



Standard 5: Elementary Mathematics

What consumers need to know about teacher preparation

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

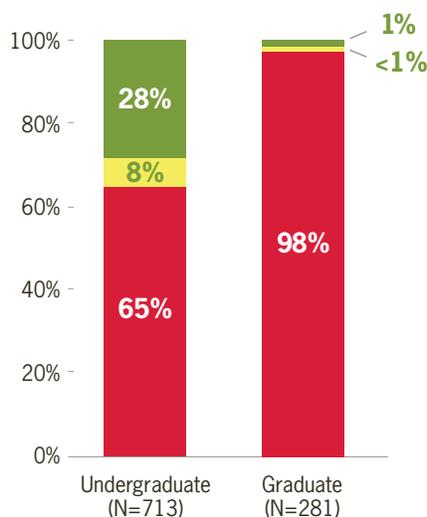
For examples of model materials on this standard, please see the [resources section](#).

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 rigorous state 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

Distribution of scores on Std. 5: Elementary Mathematics
(N=994 elementary and special education programs)



■ ● or ●
Program coursework addresses essential math topics in adequate breadth and depth.

■ ● or ●
Program coursework addresses essential math topics in adequate breadth but not depth.

■ ● or ○ (zero)
Program coursework addresses essential math topics in inadequate breadth and depth.

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 not meet or meet only a small part of the Elementary Mathematics Standard?

- *Coursework required of elementary or special education teacher candidates¹ 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.

Programs earning the “Strong Design” designation

Only four programs earn “strong design” designations on this standard; all are undergraduate elementary programs. These programs deserve special recognition for their coursework coordination efforts:

- **Elon University (NC)** — This program requires candidates to complete math tutoring as part of its math content coursework, in addition to requiring eight credits of math methods. The methods coursework requires students to complete a semester-long field placement focused specifically on math and science.
- **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.
- **St. John Fisher College (NY)** — This program incorporates observation and field work in a local school in one of its two content courses, in addition to requiring field work in each course of its two-course methods sequence.

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.

More information on elementary math preparation

Undergraduate elementary programs (N=666)

Seven percent of undergraduate programs meet this standard, meaning that they require a course sequence of at least eight semester credit hours (SCHs)² covering essential math topics in numbers and operations, algebra, geometry and data analysis, and at least three SCHs of elementary math methods coursework. Only six percent of undergraduate programs with sufficient methods coursework surpass the standard's requirement of at least eight SCHs of elementary content coursework and instead require nine or more SCHs of such coursework. Four percent of undergraduate elementary programs would have met the standard (rather than only “nearly meeting” the standard) 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), **University of Georgia**, **McDaniel College** (MD), and the **University of Wyoming** could have met 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.

More information on elementary math preparation

Graduate elementary programs (N=239)

In sharp contrast to undergraduate elementary programs, less than 1 percent of graduate elementary programs meet the standard. No IHE in our sample had both an undergraduate *and* a graduate elementary program that meets the standard.³ Fully 89 percent of graduate programs require no elementary math content coursework at all, and, as a result, do not meet the standard.

- ✓+ Unlike the vast majority of graduate elementary programs, **Ohio State University** requires that applicants have completed two specific elementary content courses 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 74 IHEs that offer both undergraduate and graduate elementary preparation programs. In 61 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.

2 A six-SCH course sequence is adequate if the program is undergraduate and housed in an IHE that satisfies standardized test requirements in Indicator 1.1a of the **Selection Criteria Standard**, or if it is graduate and requires the GRE for admission.

3 At the undergraduate level, only three IHEs have both undergraduate elementary and undergraduate special education programs that meet the standard.

More information on elementary math preparation

Undergraduate special education programs (N=47)

While 70 percent of the undergraduate special education programs evaluated require at least three SCHs of elementary math content, only 10 percent of these programs meet the standard.

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

More information on elementary math preparation

Graduate special education programs (N=42)

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 meet the standard.

More 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:⁴

Elementary math coursework requirements across all program types

Program type	Mean SCHs of required elementary math content coursework
<i>Undergraduate elementary</i>	3.9
<i>Graduate elementary</i>	0.3
<i>Undergraduate special education</i>	4.1
<i>Graduate special education</i>	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.

4 In calculating the number of math credits we consider whether coursework addresses both elementary and middle school content. For example, a three-SCH course designed for “elementary” teacher candidates who will be certified to teach grades K-8 will be noted as a two-SCH course since that is the proportion of the course addressing the elementary grades as we define them — grades K-5 or K-6.

On average, elementary and special education 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 our coursework analysis and the scores given to those texts in NCTQ's textbook [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.)

Elementary math textbooks: NCTQ scores and use in courses

Author	NCTQ's score for this textbook (out of 166 possible)	# of courses requiring textbook
Fierro	156	8
Parker ⁵	151	27
Beckmann	150	119
Billstein	137	271
Musser	123	111
Bennett	108	62
Jones	105	7
O'Daffer	104	22
Wheeler	104	15
Sonnabend	102	24
Long	100	75
Sowder	81	52
Bassarear	76	58
Miller	68	19
Van de Walle	34	61
Burris	33	2
Stump ⁶	12	3

While this tally is not complete, it provides information about textbook use in 1,046 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.

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.

How much elementary math methods coursework is required⁸

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 meet the standard only if it requires at least three SCHs of math methods coursework; otherwise, it earns a score of "nearly meets standard." 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, 54 percent do so.⁹

- 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 grades as we define them — grades K-5 or K-6.

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