Methodology for State of the States: Five Policy Levers to Improve Math Instruction

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To evaluate states, NCTQ:

1. Partnered with math experts—including researchers, teacher preparation program leaders, and state education officials—to identify key state-level policies and practices that can strengthen teachers' capacity to deliver high-quality math instruction. Through this collaboration, NCTQ identified five essential policy levers for improving math instruction, along with 16 associated actions that serve as indicators of effective implementation. Policy Levers 1 and 3 (teacher prep standards, licensure tests) address elementary teachers specifically, while Levers 2, 4, and 5 (prep program approval, high-quality instructional materials, and professional learning and coaching) include policies related to the broader K–12 teacher workforce. The levers and actions were refined with ongoing input from the expert advisory group.

2. Conducted a national scan of state policies, analyzing them against the five policy levers and 16 associated actions. Our team of expert analysts reviewed state laws, regulations, statutes, and related documents to determine whether each action was in place. We then shared our initial findings with states, offering them the opportunity to provide additional context, documentation, and corrections.

3. **Assigned a total value to each policy or practice action.** Each action is assigned a value of 1 or 2 points based on its significance. Actions worth 2 points typically involve formal policies—such as laws, regulations, or funding mechanisms—which require greater stakeholder engagement and have a broader impact. One-point actions reflect supportive state tactics that may not necessarily require legislation, such as issuing guidance on selecting high-quality math curricula or publishing data on teacher preparation outcomes.

4. **Allocated points for state policies.** States received points based on the strength of their policies. Some actions allow for partial credit. For example, if a state mandates that districts select instructional materials from a state-approved list of high-quality math curricula, it earns 2 points. If the state provides a recommended list but does not require districts to select a curriculum from that list, it earns 1 point. If no such list exists, the state receives 0 points. In some cases, actions have a simple binary value (e.g., 1 = "yes," 0 = "no").

Policy lever	Policy action	Total possible value	Coded response and assigned value
1. Teacher preparation standards	**State has math standards for elementary teacher preparation programs that cover all four core content topics (numbers and operations, algebraic thinking, geometry and measurement, data analysis and probability).**	**8** (each component is scored separately)	**2** = Yes (provides detailed and required standards) **1** = Yes (lists required standards but does not provide details) **0** = No (missing/does not require)
1. Teacher preparation standards	**State requires elementary programs to address math-specific pedagogy.**	**2**	**2** = Yes **0** = No
2. Prep program approval	**State maintains full authority over prep programs and does not permit outside entities to determine approval alone.**[1]	**2**	**2** = Yes **0** = No
2. Prep program approval	**State reviews syllabi and/or math coursework to determine the integration of all math standards as part of the program review process.**	**1**	**1** = Yes **0** = No
2. Prep program approval	**State requires the inclusion of math experts in the review of teacher prep programs.**	**1**	**1** = Yes **0** = No
2. Prep program approval	**State uses math licensure test pass rate data as part of the program review process.**	**1**	**1** = Yes **0** = No

3. Licensure test	**State uses an at least acceptable math test for elementary teacher candidates.**[2]	**2**	**2** = Yes (test is acceptable or strong) **0** = No (test is weak, unacceptable, a mix of tests that includes weak or unacceptable tests, or not required)
3. Licensure test	**State requires all elementary teacher candidates to pass an acceptable math licensure test.**	**2**	**2** = Yes (candidates must take and pass an acceptable test to earn a license) **0** = No (state does not use an acceptable test, does not require a test [e.g., makes it optional], or allows loopholes for some individuals to bypass minimum passing score)
3. Licensure test	**State publishes any pass rate data on math licensure tests at the institution or program level.**	**1**	**1** = Yes **0** = No
4. High-quality instructional materials	**State requires the use of high-quality math curriculum instructional materials.**	**2**	**2** = State requires districts to select from a published list of approved curricula **1** = State recommends a list of approved curricula **0** = Neither
4. High-quality instructional materials	**State publishes information about the math curricula being used in districts.**	**1**	**1** = Yes **0** = No

4. High-quality instructional materials	**State requires districts to post the math curricula on their website.**	**1**	**1** = Yes **0** = No
4. High-quality instructional materials	**State provides guidance and/or evaluation tools to districts to aid in the selection of high-quality core math curriculum materials.**	**1**	**1** = Yes **0** = No
4. High-quality instructional materials	**State allocates funds toward math curricula.**	**2**	**2** = State provides funding opportunities to all districts **0** = State does not provide any funding toward high-quality math instructional materials
5. Professional learning & coaches	**State financially supports training for current teachers to improve math instruction.**	**2**	**2** = Yes **0** = No
5. Professional learning & coaches	**State financially supports math coaches/specialists.**	**2**	**2** = Yes **0** = No

4. Calculated the proportion of policy action points a state earns. Each of the five policy levers—teacher preparation standards, program approval, licensure tests, high-quality instructional materials, and professional learning—are weighted equally and contribute equally to the state's overall score. To determine the percentage earned for each lever, divide the state's earned points by the total possible points for that lever. For example, if a state earned 8 out of 10 possible points in teacher preparation standards, it would receive 80% for that policy lever. The state's final score is then calculated as the average of the percentages across all five policy levers.

Example state

Policy lever	Total points earned/total available	Percentage of points earned
Teacher preparation standards	8/10	80%
Prep program approval	2/5	40%
Licensure tests	5/5	100%
High-quality instructional Materials	4/5	80%
Professional learning & coaches	4/4	100%
Total percentage of points earned	**80%**	

5. Categorized states. Each state is categorized using the following cut scores:

Strong	States earning an average of 75% or higher of possible points across the five policy levers
Moderate	States earning an average of 50–74% of possible points across the five policy levers
Weak	States earning an average of 25–49% of possible points across the five policy levers
Unacceptable	States earning an average of 0–24% of possible points across the five policy levers

Methodology for reviewing math licensure tests

NCTQ analyzed all mathematics licensure tests currently in use for elementary teachers (excluding tests that are being phased out within the next two years). This analysis determines whether these tests adequately address the math topics identified by research and experts to be essential for elementary teachers: numbers and operations, algebraic thinking, geometry and measurement, and data analysis and probability.[3]

Based on the math research, NCTQ's mathematics expert panel developed a list of subtopics that math licensure tests should address within each topic. The protocol also looks for evidence that the test addressed different aspects of mathematical proficiency, procedural fluency, conceptual understanding, and application for each topic and subtopic. (The full set of subtopics is provided below.)

Identifying available and required tests: This analysis includes all subject-matter math tests currently in use for aspiring teachers to earn an elementary certification. It does not include tests used for additional endorsements, or tests of basic skills or performance assessments. This analysis counts tests as available even when candidates can bypass them through other means (e.g., by completing a teacher prep program). Furthermore, if the state identifies a primary test used for certification yet allows other test options to substitute for that test, all offered tests count in the analysis. A state's policy counts as requiring all candidates to pass the test if the state does not provide any alternative options to bypass either taking the test or passing the test at the required minimum cut score.

Analysts: The analysts for this work are experts in mathematics, with experience teaching mathematics as well supporting others in becoming stronger math teachers.

Data sources: Analysts used official practice tests made available (for free or for purchase) by the state or testing company and official study guides or related information about the content of the tests. Analysts did not use materials developed by third-party vendors (e.g., test-prep or tutoring companies).

Coding process: Analysts reviewed all available materials and gave assessments credit for any topic that appeared in any data source. For example, if "understanding patterns, relations, and functions" is mentioned in the study guide but not in the sample test, the assessment gets credit for that topic, and the same is true if the topic is mentioned in the sample test but not the study guide. Test materials only need to mention a topic once to earn credit for that topic.

Topic-level scoring
Each content topic (e.g., numbers and operations) receives a rating of adequate or inadequate. For each subtopic (e.g., compute fluently and make reasonable estimates), analysts look for evidence of all three aspects of mathematical proficiency: procedural fluency, conceptual understanding, and application (defined below). To be adequate in a topic, the test must address an average of half of all subtopics across all aspects (e.g., a test may address more

than half of topics in one aspect and less than half of topics in another aspect, and it can still score adequate if it covers at least half of all topics).

Overall test score rating
Each test receives a rating of strong, acceptable, weak, or unacceptable.

Strong:
- Meets an average of at least 75% of content subtopics and aspects from each content topic AND
- Does not combine math with other subjects (e.g., does not test math in a subtest that also includes science)

Acceptable:
- Earns an adequate score in all four topics (addresses at least half of all subtopics and aspects in each area) AND
- Does not combine math with other subjects (e.g., does not test math in a subtest that also includes science)

Weak:
- Earns an inadequate score in one or more areas AND/OR
- Combines math in a test or subtest with other topics beyond math (e.g., a subtest includes both math and science)

Unacceptable:
- Has no coverage in one or more components (addresses 0% of topics in that area)

Defining aspects of mathematics proficiency
- *Procedural fluency:* Whether someone knows mathematical facts, can compute and do the math,[4] and whether someone has skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.[5]
- *Conceptual understanding:* Whether someone can make sense of the math, can reason about and understand math concepts and ideas,[6] and comprehends mathematical concepts, operations, and relations.[7]
- *Application:* Whether someone can solve a wide range of problems in various contexts by reasoning, thinking, and applying the mathematics they have learned.[8] Examples may include:
  - **Strategic competence**—ability to formulate, represent, and solve mathematical problems.
  - **Adaptive reasoning**—capacity for logical thought, reflection, explanation, and justification.
  - **Productive disposition**—habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

Content topics and subtopics included in analysis

Numbers and operations
- Numbers and operations (as an umbrella term).
- Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
- Understand meanings of operations and how they relate to one another.
- Compute fluently and make reasonable estimates.
- Relationship between numbers and operations and other aspects of math.

Algebraic thinking
- Algebraic thinking (as an umbrella term).
- Understand patterns, relations, and functions.
- Represent and analyze mathematical situations and structures using algebraic symbols.
- Use mathematical models to represent and understand quantitative relationships.
- Analyze change in various contexts.
- Relationship between algebraic thinking and other aspects of math.

Geometry and measurement
- Geometry and measurement (as an umbrella term).
- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
- Apply transformations and use symmetry to analyze mathematical situations.
- Use visualization, spatial reasoning, and geometric modeling to solve problems.
- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Apply appropriate techniques, tools, and formulas to determine measurements.
- Relationship between geometry and measurement and other aspects of math.

Data analysis and probability
- Data analysis and probability (as an umbrella term).
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Select and use appropriate statistical methods to analyze data.
- Develop and evaluate inferences and predictions that are based on data.
- Understand and apply basic concepts of probability.
- Relationship between data analysis and probability and other aspects of math.

End Notes

[1] In some cases, a state may use an external accreditor to review programs. However, the state receives credit only if it makes the final approval decision itself, rather than relying solely on the accreditor's judgment.

[2] Note: NCTQ did not analyze tests set to be phased out within the next two years.

[3] The mathematics content topics that should be included in elementary math licensure tests mirror the content that experts assert should be in teacher prep programs' mathematics coursework. As NCTQ reported, "NCTQ drew on multiple sources to describe the mathematics content programs should address in required coursework. Expectations for elementary students were drawn from the Common Core State Standards for Mathematics (CCSS-M) and the National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics. Teacher standards and recommendations for teacher preparation were drawn from the Conference Board of the Mathematical Sciences' Mathematical Education for Teachers II (MET II), the American Statistical Association's Guidelines and Assessments for Instruction in Education (GAISE), and the Council for the Accreditation of Educator Preparation (CAEP) K–6 Elementary Teacher Preparation Standards. A synthesis of these recommendations was reviewed by NCTQ's Expert Advisory Panel (EAP) and was shared with the field for feedback through an Open Comment Period." Among the 275 educators who completed NCTQ's Open Comment Survey on the content that should be included, "93% of respondents agreed or strongly agreed that these four topics are the 'right areas of specialized content knowledge' on which to evaluate elementary programs." National Council on Teacher Quality. (2022). *Technical manual for elementary mathematics*. https://www.nctq.org/dmsView/Technical_Manual_for_Elementary_Mathematics_2022

[4] *Definitions drawn from p. 11:* Massachusetts Department of Elementary and Secondary Education. (2017). *Mathematics grades pre-kindergarten to 12: Massachusetts curriculum framework 2017.* https://www.doe.mass.edu/frameworks/math/2017-06.pdf

[5] National Research Council. (2001). *Adding it up: Helping children learn mathematics.* The National Academies Press. https://doi.org/10.17226/9822

[6] *Definitions drawn from p. 11:* Massachusetts Department of Elementary and Secondary Education. (2017).

[7] National Research Council. (2001).

[8] *Definitions drawn from p. 11:* Massachusetts Department of Elementary and Secondary Education. (2017).