Common Core Elementary Mathematics: Standard 5

To learn more about how programs are scored on this standard, including how individual indicators are satisfied, please see its scoring methodology.

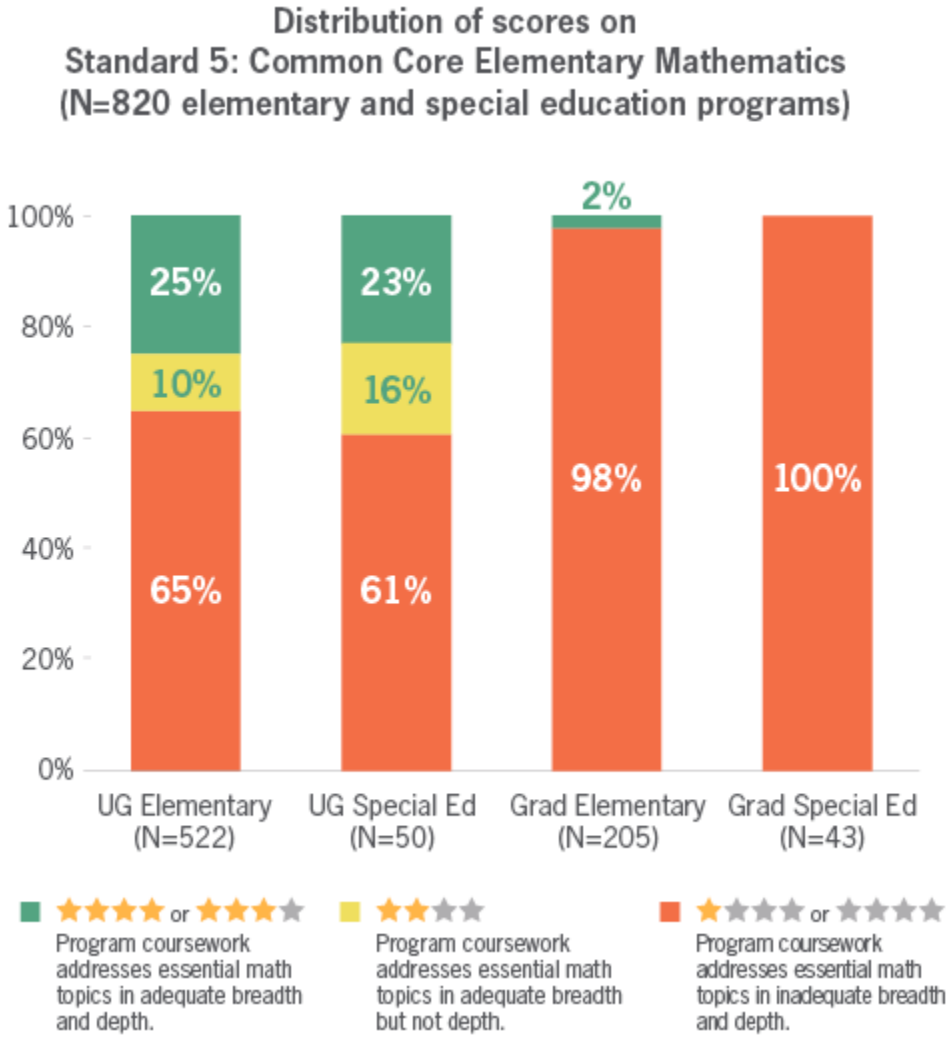
For information on resources for this standard, please see the resources section.

Background

After teaching students how to read, the most important job for elementary and special education teachers is to establish a strong foundation in mathematics. Laying such a foundation will increase the number of students who succeed in school and who go on to STEM (Science, Technology, Engineering and Math) careers.

This standard evaluates the specialized coursework elementary and special education teachers should take to gain the deep conceptual understanding of elementary math topics required to teach to the Common Core Math Standards. Programs meeting this standard in full not only require strong math content courses but also a math methods course in how to teach math. A program earning a Strong Design (🏆) designation does a particularly good job coordinating math content and methods coursework.

Overview



Sample for this standard: The sample for this standard encompasses all elementary and special education programs, both undergraduate and graduate, for which data obtained or collected are sufficiently clear to evaluate. Because of the substantially different distributions of scores found across the types of programs, findings are reported separately for each type.

Why do programs earn few stars or no stars on the Common Core Elementary Mathematics Standard?

- *Coursework required of elementary or special education teacher candidates[1] addresses both elementary and middle school math.* Elementary teacher candidates should become acquainted with the math relevant to grades a few years beyond the elementary grade span, but they should focus on elementary math concepts. A course of study designed to prepare both elementary and middle school teacher candidates shortchanges both.
- *Coursework appearing to address content actually has a substantial focus on elementary math methods.* While mixing content and methods in the same course is possible (and may even be desirable), doing so does not change the need for adequate amounts of each.
- *Program coursework does not assign high-caliber elementary content math textbooks to support instruction.* With a range of strong textbooks readily available, it is not clear why some instructors choose to require an inappropriate textbook designed for the general audience rather than one designed for teacher candidates, or why they require no textbook at all.

Strong Design

Only two programs earn Strong Design designations on this standard; both are undergraduate elementary programs. These programs deserve special recognition for their coursework coordination efforts:

- **University of Utah** -- In addition to its required elementary math methods course, math methods
  instruction and practice teaching is strongly infused into this program's two required elementary math content courses.
- **University of Wyoming** -- This program requires that two elementary methods seminars be taken concurrently with each of two elementary math content courses.[2]

Program Findings

Undergraduate elementary programs (N = 522)

Seven percent of undergraduate programs earn a score of four stars on this standard, meaning that they require a course sequence of at least eight semester credit hours (SCHs)[3] covering essential math topics in numbers and operations, algebra, geometry and data analysis, and at least three SCHs of elementary math methods coursework. Eight percent of programs surpass the standard's requirement of at least eight SCHs of elementary content coursework and instead require nine or more SCHs of such coursework. Another four percent of undergraduate

elementary programs would have earned four stars (rather than the three stars they did earn) if their math methods course requirements were sufficient.

✓+ Because they are housed in IHEs that satisfy the standard's threshold for selectivity, the **University of Maryland -- College Park**, **Louisiana State University and Agricultural & Mechanical College**, **Purdue University -- Main Campus** (IN), the **University of Wyoming** and **McDaniel College** (MD) could have earned four stars on this standard with the requirement of only six SCHs of adequate elementary math content coursework and an additional three SCHs of elementary math methods coursework. However, each of these IHEs instead requires nine or more SCHs of content coursework, clearly demonstrating their understanding of the importance of elementary math content coursework even for relatively well-qualified teacher candidates.

At the other end of the spectrum, fully 30 percent of undergraduate elementary programs earn no stars because they require no elementary math content coursework at all.

Graduate elementary programs (N=205)

In sharp contrast to undergraduate elementary programs, less than 1 percent of graduate elementary programs earn four stars on this standard. No IHE in our sample had both an undergraduate and a graduate elementary program that earns four stars.[4]Only one graduate elementary program would have earned four stars (instead of the three stars it did earn) if it had required at least three SCHs of elementary math methods coursework as a complement to its required elementary math content coursework. Fully 92 percent of graduate programs require no elementary math content coursework at all and, as a result, earn no stars.

✓+ Unlike the vast majority of graduate elementary programs, **Ohio State University** requires that applicants have completed three specific elementary content courses (or their equivalent) prior to entry into the graduate program and then complete two elementary math methods courses as part of their graduate coursework.

The contrast in preparation between undergraduate and graduate programs is notable, especially when it occurs on the same campus: Our sample includes 71 IHEs that offer both undergraduate and graduate elementary preparation programs. In 69 percent of these IHEs, the undergraduate program requires at least three SCHs of elementary math content coursework but there is no parallel requirement in the graduate program.

Undergraduate special education programs (N=50)

While 70 percent of the undergraduate special education programs evaluated require at least three SCHs of elementary math content, only 8 percent of these programs earn four stars on this standard.

✓+ **Keene State College** (NH), **Vicennes University** (IN) and the **University of Utah** provide notably strong "four star" preparation of their undergraduate special education teacher candidates in elementary math content.

Graduate special education programs (N=43)

The same contrast found between undergraduate and graduate programs with regard to the preparation of elementary teacher candidates in elementary math holds in undergraduate and graduate special education programs.

Only one graduate-level special education program requires elementary math content: **CUNY--Queens College**, which requires two SCHs. Needless to say, none of the graduate special education programs earns four stars on this standard.

General information on elementary math content and methods preparation

How much elementary math content coursework is required?

The table below reports on the mean SCHs of elementary math content coursework required in each type of program evaluated:

Elementary math coursework requirements across all program types

Program type	Mean SCHs of required elementary math content coursework
Undergraduate elementary	4.0
Graduate elementary	0.3
Undergraduate special education	4.0
Graduate special education	0.1

Even the most capable elementary and special education teacher candidates need at least six SCHs of elementary math coursework to confidently and competently teach elementary math, but the average requirement in all four types of programs evaluated is below that amount, well below in the case of graduate programs.

On average, elementary teacher preparation programs are not properly preparing candidates in math. It is hard to escape the conclusion that graduate elementary and special education preparation in elementary math is grossly inadequate.

What textbooks are used in coursework?

The following table provides information on course use of the elementary math content textbooks encountered in coursework evaluations and the scores given to those texts in NCTQ's evaluations. (It is not a complete tally because the textbooks required in courses in programs in which three or fewer SCHs of elementary math content coursework are required were not captured in most cases and are not included here.)

The table is organized by textbook score, with the highest rated textbooks at the top:

Elementary math textbooks: NCTQ scores and use in courses

Author	NCTQ's score for this textbook (out of 166 possible)	# of courses requiring textbook
Fiero	156	2
Parker[5]	151	24
Beckmann	150	79
Billstein	137	219
Musser	123	80
Bennett	108	39
Jones	105	3
O'Daffer	104	23
Wheeler	104	8
Sonnabend	102	23
Long	100	64
Sowder	81	50

Bassarear	76	52
Miller	68	8
Van de Walle	34	37
Burris	33	2
Stump[6]	12	1

While this tally is not complete, it provides information about textbook use in 713 courses.[7] Because it seems plausible to assume that weaker textbooks may be required when coursework is grossly inadequate (three or fewer SCHs), the picture here may be rosier than the reality. With that in mind, we note that fewer than half (45 percent) of courses tallied here are using "acceptable" textbooks, which we define as those earning 75 percent or more of the points available in NCTQ's evaluation.

How much elementary math methods coursework is required.[8]

Under this standard, math methods coursework enters into evaluation of undergraduate and graduate elementary programs only when a program's elementary math content coursework is adequate. After this determination on content is made, the program as a whole can earn four stars only if it requires at least three SCHs of math methods coursework; otherwise, it earns only three stars. We intentionally consider math methods coursework only after calculating the adequacy of content preparation: instruction in methods adds little value unless candidates have a firm grounding in content.
Among undergraduate elementary programs, 66 percent require three or more SCHs dedicated to elementary math methods. In graduate programs, 52 percent do so.[9]

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1. While PK-12 special education teacher candidates may need secondary math preparation, they must also have the content preparation in elementary math content specified in the standard.
2. We commended this program on the design of its elementary math content and methods coursework in *No Common Denominator*, NCTQ's 2008 national study of the math preparation of undergraduate elementary teacher candidates: http://www.nctq.org/p/edschools/reportView.jsp?reportPath=/p/publications/docs/nctq_ttmath_fullreport.pdf&reportName=National%20Mathematics%20Study%20%282008%29&reportId=110601154335-526b77e4c79f4aa9bfa0e112f6aab55c

3. A six SCH course sequence is adequate if the program is undergraduate and housed in an IHE that satisfies standardized test requirements in Indicator 1.2 of the Selection Criteria Standard, or if it is graduate and requires the GRE for admission.
4. At the undergraduate level, only three IHEs have both undergraduate elementary and undergraduate special education programs that earn four stars.

5. Two texts by these authors that together address the four subjects evaluated are combined in NCTQ's score and this report on use.
6. This text addresses only algebra, which is one of four subjects evaluated.
7. Not counting the Stump text, because it is not comprehensive and only addresses algebra.
8. Our evaluation of special education programs on this standard does not include consideration of elementary math methods coursework requirements because we have not been able to determine a professional consensus on the appropriate coursework to prepare special education candidates.
9. In both types of programs, even where instruction on math methods is required and appears to be sufficient (i.e., three or more SCHs), the requirement may still be insufficient because we consider whether coursework addresses both elementary and middle school math methods and/or addresses math methods in conjunction with methods in another subject. For example, a three-SCH course in math methods designed for "elementary" teacher candidates who will be certified to teach grades K-8 will be noted as a two-SCH elementary math methods course because that is the portion of the course addressing the elementary grade span as we define it -- grades K-5 or K-6.