Virginia Board of Education Agenda Item

Agenda Item: K **Date:** April 24, 2014

Title	First Review of Recommendation of the Advisory Board on Teacher Education and Licensure (ABTEL) for Passing Scores for the Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003) of the Praxis II Elementary Education: Multiple Subjects Test		
Presenter	Mrs. Patty S. Pitts, Assistant Superintendent, Division of Teacher Education and Licensure		
E-mail	Patty.Pitts@doe.virginia.gov	**Phone**	(804) 371-2522

Purpose of Presentation:
Action required by state or federal law or regulation.

Previous Review or Action:
No previous review or action.

Action Requested:
Action will be requested at a future meeting. Specify anticipated date below:
May 22, 2014

Alignment with Board of Education Goals: Please indicate (X) all that apply:

	Goal 1: Accountability for Student Learning
	Goal 2: Rigorous Standards to Promote College and Career Readiness
	Goal 3: Expanded Opportunities to Learn
	Goal 4: Nurturing Young Learners
X	Goal 5: Highly Qualified and Effective Educators
	Goal 6: Sound Policies for Student Success
	Goal 7: Safe and Secure Schools
	Other Priority or Initiative. Specify:

Background Information and Statutory Authority:
Goal 5: The approval of passing scores on the professional assessments supports the goal of highly qualified and effective educators in Virginia's classrooms and schools.

Section 22.1-298.1. **Regulations governing licensure** of the *Code of Virginia* require that the Board of Education's regulations "shall include requirements that a person seeking initial licensure: 1. Complete professional assessments as prescribed by the Board of Education;…."

Currently, the Virginia Board of Education requires the following licensure assessments:

- Virginia Communication and Literacy Assessment (VCLA)

- Praxis II: Specialty Area Tests
- Reading for Virginia Educators (RVE)
- School Leaders Licensure Assessment (SLLA)

The Board of Education prescribes the Praxis II (subject area content) tests as a professional teacher's assessment requirement for initial licensure in Virginia. The Praxis II assessment currently required for individuals seeking an initial license with an endorsement in Early/Primary Education PreK-3 or Elementary Education PreK-6 is the Praxis Elementary Education: Content Knowledge (0014/5014) test.

The Educational Testing Service (ETS) developed a new Praxis Elementary Education: Multiple Subjects (5031) test. This assessment, unlike the Praxis Elementary Education: Content Knowledge (0014/5014) assessment, requires a passing score for each of the four subtests. Standard-setting studies were conducted and presented to the Advisory Board on Teacher Education and Licensure.

At the recommendation of the Advisory Board on Teacher Education and Licensure, on June 27, 2013, the Virginia Board of Education adopted the following passing scores and implementation date for the Praxis Elementary Education: Multiple Subjects (5031) test required for individuals seeking an initial license with an endorsement in early/primary education or elementary education. This action strengthened content requirements for the initial licensure of elementary teachers.

Praxis Elementary Education: Multiple Subjects (5031) Test		
Subtest Name	**Pass Score**	**Implementation Date**
Reading and Language Arts (5032)	165 scaled score (46 raw-score points)	July 1, 2014
Mathematics (5033)	164 scaled score (28 raw-score points)	
Social Studies (5034)	155 scaled score (35 raw-score points)	
Science (5035)	159 scaled score (33 raw-score points)	

In December 2013, ETS contacted the Virginia Department of Education to request participation in multistate standard-setting studies on February 3-4, 2014, for the Reading and Language Arts Subtest and the Mathematics Subtest of the Praxis II Elementary Education: Multiple Subjects (5031) test because these subtests had been revised. The Department was unaware that that the subtests had been revised and new standard-setting studies would be required. Please note that the number of the Praxis II Elementary Education: Multiple Subjects test will change from 5031 to 5001 to reflect that the two subtests have been revised.

The Superintendent of Public Instruction communicated by letter and in a meeting with ETS officials her dissatisfaction with the lack of communication regarding the revisions in the subtests. ETS apologized and promised to work with Virginia to phase in the new subtests.

Summary of Important Issues:
A multistate standard-setting study was conducted by ETS in February 2014 for the revised Praxis II Reading and Language Arts (5002) and Mathematics (5003) subtests. Participants from 20 states served on the multistate study panel. Virginia was represented by three Virginia educators who were nominated by Virginia educational agencies. A detailed summary of the study, *Multistate Standard-Setting Technical Report – Praxis II Elementary Education: Reading and Language Arts Subtest (5002)*

and Mathematics Subtest (5003) is attached (Appendix A) and includes participants, methodology, and recommendations. The purposes of the study were to (a) recommend the minimum passing score for the Praxis II Elementary Education: Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003) and (b) confirm the importance of the Praxis content specifications for entry-level elementary school teachers. To pass the Praxis II Elementary Education: Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003), a candidate must meet or exceed the passing scores established by the Virginia Board of Education.

The Praxis *Test at a Glance* documents for the Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003) are attached (Appendix B) and describe the purpose and structure of the assessments. In brief, the purpose of the subtests is to assess whether the entry-level elementary school teacher has the content knowledge and skills believed necessary for competent practice. A National Advisory Committee of elementary teachers and college faculty defined the content of the assessments, and national surveys of teachers and college faculty confirmed the content.

The Reading and Language Arts Subtest (5002) contains 80 selected-response items covering two content areas: Reading (approximately 38 items) and Writing, Speaking, and Listening (approximately 42 items). The reporting scale for the Reading and Language Arts (5002) subtest ranges from 100 to 200 scaled-score points.

The Mathematics Subtest (5003) contains 50 selected-response and numeric entry items covering three content areas: Numbers and Operations (approximately 20 items), Algebraic Thinking (approximately 15 items), and Geometry and Measurement, Data, Statistics, and Probability (approximately 15 items). The reporting scale for the Mathematics (5003) subtest ranges from 100 to 200 scaled-score points.

Multistate Standard-Setting Study

The multistate standard-setting study for both the Reading and Language Arts Subtest (5002) and the Mathematics Subtest (5003) are detailed in Appendix A.

Reading and Language Arts: The multistate panel recommended a passing score of 42 out of a possible 65 raw-score points. The scaled score associated with a raw score of 42 is 157 on a 100 to 200 scale.

Mathematics: The multistate panel recommended a passing score of 26 out of a possible 40 raw-score points. The scaled score associated with a raw score of 26 is 157 on a 100 to 200 scale.

The multistate standard-setting study provides the estimated conditional standard error of measurement (CSEM). The CSEM is a statistical phenomenon and is unrelated to the accuracy of scoring. All test results are subject to the standard error of measurement. If a test taker were to take the same test repeatedly, with no change in his level of knowledge and preparation, it is possible that some of the resulting scores would be slightly higher or slightly lower than the scores that precisely reflects the test taker's actual level of knowledge or ability. The difference between a test taker's actual score and his highest or lowest hypothetical score is known as the standard error of measurement.

The CSEM for the recommended passing scores for multistate standard-setting study are shown below. Note that consistent with the recommended passing score, the passing scores at the different CSEMs have been rounded to the next highest number, and the rounded values are converted to scaled scores.

Conditional Standard Error of Measurement Summaries

Reading and Language Arts Subtest (5002)

Passing Scores Within 1 and 2 CSEMs of the Recommended Passing Score – Multistate Panel

Recommended passing score (CSEM)		Scale score equivalent
42 (3.89)		157
- 2 CSEMs	35	141
-1 CSEM	39	150
+1 CSEM	46	165
+ 2 CSEMs	50	174

Mathematics Subtest (5003)

Passing Scores Within 1 and 2 CSEMs of the Recommended Passing Score – Multistate Panel

Recommended passing score (CSEM)		Scale score equivalent
26 (3.06)		157
- 2 CSEMs	20	136
-1 CSEM	23	146
+1 CSEM	30	171
+ 2 CSEMs	33	182

At the March 24, 2014, meeting the Advisory Board on Teacher Education and Licensure recommended that the Virginia Board of Education:

(1) approve the following subtests and passing scaled scores for the Praxis II Elementary Education Multiple Subjects (5001) test effective July 1, 2015, for individuals seeking an initial license with an early/primary education or elementary endorsement:

- Reading and Language Arts Subtest (5002) – 157 scaled score
- Mathematics Subtest (5003) – 157 scaled score

(2) accept the following scores for the Praxis II Elementary Education Multiple Subjects (5001) test for candidates who take and pass the subtests prior to July 1, 2015 (i.e., allow early implementation of newly-revised subtests):

- Reading and Language Arts Subtest (5002) – 157 scaled score
- Mathematics Subtest (5003) – 157 scaled score

Impact on Fiscal and Human Resources:
Costs associated with the administration of Praxis II tests will be incurred by the Educational Testing Service. Prospective teachers are required to pay test fees.

Timetable for Further Review/Action:
This item will be presented to the Board of Education for final review at the May 22, 2014, meeting.

Superintendent's Recommendation:
The Superintendent of Public Instruction recommends that the Board of Education accept for first review the Advisory Board of Teacher Education and Licensure's recommendation that the Virginia Board of Education approve the following passing scores for the revised Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003) for the Praxis Elementary Education Multiple Subjects (5001) test to become effective July 1, 2015, and accept candidates' passing scores for these subtests taken prior to July 1, 2015.

- Reading and Language Arts Subtest (5002) – 157 scaled score
- Mathematics Subtest (5003) – 157 scaled score

APPENDICES

Appendix A: Multistate Standard-Setting Technical Report – Praxis II Elementary Education: Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003) – February 2014

Appendix B: Test at a Glance – Praxis II Elementary Education: Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003)

Appendix A

Multistate Standard-Setting Technical Report
Praxis II Elementary Education: Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003)
February 2014

Listening. Learning. Leading.

Multistate Standard-Setting Technical Report

PRAXIS™ ELEMENTARY EDUCATION: READING AND LANGUAGE ARTS SUBTEST (5002) MATHEMATICS SUBTEST (5003)

Licensure and Credentialing Research

ETS

Princeton, New Jersey

February 2014

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EXECUTIVE SUMMARY

To support the decision-making process of education agencies establishing passing scores (cut scores) for the revised Reading and Language Arts (5002) and Mathematics (5003) subtests of the Praxis™ Elementary Education: Multiple Subjects test, research staff from Educational Testing Service (ETS) designed and conducted a multistate standard-setting study. The Praxis Elementary Education: Multiple Subjects test contains four separately scored subtests.

- Reading and Language Arts
- Mathematics
- Social Studies
- Science

In July 2011, ETS conducted a multistate standard-setting study to recommend to states passing scores for each of the subtests. The test was first administered operationally in fall 2012.

To better reflect changes in national standards for reading/language arts and mathematics, including the Common Core State Standards, ETS revised the Reading and Language Arts and Mathematics subtests of the Praxis Elementary Education: Multiple Subjects test. Revisions to the subtests will require states using the Praxis Elementary Education: Multiple Subjects to establish passing scores for the new subtests. Passing scores previously established for the Social Studies and Science subtests do not need to be adjusted since these subtests were not revised.

PARTICIPATING STATES

Panelists from 20 states were recommended by their respective education agencies. The education agencies recommended panelists with (a) experience as either elementary teachers or college faculty who prepare elementary teachers and (b) familiarity with the knowledge and skills required of beginning elementary teachers.

RECOMMENDED PASSING SCORE

ETS provides recommended passing scores from the multistate standard-setting study to help education agencies determine appropriate operational passing scores for the two revised subtests. For the revised subtests of the Praxis Elementary Education: Multiple Subjects test, the recommended passing scores[1] are:

- **Reading and Language Arts**: The recommended passing score is 42 out of a possible 65 raw-score points. The scaled score associated with a raw score of 42 is 157 on a 100–200 scale.
- **Mathematics**: The recommended passing score is 26 out of a possible 40 raw-score points. The scaled score associated with a raw score of 26 is 157 on a 100–200 scale.

[1] Results from the two panels participating in the study were averaged to produce the recommended passing scores.

To support the decision-making process of education agencies establishing passing scores (cut scores) for the revised Reading and Language Arts (5002) and Mathematics (5003) subtests[2] of the Praxis™ Elementary Education: Multiple Subjects test, research staff from Educational Testing Service (ETS) designed and conducted a multistate standard-setting study in February 2014 in Princeton, New Jersey. Education agencies[3] recommended panelists with (a) experience as either elementary teachers or college faculty who prepare elementary teachers and (b) familiarity with the knowledge and skills required of beginning elementary teachers. Twenty states (Table 1) were represented by 35 panelists. (See Appendix A for the names and affiliations of the panelists.)

Table 1

Participating States and Number of Panelists

Arkansas (1 panelist)	Nevada (2 panelists)
Delaware (2 panelists)	North Dakota (1 panelist)
Hawaii (1 panelist)	Rhode Island (1 panelist)
Idaho (2 panelists)	South Carolina (3 panelists)
Kentucky (2 panelists)	South Dakota (2 panelists)
Louisiana (2 panelists)	Utah (2 panelists)
Maine (1 panelist)	Vermont (1 panelist)
Maryland (1 panelist)	Virginia (3 panelists)
New Hampshire (2 panelists)	West Virginia (2 panelists)
New Jersey (2 panelists)	Wyoming (2 panelists)

The following technical report contains three sections. The first section describes the content and format of the subtests. The second section describes the standard-setting processes and methods. The third section presents the results of the standard-setting study.

[2] Passing scores previously established for the Social Studies and Science subtests of the Praxis Elementary Education: Multiple Subjects test do not need to be adjusted since these subtests were not revised.

[3] States and jurisdictions that currently use Praxis were invited to participate in the multistate standard-setting study.

ETS provides recommended passing scores from the multistate standard-setting study to education agencies. In each state, the department of education, the board of education, or a designated educator licensure board is responsible for establishing the operational passing scores in accordance with applicable regulations. This study provides recommended passing scores,[4] which represents the combined judgments of two panels of experienced educators. Each state may want to consider the recommended passing scores but also other sources of information when setting the final passing scores for the revised Reading and Language Arts and Mathematics subtests[5] of the Praxis Elementary Education: Multiple Subjects test (see Geisinger & McCormick, 2010). A state may accept one or both recommended passing scores, adjust one or both scores upward to reflect more stringent expectations, or adjust one or both scores downward to reflect more lenient expectations. There are no *correct* decisions; the appropriateness of any adjustments may only be evaluated in terms of its meeting the state's needs.

Two sources of information to consider when setting the passing scores are the standard errors of measurement (SEM) and the standard errors of judgment (SEJ). The former addresses the reliability of the subtest scores and the latter, the reliability of panelists' passing-score recommendations. The SEM allows a state to recognize that any test score on any standardized test—including the subtests scores from the Praxis Elementary Education: Multiple Subjects test—is not perfectly reliable. A test score only *approximates* what a candidate truly knows or truly can do on the test. The SEM, therefore, addresses the question: How close of an approximation is the test score to the *true* score? The SEJ allows a state to gauge the likelihood that the recommended passing score from a particular panel would be similar to the passing scores recommended by other panels of experts similar in composition and experience. The smaller the SEJ, the more likely that another panel would recommend a passing score consistent with the recommended passing score. The larger the SEJ, the less likely the recommended passing score would be reproduced by another panel.

[4] In addition to the recommended passing scores averaged across the two panels, the recommended passing scores for each panel are presented.

[5] Passing scores previously established for the Social Studies and Science subtests of the Praxis Elementary Education: Multiple Subjects test do not need to be adjusted since these subtests were not revised.

In addition to measurement error metrics (e.g., SEM, SEJ), each state should consider the likelihood of classification errors. That is, when adjusting a passing score, policymakers should consider whether it is more important to minimize a false-positive decision or to minimize a false-negative decision. A false-positive decision occurs when a candidate's test score suggests that he should receive a license/certificate, but his actual level of knowledge/skills indicates otherwise (i.e., the candidate does not possess the required knowledge/skills). A false-negative decision occurs when a candidate's test score suggests that she should not receive a license/certificate, but she actually does possess the required knowledge/skills. The state needs to consider which decision error is more important to minimize.

OVERVIEW OF THE READING AND LANGUAGE ARTS AND MATHEMATICS SUBTESTS OF THE PRAXIS ELEMENTARY EDUCATION: MULTIPLE SUBJECTS TEST

The *Test at a Glance* documents (ETS, in press) for the Reading and Language Arts and Mathematics subtests of the Praxis Elementary Education: Multiple Subjects test describe the purpose and structure of the subtests. In brief, both subtests measures whether entry-level elementary teachers have the knowledge/skills believed necessary for competent professional practice.

The 90-minute Reading and Language Arts subtest contains 80 selected-response items[6] covering two content areas: *Reading* (approximately 38 items) and *Writing, Speaking, and Listening* (approximately 42 items).[7] The reporting scale ranges from 100 to 200 scaled-score points.

The 65-minute Mathematics subtest contains 50 selected-response and numeric entry items[8] covering three content areas: *Numbers and Operations* (approximately 20 items), *Algebraic Thinking* (approximately 15 items), and *Geometry and Measurement, Data, Statistics, and Probability* (approximately 15 items).[9] The reporting scale ranges from 100 to 200 scaled-score points.

[6] Fifteen of the 80 multiple-choice items are pretest items and do not contribute to a candidate's score.
[7] The number of items for each content area may vary slightly from form to form of the test.
[8] Ten of the 50 selected-response and numeric entry items are pretest items and do not contribute to a candidate's score.
[9] The number of items for each content area may vary slightly from form to form of the test.

PROCESSES AND METHODS

The design of the standard-setting study included two expert panels. Before the study, panelists received an email explaining the purpose of the standard-setting study and requesting that they review the content specifications for the two subtests. This review helped familiarize the panelists with the general structure and content of the subtests.

The standard-setting study began with a welcome and introduction by the meeting facilitator. The facilitator described the over structure of the Praxis Elementary Education: Multiple Subjects test, provided an overview of standard setting, and presented the agenda for the study. Appendix B shows the agenda for the panel meeting.

REVIEWING THE SUBTESTS

The standard-setting panelists first took the subtests and then discussed them. This discussion helped bring the panelists to a shared understanding of what the subtests do and do not cover, which serves to reduce potential judgment errors later in the standard-setting process.

The discussion covered the major content areas being addressed by each subtest. Panelists were asked to remark on any content areas that would be particularly challenging for entry-level teachers or areas that address content particularly important for entry-level teachers.

DESCRIBING THE JUST QUALIFIED CANDIDATE

Following the review of the test, panelists described the just qualified candidate. The *just qualified candidate description* plays a central role in standard setting (Perie, 2008); the goal of the standard-setting process is to identify the test score that aligns with this description.

Both panels worked together to create a description of the just qualified candidate — the knowledge/skills that differentiate a *just* from a *not quite* qualified candidate. To create this description, they first split into smaller groups to consider the just qualified candidate. Then they reconvened and, through whole-group discussion, created the description of the just qualified candidate to use for the remainder of the study. After the description was completed, panelists were split into two, distinct panels that worked separately for the remainder of the study.

The written description of the just qualified candidate summarized the discussion in a bulleted format. The description was not intended to describe all the knowledge and skills of the just qualified candidate but only highlight those that differentiate a *just* qualified candidate from a *not quite* qualified candidate. The written description was distributed to panelists to use during later phases of the study (see Appendix C for the just qualified candidate description).

PANELISTS' JUDGMENTS

The standard-setting process for the Reading and Language Arts and Mathematics subtests of the Praxis Elementary Education: Multiple Subjects test was a probability-based Modified Angoff method (Brandon, 2004; Hambleton & Pitoniak, 2006). In this study, each panelist judged each item on the likelihood (probability or chance) that the just qualified candidate would answer the item correctly. Panelists made their judgments using the following rating scale: 0, .05, .10, .20, .30, .40, .50, .60, .70, .80, .90, .95, 1. The lower the value, the less likely it is that the just qualified candidate would answer the item correctly because the item is difficult for the just qualified candidate. The higher the value, the more likely it is that the just qualified candidate would answer the item correctly.

Panelists were asked to approach the judgment process in two stages. First, they reviewed both the description of the just qualified candidate and the item and decided if, overall, the item would be difficult for the just qualified candidate, easy for the just qualified candidate or moderately difficult/easy. The facilitator encouraged the panelists to consider the following rules of thumb to guide their decision:

- Difficult items for the just qualified candidate are in the 0 to .30 range.
- Moderately difficult/easy items for the just qualified candidate are in the .40 to .60 range.
- Easy items for the just qualified candidate are in the .70 to 1 range.

Next, panelists decided how to refine their judgment within the range. For example, if a panelist thought that an item would be easy for the just qualified candidate, the initial decision located the item in the .70 to 1 range. The second decision for the panelist was to decide if the likelihood of answering it correctly is .70, .80, .90, .95 or 1.

After the training, panelists made practice judgments and discussed those judgments and their rationale. All panelists completed a post-training survey to confirm that they had received adequate training and felt prepared to continue; the standard-setting process continued only if all panelists confirmed their readiness.

Following this first round of judgments (*Round 1*), item-level feedback was provided to the panel. Feedback was provided separately for the two subtests. The panelists' judgments were displayed for each item and summarized across panelists. Items were highlighted to show when panelists converged in their judgments (at least two-thirds of the panelists located an item in the same difficulty range) or diverged in their judgments.

The panelists discussed their item-level judgments. These discussions helped panelists maintain a shared understanding of the knowledge/skills of the just qualified candidate and helped to clarify aspects of items that might not have been clear to all panelists during the Round 1 judgments. The purpose of the discussion was not to encourage panelists to conform to another's judgment, but to understand the different relevant perspectives among the panelists.

In Round 2, panelists discussed their Round 1 judgments and were encouraged by the facilitator (a) to share the rationales for their judgments and (b) to consider their judgments in light of the rationales provided by the other panelists. Panelists recorded their Round 2 judgments only for items when they wished to change a Round 1 judgment. Panelists' final judgments for the study, therefore, consist of their Round 1 judgments and any adjusted judgments made during Round 2.

Other than the description of the just qualified candidate, results from Panel 1, including the summary of the Round 1 judgments, were not shared with Panel 2. The item-level judgments and resulting discussions for Panel 2 were independent of judgments and discussions that occurred with Panel 1.

RESULTS

EXPERT PANELS

Table 2 presents a summary of the panelists' demographic information. The panel included 35 educators representing 20 states. (See Appendix A for a listing of panelists.) Twenty panelists were teachers, nine were college faculty, two were administrators or department heads, and four held another position. All of the faculty members' job responsibilities included the training of elementary teachers.

Table D1 (in Appendix D) presents a summary of demographic information by panel.

Table 2
Panel Member Demographics (Across Panels)

	N	%
Current position		
Teacher	20	57%
Administrator/Department head	2	6%
College faculty	9	26%
Other	4	11%
Race		
White	27	77%
Black or African American	6	17%
Native Hawaiian or Other Pacific Islander	1	3%
Prefer Not to Answer	1	3%
Gender		
Female	29	83%
Male	6	17%
Are you currently certified to teach this subject in your state?		
Yes	30	86%
No	5	14%
Are you currently teaching this subject in your state?		
Yes	30	86%
No	5	14%
Are you currently supervising or mentoring other teachers of this subject?		
Yes	26	74%
No	9	26%

Table 2 (continued)

Panel Member Demographics (Across Panels)

	N	%
At what K–12 grade level are you currently teaching this subject?		
Elementary (K–5 or K–6)	22	63%
Middle school (6–8 or 7–9)	1	3%
Elementary and Middle school	2	6%
Not currently teaching at the K–12 level	10	29%
Including this year, how many years of experience do you have teaching this subject?		
3 years or less	2	6%
4–7 years	10	29%
8–11 years	8	23%
12–15 years	3	9%
16 years or more	12	34%
Which best describes the location of your K–12 school?		
Urban	5	14%
Suburban	7	20%
Rural	14	40%
Not currently working at the K–12 level	9	26%
If you are college faculty, are you currently involved in the training/preparation of teacher candidates in this subject?		
Yes	9	26%
No	0	0%
Not college faculty	26	74%

STANDARD-SETTING JUDGMENTS

Tables 3 and 4 summarize the standard-setting judgments (Round 2) of panelists. The tables also include estimates of the measurement error associated with the judgments: the standard deviations of the mean and the standard errors of judgment (SEJ). The SEJ is one way of estimating the reliability or consistency of a panel's standard-setting judgments.[10] It indicates how likely it would be for several other panels of educators similar in makeup, experience, and standard-setting training to the current panel to recommend the same passing score on the same form of the test. For both subtests, the

[10] An SEJ assumes that panelists are randomly selected and that standard-setting judgments are independent. It is seldom the case that panelists are randomly sampled, and only the first round of judgments may be considered independent. The SEJ, therefore, likely underestimates the uncertainty of passing scores (Tannenbaum & Katz, 2013).

confidence intervals created by adding/subtracting two SEJs to each panel's recommended passing score overlap, indicating that they may be comparable.

Panelist-level results, for Rounds 1 and 2, are presented in Appendix D (Tables D2 and D3).

Table 3

Summary of Round 2 Standard-setting Judgments – Reading and Language Arts Subtest

	Panel 1	**Panel 2**
Average	40.36	42.98
Lowest	33.50	32.30
Highest	50.40	52.05
SD	4.47	5.39
SEJ	1.08	1.27

Table 4

Summary of Round 2 Standard-setting Judgments – Mathematics Subtest

	Panel 1	**Panel 2**
Average	25.10	25.25
Lowest	18.95	15.10
Highest	27.90	32.35
SD	2.22	4.34
SEJ	0.54	1.02

Round 1 judgments are made without discussion among the panelists. The most variability in judgments, therefore, is typically present in the first round. Round 2 judgments, however, are informed by panel discussion; thus, it is common to see a decrease both in the standard deviation and SEJ. This decrease — indicating convergence among the panelists' judgments — was observed for each panel for the Reading and Language Arts subtest (see Table D2 in Appendix D) and for Panel 1 for the Mathematics subtest (see Table D3 in Appendix D). The Round 2 average score is the panel's recommended passing score.

The panels' passing score recommendations for the Reading and Language Arts subtest are 40.36 for Panel 1 and 42.98 for Panel 2 (out of a possible 65 raw-score points). The values were rounded to the next highest whole number, to determine the functional recommended passing score — 41 for Panel 1 and 43 for Panel 2. The scaled scores associated with 41 and 43 raw points are 154 and 159, respectively.

In addition to the recommended passing score for each panel, the average passing score across the two panels is provided to help education agencies determine an appropriate passing score. The panels' average passing score recommendation for the Reading and Language Arts subtest is 41.67 (out of a possible 65 raw-score points). The value was rounded to 42 (next highest raw score) to determine the functional recommended passing score. The scaled score associated with 42 raw points is 157.

The panels' passing score recommendations for the Mathematics subtest are 25.10 for Panel 1 and 25.25 for Panel 2 (out of a possible 40 raw-score points). The values were rounded to the next highest whole number, to determine the functional recommended passing score — 26 for both panels. The scaled score associated with 26 raw points are 157.

In addition to the recommended passing score for each panel, the average passing score across the two panels is provided to help education agencies determine an appropriate passing score. The panels' average passing score recommendation for the Mathematics subtest is 25.18 (out of a possible 40 raw-score points). The value was rounded to 26 (next highest raw score) to determine the functional recommended passing score. The scaled score associated with 26 raw points is 157.

Tables 5 and 6 presents the estimated conditional standard errors of measurement (CSEM) around the recommended passing score for the two subtests. A standard error represents the uncertainty associated with a test score. The scaled scores associated with one and two CSEMs above and below the recommended passing scores are provided. The conditional standard errors of measurement provided are an estimate.

Table 5

Passing Scores Within 1 and 2 CSEMs of the Recommended Passing Score[11]

Reading and Language Arts Subtest

Recommended passing score (CSEM)		Scale score equivalent
42 (3.89)		157
-2 CSEMs	35	141
-1 CSEM	39	150
+ 1 CSEM	46	165
+ 2 CSEMs	50	174

Note. **CSEM = conditional standard error of measurement.**

Table 6

Passing Scores Within 1 and 2 CSEMs of the Recommended Passing Score[11]

Mathematics Subtest

Recommended passing score (CSEM)		Scale score equivalent
26 (3.06)		157
-2 CSEMs	20	136
-1 CSEM	23	146
+ 1 CSEM	30	171
+ 2 CSEMs	33	182

Note. **CSEM = conditional standard error of measurement.**

FINAL EVALUATIONS

The panelists completed an evaluation at the conclusion of their standard-setting study. The evaluation asked the panelists to provide feedback about the quality of the standard-setting implementation and the factors that influenced their decisions. The responses to the evaluation provided evidence of the validity of the standard-setting process, and, as a result, evidence of the reasonableness of the recommended passing score.

Panelists were also shown their panel's recommended passing scores and asked (a) how comfortable they are with the recommended passing scores and (b) if they think the score was too high, too low, or about right. A summary of the final evaluation results is presented in Appendix D.

[11] The unrounded CSEM value is added to or subtracted from the rounded passing-score recommendation. The resulting values are rounded up to the next-highest whole number and the rounded values are converted to scaled scores.

All panelists *strongly agreed* or *agreed* that they understood the purpose of the study and that the facilitator's instructions and explanations were clear. All panelists *strongly agreed* or *agreed* that they were prepared to make their standard-setting judgments. All panelists *strongly agreed* or *agreed* that the standard-setting process was easy to follow.

For the Reading and Language Arts subtest, all but one of the panelists indicated they were at least *somewhat comfortable* with the passing score they recommended; 26 of the 35 panelists were *very comfortable*. Thirty-four of the 35 panelists indicated the recommended passing score was *about right* with the remaining panelist indicating that the passing score was *too low*.

For the Mathematics subtest, all but one of the panelists indicated they were at least *somewhat comfortable* with the passing score they recommended; 25 of the 35 panelists were *very comfortable*. Thirty-three of the 35 panelists indicated the recommended passing score was *about right* with one panelist indicating that the passing score was *too low* and another panelist indicating that the passing score was *too high*.

SUMMARY

To support the decision-making process of education agencies establishing passing scores (cut scores) for the revised Reading and Language Arts (5002) and Mathematics (5003) subtests of the Praxis Elementary Education: Multiple Subjects test, research staff from ETS designed and conducted a multistate standard-setting study.

ETS provides recommended passing scores from the multistate standard-setting study to help education agencies determine appropriate operational passing scores for the two revised subtests. For the revised subtests of the Praxis Elementary Education: Multiple Subjects test, the recommended passing scores[12] are:

- **Reading and Language Arts**: The recommended passing score is 42 out of a possible 65 raw-score points. The scaled score associated with a raw score of 42 is 157 on a 100–200 scale.
- **Mathematics**: The recommended passing score is 26 out of a possible 40 raw-score points. The scaled score associated with a raw score of 26 is 157 on a 100–200 scale.

[12] Results from the two panels participating in the study were averaged to produce the recommended passing score.

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APPENDIX A

PANELISTS' NAMES & AFFILIATIONS

Participating Panelists With Affiliations

Panelist	**Affiliation**
Susan Altieri	Cool Spring Elementary School (VA)
Mary Alice Barksdale	Virginia Tech (VA)
Stacey-Ann Barrett	Plaquemines Parish School Board (LA)
Heather Boulanger	Bethel Elementary School (VT)
Lisa Burnham	Capital School District - WIlliam Henry Middle School (DE)
Scott Chamberlin	University of Wyoming (WY)
Matthew Davis	Silver Crest Elementary School (UT)
Melody Deprez	Georgetown College (KY)
Gregg Dixon	South Carolina Public Charter School District (SC)
Jeffrey J. Dupree	Alderson Broaddus University (WV)
VloriAnn Faul	Max Public School (ND)
Christine Fitzgerald	Davis School District (UT)
Chantel Frazier	Bridgeton Board of Education (NJ)
Cynthia Gissy	West Virginia University at Parkersburg (WV)
LaKeytria Grant	Summerville Elementary School (SC)
Rogena Hartley	St. Mary Parish School Board (LA)
Kerri-Ann Hewett Fraser	Kaho`iwai Center for Adult Teaching and Learning (HI)
Stacey Jensen	Edahow Elementary School (ID)
Lisa King	Wicomico Middle School (MD)
Pamela Koller	Edgemont School District (SD)
Erika Langlais	Gilmanton School (NH)
Crystal Monteiro	East Providence School Department (RI)
Holly Morado	Henderson State University (AR)
Alana Mosley	Franklin Pierce University (NH)
Lois Paretti	University of Nevada (NV)
Rhonda Pearcy	Wilson Elementary School (SD)
C. Pete Peterson	Panaca Elementary School, Lincoln County (NV)
Linda Salerno	Merriam Avenue School (NJ)
Tammy Schlenker	Meeteetse School (WY)
Gillian Sleeper	Hilltop Elementary School RSU39 (ME)
Stan Steiner	Boise State University (ID)
Gretchen Wolfe	Henry M. Brader Elementary School (DE)
Brittany Worthen	Nicholasville Elementary School (KY)
Krystle Yarbrough	Acquinton Elementary School (VA)
Lindsay Yearta	University of South Carolina at Upstate (SC)

APPENDIX B

STUDY AGENDA

AGENDA

Praxis Elementary Education: Multiple Subjects (5002 & 5003) Standard-Setting Study

Day 1

Welcome and Introduction

Overview of Standard Setting and the Praxis Elementary Education: Multiple Subjects test

Review the RLA and Mathematics Subtests

Discuss the RLA and Mathematics Subtests

Break

Discuss the Just Qualified Candidate (JQC)

Create the Just Qualified Candidate Description - RLA

Lunch

Create the Just Qualified Candidate Description -Mathematics

Break

Training for Standard-Setting Judgments

Practice Judgments and Discuss

Round 1 Standard Setting Judgments

Collect Materials; End of Day 1

AGENDA

Praxis Elementary Education: Multiple Subjects (5002 & 5003) Standard-Setting Study

Day 2

Overview of Day 2

Round 1 Standard Setting Judgments (continued)

Discuss Round 1 Judgments and Round 2 Judgments

Lunch

Discuss Round 1 Judgments and Round 2 Judgments (continued)

Feedback on Round 2 Recommended Passing Scores

Complete Final Evaluation

Collect Materials; End of Study

APPENDIX C

JUST QUALIFIED CANDIDATE DESCRIPTION

Description of the Just Qualified Candidate[13]
Reading and Language Arts

A just qualified candidate …

1. Knows key ideas and terminology relevant to the foundations of literacy and reading development (e.g., concepts of print, language acquisition) as it relates to each individual learner (e.g., second-language learners)
2. Understands the complexity and interrelationships of the five essential components of reading – Phonemic awareness, Phonics, Reading fluency, Vocabulary development, and Reading comprehension strategies
3. Understands the complexity of text structures and features, both print and digital, in comprehension development
4. Understands the progression of the developmental stages of writing and characteristics of effective writing
5. Understands the basic components of written language, sentence type, sentence structure and vocabulary
6. Understands the basic types, traits, and structures of writing
7. Understands the stages of writing processes and how to use resource materials in context
8. Understands conventions of grammar, usage, mechanics and spelling when writing, speaking, reading and listening
9. Understands the components of effective collaboration in speaking and listening
10. Knows the elements of a variety of genres (e.g., informational, poetry, drama)
11. Understands the basic concept of author's craft (point of view, perspective, mood)

[13] Description of the just qualified candidate focuses on the knowledge/skills that differentiate a *just* from a *not quite* qualified candidate.

Description of the Just Qualified Candidate[14]
Mathematics

A just qualified candidate …

1. Understands foundations of mathematics, including prenumeration concepts (e.g., patterns), basic number systems (e.g., whole numbers), basic four operations and their properties (e.g., order of operations)
2. Understands common mathematical terminology (e.g., mode, distributive property)
3. Understands basic concepts of number sense and theory
4. Knows strategies (e.g., investigation, estimation, and application of formulas) for mathematical problem solving (e.g., word problems),
5. Applies mathematical concepts to solve problems and explain the reasonableness of their results through a variety of strategies
6. Knows strategies for solving basic algebraic equations
7. Knows algebraic representations (variables, equations, inequalities, x-y graphs)
8. Understands and interprets tables, graphs, and visual displays
9. Knows properties and attributes of 2- and 3-dimensional figures
10. Understands measurement systems and units of measure (e.g., conversions)
11. Understands basic concepts of probability (permutations, chance) and statistics (mean, median, mode, range)
12. Understands basic proportional reasoning (e.g., percents, ratio)

[14] Description of the just qualified candidate focuses on the knowledge/skills that differentiate a *just* from a *not quite* qualified candidate.

APPENDIX D

RESULTS

Table D1

Panel Member Demographics (by Panel)

	Panel 1		Panel 2	
	N	**%**	***N***	**%**
Current position				
Teacher	9	53%	11	61%
Administrator/Department head	1	6%	1	6%
College faculty	5	29%	4	22%
Other	2	12%	2	11%
Race				
White	13	76%	14	78%
Black or African American	3	18%	3	17%
Native Hawaiian or Other Pacific Islander	0	0%	1	6%
Prefer Not to Answer	1	6%	0	0%
Gender				
Female	14	82%	15	83%
Male	3	18%	3	17%
Are you currently certified to teach this subject in your state?				
Yes	15	88%	15	83%
No	2	12%	3	17%
Are you currently teaching this subject in your state?				
Yes	14	82%	16	89%
No	3	18%	2	11%
Are you currently supervising or mentoring other teachers of this subject?				
Yes	12	71%	14	78%
No	5	29%	4	22%
At what K–12 grade level are you currently teaching this subject?				
Elementary (K–5 or K–6)	10	59%	12	67%
Middle school (6–8 or 7–9)	1	6%	0	0%
Elementary and Middle school	1	6%	1	6%
Not currently teaching at the K–12 level	5	29%	5	28%

Table D1 (continued)

Panel Member Demographics (by Panel)

	Panel 1		Panel 2	
	N	**%**	***N***	**%**
Including this year, how many years of experience do you have teaching this subject?				
3 years or less	2	12%	0	0%
4–7 years	4	24%	6	33%
8–11 years	3	18%	5	28%
12–15 years	3	18%	0	0%
16 years or more	5	29%	7	39%
Which best describes the location of your K–12 school?				
Urban	4	24%	1	6%
Suburban	2	12%	5	28%
Rural	6	35%	8	44%
Not currently working at the K–12 level	5	29%	4	22%
If you are college faculty, are you currently involved in the training/preparation of teacher candidates in this subject?				
Yes	5	29%	4	22%
No	0	0%	0	0%
Not college faculty	12	71%	14	78%

Table D2

Passing Score Summary by Round of Judgments – Reading and Language Arts Subtest

	Panel 1		Panel 2	
Panelist	**Round 1**	**Round 2**	**Round 1**	**Round 2**
1	48.85	48.55	38.95	38.35
2	50.40	50.40	39.70	40.00
3	37.90	38.50	47.75	46.30
4	38.00	38.90	39.65	42.55
5	32.70	34.20	32.85	32.30
6	39.70	39.90	44.45	44.05
7	45.00	44.80	44.10	44.40
8	40.35	40.35	47.25	48.00
9	40.90	41.10	35.70	37.95
10	40.65	41.05	39.70	41.00
11	36.20	36.60	50.35	50.65
12	35.15	35.65	33.05	33.50
13	39.25	40.85	44.15	46.05
14	33.50	33.50	53.50	52.05
15	33.60	39.10	41.70	42.20
16	41.65	41.75	39.70	41.10
17	40.65	40.85	48.50	48.80
18			44.00	44.40
Average	39.67	40.36	42.50	42.98
Lowest	32.70	33.50	32.85	32.30
Highest	50.40	50.40	53.50	52.05
SD	4.99	4.47	5.71	5.39
SEJ	1.21	1.08	1.35	1.27

Table D3

Passing Score Summary by Round of Judgments – Mathematics Subtest

	Panel 1		Panel 2	
Panelist	**Round 1**	**Round 2**	**Round 1**	**Round 2**
1	26.15	26.15	21.35	21.85
2	27.50	27.90	26.20	26.20
3	23.80	24.50	29.00	28.40
4	21.80	22.50	28.15	28.35
5	20.80	22.20	15.25	15.10
6	25.45	25.25	18.85	18.85
7	24.90	24.90	27.00	27.75
8	28.25	27.45	26.80	27.45
9	25.90	26.50	21.80	22.00
10	25.45	25.85	25.70	26.55
11	24.70	25.80	27.80	28.65
12	18.60	18.95	18.35	19.05
13	24.70	26.00	27.40	28.70
14	26.50	26.50	31.85	32.35
15	22.70	23.60	25.35	24.55
16	26.55	26.75	24.55	25.65
17	25.55	25.85	27.75	28.05
18			25.00	25.00
Average	24.66	25.10	24.90	25.25
Lowest	18.60	18.95	15.25	15.10
Highest	28.25	27.90	31.85	32.35
SD	2.48	2.22	4.23	4.34
SEJ	0.60	0.54	1.00	1.02

Table D4

Final Evaluation: Panel 1

	Strongly agree		Agree		Disagree		Strongly disagree	
	N	**%**	***N***	**%**	***N***	**%**	***N***	**%**
• I understood the purpose of this study.	15	88%	2	12%	0	0%	0	0%
• The instructions and explanations provided by the facilitator were clear.	15	88%	2	12%	0	0%	0	0%
• The training in the standard-setting method was adequate to give me the information I needed to complete my assignment.	13	76%	4	24%	0	0%	0	0%
• The explanation of how the recommended passing score is computed was clear.	12	71%	5	29%	0	0%	0	0%
• The opportunity for feedback and discussion between rounds was helpful.	14	82%	3	18%	0	0%	0	0%
• The process of making the standard-setting judgments was easy to follow.	11	65%	6	35%	0	0%	0	0%

Table D4 (continued)

Final Evaluation: Panel 1

How influential was each of the following factors in guiding your standard-setting judgments?	Very influential		Somewhat influential		Not influential	
	N	%	*N*	%	*N*	%
• The description of the just qualified candidate	16	94%	1	6%	0	0%
• The between-round discussions	10	59%	7	41%	0	0%
• The knowledge/skills required to answer each test item	12	71%	5	29%	0	0%
• The passing scores of other panel members	1	6%	10	59%	6	35%
• My own professional experience	13	76%	4	24%	0	0%

	Very comfortable		Somewhat comfortable		Somewhat uncomfortable		Very uncomfortable	
	N	%	*N*	%	*N*	%	*N*	%
Overall, how comfortable are you with the panel's recommended passing score?								
Reading and Language Arts	14	82%	3	18%	0	0%	0	0%
Mathematics	13	76%	4	24%	0	0%	0	0%

	Too low		About right		Too high	
	N	%	*N*	%	*N*	%
Overall, the recommended passing score is:						
Reading and Language Arts	0	0%	17	100%	0	0%
Mathematics	1	6%	16	94%	0	0%

Table D5

Final Evaluation: Panel 2

	Strongly agree		Agree		Disagree		Strongly disagree	
	N	**%**	***N***	**%**	***N***	**%**	***N***	**%**
• I understood the purpose of this study.	15	83%	3	17%	0	0%	0	0%
• The instructions and explanations provided by the facilitator were clear.	16	89%	2	11%	0	0%	0	0%
• The training in the standard-setting method was adequate to give me the information I needed to complete my assignment.	14	78%	4	22%	0	0%	0	0%
• The explanation of how the recommended passing score is computed was clear.	13	72%	5	28%	0	0%	0	0%
• The opportunity for feedback and discussion between rounds was helpful.	17	94%	1	6%	0	0%	0	0%
• The process of making the standard-setting judgments was easy to follow.	13	72%	5	28%	0	0%	0	0%

Table D5 (continued)

Final Evaluation: Panel 2

How influential was each of the following factors in guiding your standard-setting judgments?	Very influential		Somewhat influential		Not influential	
	N	%	*N*	%	*N*	%
• The description of the just qualified candidate	17	94%	1	6%	0	0%
• The between-round discussions	12	67%	6	33%	0	0%
• The knowledge/skills required to answer each test item	12	67%	6	33%	0	0%
• The passing scores of other panel members	1	6%	12	67%	5	28%
• My own professional experience	13	72%	4	22%	1	6%

	Very comfortable		Somewhat comfortable		Somewhat uncomfortable		Very uncomfortable	
	N	%	*N*	%	*N*	%	*N*	%
Overall, how comfortable are you with the panel's recommended passing score?								
Reading and Language Arts	12	67%	5	28%	0	0%	1	6%
Mathematics	12	67%	5	28%	0	0%	1	6%

	Too low		About right		Too high	
	N	%	*N*	%	*N*	%
Overall, the recommended passing score is:						
Reading and Language Arts	1	6%	17	94%	0	0%
Mathematics	0	0%	17	94%	1	6%

Appendix B

Test at a Glance
Praxis II Elementary Education: Reading and Language Arts Subtest (5002) and Mathematics Subtest (5003)

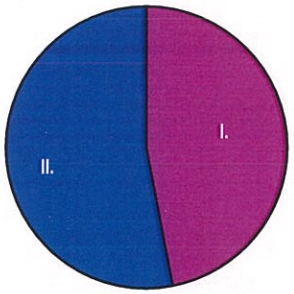
The PRAXIS Series

Listening. Learning. Leading.

Elementary Education: Reading and Language Arts Subtest (5002)

Test at a Glance

Test Name	**Elementary Education: Reading and Language Arts Subtest**
Test Code	**5002**
Time	**90 minutes**
Number of Questions	**80**
Format	**Selected-response questions**
Test Delivery	**Computer delivered**



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Reading	38	47%
II. Writing, Speaking, and Listening	42	53%

About This Test

The Elementary Education: Reading and Language Arts Subtest is designed for prospective teachers of children in primary through upper elementary school grades. The 80 selected-response questions focus on the broad knowledge of language arts and related competencies necessary to be licensed as a beginning teacher at the elementary school level. The specifications were designed to align with the Common Core State Standards for English Language Arts and to reflect the findings of the National Reading Panel.

This test may contain some questions that will not count toward your score.

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Topics Covered

Representative descriptions of topics covered in each category are provided below.

I. READING

A. Foundational Skills

1. Understands the role of phonological awareness in literacy development
   a. Explains the importance of phonological awareness as a foundational skill for literacy development
   b. Identifies and provides examples of phonemes, syllables, onsets, and rimes
   c. Identifies and provides examples of blending, segmenting, substituting, and deleting phonemes, syllables, onsets, rimes

2. Understands the role of phonics and word analysis in literacy development
   a. Explains the importance of phonics and word analysis in literacy development
   b. Distinguishes among common letter-sound correspondences and spelling conventions
   c. Distinguishes high-frequency sight words from decodable words appropriate for particular grades
   d. Identifies roots and affixes to decode unfamiliar words
   e. Recognizes various stages of language acquisition (e.g., WIDA taxonomy)
   f. Delineates common phonics and word-recognition approaches for ELLs (pedagogy)
   g. Differentiates syllabication patterns (e.g., open, closed, CVe)

3. Understands the role of fluency in literacy development
   a. Defines fluency and related terms (e.g., accuracy, rate, prosody)
   b. Explains the impact of fluency on comprehension

B. Literature and Informational Text

1. Understands how to use key ideas and details to comprehend literature and informational text
   a. Identifies the key details, moral, and/or theme of a literary text, citing specific textual evidence
   b. Identifies the key details and/or central idea of an informational text, citing specific textual evidence
   c. Makes inferences from a text and supports them with appropriate evidence
   d. Summarizes information from a text
   e. Analyzes the characters, setting, and plot of a literary text
   f. Analyzes the relationships among individuals, events, ideas, and concepts in an informational text

2. Understands how features and structures of text across genres affect comprehension
   a. Identifies structural elements of literature across genres (e.g., casts of characters and stage directions in drama, rhyme and meter in poetry)
   b. Uses text features (e.g., headings, sidebars, hyperlinks) to locate information in a print or digital informational text
   c. Identifies organizational structures of informational text (e.g., cause/effect, problem/solution)
   d. Identifies how structural elements contribute to the development of a literary text as a whole

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3. Understands the concept of point of view using evidence from the text
   a. Identifies author's point of view in various genres and supports conclusions with evidence from the text
   b. Compares multiple accounts of the same event or topic to identify similarities or differences in point of view
   c. Identifies how point of view impacts the overall structure of a literary or informational text

4. Understands how to integrate and compare written, visual, and oral information from texts and multimedia sources
   a. Explains how visual and oral elements enhance the meaning and effect of a literary text (e.g., picture book, graphic novel, multimedia presentation of a folktale)
   b. Compares the written version of a literary text with an oral, staged, or filmed version
   c. Compares two or more literary texts that address the same theme
   d. Compares two or more informational texts that address the same topic
   e. Interprets visual and multimedia elements in literary and informational texts
   f. Evaluates key claims in a text and supports them with reasons and evidence from the text

5. Knows the role of text complexity in reading development
   a. Explains the three factors (i.e., quantitative, qualitative, and reader and task) that measure text complexity
   b. Identifies features of text-leveling systems

II. WRITING, SPEAKING, AND LISTENING

A. Writing

1. Understands the characteristics of common types of writing
   a. Distinguishes among common types of writing (e.g., opinion/argument, informative/explanatory, narrative)
   b. Identifies the purpose, key components, and subgenres (e.g., speeches, advertisements, narrative poems) of each common type of writing
   c. Evaluates the effectiveness of writing samples of each type

2. Understands the characteristics of effective writing
   a. Evaluates the appropriateness of a particular piece of writing for a specific task, purpose, and audience
   b. Evaluates the development, organization, or style of a piece of writing
   c. Identifies appropriate revisions to strengthen a piece of writing
   d. Writes clearly and coherently
   e. Identifies the interrelationships among planning, revising, and editing in the process of writing

3. Knows the developmental stages of writing (e.g., picture, scribble)
   a. Identifies the grade-appropriate continuum of student writing

4. Knows the importance of digital tools for producing and publishing writing and for interacting with others
   a. Identifies the characteristics and purposes of a variety of digital tools for producing and publishing writing
   b. Identifies the purposes of a variety of digital tools for interacting with others

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5. Knows the research process
   a. Identifies the steps in the research process
   b. Distinguishes between primary and secondary sources and their uses
   c. Distinguishes between reliable and unreliable sources
   d. Distinguishes between paraphrasing and plagiarizing
   e. Knows how to locate credible print and digital sources, locate information within the sources, and cite the sources

B. Language

1. Knows the conventions of standard English grammar, usage, mechanics, and spelling when writing, speaking, reading, and listening
   a. Explains the function of different parts of speech
   b. Corrects errors in usage, mechanics, and spelling
   c. Identifies examples of different sentence types (e.g., simple, compound, compound-complex)
   d. Identify how varieties of English (e.g., dialects, registers) used in stories, dramas, or poems support the overall meaning

2. Understands how to determine the meaning of words and phrases
   a. Determines the literal meaning of unknown words and phrases from context, syntax, and/or knowledge of roots and affixes
   b. Identifies types of figurative language
   c. Interprets figurative language
   d. Analyzes the relationship between word choice and tone in a text

3. Understands characteristics of conversational, academic, and domain-specific language
   a. Differentiates among the three tiers of vocabulary
   b. Identifies relevant features of language such as word choice, order, and punctuation

C. Speaking and Listening

1. Knows the characteristics of effective collaboration to promote comprehension
   a. Identifies techniques to communicate for a variety of purposes with diverse partners
   b. Identifies the characteristics of active listening

2. Knows the characteristics of engaging oral presentations
   a. Identifies elements of engaging oral presentations (e.g., volume, articulation, awareness of audience)

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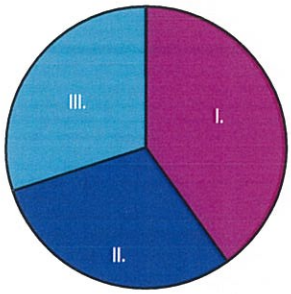
Elementary Education: Mathematics Subtest (5003)

Test at a Glance

Test Name	**Elementary Education: Mathematics Subtest**
Test Code	**5003**
Time	**65 minutes**
Number of Questions	**50**
Format	**Selected-response and numeric entry questions**
Test Delivery	**Computer delivered; on-screen scientific calculator provided**



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Numbers and Operations	20	40%
II. Algebraic Thinking	15	30%
III. Geometry and Measurement, Data, Statistics, and Probability	15	30%

About This Test

The Elementary Education: Mathematics Subtest is designed for prospective teachers of children in primary through upper elementary school grades. The 50 selected-response and numeric entry questions focus on the broad knowledge of mathematics and related competencies necessary to be licensed as a beginning teacher at the elementary school level.

The test is not designed to be aligned with any particular school mathematics curriculum, but it is intended to be consistent with the recommendations of national studies on mathematics education, such as the *Common Core State Standards for Mathematics* (2010), the National Council of Teachers of Mathematics (NCTM) and the National Council for Accreditation of Teacher Education (NCATE) *NCTM NCATE Standards* (2012), and the NCTM *Principles and Standards for School Mathematics* (2000).

The test includes selected-response questions, such as single-selection multiple-choice questions with four choices and multiple-selection multiple-choice questions, and numeric entry questions.

This test may contain some questions that will not count toward your score.

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Topics Covered

Representative descriptions of topics covered in each category are provided below.

I. Numbers and Operations

A. Understands the Place-Value System

1. Writes numbers using base-10 numerals, number names, and expanded form
2. Composes and decomposes multi-digit numbers
3. Given a digit, identifies the place the digit is in and its value in that place
4. Recognizes that a digit in one place represents ten times what it represents in the place to its right and one-tenth what it represents in the place to its left, and extend this recognition to several place to the right or left
5. Uses whole-number exponents to denote powers of 10
6. Rounds multi-digit numbers to any place value

B. Understands Operations and Properties of Rational Numbers

1. Solves multistep mathematical and real-world problems using addition, subtraction, multiplication, and division of rational numbers
   a. Identifies different problem situations for the operations (e.g., adding to, taking from, putting together, taking apart, and comparing for subtraction)
   b. Uses the relationship between addition and subtraction and the relationship between multiplication and division to solve problems (e.g., inverse operations)
   c. Interprets remainders in division problems
2. Understands various strategies and algorithms used to perform operations on rational numbers
3. Recognizes concepts of rational numbers and their operations
   a. Identifies examples where multiplication does not result in a product greater than both factors and division does not result in a quotient smaller than the dividend
   b. Composes and decomposes fractions, including the use of unit fractions.
   c. Recognizes that the value of a unit fraction decreases as the value of the denominator increases
   d. Recognizes that the same whole must be used when comparing fractions
4. Solves problems using the order of operations, including problems involving whole number exponents
5. Identifies properties of operations (e.g., commutative, associative, distributive) and uses them to solve problems
6. Represents rational numbers and their operations in different ways
   a. Uses, interprets, and explains concrete models or drawings of the addition, subtraction, multiplication, and division of rational numbers
   b. Represents rational numbers and sums and differences of rational numbers on a number line
   c. Illustrates and explains multiplication and division problems using equations, rectangular arrays, and area models
7. Compares, classifies, and orders rational numbers
8. Converts between fractions, decimals, and percents

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C. Understands Proportional Relationships and Percents

1. Applies the concepts of ratios and unit rates to describe relationships between two quantities
2. Understands percent as a rate per 100
3. Solves unit-rate problems
4. Uses proportional relationships to solve ratio and percent problems

D. Knows How to Use Basic Concepts of Number Theory

1. Identifies and uses prime and composite numbers
2. Finds factors and multiples of numbers

E. Knows a Variety of Strategies to Determine the Reasonableness of Results

1. Recognizes the reasonableness of results within the context of a given problem
2. Uses mental math, estimation, and rounding strategies to solve problems and determine reasonableness of results

II. Algebraic Thinking

A. Knows How to Evaluate and Manipulate Algebraic Expressions, Equations, and Formulas

1. Differentiates between algebraic expressions and equations
2. Adds and subtracts linear algebraic expressions
3. Uses the distributive property to generate equivalent linear algebraic expressions
4. Evaluates simple algebraic expressions (i.e., one variable, binomial) for given values of variables
5. Uses mathematical terms to identify parts of expressions and describe expressions
6. Translates between verbal statements and algebraic expressions or equations (e.g., the phrase "the number of cookies Joe has is equal to twice the number of cookies Sue has" can be represented by the equation $j = 2s$)
7. Uses formulas to determine unknown quantities
8. Differentiates between dependent and independent variables in formulas

B. Understands the Meanings of the Solutions to Linear Equations and Inequalities

1. Solves multistep one-variable linear equations and inequalities
2. Interprets solutions of multistep one-variable linear equations and inequalities (e.g., graphs the solution on a number line, states constraints on a situation)
3. Uses linear relationships represented by equations, tables, and graphs to solve problems

C. Knows How to Recognize and Represent Patterns (e.g., Number, shape)

1. Identifies, extends, describes, or generates number and shape patterns
2. Makes conjectures, predictions, or generalizations based on patterns
3. Identifies relationships between the corresponding terms of two numerical patterns (e.g., find a rule for a function table)

III. Geometry and Measurement, Data, Statistics, and Probability

A. Understands How to Classify One-, Two-, and Three-Dimensional Figures

1. Uses definitions to identify lines, rays, line segments, parallel lines, and perpendicular lines
2. Classifies angles based on their measure
3. Composes and decomposes two- and three-dimensional shapes
4. Uses attributes to classify or draw polygons and solids

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B. Knows How to Solve Problems Involving Perimeter, Area, Surface Area, and Volume

1. Represents three-dimensional figures with nets
2. Uses nets that are made of rectangles and triangles to determine the surface area of three-dimensional figures
3. Finds the area and perimeter of polygons, including those with fractional side lengths
4. Finds the volume and surface area of right rectangular prisms, including those with fractional edge lengths
5. Determines how changes to dimensions change area and volume

C. Knows the Components of the Coordinate Plane and How to Graph Ordered Pairs on the Plane

1. Identifies the x-axis, the y-axis, the origin, and the four quadrants in the coordinate plane
2. Solves problems by plotting points and drawing polygons in the coordinate plane

D. Knows How to Solve Problems Involving Measurement

1. Solves problems involving elapsed time, money, length, volume, and mass
2. Measures and compares lengths of objects using standard tools
3. Knows relative sizes of United States customary units and metric units
4. Converts units within both the United States customary system and the metric system

E. Is Familiar With Basic Statistical Concepts

1. Identifies statistical questions
2. Solves problems involving measures of center (mean, median, mode) and range
3. Recognizes which measure of center best describes a set of data
4. Determines how changes in data affect measures of center or range
5. Describes a set of data (e.g., overall patterns, outliers)

F. Knows How to Represent and Interpret Data Presented in Various Forms

1. Interprets various displays of data (e.g., box plots, histograms, scatterplots)
2. Identifies, constructs, and completes graphs that correctly represent given data (e.g., circle graphs, bar graphs, line graphs, histograms, scatterplots, double bar graphs, double line graphs, box plots, and line plots/dot plots)
3. Chooses appropriate graphs to display data

G. Is Familiar With How to Interpret the Probability of Events

1. Interprets probabilities relative to likelihood of occurrence

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