



# How NCTQ scores the Elementary Mathematics Standard

## [Standard and indicators](#)

### Data used to score this standard

Evaluation of elementary and special education programs on Standard 5: Elementary Mathematics uses the following sources of data:

- Course descriptions of elementary mathematics content and methods courses in institution of higher education (IHE) catalogs
- Elementary math content and methods course credit information in IHE catalogs
- Syllabi of required elementary math content courses
- Required primary textbooks in required elementary math content courses
- Integrated Postsecondary Education Data System (IPEDS) data on mean university SAT/ACT scores and mean of SAT/ACT scores self-reported to the College Board<sup>1</sup> (undergraduate), or requirement of the Graduate Records Examination (GRE) (graduate)

### Who analyzes the data

One [subject specialist](#) evaluates each program using a detailed scoring protocol from which this scoring methodology is abstracted. Ten percent of programs are randomly selected for a second evaluation to assess scoring variances.

### Scope of analysis

Scores of **undergraduate** and **graduate** teacher preparation programs on elementary math preparation are based on examination of course descriptions, syllabi and required primary textbooks in coursework designed for teacher audiences.<sup>2</sup> (A discussion of the use of syllabi and textbooks for analysis of course content is provided [here](#).) Unlike the evaluation process for some other content standards, no distinction is drawn between undergraduate and graduate programs; the fact that elementary math coursework is a part of undergraduate education only for prospective elementary teachers makes untenable the substitution of a graduate-level transcript review process for coursework requirements.

Required textbooks are evaluated in each of four “critical subject areas” (numbers and operations, algebra, geometry, and data analysis and probability) by [mathematicians](#) according to a specific protocol.<sup>3</sup> Ratings of reviewed elementary math textbooks are provided [here](#).

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<sup>1</sup> Used if more than 50 percent of the student body report such scores and no other source of SAT/ACT data is available.

<sup>2</sup> In the case of **Illinois**, for IHEs that did not provide documents for evaluation for this *Review*, analyses of syllabi developed for NCTQ’s review of Illinois teacher preparation (2010) were incorporated into the current scoring methodology and scored accordingly.

<sup>3</sup> The evaluators assess the topics in each critical area on the basis of coverage, connection, integrity, the sufficiency and significance of examples, and whether the text addresses methods of teaching.

Analysts score syllabi based on coverage in lectures, assignments and/or assessments of 12 “essential topics” subsumed within those four critical subject areas.<sup>4</sup> For credit to be awarded, mention of a topic or subtopic is needed only in a course topic outline, a listing of lectures, or a listing of assignments; no textbook coverage of a topic is necessary. However, because of the many subtopics that the evaluation looks for in lectures and assignment — more than would be found even in the most detailed syllabus — the analysis is enhanced to encompass the full breadth of classroom instruction by consulting the sections of the textbook to which the syllabus explicitly connects that instruction.<sup>5</sup>

In accordance with Indicators 5.1 and 5.2, classroom instruction scores for each of the essential topics and textbook scores for each course are used to develop a composite syllabus/textbook score that is then averaged to produce a “cumulative score” for the program as a whole. Topics addressed by the program that are not included in those identified as essential are classified as “other”; one-half of the proportion of such coverage (up to 10 percent) is added to the “cumulative score” for a final “instructional score.” The instructional score must be 75 percent or higher for a program to at least partly meet the standard.

Overall program scores factor in the instructional score of the courses and the number of required course credits in elementary math<sup>6</sup> (as determined by evaluation of course descriptions and course titles in the context provided by state certification grade spans<sup>7</sup>). As precise an estimate as possible of the semester credit hours (SCHs) devoted to elementary math content relevant to the K–5 teacher<sup>8</sup> is used. Elementary math methods coursework is relevant only to determine if an elementary program<sup>9</sup> fully satisfies the requirement for adequate elementary content instruction.<sup>10</sup>

#### Common misconceptions about how analysts evaluate the Common Core Elementary Math Standard:

- *Any math content course required of teacher candidates is relevant for evaluation for this standard.* It may be advisable for teacher candidates to take a variety of math courses additional to those on elementary math — as it would be for any undergraduate or graduate student. However, this standard evaluates only elementary math content coursework because of the unique value this coursework provides for professional preparation.
- *Elementary math methods coursework that addresses content is interchangeable with elementary content coursework.* Elementary math methods course should be grounded in an understanding of the relevant content, and references to that content are essential to full development of pedagogy. However, even the most content-infused math methods course does not substitute for elementary math content coursework.
- *Math content coursework designed for both elementary and middle school teacher candidates provides adequate instruction for each type of candidate.* While both elementary and middle school teacher candidates need to have some grasp of the content relevant to the full K–8 grade span, they will not develop the conceptual understanding necessary for adequate instruction without the benefit of coursework focusing on the grades they will teach.

<sup>4</sup>Whole numbers and place value; fractions and integers; decimals (including ratio, proportion, percent); estimation; constants, variables, expressions; equations; graphs and functions; measurement; basic concepts in plane and solid geometry; polygons and circles; perimeter, area, surface area, volume; probability and data display and analysis.

<sup>5</sup>Samples of course syllabi and their evaluation are contained in Appendix E of NCTQ’s national mathematics report which can be accessed at [http://www.nctq.org/p/publications/docs/nctq\\_ttmath\\_fullreport\\_20090603062928.pdf](http://www.nctq.org/p/publications/docs/nctq_ttmath_fullreport_20090603062928.pdf)

<sup>6</sup>We note that non-elementary math coursework (such as a college algebra course) is not relevant for this standard.

<sup>7</sup>For example, unless otherwise indicated in the course description, an “elementary” math content course is presumed to provide instruction designed for both elementary and middle school teacher candidates in a state in which elementary teacher certification spans grades K–8. A course in the same state whose description contains a significant number of references to pedagogical *and* content concerns would be presumed to be designed for both elementary and middle school teacher candidates to address both elementary methods and content and middle school methods and content.

We note that a course designed for elementary teacher candidates should address both elementary and middle school math content but should do so in a manner appropriate for elementary teacher candidates, not for elementary and middle school teacher candidates. Elementary certification grade spans in each state are found in Teacher Licensing Structure [Infographics](#).

<sup>8</sup>This includes content for grades K–5 and also some coverage of middle school math topics.

<sup>9</sup>Special education programs can fully satisfy the standard based on consideration of only math content requirements, with no consideration of math methods coursework requirements.

<sup>10</sup>“Adequacy” is defined differently based on the selectivity of the IHE in which the program is housed: At least six SCHS for programs in IHEs whose student body’s mean math and verbal SATs/composite ACT scores are at or above 1120/24 respectively; at least eight SCHs for programs in all other IHEs.

Programs with instructional scores below 60 percent or requiring three or fewer SCHs of elementary math coursework do not meet the standard. For Indicator 5.3, elementary programs meeting the standard with regard to instructional scores and required coursework credits are evaluated for adequacy in math methods coursework<sup>11</sup> to determine if they meet the standard.

If coverage of essential topics cannot be determined in the review of syllabi, analysts attempt to evaluate the program using the alternate scoring process outlined below.

### How a program earns a “strong design” rating

Evaluation of programs for strong design entails a review of how programs that fully satisfy the standard for strong elementary math preparation coordinate or integrate elementary math content and methods coursework.

### An alternate scoring process if data are not provided

Because elementary preparation is critical to ensuring that elementary and special education teacher candidates are competent to enter the classroom, NCTQ could not allow the lack of cooperation on the part of IHEs to place them out of the reach of evaluations on this standard. To that end, a means of evaluating elementary and special education programs on this standard using imputation was devised after extensive field work.<sup>12</sup>

This imputation process relies on the following sources of data:

- Course descriptions of elementary math content and methods courses in institution of higher education (IHE) catalogs
- Elementary math content and methods course credit information in IHE catalogs
- Listings in IHE bookstores of required primary textbooks in required elementary math content courses
- Integrated Postsecondary Education Data System (IPEDS) data on mean university SAT/ACT scores and mean of SAT/ACT scores self-reported to the College Board<sup>13</sup> (undergraduate) or requirement of the Graduate Records Examination (GRE; graduate)

The fundamental difference between the two scoring approaches is that the instructional score produced by imputation uses course descriptions and textbook evaluations rather than course descriptions, textbook evaluations and syllabi.

Scores produced by imputation are reported as ●\* (3.5 on a 0-4 scale) or ◐\* (1 on a 0-4 scale).

Any program that could not be evaluated by either the standard scoring process or by the above process was removed from the sample.

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<sup>11</sup> At least three SCHs.

<sup>12</sup> We estimate that in 80 percent of programs, imputation produces the same program scores as evaluation with complete data.

<sup>13</sup> Used if more than 50 percent of the student body report such scores and no other source of SAT/ACT data is available.

## Examples of what satisfies or does not satisfy the standard's indicators

### Adequate course sequence supported by textbooks and including a methods course (Indicators 5.1–5.3)

✓ - fully satisfies the indicators	✗ - does not satisfy the indicators
<p data-bbox="138 359 747 422"><i>In an undergraduate elementary program housed in a sufficiently selective IHE...</i></p> <p data-bbox="138 453 669 516"><i>Coursework designed for grades K–5 teacher candidates satisfies Indicators 5.1 – 5.3:</i></p> <ul data-bbox="138 548 756 737" style="list-style-type: none"><li data-bbox="138 548 756 579">■ <i>It earns an instructional <b>score of 86 percent</b>;</i></li><li data-bbox="138 611 756 737">■ <i>Nine SCHS of combined math content and methods coursework — <b>six SCHs of elementary math content and three SCHs of math methods</b> — are required.</i></li></ul> <p data-bbox="138 768 756 978"><b>Note:</b> Eight SCHs of elementary math content coursework is required to satisfy Indicator 5.1 unless, as is the case in this program, the IHE student body's mean combined math and verbal SAT is at or above 1120 (or its composite ACT is at or above 24). In such cases, only six SCHs are required. Indicator 5.3 is satisfied by the three SCHs of methods instruction in the combined math content and methods coursework.</p>	<p data-bbox="855 359 1383 422"><i>In a graduate program that is not sufficiently selective ...</i></p> <p data-bbox="855 453 1383 516"><i>Coursework designed for grades K–5 teacher candidates satisfies only Indicator 5.3:</i></p> <ul data-bbox="855 548 1383 705" style="list-style-type: none"><li data-bbox="855 548 1383 611">■ <i>No elementary math content coursework is required of teacher candidates;</i></li><li data-bbox="855 642 1383 705">■ <i>Three SCHs of elementary math methods coursework is required.</i></li></ul> <p data-bbox="855 737 1448 915"><b>Note:</b> Because it does not signify that it is selective by requiring the GRE for admission, this program would have to require at least eight SCHs of elementary math content designed for grades K–5 teacher candidates to have the potential to satisfy the standard either partly or fully. While valuable, the math methods course does not satisfy the standard.</p>