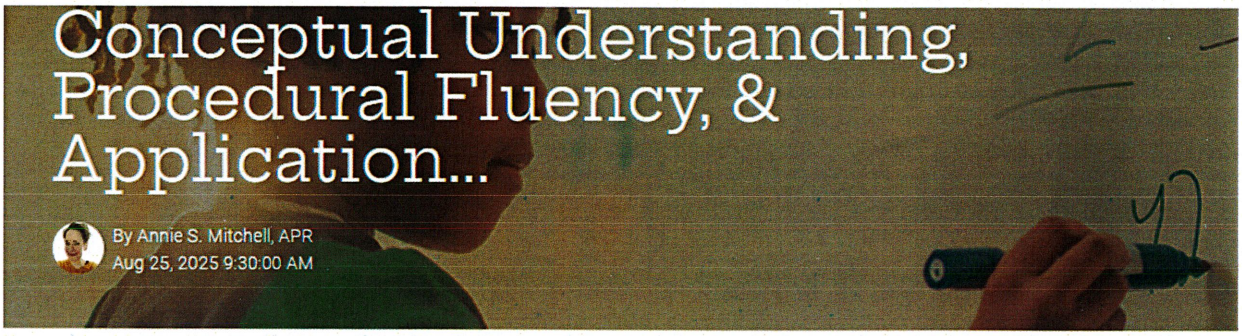
2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:
   a. 10 can be thought of as a bundle of ten ones — called a "ten."
   b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
   c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).

   - The proposed standards seem to focus heavily on procedure and memorization without connecting concepts to understanding. This represents a move in the wrong direction and

does not prepare South Dakota students for future careers. It will negatively affect workforce development statewide.

Proposed 1st Grade Standard
1.N.4 *Compose and decompose two-digit numbers into tens and ones.*

CARNEGIE LEARNING



...the Avengers of Mathematics.

Picture this: A third-grader sees the problem 8 × 7 and instantly thinks, "I know 8 × 8 = 64, so 8 × 7 is just one less 8... that's 56!" Another student counts on their fingers or draws 8 groups of 7 dots. Both get the correct answer, but something magical happened with the first student—they combined understanding (knowing how multiplication relates to addition and subtraction) with fluency (quickly recalling 8 × 8).

That magic happens when **conceptual understanding** and **procedural fluency** work together alongside **real-world application**, creating what educators call mathematical rigor. This approach ensures students understand the why, master the how, and apply their learning in diverse contexts.

Think of rigor as a three-legged stool: remove any one leg, you won't keep your balance, and you'll fall. This three-pronged approach to rigor is woven into the DNA of the ClearMath® solutions we provide.

The origin story: how we got here

Let's rewind to 2001, when the National Research Council dropped a game-changer called "Adding It Up: Helping Children Learn Mathematics." This landmark report didn't just give us fancy educational jargon; it reshaped how we think about math learning by identifying five strands of mathematical proficiency. Two of these strands, conceptual understanding and procedural fluency, became the Iron Man and Captain America of mathematics education, with real-world application as Thor.

> It's like learning to ride a bike: you need to understand balance and steering (**conceptual understanding**), develop the automatic reflexes to pedal and brake (**procedural fluency**), and put it all together to ride (**real-world application**). Try riding with only one of these, and you'll be stuck, wobbly, or crash!

But what exactly are these mathematical superpowers?

According to the National Council of Teachers of Mathematics, conceptual understanding refers to comprehension of mathematical concepts, operations, and relations. Meanwhile, procedural fluency is the ability to apply procedures efficiently, flexibly, and accurately; transfer procedures to different problems and contexts; build or modify procedures from other procedures; and recognize when one strategy or procedure is more appropriate. Real-world application helps students understand and appreciate mathematics by connecting abstract concepts to their everyday lives.

Think of it this way:

- **Conceptual understanding** is the "why" behind the math, like understanding that multiplication is really repeated addition, or grasping why we flip and multiply when dividing fractions.
- **Procedural fluency** is the "how"—being able to execute these operations smoothly and choose the right tool for the job.
- **Real-world application** is the "when and where"—recognizing mathematical patterns in everyday situations, like how much pizza everyone gets at a party, figuring out how much allowance you need to save to buy the awesome new video game, and knowing which mathematical tools to use in each context.

The historical pendulum in math education has swung dramatically between these approaches. **Direct instruction** emphasized rote memorization and procedural skills (hello, endless worksheets!). **Reform movements** pushed for conceptual understanding and discovery learning. **Students were stuck in the middle**, either becoming human calculators without understanding or mathematical philosophers who couldn't solve fundamental problems efficiently.

Which math pedagogy wins? *(Hint: it's not a competition.)*

Here's where things get exciting, and what decades of research have been shouting from the rooftops: conceptual understanding, procedural fluency, and real-world application are mutually reinforcing, with conceptual knowledge more strongly and consistently supporting procedural knowledge than the reverse (Rittle-Johnson & Schneider, 2015). But here's the kicker—all three work best as a team!

Current research indicates that these strands of proficiency continually interact:

- **As conceptual understanding grows**, computational procedures are remembered better and more flexibly used.
- **As procedures become more automatic**, students can think about other aspects of problems and tackle new kinds of challenges.
- **When students forget an algorithm**, conceptual understanding becomes their safety net, and they can reconstruct the process.
- **When students have strong procedural fluency**, their mental energy is freed up for more complex problem-solving.

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The real magic happens when students can confidently bounce between understanding and execution. As the National Research Council puts it, when students grasp the "why," they remember the "how" more flexibly, and they can solve more complex problems later.

The bottom line: students need all three to soar

The research is clear: students need conceptual understanding, procedural fluency, and real-world application to thrive in math. Great math instruction doesn't pick sides; it builds on a strong foundation of understanding.

That's where Carnegie Learning comes in. Our curriculum is designed to build conceptual understanding, procedural fluency, and real-world application together, not as separate boxes to check. We create learning experiences that demonstrate how all three legs of the rigor stool work in harmony.

For example, in MATHia®, students extend their reasoning with the double number line to solve one-step equations involving addition and multiplication. This structured exploration reinforces their understanding of equality, variables, solutions, and the overall structure of equations, then connects this learning to real contexts where equation-solving matters, like calculating discounts or determining break-even points. We help teachers create meaningful learning experiences while giving students the computational confidence they need to tackle authentic problems.

When students have conceptual understanding and procedural fluency working alongside real-world application, they can:

- tackle new problems with confidence
- explain their thinking clearly
- choose efficient strategies
- make connections across mathematical concepts
- apply mathematical reasoning to real-world situations
- approach math with curiosity rather than fear