

# **The Connecticut Mastery Test: Technical Report**

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# Part 1: Introduction

## 1.1. General Description of CMT

Connecticut General Statutes Section 10-14n mandates a statewide mastery test to be administered annually in March to all public school students enrolled in grades 3-8. In accordance with that mandate, the Connecticut Mastery Test (CMT) was designed to measure student performance in the areas of Mathematics, Reading, Writing, and Science. The assessment focuses on content that students at each grade level can reasonably be expected to have mastered. Although the legislation specifically prohibits the use of test results as the sole criterion for promotion or graduation, the CMT provides information about achievement that is used for many purposes. Some purposes of the CMT are to:

- set high expectations and standards for student achievement;
- test a comprehensive range of academic skills;
- disseminate useful test achievement information about students, schools, and districts;
- identify students in need of intervention;
- assess equitable educational opportunities; and
- continually monitor student progress in grades 3-8 over time.

The CMT has measured growth in achievement for Connecticut students since 1985, when it was first administered. A second generation of the CMT was introduced in 1993 and a third generation in fall 2000. A fourth generation, which is the version currently in use statewide, was introduced in March 2006. New generations of the test offer an opportunity to adjust content, re-establish standards, and reflect changes in philosophy and technology that have occurred since the previous generation was developed.

The CMT is one important measure for determining student achievement in all of Connecticut's public elementary and middle schools. In 1994, the Connecticut Academic Performance Test (CAPT) was instituted for all Connecticut 10<sup>th</sup>-grade students as the logical extension of the CMT in the high school. Together, the CMT and CAPT provide a comprehensive system of monitoring and reporting on the academic progress of Connecticut students.

All Connecticut public school students are required to participate in the CMT except for a small number of students with very limited English proficiency that may be exempted from the test. The CMT results provide the opportunity to publicly account for statewide student achievement on the skills and knowledge that Connecticut considers to be important.

The content of the CMT was selected to represent the most important Mathematics, Reading, Writing, and Science skills for students at each of the grades tested. The test content reflects the standards of Connecticut's Curriculum Frameworks. This document, combined with the CMT, aids educators throughout Connecticut in designing instructional programs across all grades to bring about continued improvement in student achievement.

The interpretation of CMT results does not depend on comparing students against one another in terms of performance. Instead, the best way to understand CMT scores is to compare student performance against the established achievement standards. While scores are reported for each of the five tests on the CMT, achievement standards have been established in the four broad areas of Mathematics, Reading, Writing, and Science. In 2000, three achievement standards were established by the Connecticut Board of Education (CSBE), creating four levels of achievement. In 2002, a fourth standard was added to the previous three by CSBE, creating five levels of performance: Advanced, Goal, Proficient, Basic, and Below Basic. The top two levels (Advanced and Goal) define the Goal Range, which is the same as what has historically been referred to as "at or above goal."

There are other ways in which student results are presented. The sections of the test differ in breadth and complexity for each grade and content area. For this reason, student performance is reported in various ways for

each section, most frequently in relation to content strand mastery standards. This information will be explained in more detail in later sections.

The CMT requires more from students than most traditional tests in the areas of mathematics, reading, writing, and science. While traditional assessments typically measure what students know, the CMT also employs performance tasks to measure what students can do with what they know. For example, instead of just doing mathematical calculations, students are asked to apply calculation skills to solve everyday problems. In writing, students are asked to demonstrate their communication skills by producing an essay on a grade-appropriate topic.

The CMT is intended to support high-quality classroom instruction by providing useful feedback to teachers. By administering the CMT in grades 3-8, school districts can gain a comprehensive picture of student achievement. This information can be used for such purposes as individual student diagnosis and placement, curriculum alignment, instructional programs, and communication with parents about student progress.

The CMT plays an important role in education at the school and district levels. CMT results are reported for each school, each school district, and the state as a whole. They are available to the press and to the public on the website [www.cmtreports.com](http://www.cmtreports.com).

An aligned assessment program reinforces educational priorities established by Connecticut educators. The CMT provides important feedback to schools and school districts as they work to improve the effectiveness of their educational programs. Many initiatives are in place to support the use of CMT results and to guide instruction toward greater effectiveness.

## **1.2. 2013 CMT Test Design**

The content of the 2013 CMT was selected to represent the most important Mathematics, Reading, Writing, and Science skills for students at each of the grades tested. The test content reflects the standards of Connecticut's Curriculum Frameworks. From Connecticut's Curriculum Frameworks, assessment standards were developed for the CMT.

The spring 2013 administration was the eighth operational (OP) administration of CMT4. Each administration comprises the following content areas:

1. **Mathematics**  
Mathematics (MA) consists of a single test administered in two sessions for grades 3 and 4 and three sessions for grades 5 through 8. The tests contain dichotomously scored multiple-choice (MC) items, grid-in (GR) response items, and open-ended (OE) items scored on a 0-1, 0-2, or 0-3 scale.
2. **Reading**  
Reading (RD) consists of two subtests:
  - 2.1. **Degrees of Reading Power**  
Degrees of Reading Power (DRP) has a single session of MC items.
  - 2.2. **Reading Comprehension**  
Reading Comprehension (RC) consists of MC items and OE items scored on a 0-2 scale. RC has two sessions.
3. **Writing**  
Writing (WR) consists of two subtests:
  - 3.1. **Editing & Revising**  
Editing & Revising (ER) has only MC items and one session.
  - 3.2. **Direct Assessment of Writing**  
Direct Assessment of Writing (DAW) has a single prompt test scored on a 2-12 scale.

4. Science

Science (SC), which is administered in grades 5 and 8 only, consists of MC items and OE items scored on 0-2 scale.

The 2013 CMT Operational forms for Mathematics, Reading, and Science are the same forms used in the 2012 CMT Operational (Form U for census and form QU for replacement). For Writing, form U' consists of mostly Editing & Revising (ER) items from 2012 Operational form U and a new DAW prompt (EX) scored on a 2-12 scale..

**Table 1: 2013 CMT Operational Test Design**

| Content     | Subject                      | Grade | Number of Items |    |    |    | Total Items | Score Points |
|-------------|------------------------------|-------|-----------------|----|----|----|-------------|--------------|
|             |                              |       | MC              | GR | OE | ER |             |              |
| Mathematics | Mathematics                  | 3     | 76              |    | 18 |    | 94          | 0 – 106      |
|             |                              | 4     | 80              |    | 16 |    | 96          | 0 – 110      |
|             |                              | 5     | 80              | 13 | 20 |    | 113         | 0 – 132      |
|             |                              | 6     | 71              | 18 | 27 |    | 116         | 0 – 140      |
|             |                              | 7     | 70              | 19 | 31 |    | 120         | 0 – 146      |
|             |                              | 8     | 61              | 20 | 36 |    | 117         | 0 – 146      |
| Reading     | Degree of Reading Power      | 3     | 42              |    |    |    | 42          | 0 – 42       |
|             |                              | 4     | 42              |    |    |    | 42          | 0 – 42       |
|             |                              | 5     | 49              |    |    |    | 49          | 0 – 49       |
|             |                              | 6     | 49              |    |    |    | 49          | 0 – 49       |
|             |                              | 7     | 49              |    |    |    | 49          | 0 – 49       |
|             |                              | 8     | 49              |    |    |    | 49          | 0 – 49       |
|             | Reading Comprehension        | 3     | 22              |    | 9  |    | 31          | 0 – 40       |
|             |                              | 4     | 24              |    | 8  |    | 32          | 0 – 40       |
|             |                              | 5     | 22              |    | 9  |    | 31          | 0 – 40       |
|             |                              | 6     | 22              |    | 9  |    | 31          | 0 – 40       |
|             |                              | 7     | 20              |    | 10 |    | 30          | 0 – 40       |
|             |                              | 8     | 20              |    | 10 |    | 30          | 0 – 40       |
| Writing     | Editing & Revising           | 3     | 32              |    |    |    | 32          | 0 – 32       |
|             |                              | 4     | 32              |    |    |    | 32          | 0 – 32       |
|             |                              | 5     | 36              |    |    |    | 36          | 0 – 36       |
|             |                              | 6     | 36              |    |    |    | 36          | 0 – 36       |
|             |                              | 7     | 40              |    |    |    | 40          | 0 – 40       |
|             |                              | 8     | 40              |    |    |    | 40          | 0 – 40       |
|             | Direct Assessment of Writing | 3     |                 |    |    | 1  | 1           | 2 - 12       |
|             |                              | 4     |                 |    |    | 1  | 1           | 2 - 12       |
|             |                              | 5     |                 |    |    | 1  | 1           | 2 - 12       |
|             |                              | 6     |                 |    |    | 1  | 1           | 2 - 12       |
|             |                              | 7     |                 |    |    | 1  | 1           | 2 - 12       |
|             |                              | 8     |                 |    |    | 1  | 1           | 2 - 12       |
| Science     | Science                      | 5     | 36              |    | 3  |    | 39          | 0 - 42       |
|             |                              | 8     | 45              |    | 3  |    | 48          | 0 - 51       |

## **Part 2: Test Development**

The process by which each form of the CMT is developed is extensive, spanning a two- or three-year period and going through many stages. The development process is led and overseen by staff members in the Bureau of Student Assessment at the Connecticut State Department of Education (CSDE), but it also involves many other people who represent a wide variety of perspectives and areas of expertise. CSDE curriculum specialists and content experts play a critical role and work closely with the assessment staff throughout the process. In addition, a major testing company and other organizations and individuals with experience in educational assessment are involved at appropriate points in the development process.

Advisory committees of Connecticut educators are particularly important throughout the development of the CMT. Advisory committees are composed of Connecticut educators with respected knowledge in particular content areas. A separate advisory committee is established for each part of the CMT: Mathematics, Reading, Writing and Science. Additionally, a Fairness Committee screens all test material to ensure that all groups of examinees are validly assessed. Educators are carefully selected for the advisory committees to be representative of school districts throughout Connecticut.

### **2.1. Content Standards**

The first and most critical stage of test development is the basic conceptual design of the test, determining what the most important content to assess is and how that content can best be assessed given the present resources and constraints. These decisions have important implications for the direction of education in Connecticut and for the manner in which the progress of students, schools, and school districts will be measured for several years. These basic decisions are based on the collective expertise of both assessment specialists and curriculum specialists at CSDE, along with input from the CMT advisory committees. Current educational research in the content areas, current assessment research, and current policies and priorities for education in Connecticut form the bases for these decisions. For example, the content tested on the CMT is directly aligned with the content outlined in *The Connecticut Framework: K-12 Curricular Goals and Standards*.

Once content is determined, other issues must be decided. Test formats (i.e., the types of questions used) must be selected. Also, the methods of scoring the questions and performance tasks must be established. These factors are directly related to the skills and knowledge being assessed. There is, therefore, great variation between and within CMT tests, each uniquely designed to assess specific abilities.

When decisions have been made about test content and test format, they are referred to as “test specifications.” Test specifications serve as the rules for developing the actual test questions. Clear test specifications ensure that test material is not only consistent with the priorities of Connecticut educators, but also that test forms are comparable from year to year. Hundreds of Connecticut citizens and educators responded to surveys that identified the content intended to be included on each test form, validating the appropriateness of the material for students at each grade.

### **2.2 Item Development**

Test items for the CMT4 were carefully developed in accordance with the established test specifications and test blueprint for each grade to reflect content standards in the Connecticut Curriculum Frameworks for mathematics, reading/language arts, and science. After test items were developed according to the test specifications, they underwent extensive review by the testing company, CMT content advisory committees, and the fairness committee before being piloted with Connecticut students in grades 3 through 8. The content advisory committees included content experts, regular and special education teachers, Connecticut State Department of Education curriculum and assessment content specialists, who are knowledgeable about grade appropriate educational content and processes. For the CMT4, the fairness committee was responsible for determining whether items were appropriate and fair to all examinees. Items that did not pass the scrutiny of the either committee were eliminated from the pool of pilot items.

After committee reviews, field test forms were created and piloted on a representative sample, stratified by scale score distribution, of approximately 2000 students per form. During pilot testing, representative samples of students in grades 3 through 8 try out new test questions for the purpose of identifying potential problems with the questions. Questions that are being piloted do not count toward a student's score. The utility of the potential test questions is evaluated based on the results of the pilot testing. Estimated pilot statistics such as the mean, point biserial, and Rasch difficulty, misinterpretation or confusion on the part of the test takers, and performance of various demographic groups are reviewed by CSDE assessment content staff and psychometricians. A judgment is made as to whether each test question enabled students to demonstrate the required skills and knowledge. In addition, for constructed response items that require hand-scoring, the contractor provides qualitative summaries about whether students appeared to have sufficient contextual knowledge to be able to fully respond to the item. Based on these pilot results, flawed items were removed from the item pool, including those showing test item bias or inappropriate levels of difficulty, some were revised for re-piloting, and some became candidates for inclusion on a future form of the CMT.

### **2.3 Forms Construction**

With test specifications as a guide, test forms are carefully constructed, taking into consideration the difficulty of the items and the balance of content. Because a new form of the CMT is developed and administered every few years, it is critical that the forms are “parallel,” that is, as similar as possible in terms of both content coverage and test difficulty. This parallelism allows meaningful comparisons to be made from one test form to another. Any slight differences in difficulty among test forms that remain are accounted for through the equating process.

In Connecticut, we think in terms of “generations” of our testing program to allow predictable points where the testing process can be reevaluated and revised as necessary. A “generation” of a Connecticut test spans about five to seven years. During those years, every effort is made to create test forms, score student work, and interpret results in the same way from year to year. The first generation of CMT began in 1985, the second generation began in 1993, and the third generation began in fall 2000. The current, fourth generation CMT began in March 2006. Each new generation of the CMT involves a process similar to the one described above.

Based on the CMT4 blueprints, all test forms of equivalent difficulty per grade were then simultaneously constructed from the grade level pool of items that met all the review criteria, using eMetric's proprietary software, TestBuilder. Every effort was made to ensure that strand level difficulties were comparable and that the items reflected the range of content within the strands across the generation.

## Part 3: Validity

According to the 1999 AERA, APA, NCME *Standards*, “It is helpful to consider the four phases leading from the original statement of purpose(s) to the final product: (a) delineation of the purpose(s) of the test and the scope of the construct or the extent of the domain to be measured; (b) development and evaluation of the test specifications; (c) development, field testing, evaluation, and selection of the items and scoring guides and procedures; and (d) the assembly and evaluation of the test for operational use.

In the development and maintenance of CMT each of these phases is carefully planned and implemented. The following section details the critical psychometric procedures undertaken to ensure a strong validity argument for the use and interpretation of CMT (Kane, 2006; Messick, 1989).

### 3.1. Content Validity Survey

To examine the validity of the CMT for its intended applications, a number of studies have been conducted. The first focused on establishing content validity of each part of the CMT. In October 1984 (the year before the first administration of the grade 4 CMT), a survey of the objectives proposed for the grade 4 CMT was sent to more than 3,000 Connecticut educators. The purpose of the survey was to determine (1) the importance of the proposed mathematics and reading/writing objectives and (2) whether the objectives were taught prior to the fall administration of grade 4. Similar surveys of objectives proposed for grades 6 and 8 were sent to more than 8,000 Connecticut educators in October 1985.

For the third generation, another survey was developed and distributed in January 2000 for the same purpose. The respondents characterized the objectives as important educational outcomes to which students would be instructed prior to being tested. In addition to the test objective validation process, a two-step validation process was carried out. First, content experts reviewed all objectives and test items, examining the relationship between each item and its associated objective. Second, content experts judged how well each item and objective measured the purported content domain.

With the development of CMT4, CSDE commissioned Assessment and Evaluation Concepts, Inc. (AEC) to undertake a comprehensive survey of the Language Arts and Mathematics items to determine the match between item content and respective content strands, as well as the categorical concurrence between the test items and the broader content standards. In their summary report, AEC concluded that CSDE “has done a solid, quality job in matching the test items included on the CMT4 with the relevant content strands and standards of the Language Arts and Mathematics Curriculum Framework.” Such evidence, provided by an external reviewer, enhances the validity argument that the CMT4 content is relevant and representative of the constructs being measured.

When establishing validity for a newly developed test, it is common to correlate the examinee scores of the new test with the scores of other tests intended to measure similar content. The two tests need not be parallel or interchangeable, nor do they need to be used for the same purpose. Accordingly, the seventh edition of the Metropolitan Achievement Test (MAT7) was correlated with the CMT in 1993. In 2000, the Metropolitan Achievement Test, eighth edition (MAT8) was used during the first administration of the third generation CMT. Data from each of the four sections of the MAT (Total Language, Reading Comprehension, Math Concepts and Math Procedures) were used to compute the correlations among CMT tests and MAT sections. These correlations provided additional evidence to establish concurrent validity of the CMT.

The Direct Assessment of Writing portion of the CMT was additionally analyzed in another way. This was done because the Direct Assessment of Writing is a single, extended-response measure and, therefore, considerably different from the rest of the CMT tests. Validity concerns in this measure include the relation of the writing sample with the other language arts scores. Correlations between the Direct Assessment of Writing test and the other Language Arts tests (i.e., Degrees of Reading Power, Reading Comprehension, and Editing & Revising) were calculated to establish evidence of construct and concurrent validity.

### 3.2. Scoring Quality Assurance Procedures Undertaken during Development

Much of the following discussion applies to procedures undertaken during field testing and test construction phases of development work. Of course quality control is applied during the operational administration, but not with the aim of selecting or removing items.

In order to ensure the validity of inferences made from the CMT tests is to make certain there are quality control procedures in place for the scoring of the test. One such quality assurance component is to check the MC answer keys for MC items several times prior to test administration and one final time during the first run of live results. Items yielding low point-biserial correlations are checked a final time for miskeying.

For constructed-response (CR) items, CMT staff and contractor staff work with Connecticut educators to establish score boundaries in a process known as “range finding”. The score point examples and training sets so established are carried forward into operational scoring and elaborated with new samples of student responses. Reader training lasts up to several days, and readers must qualify by matching scores to several sets of prescored student responses. Once scoring begins, validity packets are used to maintain reader accuracy. These are packets of student responses with scores pre-assigned by CMT staff and Connecticut educators. Readers periodically receive these packets, and their responses are compared to the pre-assigned scores. If a reader assigns too many discrepant scores, that reader is retrained or removed from the project. Other QA procedures include a 100% second read for the writing prompts (DAW). There is a 20% second read for short answer and extended response items in mathematics and reading comprehension.

### 3.3. Item Quality Analysis Undertaken During Development

Another part of assessing the quality and validity of inferences made from an instrument is to assess the quality of the items on the test. This quality is typically assessed by examining the classical item statistics as well as the potential for item bias. Item bias could lead to less valid inferences made for certain subgroups.

*Item specifications.* CMT employs *Standards for Educational and Psychological Testing* (AERA, APA, NCME, 1999) as a primary source of guidance in the construction, field testing, and documentation of the tests. The introduction to the 1999 *Standards* best describes how those *Standards* are and will be used in the development and evaluation of CMT tests:

Evaluating the acceptability of a test or test application does not rest on the literal satisfaction of every standard in this document, and acceptability cannot be determined by using a checklist. (*Standards*, p. 4)

Thus, the terms ‘target’ and ‘goal’ are used when referring to various psychometric properties of the tests. For example, while it is a goal of test development for each high school test to have a reliability coefficient of .90 or greater, it is not our intention to scrap a test with a reliability coefficient of .89. Instead, the test results would be published, along with the reliability coefficient and associated standard error of measurement.

*Item statistics.* Because the CMT tests are used in making individual decisions about students, they must be very reliable, particularly at cut points (the score points that separate adjacent achievement categories). Target reliability coefficients of .90 (or higher) are therefore set for the important cut points of each test.

Other psychometric properties include item difficulty, item discrimination, and differential item functioning. General statistical targets are provided below:

#### *For Multiple-Choice (MC) Items*

Percent correct: greater than or equal to .25

Point biserial correlation with total score: greater than or equal to .20

Mantel-Haenszel: No Category C items (see below)

#### *For Constructed-Response (CR) Items*

Difficulty: any level as long as all score points are well represented

Correlation with total score: greater than or equal to .20

Generalized Mantel-Haenszel: No chi-square significant at .05 level of alpha

It should be pointed out that the point biserial correlations for MC items and the correlations for CR items refer to total scores of the field test form with the influence of the item in question removed.

*Differential item functioning.* The Mantel\_Haenszel statistic computes an odds ratio for each item that compares item performance for a reference group and a focal group (for whom bias may be an issue). Specifically, the M-H statistic is a ratio of the probability of success on an item for the reference group to the probability of success on the same item for the focus group. When the ratio is greater than one, the probability of success on the item favors the reference group over the focus group. Note that M-H and other methods for identifying statistical bias are flagging mechanisms that do not necessarily mean that the performance difference is due to unfairness in the item. Instead, the standard procedure is for the bias committee review the items to make a final judgmental determination as to whether or not the item is actually biased.

Since its introduction in the field of epidemiology in 1959, Mantel-Haenszel statistics have been employed by many test developers, and several refinements have been added. Educational Testing Service (ETS) uses the Mantel-Haenszel statistic and calculates a D statistic which permits grouping of test items into three categories (Zieky, 1993). The D statistic is a function of the case-control odds estimator of risk generated by SAS's PROC FREQ. The D statistic is calculated as follows:

1.  $\alpha$  = case-control estimate of risk (odds ratio)
2.  $\beta$  = natural log of  $\alpha$
3.  $D = -2.35 * \beta$

Camilli and Shepard (1994, p. 121) describe three categories of items with respect to D:

- A D does not significantly differ from zero using Mantel-Haenszel chi-square, or D's absolute value is less than 1
- B D significantly differs from 0 and D has either (a) an absolute value less than 1.5 or (b) an absolute value not significantly different from 1
- C D's absolute value is significantly greater than or equal to 1.5

Camilli and Shepard note that Category B items are typically investigated for potential bias, while Category C items are typically removed. Others treat Category C items only as candidates for elimination, pending a reprieve from the committee. In other words, Category C items are considered unusable unless specifically declared usable by the committee. It should be noted that an item that allowed a target group to break out of a pattern of trailing behind the reference group on all other items would tend to fall into Category C. The committee would likely want to keep such an item, in spite of its Mantel-Haenszel status.

DIF occurs when an item shows different results by group (e.g., by race or sex) that cannot be explained by known differences in the overall achievement levels of the two groups. Overall achievement level is typically taken as score on an operational test, assuming that the operational test is itself free of bias. While committee members are free to examine all field-tested items, they must review all items with a Category C rating. Unless the committee specifically calls for the inclusion of any such item, that item is removed from the pool.

## **Part 4: CMT4 Achievement Standards**

To continue to comply with the *No Child Left Behind* (NCLB) accountability requirements, the Connecticut State Department of Education (CSDE) carried over from the third generation Connecticut Mastery Test (CMT3) to the fourth generation (CMT4) the previously adopted achievement standards: Below Basic, Basic, Proficient, Goal and Advanced. The CMT3 was last administered in fall 2004 to students in Grades 4, 6 and 8 in mathematics, reading and writing. The CMT4 was first administered in Grades 3 through 8 in spring 2006 in the same three content areas.

The purpose of this section is to summarize the procedures used to accomplish the task of carrying over CMT3 standards to CMT4 and to recommend for approval the CMT4 achievement standards for each grade and content area. The recommendations take into consideration the results from a statistical intergenerational equating study, historical results from past CMT3 administrations, and input from our CMT Standards Review Panel composed of a diverse group of Connecticut educators. All procedures were discussed with and approved by our Technical Advisory Committee (TAC) prior to implementation. The TAC is composed of nationally recognized experts in the measurement field.

### **4.1. Standards for CMT3**

In June 2002, the State Board of Education approved revisions to the standards for the CMT3 in Grades 4, 6 and 8. Standards were established based on scale scores (100-400) in three areas: mathematics, reading and writing. In all content areas, the standards define the different academic performance levels, denoted as Below Basic, Basic, Proficient, Goal and Advanced. The state goal has been an important benchmark for judging the quality of education in Connecticut for more than a decade. The proficient standard is used for accountability purposes as required by NCLB to make determinations about Adequate Yearly Progress (AYP) and schools in need of improvement.

### **4.2. Establishment of Standards for CMT4**

When standards were being established for first and second generation CMT, a judgmental standard setting process called Modified Angoff, was employed. Through that process, groups of educators who were familiar with the performance of students at a particular grade level in a particular content area were asked to predict how students who just meet a particular standard (e.g., remedial standard) would perform on many different CMT items. Using the judgment of these groups of educators in consideration with other validity checks, appropriate state goal and remedial standards were recommended by the Department and adopted by the State Board of Education.

The third generation standards were developed through department staff working with a CMT3 Standards Advisory Panel composed of technical experts, district content experts and district research and testing specialists. The CMT3 standards were set to be as rigorous as the CMT2 standards and to be equivalent across grade levels and across content areas as much as possible.

The process of carrying over CMT3 standards to the CMT4 was based on an intergeneration linking study, consideration of historical results from the CMT3, and judgmental input from the CMT Standards Review Panel. The purpose of the linking study was to equate standards from Grades 3, 5 and 7 of CMT4 with Grades 4, 6 and 8 of CMT3 in order to maintain the same performance standards for NCLB purposes. The equating not only adjusted for differences in difficulty between CMT3 and CMT4, but also for differences due to the change in the testing window. The CMT4 standards for Grades 4, 6 and 8 were then derived through interpolation and extrapolation procedures by examining the previously established trends in standards across Grades 3, 5 and 7.

The Standards Review Panel assisted in the identification of acceptable and valid test standards for each content area of CMT4. Committee membership was broadly constituted to be representative of the state and to include a variety of stakeholders. The CMT Standards Review Panel was given an overview of the CMT3 including the content covered, score weighting, and reporting conventions. Differences between CMT3 and CMT4 were also discussed. Copies of the complete CMT4 were available for reference. In addition, the procedures for carrying

CMT3 standards over to CMT4 were presented in detail so that committee members would better understand their role in the process. They reviewed data from several related analyses and discussed implications from both an educational perspective and a technical perspective. They were asked particularly to provide input in the following three areas:

- Review results from the intergenerational linking procedure to ensure that standards are reasonable and appropriate across grades and content areas,
- Provide subjective input about the effect of changing testing from fall to spring and losing instructional time in March through June for CMT4 examinees, so that the CMT3 standards are maintained across the two generations of testing, and
- Provide subjective input about the reasonableness and consistency of the standards for all grades and content areas.

The full standard-setting report contains the projected percentages of students who will score at or above the CMT4 standards along with the comparative data from the 2004 CMT3 administration.

On May 20-22, 2008, the Connecticut State Department of Education (CSDE) conducted standard setting for the Science Test component of the Connecticut Mastery Test (CMT). CSDE staff had invited 25 science educators from around the state to participate in this activity and to recommend cut scores for the tests for grades 5 and 8. Measurement Incorporated (MI), the contractor for CMT, served as facilitator for the session employing the bookmark procedure (Cizek & Bunch, 2007). The details of procedures and results are available in a separate standard-setting report.

Table 2 shows the range of scale scores in each performance category that will be applied in all future CMT4 administrations.

**Table 2: CMT4 Achievement Levels and Scale Score Ranges**

| <b>Content Area</b> | <b>Grade</b> | <b>Below Basic</b> | <b>Basic</b> | <b>Proficient</b> | <b>Goal</b> | <b>Advanced</b> |
|---------------------|--------------|--------------------|--------------|-------------------|-------------|-----------------|
| Mathematics         | 3            | 100 - 186          | 187 - 209    | 210 - 241         | 242 - 287   | 288 - 400       |
|                     | 4            | 100 - 193          | 194 - 214    | 215 - 244         | 245 - 289   | 290 - 400       |
|                     | 5            | 100 - 190          | 191 - 214    | 215 - 244         | 245 - 292   | 293 - 400       |
|                     | 6            | 100 - 189          | 190 - 213    | 214 - 243         | 244 - 284   | 285 - 400       |
|                     | 7            | 100 - 190          | 191 - 215    | 216 - 245         | 246 - 289   | 290 - 400       |
|                     | 8            | 100 - 190          | 191 - 213    | 214 - 244         | 245 - 286   | 287 - 400       |
| Reading             | 3            | 100 - 201          | 202 - 216    | 217 - 234         | 235 - 278   | 279 - 400       |
|                     | 4            | 100 - 212          | 213 - 226    | 227 - 243         | 244 - 294   | 295 - 400       |
|                     | 5            | 100 - 202          | 203 - 214    | 215 - 229         | 230 - 278   | 279 - 400       |
|                     | 6            | 100 - 206          | 207 - 219    | 220 - 235         | 236 - 288   | 289 - 400       |
|                     | 7            | 100 - 193          | 194 - 207    | 208 - 221         | 222 - 272   | 273 - 400       |
|                     | 8            | 100 - 205          | 206 - 218    | 219 - 231         | 232 - 281   | 282 - 400       |
| Writing             | 3            | 100 - 187          | 188 - 211    | 212 - 239         | 240 - 286   | 287 - 400       |
|                     | 4            | 100 - 184          | 185 - 208    | 209 - 236         | 237 - 280   | 281 - 400       |
|                     | 5            | 100 - 185          | 186 - 208    | 209 - 237         | 238 - 283   | 284 - 400       |
|                     | 6            | 100 - 184          | 185 - 210    | 211 - 236         | 237 - 283   | 284 - 400       |
|                     | 7            | 100 - 191          | 192 - 212    | 213 - 235         | 236 - 269   | 270 - 400       |
|                     | 8            | 100 - 188          | 189 - 211    | 212 - 235         | 236 - 282   | 283 - 400       |
| Science             | 5            | 100 - 187          | 188 - 212    | 213 - 247         | 248 - 299   | 300 - 400       |
|                     | 8            | 100 - 201          | 202 - 220    | 221 - 243         | 244 - 298   | 299 - 400       |

## Part 5: Scaling and Equating

### 5.1 Calibration Process

The 2013 CMT test forms were scaled and equated using the Rasch model. The WINSTEPS software, written by Linacre (Mesa Press, 2005) was used to estimate the latent trait difficulty of each item on the test. WINSTEPS is a WINDOWS-based program that is widely used for similar high stakes tests. WINSTEPS (the Rasch model), allows for the estimation of item difficulty for multiple-choice, open-ended, and extended response items on a single scale. Using these item difficulties, the model is able to estimate the ability (theta) of each student corresponding to each student’s raw score.

All scaling and equating analyses were undertaken by three independent groups: Measurement Incorporated (MI), the contractor, the Connecticut State Department of Education (CSDE), and H. Jane Rogers and H. Swaminathan from the University of Connecticut (UCONN). Results were compared and cross-checked to the fourth decimal point to ensure accuracy.

The 2013 CMT Operational forms for Mathematics, Reading, and Science are the same forms used in the 2012 CMT Operational (Forms U and QU). CSDE has decided to use 2012 score tables (raw-to-scale score and raw-to-vertical scale score) for these subject areas. Please refer to the 2012 Technical Report.

For Writing, form U’ consists of mostly Editing & Revising (ER) items from 2012 Operational form U and a new DAW prompt (EX) scored on a 2-12 scale. New raw score to scale score tables for Writing were constructed.

The Writing equating was accomplished using a common item equating design. The purpose of the equating was to place the difficulty estimates of the Form U’ items on the same scale as Form U (CMT 2012 Live). The Writing equating was accomplished in the following steps:

1. For Writing, calibrate the 2013 OP with Form U’ (see Chart 1 for sample calibration data matrix) by fixing Rasch values of ER items with parameters obtained from Form U (see Appendix A). For Grade 6, ER item #6 is a new item and will be calibrated by fixing the remaining ER items. For DAW two points are subtracted from each score so that scores are on a scale from 0 to 10.

**Chart 1: Calibration Design for 2013 CMT Operational Writing**

|                 |         |                                 |          |
|-----------------|---------|---------------------------------|----------|
| Grade 3,4,5,7,8 | Form U’ | U_ER                            | 2013_DAW |
| Grade 6         | Form U’ | U_ER,<br>item #6 new<br>ER item | 2013_DAW |

**Note:**

U\_ER = Form U Editing & Revising  
2013\_DAW = new DAW prompt

2. Create raw to theta table by fixing parameters obtained from step 1 and applying weights in Table 3.

**Table 3: Summary of Weighting for Reading and Writing**

| Content/Subject              | Grade | Unweighted Scale | % of Total Scale | Score Weight | Compute Formula | Weighted Scale |
|------------------------------|-------|------------------|------------------|--------------|-----------------|----------------|
| Editing & Revising           | 3     | 0 – 32           | 40%              | 1.00         |                 | 0 – 32         |
|                              | 4     | 0 – 32           | 40%              | 1.00         |                 | 0 – 32         |
|                              | 5     | 0 – 36           | 40%              | 1.00         |                 | 0 – 36         |
|                              | 6     | 0 – 36           | 40%              | 1.00         |                 | 0 – 36         |
|                              | 7     | 0 – 40           | 40%              | 1.00         |                 | 0 – 40         |
|                              | 8     | 0 – 40           | 40%              | 1.00         |                 | 0 – 40         |
| Direct Assessment of Writing | 3     | 2 – 12           | 60%              | 4.80         | (DAW-2)*4.80    | 0 – 48         |
|                              | 4     | 2 – 12           | 60%              | 4.80         | (DAW-2)*4.80    | 0 – 48         |
|                              | 5     | 2 – 12           | 60%              | 5.40         | (DAW-2)*5.40    | 0 – 54         |
|                              | 6     | 2 – 12           | 60%              | 5.40         | (DAW-2)*5.40    | 0 – 54         |
|                              | 7     | 2 – 12           | 60%              | 6.00         | (DAW-2)*6.00    | 0 – 60         |
|                              | 8     | 2 – 12           | 60%              | 6.00         | (DAW-2)*6.00    | 0 – 60         |
| Total Writing                | 3     | 2 – 44           |                  |              |                 | 0 – 80         |
|                              | 4     | 2 – 44           |                  |              |                 | 0 – 80         |
|                              | 5     | 2 – 48           |                  |              |                 | 0 – 90         |
|                              | 6     | 2 – 48           |                  |              |                 | 0 – 90         |
|                              | 7     | 2 – 52           |                  |              |                 | 0 – 100        |
|                              | 8     | 2 – 52           |                  |              |                 | 0 – 100        |

3. Compute scale score (SS) and scale score standard error (SSE) for each forms

$$SS = \left( \frac{T - T_{mean}}{T_{SD}} \right) * 45 + 250 \text{ and } SSE = \frac{T_{err}}{T_{SD}} * 45$$

where

$T$  and  $T_{err}$  are the ability score and the standard error of the ability from the score file in Step 2.

$T_{mean}$  and  $T_{SD}$  are the scaling coefficients from CMT3 and 2006 CMT (see Table 4).

**Table 4: Scaling Coefficients**

| Content | Grade | T_mean   | T_SD     |
|---------|-------|----------|----------|
| Writing | 3     | 0.97123  | 1.24615  |
|         | 4     | 1.405899 | 1.303604 |
|         | 5     | 1.06359  | 1.23642  |
|         | 6     | 1.200022 | 1.203568 |
|         | 7     | 1.21748  | 1.36516  |
|         | 8     | 1.123911 | 1.2611   |

The minimum SS will be 100 and the maximum SS will be 400. SS less than 100 will be reported as 100 and SS greater than 400 will be reported as 400.

Appendix C contains the results of raw scores, theta, and scale score for Form U' Writing. Please contact CSDE for other subjects, forms and combinations.

## Part 6: Item and Test Statistics

Table 5 and Appendix B present a summary and detailed of item analysis (item quality) data for grades 3-8 Writing Form U'. The following information is presented in each item analysis:

**Classical and IRT difficulties:** Item difficulty is fundamentally a ratio of the proportion of examinees who answered the item correctly. Thus, an easy item has a high p-value and a difficult item has a low p-value. If an item has a very high p-value it may be so easy that it does not provide much information about what most examinees know or can do, while an item with a very low p-value may be so difficult that it is beyond the range of what most students know or can do. Therefore, items with very high or very low p-values may be rejected, unless content relevance overrides that concern.

**Item Discriminations:** The point biserial correlation or item-total correlations measure the strength of the relationship between the particular item score and the total score. Thus, item discrimination reflects how well a particular item differentiates between high and low total test performers. When the correlation is high, examinees that do well on the item also tend to do well on the entire test and correspondingly, examinees that do not do well on the item also tend not to do well on the total test.

**Distractor Frequencies:** The proportion of students who answered each option (A-E and 2-12) are presented for the multiple-choice items and extended response, respectively. The percent of students at each score point is presented for extended response (2-12).

**Table 5: Summary of Item Analysis Writing Form U'**

| Subject                      | Grade | Rasch |      | P-value |      | Point biserial |      |
|------------------------------|-------|-------|------|---------|------|----------------|------|
|                              |       | Mean  | Std  | Mean    | Std  | Mean           | Std  |
| Editing & Revising           | 3     | -0.21 | 0.99 | 0.70    | 0.16 | 0.38           | 0.09 |
|                              | 4     | -0.16 | 0.95 | 0.75    | 0.14 | 0.38           | 0.07 |
|                              | 5     | -0.03 | 0.95 | 0.71    | 0.15 | 0.35           | 0.10 |
|                              | 6     | -0.12 | 0.81 | 0.75    | 0.11 | 0.38           | 0.07 |
|                              | 7     | -0.24 | 1.07 | 0.73    | 0.16 | 0.34           | 0.09 |
|                              | 8     | -0.13 | 0.95 | 0.73    | 0.13 | 0.35           | 0.10 |
| Direct Assessment of Writing | 3     | 0.34  |      | 8.18    |      | 0.56           |      |
|                              | 4     | 0.63  |      | 8.41    |      | 0.51           |      |
|                              | 5     | 0.49  |      | 8.17    |      | 0.51           |      |
|                              | 6     | 0.84  |      | 8.12    |      | 0.55           |      |
|                              | 7     | 0.62  |      | 8.13    |      | 0.59           |      |
|                              | 8     | 0.53  |      | 8.32    |      | 0.59           |      |

### 6.1. Reliability

Reliability is a statistical index of the consistency of test performance over repeated trials. The simplest model for conveying the concept of reliability is to describe the test re-test method. If a test is administered to a group of examinees and then re-administered to the same examinees a short time later, the correlation of the scores across both test administrations estimates the reliability of the test. To measure reliability using a single administration, the test items are split using various techniques into half-length tests and those scores are then correlated. Cronbach's alpha estimates the lower-bound estimate of an infinite combination of split-halves and therefore is regarded as a very conservative method for assessing test reliability.

Table 6 summarizes reliability estimates for 2013 CMT Writing. The reliability coefficients are based on Cronbach's alpha measure of internal consistency. When evaluating these results it is important to remember that reliability is partially a function of test length and thus reliability is likely to be greater for clusters that have more items. Table 7 presents the mean and standard deviation of students' scale scores.

**Table 6: 2013 CMT Writing Cronbach's Alpha**

| Grade | Writing |
|-------|---------|
| 3     | 0.87    |
| 4     | 0.88    |
| 5     | 0.86    |
| 6     | 0.88    |
| 7     | 0.87    |
| 8     | 0.87    |

**Table 7: 2013 CMT Scale Score Summary Statistics**

| Grade | MA     |       | Reading |       | Writing |       | Science |       |
|-------|--------|-------|---------|-------|---------|-------|---------|-------|
|       | Mean   | Std   | Mean    | Std   | Mean    | Std   | Mean    | Std   |
| 3     | 255.63 | 50.43 | 242.49  | 42.48 | 250.03  | 45.28 |         |       |
| 4     | 264.50 | 50.32 | 256.73  | 41.29 | 251.62  | 46.42 |         |       |
| 5     | 269.35 | 52.57 | 247.13  | 40.78 | 254.69  | 40.75 | 260.10  | 50.25 |
| 6     | 263.45 | 46.13 | 260.07  | 41.18 | 258.12  | 49.48 |         |       |
| 7     | 264.15 | 46.01 | 255.47  | 42.98 | 248.87  | 38.90 |         |       |
| 8     | 261.65 | 43.06 | 264.05  | 43.65 | 254.40  | 42.31 | 254.78  | 46.25 |

## 6.2. Classification Consistency and Accuracy

Classification Consistency and Accuracy studies were measured using the IRT-Class program (see Lee, Hanson, and Brennan, 2002), developed by [CASMA](#) (Center for Advanced Studies in Measurement and Assessment) at the University of Iowa. The classification consistency and accuracy can be assessed based on the given ability distribution and the difficulty of the items (IRT parameters). Tables 8-11 contain the results of these analyses.

The results of decision consistency and accuracy computations show that for the most part, decisions are highly consistent (see Table 8). The consistency ratings at each cut score are generally in the upper 90s. The cumulative effect of applying all cut scores simultaneously yields an average consistency of around mid 90s. The classification accuracy estimates show (see Table 9), similarly, that the accuracy ratings at each cut score are generally in the upper 90s.

The program also computes the false negative rates for the test, which in effect are an estimate of those students that may have been misclassified to a performance category lower than their true performance category. The results of the false negatives, found in Table 10, indicate that a very small number of students may have been negatively misclassified in this way. Table 11 shows the false positive classification.

**Table 8: Classification Consistency**

| Content Area | Grade | Overall Classification Consistency | Cut 1   | Cut 2   | Cut 3   | Cut 4   |
|--------------|-------|------------------------------------|---------|---------|---------|---------|
| Writing      | 3     | 0.96438                            | 0.96465 | 0.96463 | 0.96463 | 0.96467 |
|              | 4     | 0.96573                            | 0.96574 | 0.96574 | 0.96574 | 0.96576 |

| Content Area | Grade | Overall Classification Consistency | Cut 1   | Cut 2   | Cut 3   | Cut 4   |
|--------------|-------|------------------------------------|---------|---------|---------|---------|
|              | 5     | 0.96382                            | 0.96430 | 0.96415 | 0.96415 | 0.96416 |
|              | 6     | 0.96253                            | 0.96286 | 0.96281 | 0.96281 | 0.96281 |
|              | 7     | 0.96182                            | 0.96185 | 0.96184 | 0.96184 | 0.96184 |
|              | 8     | 0.96467                            | 0.96472 | 0.96472 | 0.96472 | 0.96473 |

**Table 9: Classification Accuracy**

| Content Area | Grade | Overall Classification Accuracy | Cut 1   | Cut 2   | Cut 3   | Cut 4   |
|--------------|-------|---------------------------------|---------|---------|---------|---------|
| Writing      | 3     | 0.94113                         | 0.96183 | 0.97436 | 0.97464 | 0.97158 |
|              | 4     | 0.94197                         | 0.96466 | 0.97490 | 0.97679 | 0.97029 |
|              | 5     | 0.94095                         | 0.96267 | 0.97331 | 0.97506 | 0.97053 |
|              | 6     | 0.93821                         | 0.95583 | 0.97055 | 0.97185 | 0.97279 |
|              | 7     | 0.94480                         | 0.96398 | 0.97330 | 0.97330 | 0.97065 |
|              | 8     | 0.94715                         | 0.96313 | 0.97424 | 0.97424 | 0.97420 |

**Table 10: False Negative Classification**

| Content | Grade | Overall False Negative | Cut 1   | Cut 2   | Cut 3   | Cut 4   |
|---------|-------|------------------------|---------|---------|---------|---------|
| Writing | 3     | 0.03619                | 0.03609 | 0.01835 | 0.01721 | 0.00585 |
|         | 4     | 0.03317                | 0.03316 | 0.01754 | 0.01360 | 0.00486 |
|         | 5     | 0.03512                | 0.03484 | 0.01970 | 0.01432 | 0.00562 |
|         | 6     | 0.04273                | 0.04251 | 0.02380 | 0.02165 | 0.00818 |
|         | 7     | 0.03291                | 0.03288 | 0.01774 | 0.01774 | 0.00707 |
|         | 8     | 0.03483                | 0.03480 | 0.01926 | 0.01926 | 0.00780 |

**Table 11: False Positive Classification**

| Content | Grade | Overall False Positive | Cut 1   | Cut 2   | Cut 3   | Cut 4   |
|---------|-------|------------------------|---------|---------|---------|---------|
| Writing | 3     | 0.02268                | 0.00208 | 0.00729 | 0.00815 | 0.02257 |
|         | 4     | 0.02487                | 0.00218 | 0.00756 | 0.00961 | 0.02485 |
|         | 5     | 0.02393                | 0.00249 | 0.00699 | 0.01062 | 0.02386 |
|         | 6     | 0.01906                | 0.00166 | 0.00565 | 0.00650 | 0.01903 |
|         | 7     | 0.02229                | 0.00314 | 0.00896 | 0.00896 | 0.02228 |
|         | 8     | 0.01803                | 0.00207 | 0.00650 | 0.00650 | 0.01801 |

## Part 7: Vertical Scale Score Development for CMT4

### 7.1. Overview

Vertical scaling is used to place test scores from assessments that vary in difficulty, but measure similar constructs, on the same scale. For example, students in grades 3-8 who take their state's reading achievement assessments, whereby each grade level has its own test can be provided vertically scaled scores so that a given student's achievement can be compared to students' scores from the same grade as well as across the grades. In addition, a vertical scale allows one to track a student's growth, e.g., in reading from year to year. Vertically scaled scores can also be aggregated, so that one could also track scores at the grade, school, or district level.

This type of scale can also be used to track student growth, relate the content and skills in items across grades, and examine the relationship of performance standards from grade to grade (see hypothetical values in Tables 12 and 13). Such a scale might also afford the state of Connecticut an additional method for reporting student achievement for purposes of No Child Left Behind, or simply as another approach to investigating and interpreting test scores for purposes of tracking growth and development.

The hypothetical numbers in Table 16 illustrate growth in two directions. First within a grade, e.g., grade 3, the raw and scale scores needed to attain Basic, Proficient, and Advanced proceed from 48 to 65 to 80 (raw) and 330 to 500 to 654 (scale). Looking across grades within a level, e.g., at the Proficient level, a grade 3 student must obtain a scale score of 500, while a grade 4 student needs a score of 559, etc., up to grade 8 where a student must score 700. (Raw scores are not relevant when examining growth across grades within a proficiency level.)

Table 13 illustrates, again using hypothetical numbers, the level of growth or the amount of score change needed when moving from grade to grade. As just described, at the Proficiency level, a score change of 59 points would be required. Likewise, a 45-point score change between grades 4 and 5 is needed to maintain a performance level of Proficient.

In summary, a vertical scale can be a useful tool to examine the growth of individual students or aggregates of students (e.g., schools). The scale can provide information regarding students' progress across grades as well as within a grade across proficiency levels.

**Table 12: An Example of Scale Values, Cut Scores, and Performance Levels**

| Grade | Basic |       | Proficient |       | Advanced |       |
|-------|-------|-------|------------|-------|----------|-------|
|       | Raw   | Scale | Raw        | Scale | Raw      | Scale |
| 3     | 48    | 330   | 65         | 500   | 80       | 654   |
| 4     | 42    | 354   | 64         | 559   | 80       | 748   |
| 5     | 39    | 382   | 62         | 604   | 81       | 799   |
| 6     | 44    | 417   | 69         | 641   | 83       | 823   |
| 7     | 43    | 426   | 65         | 673   | 80       | 867   |
| 8     | 47    | 507   | 64         | 700   | 81       | 914   |

**Table 13: An Example of Scale Score Growth Expectations at Proficient**

| Grade Progression | Gain       |
|-------------------|------------|
| 3 to 4            | 59 points  |
| 4 to 5            | 45 points  |
| 5 to 6            | 37 points  |
| 6 to 7            | 32 points  |
| 7 to 8            | 27 points  |
| 3 to 8            | 200 points |

In Spring 2007, the Connecticut State Department of Education (CSDE) decided to investigate the possibility of using vertical scales in its statewide testing program. This part provides information with respect to the vertical scaling analyses undertaken by the state’s contractor, Measurement Incorporated (MI).

## 7.2. Data Collection and Design

Data were collected as part of the regular testing administration in Spring 2007. Test scores from the regular, operational administration (Form P’) were used, as well as scores from shorter, supplemental exams. Items from the operational tests were used to construct all supplemental exams. Tables 14-16 provide the numbers and types of items from the Form P’ operational tests across grades 3-8. The Math tests were comprised of multiple-choice (MC), grid-in (GR), and open-ended (OE) questions. The Reading test is a combination of two separate parts, the Degree of Reading Power (DRP) and the Reading Comprehension (RC) test.

**Table 14: Number and Item Types for Mathematics across Grades**

| Grade | Number of Items |    |    | Total Items |
|-------|-----------------|----|----|-------------|
|       | MC              | GR | OE |             |
| 3     | 76              |    | 18 | 94          |
| 4     | 80              |    | 16 | 96          |
| 5     | 80              | 13 | 20 | 113         |
| 6     | 71              | 18 | 27 | 116         |
| 7     | 70              | 19 | 31 | 120         |
| 8     | 61              | 20 | 36 | 117         |

**Table 15: Number and Item Types for DRP across Grades**

| Grade | Number of MC Items | Total Items |
|-------|--------------------|-------------|
| 3     | 42                 | 42 of 73    |
| 4     | 42                 | 42 of 74    |
| 5     | 49                 | 49 of 80    |
| 6     | 49                 | 49 of 80    |
| 7     | 49                 | 49 of 79    |
| 8     | 49                 | 49 of 79    |

**Table 16: Number and Item Types for RC across Grades**

| Grade | Number of Items |    | Total Items |
|-------|-----------------|----|-------------|
|       | MC              | OE |             |
| 3     | 22              | 9  | 31 of 73    |
| 4     | 24              | 8  | 32 of 74    |
| 5     | 22              | 9  | 31 of 80    |
| 6     | 22              | 9  | 31 of 80    |
| 7     | 20              | 10 | 30 of 79    |
| 8     | 20              | 10 | 30 of 79    |

During the 2007 CMT administration, students in grades 3-8 were given a supplemental exam in addition to the regular, operational assessments. The supplemental exams were constructed so that the students could be tested ‘off grade’, meaning that, for example, grade 5 students were administered a supplemental test that contained either grade 4 or grade 6 operational items. The supplemental tests were shorter than the operational exams (students took only one section within the supplemental content area), but enough supplemental forms were created and administered to include all operational items. So for a given grade-level operational test, all items

were also administered to students in the adjacent grades via the supplemental exams. The design called for the administration of each grade-level item to approximately 1,500 students from each adjacent grade. This common item and student design permits vertical linking of performance across grades (see Table 17). The diagonal (boldface) fields represent the on-level items at a given grade level, while the off-diagonal fields represent the off-grade administration of the operational items to adjacent grades (the upper diagonal are the supplemental exams administered to adjacent lower grades, while the lower are the tests given to the adjacent higher grades).

**Table 17: Common Item and Student Design**

|          |         | Items       |             |             |             |             |             |
|----------|---------|-------------|-------------|-------------|-------------|-------------|-------------|
|          |         | Grade 3     | Grade 4     | Grade 5     | Grade 6     | Grade 7     | Grade 8     |
| Students | Grade 3 | <b>OP33</b> | SU34        |             |             |             |             |
|          | Grade 4 | SU43        | <b>OP44</b> | SU45        |             |             |             |
|          | Grade 5 |             | SU54        | <b>OP55</b> | SU56        |             |             |
|          | Grade 6 |             |             | SU65        | <b>OP66</b> | SU67        |             |
|          | Grade 7 |             |             |             | SU76        | <b>OP77</b> | SU78        |
|          | Grade 8 |             |             |             |             | SU87        | <b>OP88</b> |
|          | Grade 8 |             |             |             |             |             |             |

Notation: OP=Operational test; SU=Supplemental test; Numerals=grade-level students and test level taken, e.g., SU56 refers to fifth-grade students who took the supplemental exam containing grade-six operational items.

### 7.3. Methodology

Only students who were administered Form P' (main form) during the 2007 Spring administration were included in the analyses. Equating analyses for the 2007 operational forms for the six grades and three content areas were performed and cross-validated (see 2007 CMT Technical Report).

Before beginning with the linking, we first examined the classical difficulties (p-values) from the on-grade data and values for the same items from the next higher grade. If an item had a p-value for the on-grade students that was 5%\*maximum score or greater than that obtained from students in the next higher grade, we removed it from subsequent analyses. (Experience has shown that p-values from on-grade students are almost always higher than those obtained from students in the next lower grade, e.g., grade 4 students administered grade 4 test materials will, in general, perform better on every item than 3<sup>rd</sup>-grades taking those same 4<sup>th</sup>-grade items.) Because students in higher grades may have forgotten material learned the previous year, some items are likely to exhibit this 'reverse' pattern of difficulty. The item can work well when measuring on-grade performance, but may not be suitable for modeling a vertically linked continuum of learning. For this reason, we removed such items.

The linking plan follows the scheme represented in Appendix D. As explained below, there are two linking paths to follow, meaning we obtained two sets of item parameters for each grade level. The strength of this design is that we were able to determine how well the two links result in convergent values for the rescaled parameters.

Having obtained the two sets of parameters from following the upper and lower linking paths we then examined the item parameters to determine how similar they were by obtaining a correlation coefficient between the sets of parameters and used Fisher's z-test to determine if the differences were significant. An item that exhibited

very different parameter values was to be removed from further analysis. We then used the mean of the two parameter values for each item to proceed. The following steps detail the analyses.

**Step 1 (see Appendix D).** Based on advice from the Technical Advisory Committee, we set a middle grade as the base scale, namely grade 5. We first did a free run on the OP55 items and obtained item and person parameters.

There are common items linking OP55 and SU45. By anchoring the grade 5 items we obtained ‘new’ (i.e., different from what these grade 4 students would have from having taken OP44) thetas for the SU45 test takers. We then fixed these new theta values. Using the PAFILE command in WINSTEPS, i.e., anchoring students’ thetas, we then obtained item parameter estimates by linking to OP44.

Again starting from OP55, we had theta values for the grade-5 students from their on-grade testing and the initial free run. Linking to SU54 via the common students, we anchor their grade-5 theta values and obtained parameter estimates for the grade-4 items.

At this point we have two sets of parameters for the grade-4 items, each set linked to the grade-5 scale. We compared the two sets using a Pearson correlation and the Fisher Z-test. We expected  $r > 0.90$ . Fisher’s Z is calculated by:

$$Z = .5 \log \left( \frac{1+(r-0.9)}{1-(r-0.9)} \right), \text{ where}$$

$$Z \sim N \left( 0, 1/\sqrt{n-3} \right), \text{ and where } n \text{ is the number of observations.}$$

Our plan was to remove ‘outliers’ until  $Z < 1.96 / \sqrt{n-3}$ , then calculate the average of the remaining item parameters. These estimates were then be used to obtain thetas for the OP44 students.

**Step 2.** At this point we had the OP44 item parameters and thetas, linked to the grade-5 scale, and proceeded as in the first step. There are common OP44 items linked to SU34. By fixing those item values, we obtained thetas for the test takers in SU34. We then anchored their theta values and linked to OP33, obtaining a set of item parameters for the grade-3 items.

Similar to the grades 5 and 4 connection, there are common students between OP44 and SU43. We anchored the theta values in OP44 and linked to SU43, giving us a second set of item parameter estimates for grade 3.

We then went through the same procedure described above to determine if the two linking paths and procedures gave us similar results. Finally, we used the average item parameter estimates to obtain thetas for the grade 3 students.

**Step 3.** The same procedures were used to link the higher grades. Again, we started with the free run of OP55, using those item parameter and theta estimates as the starting point. Common items link OP55 to SU65. Fixing the grade 5 item parameters, we obtained theta estimates for SU65. By fixing these theta values, we linked to OP66 to obtain grade-6 item parameters.

The link from OP55 to SU56 is the common students. We fixed the students’ theta values from their on-grade testing, i.e., OP55, and obtained item parameter estimates for the grade-6 items.

The items were examined to identify problematic ones, which were to be discarded. For the remaining items we calculated the mean of the two parameters and used that to get thetas for the grade-6 students.

**Steps 4 and 5.** The same procedures were used as just delineated for grades 7 and 8. When finished we had items and students on the same Rasch scale using grade 5 as the base.

Using the final item parameter and theta estimates a vertical, developmental scale was created to demonstrate what growth would look like across the grades in Math and Reading. It is emphasized here that the choice of a scale was somewhat arbitrary and was undertaken without consultation with CSDE or the TAC. The scale is for illustrative purpose only.

## 7.4. Results

Table 18 presents the number of items that were removed because of item p-value reversals, i.e., where the p-value for the item taken by the on-grade students was 5%\*maximum score or higher than the p-value for the students at the higher adjacent grade. Noteworthy is that few items were removed, especially at the lower grades 3 and 4. More Math items were removed than Reading items. With respect to Reading, no items were

removed until grade 6, where 10 of 80 had to be discarded for further analysis. Grade 6 also saw the most Math items removed. The TAC and CSDE discussed why so many items from this particular grade level showed reversals and whether the content of the items might play a role. In addition, having removed a larger number of items, especially in Reading, likely affected the subsequent vertical scaling, although to what extent would be very difficult to determine. While removing these ‘misfitting’ items likely results in better vertical scales, further analysis, interpretation, and justification is needed to improve our understanding of how this procedure affects vertical scaling.

**Table 18: Number of Items Removed based on P-value Reversal**

| Grade | # Items Removed |         |
|-------|-----------------|---------|
|       | Mathematics     | Reading |
| 3     |                 |         |
| 4     | 2 / 96          |         |
| 5     | 4 / 113         |         |
| 6     | 8 / 116         | 10 / 80 |
| 7     | 4 / 120         | 3 / 79  |

The WINSTEPS runs were performed in the manner described above in Section 7.2.2. The two linking paths were followed linking grade to grade. The resulting two sets of item parameters were compared using Pearson’s correlation and the Fisher Z-test. No items were removed based on these analyses. The TAC suggested that the method of comparing the parameters may not have been stringent enough. An investigation into what other procedures might be more appropriate would be a worthwhile research project.

The final Rasch item parameters, using grade 5 as the base scale, can be found in Appendix E. Figure 1 is output from SAS that shows the distributions of thetas across grades in Mathematics based on the vertical scaling using the obtained Rasch values. The mean thetas increase across grades, from a mean of 0.3021 for grade 3 to a high of 2.9339 for grade 8. The variability in the distributions is quite similar, with standard deviations between 1.2 and 1.3. The range of the thetas across the six grades is approximately 10 logits, from -3.5 to 6.0.

**Figure 1: Theta Distributions for Mathematics across Grades**

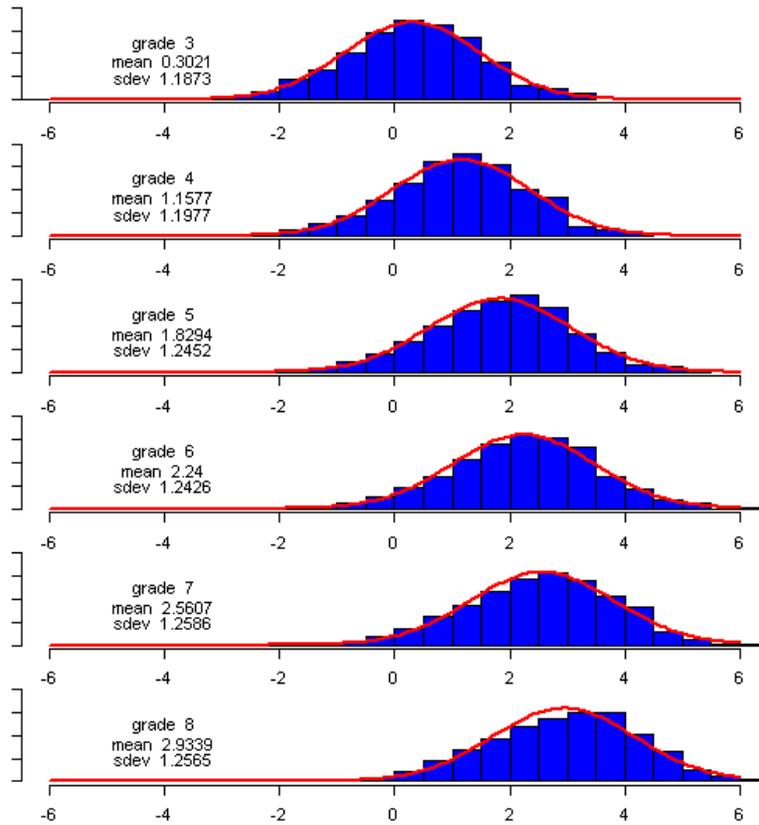
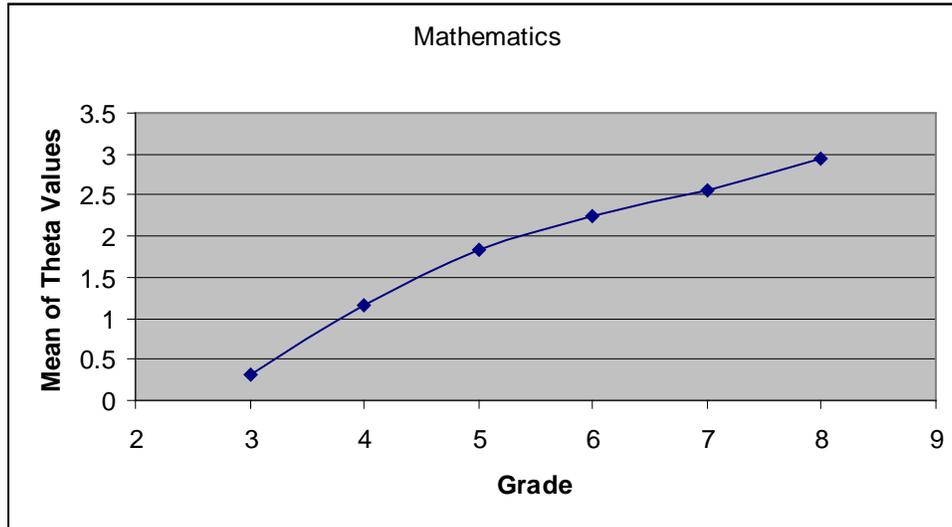


Figure 2 provides a graphic depiction of the increasing mean theta values in Mathematics across grades 3-8. Growth, as depicted here, appears to be steeper at the lower grades and becomes somewhat flatter in the upper grades. In other words, growth appears to slow as the students get older.

**Figure 2: Mean of Theta Values for Mathematics across Grades**



The pattern of thetas for Reading was similar to the pattern for the Mathematics (Figures 3-4). Again, the mean thetas increase across grades, from a mean of -0.0991 for grade 3 to a high of 2.0393 for grade 8 in Reading. The standard deviations were between 1.1 and 1.3 in Reading. Similar to Mathematics, the range of the thetas for Reading across the six grades is approximately 10 logits, from -3.5 to 6.0. Figure 4 show the increasing mean theta values in Reading across grades 3-8 respectively. Once again, growth appears to be steeper at the lower grades and becomes somewhat flatter in the upper grades, i.e., growth looks to slow as the students get older.

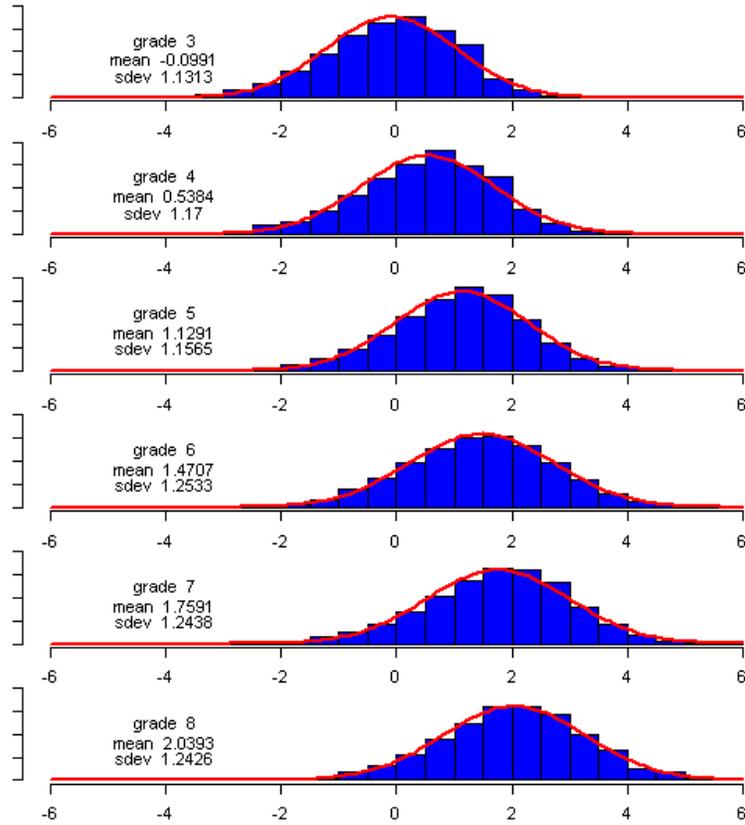
For illustrative purposes we constructed a vertical scale score in order to demonstrate what growth would look like across such a scale, and just as importantly, what the relationship would be across the grades when examining the performance levels. MI did not consult with CSDE or the TAC to generate this scale, although the results appear to be very promising.

At the outset of constructing the scale, we discovered that we could not use the score files given by WINSTEPS because some items were not included (a number of items had been removed due to p-value reversals). So we anchored the thetas and recalibrated all items. Having done that, we then recalibrated the thetas using all items with parameters obtained above.

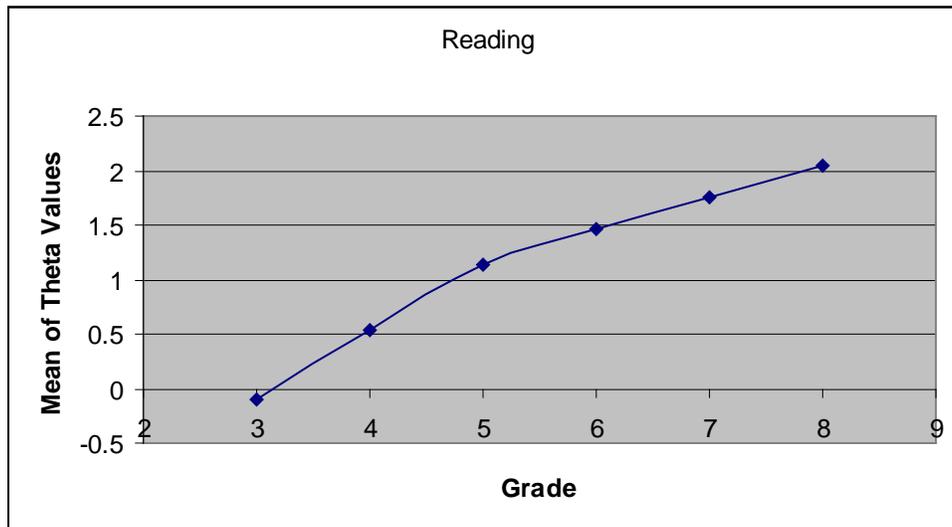
The scale range chosen was 100-800. These somewhat arbitrary values come from simply doubling the present score scale used for all CMT tests (i.e., 100-400). At this point we have a theta for each student in grades 3-8. The student's vertical scale score (VS) is equal to:

$$VS = 100 + 700 * ((\text{theta} - \min(\text{theta})) / (\max(\text{theta}) - \min(\text{theta}))).$$

**Figure 3: Theta Distributions for Reading across Grades**



**Figure 4: Mean of Theta Values for Reading across Grades**



The vertical scores of the above formula have resulted in inconsistent vertical scale scores changes at the lower and upper end of the scale, which may lead to misinterpretation. University of Connecticut (H. Swaminathan and H. Jane Rogers) suggested and have implemented the necessary adjustments.

To obtain the vertically scaled cut scores, we started with the Mathematics and Reading scale score cut points for the different performance levels used operationally in CMT4 (where the scale is 100-400), and then found the corresponding raw cut scores. We then looked at the score file out of the final vertical scaling run in WINSTEPS to obtain the theta value that corresponds to the raw score. Finally, the theta values were inserted into the scale score formula above to obtain a student's VS on the vertical scale of 100-800 (Table 19).

Figures 5-6 depict the relationship between the vertically scaled cut scores across the proficiency levels for Mathematics and Reading respectively. Growth increases across the grades as do the cut scores. From the graphs it is clear that the cut scores for Advanced, especially in Reading, set this group well apart from the others.

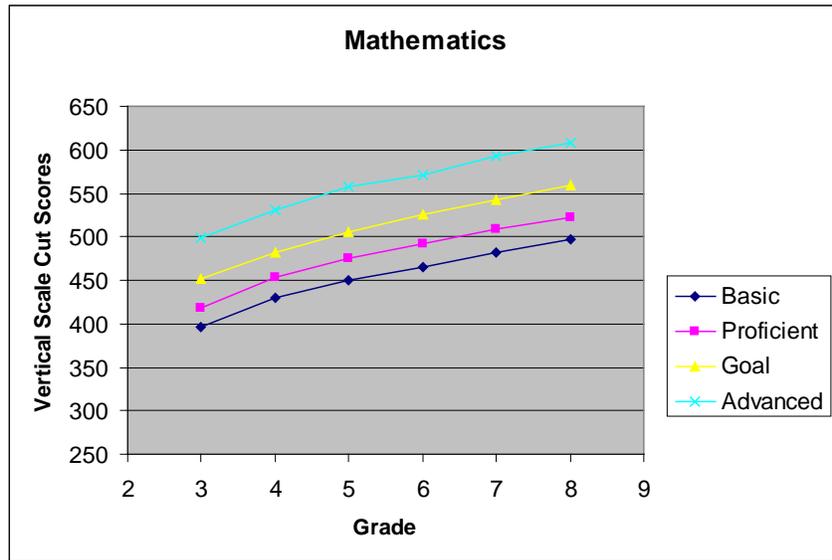
Some degree of caution is advisable when interpreting the extent of growth, the speed of growth, and the extent of differences across grades. A vertical scale is most helpful when looking at such information across years and not simply for a single year, as presented in this report. That said, it appears these initial results indicate that a vertical scale may add another, and important, dimension for Connecticut's educators to interpret test scores.

Based on vertical scaling in CMT 2007, CSDE has decided to use the available results to generate the conversion tables for the whole generation of CMT4. In order to generate conversion tables in subsequent years, conversion tables mapping the conventional scale score to the vertical scale score will be used as lookup tables to determine the appropriate vertical scale score for a given conventional scale score.

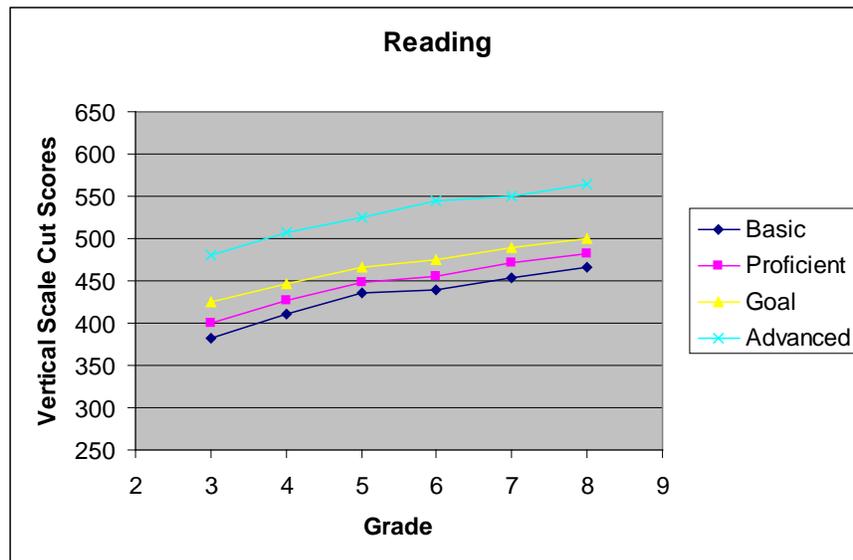
**Table 19: Vertical Scale Cut Scores in Mathematics and Reading at Each Proficiency Level for Grades 3-8 for CMT4**

| Content Area | Grade | Basic | Proficient | Goal | Advanced |
|--------------|-------|-------|------------|------|----------|
| Mathematics  | 3     | 396   | 418        | 452  | 499      |
|              | 4     | 429   | 453        | 483  | 531      |
|              | 5     | 450   | 476        | 506  | 558      |
|              | 6     | 466   | 492        | 526  | 572      |
|              | 7     | 483   | 509        | 543  | 593      |
|              | 8     | 496   | 523        | 559  | 608      |
| Reading      | 3     | 382   | 400        | 425  | 481      |
|              | 4     | 410   | 427        | 447  | 507      |
|              | 5     | 436   | 449        | 467  | 525      |
|              | 6     | 439   | 455        | 475  | 545      |
|              | 7     | 453   | 472        | 489  | 550      |
|              | 8     | 466   | 483        | 500  | 564      |

**Figure 5: Relationship of Mathematics Cut Scores for Each Proficiency Level across Grades**



**Figure 6: Relationship of Reading Cut Scores for Each Proficiency Level across Grades**



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**Appendix A: Rasch Values for Editing and Revising Form U**

| Item | Grade 3 | Grade 4 | Grade 5 | Grade 7 | Grade 8 |
|------|---------|---------|---------|---------|---------|
| 1    | 0.9535  | -0.6074 | -2.8183 | 0.4412  | -1.5912 |
| 2    | -0.5812 | 0.8778  | -0.3811 | -0.3492 | -1.5841 |
| 3    | 0.3589  | -1.5714 | -0.7235 | 0.8599  | 0.8714  |
| 4    | -0.8994 | -0.9371 | -0.5816 | -0.7903 | 0.2831  |
| 5    | -1.2166 | 0.1505  | 1.7346  | -1.0277 | -1.0622 |
| 6    | 1.4114  | -0.8791 | -0.8064 | -2.0569 | 0.9365  |
| 7    | -0.3210 | 0.5188  | 0.9521  | -1.3634 | 0.2149  |
| 8    | -0.6598 | -0.1064 | 1.5456  | -1.9585 | -1.5151 |
| 9    | -1.5140 | -1.0326 | 0.7797  | 0.3607  | -0.8343 |
| 10   | -0.9376 | -0.8555 | 0.6801  | -0.1074 | -1.7249 |
| 11   | -1.7227 | 1.1900  | -0.8308 | 0.4494  | -1.5561 |
| 12   | -1.5490 | 0.4635  | -1.0697 | -0.7036 | 0.4863  |
| 13   | 2.3402  | -0.2982 | 0.0928  | 0.3073  | 0.2091  |
| 14   | -0.7058 | 0.5792  | 0.1097  | 0.0985  | 0.4675  |
| 15   | -0.9120 | -0.5783 | 0.7225  | -0.0633 | -2.0387 |
| 16   | -0.4376 | -1.9838 | -0.7158 | 0.8599  | 1.5829  |
| 17   | -1.0565 | -1.0482 | -1.1554 | -2.7202 | -0.2230 |
| 18   | -0.0006 | 0.5992  | 1.1428  | -2.1834 | 0.2775  |
| 19   | -0.2315 | -0.5374 | -0.5816 | -1.9158 | -0.4694 |
| 20   | 1.1321  | -0.8743 | 0.1459  | -0.7485 | -0.0642 |
| 21   | 0.1618  | -1.2457 | -0.2676 | 0.7447  | 0.6053  |
| 22   | -0.4622 | -0.3577 | 0.6901  | -0.2240 | 0.5316  |
| 23   | 0.0693  | -0.1935 | -1.3743 | -0.7903 | 1.9715  |
| 24   | 0.0512  | -0.6242 | -0.3910 | 2.8921  | -1.1885 |
| 25   | 0.2001  | -1.2573 | -0.0925 | -0.5029 | -1.0221 |
| 26   | -1.2020 | 1.0187  | 0.0360  | -0.2909 | 0.2264  |
| 27   | 1.4252  | 0.6049  | 0.7001  | -1.0087 | -0.5373 |
| 28   | 1.4810  | 0.9377  | 0.6399  | -0.2240 | -0.5069 |
| 29   | -0.3650 | 0.8285  | 0.9325  | -0.6915 | 0.0979  |
| 30   | -0.4202 | 0.4371  | -0.4347 | 1.1838  | 0.8563  |
| 31   | -1.1826 | -0.6711 | 0.6550  | 0.3073  | 0.9514  |
| 32   | -0.0500 | 2.3593  | 0.4068  | -0.3946 | -0.2908 |
| 33   |         |         | -1.3357 | -0.0167 | 0.1511  |
| 34   |         |         | 1.1869  | 0.5610  | -0.0990 |
| 35   |         |         | -0.0717 | 0.3186  | 0.1364  |

| Item | Grade 3 | Grade 4 | Grade 5 | Grade 7 | Grade 8 |
|------|---------|---------|---------|---------|---------|
| 36   |         |         | -0.4585 | -0.7362 | 0.0979  |
| 37   |         |         |         | -0.0136 | 0.2378  |
| 38   |         |         |         | 0.2561  | 0.8789  |
| 39   |         |         |         | 0.5177  | 0.3056  |
| 40   |         |         |         | 1.1734  | -1.3134 |

| Grade | Form U' Item Position | Form U Item Position | Rasch   |
|-------|-----------------------|----------------------|---------|
| 6     | 1                     | 1                    | 0.1738  |
|       | 2                     | 2                    | -0.0411 |
|       | 3                     | 3                    | -1.5198 |
|       | 4                     | 4                    | 0.8246  |
|       | 5                     | 5                    | 0.0745  |
|       | 7                     | 6                    | -0.2804 |
|       | 8                     | 7                    | 1.7615  |
|       | 9                     | 8                    | -0.2554 |
|       | 10                    | 9                    | 0.2822  |
|       | 11                    | 10                   | -0.7249 |
|       | 12                    | 11                   | -0.8514 |
|       | 13                    | 12                   | -0.7205 |
|       | 14                    | 13                   | -0.2133 |
|       | 15                    | 14                   | -0.7558 |
|       | 16                    | 15                   | 0.4451  |
|       | 17                    | 16                   | -0.7425 |
|       | 18                    | 17                   | 0.4308  |
|       | 19                    | 18                   | 0.3703  |
|       | 20                    | 19                   | 0.7925  |
|       | 21                    | 21                   | -0.7381 |
|       | 22                    | 22                   | -0.1445 |
|       | 23                    | 23                   | -1.5766 |
|       | 24                    | 24                   | 0.3177  |
|       | 25                    | 25                   | 0.5102  |
|       | 26                    | 26                   | 0.5550  |
|       | 27                    | 27                   | -0.0906 |
|       | 28                    | 28                   | 0.6654  |
|       | 29                    | 29                   | 0.3059  |
|       | 30                    | 30                   | -0.4127 |
|       | 31                    | 31                   | 0.5102  |

| <b>Grade</b> | <b>Form U' Item Position</b> | <b>Form U Item Position</b> | <b>Rasch</b> |
|--------------|------------------------------|-----------------------------|--------------|
|              | 32                           | 32                          | -0.3457      |
|              | 33                           | 33                          | -0.3901      |
|              | 34                           | 34                          | 1.0539       |
|              | 35                           | 35                          | -0.4127      |
|              | 36                           | 36                          | -0.7736      |

## Appendix B: Item Analysis

### Editing and Revising Form U' Grade 3 Item Analysis

**Multiple-choice Items**

PC = Proportion Correct

RPB = Point-biserial correlation for keyed answer

A – D = Proportion answering each distractor; answer key is shaded

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 1    | MC   | 0.9535  | 0.50 | 0.29 |
| 2    | MC   | -0.5812 | 0.81 | 0.33 |
| 3    | MC   | 0.3589  | 0.59 | 0.32 |
| 4    | MC   | -0.8994 | 0.80 | 0.38 |
| 5    | MC   | -1.2166 | 0.89 | 0.30 |
| 6    | MC   | 1.4114  | 0.39 | 0.17 |
| 7    | MC   | -0.3210 | 0.73 | 0.47 |
| 8    | MC   | -0.6598 | 0.75 | 0.47 |
| 9    | MC   | -1.5140 | 0.86 | 0.45 |
| 10   | MC   | -0.9376 | 0.83 | 0.41 |
| 11   | MC   | -1.7227 | 0.86 | 0.34 |
| 12   | MC   | -1.5490 | 0.89 | 0.49 |
| 13   | MC   | 2.3402  | 0.28 | 0.26 |
| 14   | MC   | -0.7058 | 0.78 | 0.49 |
| 15   | MC   | -0.9120 | 0.85 | 0.33 |
| 16   | MC   | -0.4376 | 0.75 | 0.44 |
| 17   | MC   | -1.0565 | 0.82 | 0.30 |
| 18   | MC   | -0.0006 | 0.66 | 0.46 |
| 19   | MC   | -0.2315 | 0.76 | 0.34 |
| 20   | MC   | 1.1321  | 0.47 | 0.29 |
| 21   | MC   | 0.1618  | 0.62 | 0.44 |
| 22   | MC   | -0.4622 | 0.76 | 0.41 |
| 23   | MC   | 0.0693  | 0.67 | 0.48 |
| 24   | MC   | 0.0512  | 0.67 | 0.44 |
| 25   | MC   | 0.2001  | 0.64 | 0.34 |
| 26   | MC   | -1.2020 | 0.86 | 0.51 |
| 27   | MC   | 1.4252  | 0.38 | 0.25 |
| 28   | MC   | 1.4810  | 0.42 | 0.34 |
| 29   | MC   | -0.3650 | 0.76 | 0.42 |
| 30   | MC   | -0.4202 | 0.73 | 0.49 |

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 31   | MC   | -1.1826 | 0.83 | 0.42 |
| 32   | MC   | -0.0500 | 0.69 | 0.33 |

**Direct Assessment of Writing Form U' Grade 3 Item Analysis**

**Extended Response**

Mean = Mean EX score

Corr = Item-total correlation

2 – 12 = Percent of students at each score point

| Item | Type | Rasch  | Mean | Corr | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1    | EX   | 0.3357 | 8.18 | 0.56 | 0.01 | 0.01 | 0.03 | 0.02 | 0.11 | 0.11 | 0.31 | 0.17 | 0.15 | 0.07 | 0.03 |

## Editing and Revising Form U' Grade 4 Item Analysis

### Multiple-choice Items

PC = Proportion Correct

RPB = Point-biserial correlation for keyed answer

A – D = Proportion answering each distractor; answer key is shaded

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 1    | MC   | -0.6074 | 0.82 | 0.43 |
| 2    | MC   | 0.8778  | 0.59 | 0.43 |
| 3    | MC   | -1.5714 | 0.92 | 0.31 |
| 4    | MC   | -0.9371 | 0.85 | 0.42 |
| 5    | MC   | 0.1505  | 0.69 | 0.27 |
| 6    | MC   | -0.8791 | 0.86 | 0.39 |
| 7    | MC   | 0.5188  | 0.65 | 0.39 |
| 8    | MC   | -0.1064 | 0.77 | 0.37 |
| 9    | MC   | -1.0326 | 0.87 | 0.50 |
| 10   | MC   | -0.8555 | 0.87 | 0.33 |
| 11   | MC   | 1.1900  | 0.55 | 0.40 |
| 12   | MC   | 0.4635  | 0.68 | 0.45 |
| 13   | MC   | -0.2982 | 0.81 | 0.28 |
| 14   | MC   | 0.5792  | 0.67 | 0.37 |
| 15   | MC   | -0.5783 | 0.82 | 0.43 |
| 16   | MC   | -1.9838 | 0.95 | 0.35 |
| 17   | MC   | -1.0482 | 0.90 | 0.43 |
| 18   | MC   | 0.5992  | 0.60 | 0.46 |
| 19   | MC   | -0.5374 | 0.83 | 0.46 |
| 20   | MC   | -0.8743 | 0.88 | 0.36 |
| 21   | MC   | -1.2457 | 0.88 | 0.40 |
| 22   | MC   | -0.3577 | 0.76 | 0.41 |
| 23   | MC   | -0.1935 | 0.76 | 0.44 |
| 24   | MC   | -0.6242 | 0.82 | 0.36 |
| 25   | MC   | -1.2573 | 0.91 | 0.36 |
| 26   | MC   | 1.0187  | 0.57 | 0.50 |
| 27   | MC   | 0.6049  | 0.65 | 0.43 |
| 28   | MC   | 0.9377  | 0.57 | 0.27 |
| 29   | MC   | 0.8285  | 0.62 | 0.40 |
| 30   | MC   | 0.4371  | 0.71 | 0.32 |
| 31   | MC   | -0.6711 | 0.84 | 0.32 |
| 32   | MC   | 2.3593  | 0.33 | 0.23 |

### Direct Assessment of Writing Form U' Grade 4 Item Analysis

#### Extended Response

Mean = Mean EX score

Corr = Item-total correlation

2 – 12 = Percent of students at each score point

| Item | Type | Rasch  | Mean | Corr | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1    | EX   | 0.6349 | 8.41 | 0.51 | 0.00 | 0.00 | 0.02 | 0.01 | 0.07 | 0.07 | 0.38 | 0.18 | 0.18 | 0.06 | 0.02 |

## Editing and Revising Form U' Grade 5 Item Analysis

### Multiple-choice Items

PC = Proportion Correct

RPB = Point-biserial correlation for keyed answer

A – D = Proportion answering each distractor; answer key is shaded

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 1    | MC   | -2.8183 | 0.96 | 0.29 |
| 2    | MC   | -0.3811 | 0.79 | 0.33 |
| 3    | MC   | -0.7235 | 0.83 | 0.45 |
| 4    | MC   | -0.5816 | 0.84 | 0.26 |
| 5    | MC   | 1.7346  | 0.36 | 0.31 |
| 6    | MC   | -0.8064 | 0.87 | 0.33 |
| 7    | MC   | 0.9521  | 0.52 | 0.41 |
| 8    | MC   | 1.5456  | 0.47 | 0.20 |
| 9    | MC   | 0.7797  | 0.51 | 0.38 |
| 10   | MC   | 0.6801  | 0.58 | 0.29 |
| 11   | MC   | -0.8308 | 0.86 | 0.45 |
| 12   | MC   | -1.0697 | 0.87 | 0.44 |
| 13   | MC   | 0.0928  | 0.70 | 0.34 |
| 14   | MC   | 0.1097  | 0.74 | 0.32 |
| 15   | MC   | 0.7225  | 0.52 | 0.12 |
| 16   | MC   | -0.7158 | 0.83 | 0.47 |
| 17   | MC   | -1.1554 | 0.89 | 0.41 |
| 18   | MC   | 1.1428  | 0.48 | 0.27 |
| 19   | MC   | -0.5816 | 0.82 | 0.18 |
| 20   | MC   | 0.1459  | 0.69 | 0.41 |
| 21   | MC   | -0.2676 | 0.77 | 0.53 |
| 22   | MC   | 0.6901  | 0.62 | 0.29 |
| 23   | MC   | -1.3743 | 0.90 | 0.29 |
| 24   | MC   | -0.3910 | 0.81 | 0.47 |
| 25   | MC   | -0.0925 | 0.77 | 0.46 |
| 26   | MC   | 0.0360  | 0.73 | 0.35 |
| 27   | MC   | 0.7001  | 0.59 | 0.36 |
| 28   | MC   | 0.6399  | 0.62 | 0.38 |
| 29   | MC   | 0.9325  | 0.52 | 0.28 |
| 30   | MC   | -0.4347 | 0.78 | 0.52 |
| 31   | MC   | 0.6550  | 0.59 | 0.33 |
| 32   | MC   | 0.4068  | 0.65 | 0.38 |

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 33   | MC   | -1.3357 | 0.92 | 0.36 |
| 34   | MC   | 1.1869  | 0.52 | 0.15 |
| 35   | MC   | -0.0717 | 0.74 | 0.37 |
| 36   | MC   | -0.4585 | 0.80 | 0.40 |

**Direct Assessment of Writing Form U' Grade 5 Item Analysis**

**Extended Response**

Mean = Mean EX score

Corr = Item-total correlation

2 – 12 = Percent of students at each score point

| Item | Type | Rasch  | Mean | Corr | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1    | EX   | 0.4890 | 8.17 | 0.51 | 0.00 | 0.00 | 0.02 | 0.02 | 0.11 | 0.13 | 0.34 | 0.17 | 0.12 | 0.06 | 0.03 |

## Editing and Revising Form U' Grade 6 Item Analysis

### Multiple-choice Items

PC = Proportion Correct

RPB = Point-biserial correlation for keyed answer

A – D = Proportion answering each distractor; answer key is shaded

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 1    | MC   | 0.1738  | 0.66 | 0.35 |
| 2    | MC   | -0.0411 | 0.76 | 0.28 |
| 3    | MC   | -1.5198 | 0.89 | 0.39 |
| 4    | MC   | 0.8246  | 0.63 | 0.34 |
| 5    | MC   | 0.0745  | 0.72 | 0.26 |
| 6    | MC   | -2.5348 | 0.96 | 0.33 |
| 7    | MC   | -0.2804 | 0.80 | 0.27 |
| 8    | MC   | 1.7615  | 0.49 | 0.43 |
| 9    | MC   | -0.2554 | 0.80 | 0.42 |
| 10   | MC   | 0.2822  | 0.66 | 0.42 |
| 11   | MC   | -0.7249 | 0.85 | 0.37 |
| 12   | MC   | -0.8514 | 0.85 | 0.41 |
| 13   | MC   | -0.7205 | 0.85 | 0.37 |
| 14   | MC   | -0.2133 | 0.78 | 0.43 |
| 15   | MC   | -0.7558 | 0.81 | 0.41 |
| 16   | MC   | 0.4451  | 0.65 | 0.36 |
| 17   | MC   | -0.7425 | 0.85 | 0.46 |
| 18   | MC   | 0.4308  | 0.70 | 0.37 |
| 19   | MC   | 0.3703  | 0.72 | 0.25 |
| 20   | MC   | 0.7925  | 0.59 | 0.39 |
| 21   | MC   | -0.7381 | 0.84 | 0.28 |
| 22   | MC   | -0.1445 | 0.75 | 0.28 |
| 23   | MC   | -1.5766 | 0.94 | 0.35 |
| 24   | MC   | 0.3177  | 0.72 | 0.40 |
| 25   | MC   | 0.5102  | 0.69 | 0.41 |
| 26   | MC   | 0.5550  | 0.63 | 0.40 |
| 27   | MC   | -0.0906 | 0.78 | 0.54 |
| 28   | MC   | 0.6654  | 0.57 | 0.29 |
| 29   | MC   | 0.3059  | 0.68 | 0.42 |
| 30   | MC   | -0.4127 | 0.83 | 0.52 |
| 31   | MC   | 0.5102  | 0.70 | 0.46 |
| 32   | MC   | -0.3457 | 0.78 | 0.41 |

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 33   | MC   | -0.3901 | 0.81 | 0.41 |
| 34   | MC   | 1.0539  | 0.60 | 0.49 |
| 35   | MC   | -0.4127 | 0.82 | 0.43 |
| 36   | MC   | -0.7736 | 0.83 | 0.40 |

**Direct Assessment of Writing Form U' Grade 6 Item Analysis**

**Extended Response**

Mean = Mean EX score

Corr = Item-total correlation

2 – 12 = Percent of students at each score point

| Item | Type | Rasch  | Mean | Corr | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1    | EX   | 0.8427 | 8.12 | 0.55 | 0.00 | 0.00 | 0.02 | 0.02 | 0.10 | 0.12 | 0.39 | 0.18 | 0.12 | 0.04 | 0.01 |

## Editing and Revising Form U' Grade 7 Item Analysis

### Multiple-choice Items

PC = Proportion Correct

RPB = Point-biserial correlation for keyed answer

A – D = Proportion answering each distractor; answer key is shaded

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 1    | MC   | 0.4412  | 0.66 | 0.24 |
| 2    | MC   | -0.3492 | 0.76 | 0.37 |
| 3    | MC   | 0.8599  | 0.56 | 0.40 |
| 4    | MC   | -0.7903 | 0.76 | 0.33 |
| 5    | MC   | -1.0277 | 0.87 | 0.26 |
| 6    | MC   | -2.0569 | 0.95 | 0.35 |
| 7    | MC   | -1.3634 | 0.90 | 0.34 |
| 8    | MC   | -1.9585 | 0.93 | 0.39 |
| 9    | MC   | 0.3607  | 0.66 | 0.27 |
| 10   | MC   | -0.1074 | 0.74 | 0.38 |
| 11   | MC   | 0.4494  | 0.62 | 0.27 |
| 12   | MC   | -0.7036 | 0.85 | 0.34 |
| 13   | MC   | 0.3073  | 0.65 | 0.35 |
| 14   | MC   | 0.0985  | 0.72 | 0.24 |
| 15   | MC   | -0.0633 | 0.73 | 0.41 |
| 16   | MC   | 0.8599  | 0.53 | 0.32 |
| 17   | MC   | -2.7202 | 0.97 | 0.24 |
| 18   | MC   | -2.1834 | 0.95 | 0.31 |
| 19   | MC   | -1.9158 | 0.94 | 0.36 |
| 20   | MC   | -0.7485 | 0.86 | 0.34 |
| 21   | MC   | 0.7447  | 0.58 | 0.46 |
| 22   | MC   | -0.2240 | 0.79 | 0.43 |
| 23   | MC   | -0.7903 | 0.83 | 0.49 |
| 24   | MC   | 2.8921  | 0.19 | 0.21 |
| 25   | MC   | -0.5029 | 0.80 | 0.44 |
| 26   | MC   | -0.2909 | 0.79 | 0.43 |
| 27   | MC   | -1.0087 | 0.87 | 0.39 |
| 28   | MC   | -0.2240 | 0.81 | 0.35 |
| 29   | MC   | -0.6915 | 0.78 | 0.31 |
| 30   | MC   | 1.1838  | 0.49 | 0.11 |
| 31   | MC   | 0.3073  | 0.64 | 0.20 |
| 32   | MC   | -0.3946 | 0.80 | 0.46 |

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 33   | MC   | -0.0167 | 0.69 | 0.45 |
| 34   | MC   | 0.5610  | 0.59 | 0.44 |
| 35   | MC   | 0.3186  | 0.63 | 0.27 |
| 36   | MC   | -0.7362 | 0.83 | 0.46 |
| 37   | MC   | -0.0136 | 0.78 | 0.36 |
| 38   | MC   | 0.2561  | 0.70 | 0.47 |
| 39   | MC   | 0.5177  | 0.61 | 0.32 |
| 40   | MC   | 1.1734  | 0.49 | 0.20 |

**Extended Response**

Mean = Mean EX score

Corr = Item-total correlation

2 – 12 = Percent of students at each score point

**Direct Assessment of Writing Form U' Grade 7 Item Analysis**

| Item | Type | Rasch  | Mean | Corr | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1    | EX   | 0.6180 | 8.13 | 0.59 | 0.01 | 0.00 | 0.02 | 0.02 | 0.12 | 0.10 | 0.35 | 0.18 | 0.15 | 0.04 | 0.01 |

### Editing and Revising Form U' Grade 8 Item Analysis

**Multiple-choice Items**

PC = Proportion Correct

RPB = Point-biserial correlation for keyed answer

A – D = Proportion answering each distractor; answer key is shaded

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 1    | MC   | -1.5912 | 0.91 | 0.37 |
| 2    | MC   | -1.5841 | 0.92 | 0.40 |
| 3    | MC   | 0.8714  | 0.62 | 0.28 |
| 4    | MC   | 0.2831  | 0.68 | 0.51 |
| 5    | MC   | -1.0622 | 0.89 | 0.40 |
| 6    | MC   | 0.9365  | 0.52 | 0.27 |
| 7    | MC   | 0.2149  | 0.73 | 0.29 |
| 8    | MC   | -1.5151 | 0.90 | 0.35 |
| 9    | MC   | -0.8343 | 0.83 | 0.21 |
| 10   | MC   | -1.7249 | 0.92 | 0.40 |
| 11   | MC   | -1.5561 | 0.92 | 0.14 |
| 12   | MC   | 0.4863  | 0.69 | 0.49 |
| 13   | MC   | 0.2091  | 0.67 | 0.30 |
| 14   | MC   | 0.4675  | 0.65 | 0.37 |
| 15   | MC   | -2.0387 | 0.93 | 0.27 |
| 16   | MC   | 1.5829  | 0.46 | 0.27 |
| 17   | MC   | -0.2230 | 0.70 | 0.19 |
| 18   | MC   | 0.2775  | 0.66 | 0.32 |
| 19   | MC   | -0.4694 | 0.80 | 0.43 |
| 20   | MC   | -0.0642 | 0.74 | 0.14 |
| 21   | MC   | 0.6053  | 0.65 | 0.30 |
| 22   | MC   | 0.5316  | 0.64 | 0.55 |
| 23   | MC   | 1.9715  | 0.39 | 0.36 |
| 24   | MC   | -1.1885 | 0.88 | 0.45 |
| 25   | MC   | -1.0221 | 0.86 | 0.45 |
| 26   | MC   | 0.2264  | 0.68 | 0.28 |
| 27   | MC   | -0.5373 | 0.78 | 0.44 |
| 28   | MC   | -0.5069 | 0.79 | 0.36 |
| 29   | MC   | 0.0979  | 0.72 | 0.51 |
| 30   | MC   | 0.8563  | 0.54 | 0.33 |
| 31   | MC   | 0.9514  | 0.54 | 0.43 |
| 32   | MC   | -0.2908 | 0.76 | 0.51 |

| Item | Type | Rasch   | PC   | RPB  |
|------|------|---------|------|------|
| 33   | MC   | 0.1511  | 0.71 | 0.19 |
| 34   | MC   | -0.0990 | 0.73 | 0.43 |
| 35   | MC   | 0.1364  | 0.69 | 0.36 |
| 36   | MC   | 0.0979  | 0.72 | 0.39 |
| 37   | MC   | 0.2378  | 0.72 | 0.29 |
| 38   | MC   | 0.8789  | 0.58 | 0.20 |
| 39   | MC   | 0.3056  | 0.71 | 0.36 |
| 40   | MC   | -1.3134 | 0.89 | 0.42 |

### Direct Assessment of Writing Form U' Grade 8 Item Analysis

#### Extended Response

Mean = Mean EX score

Corr = Item-total correlation

2 – 12 = Percent of students at each score point

| Item | Type | Rasch  | Mean | Corr | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1    | EX   | 0.5299 | 8.32 | 0.59 | 0.01 | 0.00 | 0.01 | 0.01 | 0.08 | 0.09 | 0.41 | 0.18 | 0.13 | 0.06 | 0.02 |

**Appendix C: Raw Score, Theta, and Scale Score**

**Writing Grade 3 Form U'**

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 0         | -5.4434 | 100         |
| 1         | -4.2707 | 100         |
| 2         | -3.6171 | 100         |
| 3         | -3.2455 | 100         |
| 4         | -2.9866 | 107         |
| 5         | -2.7877 | 114         |
| 6         | -2.6258 | 120         |
| 7         | -2.4886 | 125         |
| 8         | -2.3688 | 129         |
| 9         | -2.2619 | 133         |
| 10        | -2.1649 | 137         |
| 11        | -2.0755 | 140         |
| 12        | -1.9923 | 143         |
| 13        | -1.9139 | 146         |
| 14        | -1.8395 | 149         |
| 15        | -1.7683 | 151         |
| 16        | -1.6997 | 154         |
| 17        | -1.6333 | 156         |
| 18        | -1.5687 | 158         |
| 19        | -1.5054 | 161         |
| 20        | -1.4432 | 163         |
| 21        | -1.3820 | 165         |
| 22        | -1.3214 | 167         |
| 23        | -1.2612 | 169         |
| 24        | -1.2013 | 172         |
| 25        | -1.1415 | 174         |
| 26        | -1.0817 | 176         |
| 27        | -1.0216 | 178         |

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 28        | -0.9613 | 180         |
| 29        | -0.9007 | 182         |
| 30        | -0.8395 | 185         |
| 31        | -0.7778 | 187         |
| 32        | -0.7153 | 189         |
| 33        | -0.6521 | 191         |
| 34        | -0.5880 | 194         |
| 35        | -0.5230 | 196         |
| 36        | -0.4571 | 198         |
| 37        | -0.3900 | 201         |
| 38        | -0.3218 | 203         |
| 39        | -0.2523 | 206         |
| 40        | -0.1816 | 208         |
| 41        | -0.1093 | 211         |
| 42        | -0.0354 | 214         |
| 43        | 0.0400  | 216         |
| 44        | 0.1172  | 219         |
| 45        | 0.1963  | 222         |
| 46        | 0.2774  | 225         |
| 47        | 0.3604  | 228         |
| 48        | 0.4455  | 231         |
| 49        | 0.5327  | 234         |
| 50        | 0.6219  | 237         |
| 51        | 0.7132  | 241         |
| 52        | 0.8063  | 244         |
| 53        | 0.9010  | 247         |
| 54        | 0.9974  | 251         |
| 55        | 1.0950  | 254         |

| Raw Score | Theta  | Scale Score |
|-----------|--------|-------------|
| 56        | 1.1939 | 258         |
| 57        | 1.2938 | 262         |
| 58        | 1.3946 | 265         |
| 59        | 1.4964 | 269         |
| 60        | 1.5993 | 273         |
| 61        | 1.7034 | 276         |
| 62        | 1.8091 | 280         |
| 63        | 1.9166 | 284         |
| 64        | 2.0266 | 288         |
| 65        | 2.1395 | 292         |
| 66        | 2.2561 | 296         |
| 67        | 2.3771 | 301         |
| 68        | 2.5036 | 305         |
| 69        | 2.6367 | 310         |
| 70        | 2.7776 | 315         |
| 71        | 2.9282 | 321         |
| 72        | 3.0907 | 327         |
| 73        | 3.2680 | 333         |
| 74        | 3.4647 | 340         |
| 75        | 3.6880 | 348         |
| 76        | 3.9498 | 358         |
| 77        | 4.2734 | 369         |
| 78        | 4.7112 | 385         |
| 79        | 5.4323 | 400         |
| 80        | 6.6525 | 400         |

**Writing Grade 4 Form U'**

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 0         | -5.3362 | 100         |
| 1         | -4.1650 | 100         |
| 2         | -3.5154 | 100         |
| 3         | -3.1487 | 100         |
| 4         | -2.8948 | 102         |
| 5         | -2.7007 | 108         |
| 6         | -2.5432 | 114         |
| 7         | -2.4100 | 118         |
| 8         | -2.2939 | 122         |
| 9         | -2.1905 | 126         |
| 10        | -2.0966 | 129         |
| 11        | -2.0101 | 132         |
| 12        | -1.9293 | 135         |
| 13        | -1.8533 | 137         |
| 14        | -1.7810 | 140         |
| 15        | -1.7117 | 142         |
| 16        | -1.6449 | 145         |
| 17        | -1.5801 | 147         |
| 18        | -1.5170 | 149         |
| 19        | -1.4551 | 151         |
| 20        | -1.3943 | 153         |
| 21        | -1.3343 | 155         |
| 22        | -1.2748 | 157         |
| 23        | -1.2158 | 159         |
| 24        | -1.1570 | 162         |
| 25        | -1.0984 | 164         |
| 26        | -1.0397 | 166         |
| 27        | -0.9809 | 168         |

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 28        | -0.9218 | 170         |
| 29        | -0.8624 | 172         |
| 30        | -0.8025 | 174         |
| 31        | -0.7420 | 176         |
| 32        | -0.6808 | 178         |
| 33        | -0.6188 | 180         |
| 34        | -0.5559 | 182         |
| 35        | -0.4919 | 184         |
| 36        | -0.4268 | 187         |
| 37        | -0.3603 | 189         |
| 38        | -0.2924 | 191         |
| 39        | -0.2228 | 194         |
| 40        | -0.1515 | 196         |
| 41        | -0.0782 | 199         |
| 42        | -0.0026 | 201         |
| 43        | 0.0753  | 204         |
| 44        | 0.1558  | 207         |
| 45        | 0.2392  | 210         |
| 46        | 0.3254  | 213         |
| 47        | 0.4149  | 216         |
| 48        | 0.5077  | 219         |
| 49        | 0.6038  | 222         |
| 50        | 0.7034  | 226         |
| 51        | 0.8065  | 229         |
| 52        | 0.9129  | 233         |
| 53        | 1.0225  | 237         |
| 54        | 1.1348  | 241         |
| 55        | 1.2499  | 245         |

| Raw Score | Theta  | Scale Score |
|-----------|--------|-------------|
| 56        | 1.3672 | 249         |
| 57        | 1.4865 | 253         |
| 58        | 1.6076 | 257         |
| 59        | 1.7304 | 261         |
| 60        | 1.8549 | 265         |
| 61        | 1.9815 | 270         |
| 62        | 2.1106 | 274         |
| 63        | 2.2430 | 279         |
| 64        | 2.3794 | 284         |
| 65        | 2.5211 | 288         |
| 66        | 2.6693 | 294         |
| 67        | 2.8254 | 299         |
| 68        | 2.9910 | 305         |
| 69        | 3.1671 | 311         |
| 70        | 3.3549 | 317         |
| 71        | 3.5549 | 324         |
| 72        | 3.7677 | 332         |
| 73        | 3.9940 | 339         |
| 74        | 4.2364 | 348         |
| 75        | 4.5005 | 357         |
| 76        | 4.7975 | 367         |
| 77        | 5.1502 | 379         |
| 78        | 5.6110 | 395         |
| 79        | 6.3486 | 400         |
| 80        | 7.5765 | 400         |

**Writing Grade 5 Form U'**

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 0         | -5.4489 | 100         |
| 1         | -4.2604 | 100         |
| 2         | -3.5973 | 100         |
| 3         | -3.2236 | 100         |
| 4         | -2.9658 | 103         |
| 5         | -2.7695 | 110         |
| 6         | -2.6107 | 116         |
| 7         | -2.4768 | 121         |
| 8         | -2.3603 | 125         |
| 9         | -2.2567 | 129         |
| 10        | -2.1629 | 133         |
| 11        | -2.0766 | 136         |
| 12        | -1.9962 | 139         |
| 13        | -1.9206 | 141         |
| 14        | -1.8488 | 144         |
| 15        | -1.7802 | 146         |
| 16        | -1.7141 | 149         |
| 17        | -1.6501 | 151         |
| 18        | -1.5877 | 154         |
| 19        | -1.5268 | 156         |
| 20        | -1.4669 | 158         |
| 21        | -1.4078 | 160         |
| 22        | -1.3493 | 162         |
| 23        | -1.2913 | 164         |
| 24        | -1.2336 | 166         |
| 25        | -1.1760 | 168         |
| 26        | -1.1184 | 171         |
| 27        | -1.0607 | 173         |
| 28        | -1.0029 | 175         |
| 29        | -0.9447 | 177         |
| 30        | -0.8862 | 179         |

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 31        | -0.8273 | 181         |
| 32        | -0.7680 | 183         |
| 33        | -0.7081 | 186         |
| 34        | -0.6477 | 188         |
| 35        | -0.5868 | 190         |
| 36        | -0.5253 | 192         |
| 37        | -0.4632 | 194         |
| 38        | -0.4004 | 197         |
| 39        | -0.3372 | 199         |
| 40        | -0.2732 | 201         |
| 41        | -0.2086 | 204         |
| 42        | -0.1434 | 206         |
| 43        | -0.0775 | 208         |
| 44        | -0.0109 | 211         |
| 45        | 0.0564  | 213         |
| 46        | 0.1246  | 216         |
| 47        | 0.1936  | 218         |
| 48        | 0.2637  | 221         |
| 49        | 0.3347  | 223         |
| 50        | 0.4067  | 226         |
| 51        | 0.4799  | 229         |
| 52        | 0.5544  | 231         |
| 53        | 0.6301  | 234         |
| 54        | 0.7070  | 237         |
| 55        | 0.7854  | 240         |
| 56        | 0.8651  | 243         |
| 57        | 0.9462  | 246         |
| 58        | 1.0285  | 249         |
| 59        | 1.1121  | 252         |
| 60        | 1.1968  | 255         |
| 61        | 1.2824  | 258         |

| Raw Score | Theta  | Scale Score |
|-----------|--------|-------------|
| 62        | 1.3689 | 261         |
| 63        | 1.4561 | 264         |
| 64        | 1.5438 | 267         |
| 65        | 1.6319 | 271         |
| 66        | 1.7204 | 274         |
| 67        | 1.8091 | 277         |
| 68        | 1.8981 | 280         |
| 69        | 1.9874 | 284         |
| 70        | 2.0772 | 287         |
| 71        | 2.1676 | 290         |
| 72        | 2.2588 | 294         |
| 73        | 2.3512 | 297         |
| 74        | 2.4451 | 300         |
| 75        | 2.5409 | 304         |
| 76        | 2.6393 | 307         |
| 77        | 2.7409 | 311         |
| 78        | 2.8464 | 315         |
| 79        | 2.9570 | 319         |
| 80        | 3.0738 | 323         |
| 81        | 3.1984 | 328         |
| 82        | 3.3333 | 333         |
| 83        | 3.4813 | 338         |
| 84        | 3.6472 | 344         |
| 85        | 3.8379 | 351         |
| 86        | 4.0658 | 359         |
| 87        | 4.3535 | 370         |
| 88        | 4.7530 | 384         |
| 89        | 5.4323 | 400         |
| 90        | 6.6200 | 400         |

**Writing Grade 6 Form U'**

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 0         | -5.4195 | 100         |
| 1         | -4.2211 | 100         |
| 2         | -3.5434 | 100         |
| 3         | -3.1583 | 100         |
| 4         | -2.8931 | 100         |
| 5         | -2.6928 | 104         |
| 6         | -2.5328 | 110         |
| 7         | -2.3998 | 115         |
| 8         | -2.2859 | 120         |
| 9         | -2.1860 | 123         |
| 10        | -2.0968 | 127         |
| 11        | -2.0158 | 130         |
| 12        | -1.9413 | 133         |
| 13        | -1.8720 | 135         |
| 14        | -1.8068 | 138         |
| 15        | -1.7449 | 140         |
| 16        | -1.6858 | 142         |
| 17        | -1.6288 | 144         |
| 18        | -1.5736 | 146         |
| 19        | -1.5197 | 148         |
| 20        | -1.4668 | 150         |
| 21        | -1.4147 | 152         |
| 22        | -1.3631 | 154         |
| 23        | -1.3118 | 156         |
| 24        | -1.2606 | 158         |
| 25        | -1.2093 | 160         |
| 26        | -1.1577 | 162         |
| 27        | -1.1057 | 164         |
| 28        | -1.0532 | 166         |
| 29        | -1.0000 | 168         |
| 30        | -0.9461 | 170         |

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 31        | -0.8914 | 172         |
| 32        | -0.8357 | 174         |
| 33        | -0.7791 | 176         |
| 34        | -0.7217 | 178         |
| 35        | -0.6631 | 180         |
| 36        | -0.6037 | 183         |
| 37        | -0.5433 | 185         |
| 38        | -0.4819 | 187         |
| 39        | -0.4197 | 189         |
| 40        | -0.3565 | 192         |
| 41        | -0.2925 | 194         |
| 42        | -0.2274 | 197         |
| 43        | -0.1616 | 199         |
| 44        | -0.0947 | 202         |
| 45        | -0.0269 | 204         |
| 46        | 0.0420  | 207         |
| 47        | 0.1121  | 209         |
| 48        | 0.1834  | 212         |
| 49        | 0.2561  | 215         |
| 50        | 0.3304  | 217         |
| 51        | 0.4063  | 220         |
| 52        | 0.4842  | 223         |
| 53        | 0.5640  | 226         |
| 54        | 0.6461  | 229         |
| 55        | 0.7306  | 232         |
| 56        | 0.8177  | 236         |
| 57        | 0.9077  | 239         |
| 58        | 1.0006  | 243         |
| 59        | 1.0967  | 246         |
| 60        | 1.1960  | 250         |
| 61        | 1.2986  | 254         |

| Raw Score | Theta  | Scale Score |
|-----------|--------|-------------|
| 62        | 1.4045 | 258         |
| 63        | 1.5135 | 262         |
| 64        | 1.6255 | 266         |
| 65        | 1.7402 | 270         |
| 66        | 1.8574 | 275         |
| 67        | 1.9768 | 279         |
| 68        | 2.0982 | 284         |
| 69        | 2.2212 | 288         |
| 70        | 2.3460 | 293         |
| 71        | 2.4728 | 298         |
| 72        | 2.6017 | 302         |
| 73        | 2.7334 | 307         |
| 74        | 2.8684 | 312         |
| 75        | 3.0076 | 318         |
| 76        | 3.1521 | 323         |
| 77        | 3.3029 | 329         |
| 78        | 3.4613 | 335         |
| 79        | 3.6287 | 341         |
| 80        | 3.8065 | 347         |
| 81        | 3.9963 | 355         |
| 82        | 4.2001 | 362         |
| 83        | 4.4205 | 370         |
| 84        | 4.6615 | 379         |
| 85        | 4.9296 | 389         |
| 86        | 5.2366 | 400         |
| 87        | 5.6058 | 400         |
| 88        | 6.0898 | 400         |
| 89        | 6.8583 | 400         |
| 90        | 8.1130 | 400         |

**Writing Grade 7 Form U'**

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 0         | -5.8124 | 100         |
| 1         | -4.5947 | 100         |
| 2         | -3.8879 | 100         |
| 3         | -3.4746 | 100         |
| 4         | -3.1835 | 105         |
| 5         | -2.9601 | 112         |
| 6         | -2.7799 | 118         |
| 7         | -2.6293 | 123         |
| 8         | -2.5002 | 127         |
| 9         | -2.3875 | 131         |
| 10        | -2.2872 | 134         |
| 11        | -2.1968 | 137         |
| 12        | -2.1144 | 140         |
| 13        | -2.0384 | 143         |
| 14        | -1.9678 | 145         |
| 15        | -1.9015 | 147         |
| 16        | -1.8389 | 149         |
| 17        | -1.7793 | 151         |
| 18        | -1.7223 | 153         |
| 19        | -1.6675 | 155         |
| 20        | -1.6144 | 157         |
| 21        | -1.5628 | 158         |
| 22        | -1.5124 | 160         |
| 23        | -1.4630 | 162         |
| 24        | -1.4144 | 163         |
| 25        | -1.3663 | 165         |
| 26        | -1.3186 | 166         |
| 27        | -1.2712 | 168         |
| 28        | -1.2239 | 170         |
| 29        | -1.1766 | 171         |
| 30        | -1.1292 | 173         |
| 31        | -1.0815 | 174         |
| 32        | -1.0335 | 176         |
| 33        | -0.9851 | 177         |

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 34        | -0.9362 | 179         |
| 35        | -0.8867 | 181         |
| 36        | -0.8367 | 182         |
| 37        | -0.7860 | 184         |
| 38        | -0.7347 | 186         |
| 39        | -0.6826 | 187         |
| 40        | -0.6299 | 189         |
| 41        | -0.5765 | 191         |
| 42        | -0.5225 | 193         |
| 43        | -0.4678 | 194         |
| 44        | -0.4124 | 196         |
| 45        | -0.3565 | 198         |
| 46        | -0.2999 | 200         |
| 47        | -0.2428 | 202         |
| 48        | -0.1851 | 204         |
| 49        | -0.1268 | 206         |
| 50        | -0.0678 | 208         |
| 51        | -0.0083 | 210         |
| 52        | 0.0521  | 212         |
| 53        | 0.1130  | 214         |
| 54        | 0.1749  | 216         |
| 55        | 0.2376  | 218         |
| 56        | 0.3013  | 220         |
| 57        | 0.3660  | 222         |
| 58        | 0.4319  | 224         |
| 59        | 0.4991  | 226         |
| 60        | 0.5675  | 229         |
| 61        | 0.6375  | 231         |
| 62        | 0.7089  | 233         |
| 63        | 0.7819  | 236         |
| 64        | 0.8567  | 238         |
| 65        | 0.9331  | 241         |
| 66        | 1.0111  | 243         |
| 67        | 1.0910  | 246         |

| Raw Score | Theta  | Scale Score |
|-----------|--------|-------------|
| 68        | 1.1725 | 249         |
| 69        | 1.2557 | 251         |
| 70        | 1.3405 | 254         |
| 71        | 1.4268 | 257         |
| 72        | 1.5147 | 260         |
| 73        | 1.6040 | 263         |
| 74        | 1.6946 | 266         |
| 75        | 1.7869 | 269         |
| 76        | 1.8807 | 272         |
| 77        | 1.9761 | 275         |
| 78        | 2.0735 | 278         |
| 79        | 2.1731 | 282         |
| 80        | 2.2751 | 285         |
| 81        | 2.3798 | 288         |
| 82        | 2.4878 | 292         |
| 83        | 2.5994 | 296         |
| 84        | 2.7151 | 299         |
| 85        | 2.8353 | 303         |
| 86        | 2.9603 | 307         |
| 87        | 3.0907 | 312         |
| 88        | 3.2269 | 316         |
| 89        | 3.3693 | 321         |
| 90        | 3.5188 | 326         |
| 91        | 3.6763 | 331         |
| 92        | 3.8435 | 337         |
| 93        | 4.0231 | 342         |
| 94        | 4.2193 | 349         |
| 95        | 4.4390 | 356         |
| 96        | 4.6942 | 365         |
| 97        | 5.0079 | 375         |
| 98        | 5.4323 | 389         |
| 99        | 6.1357 | 400         |
| 100       | 7.3402 | 400         |

Writing Grade 8 Form U'

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 0         | -5.5978 | 100         |
| 1         | -4.3848 | 100         |
| 2         | -3.6824 | 100         |
| 3         | -3.2718 | 100         |
| 4         | -2.9830 | 103         |
| 5         | -2.7623 | 111         |
| 6         | -2.5856 | 118         |
| 7         | -2.4395 | 123         |
| 8         | -2.3158 | 127         |
| 9         | -2.2090 | 131         |
| 10        | -2.1153 | 134         |
| 11        | -2.0320 | 137         |
| 12        | -1.9570 | 140         |
| 13        | -1.8886 | 143         |
| 14        | -1.8257 | 145         |
| 15        | -1.7671 | 147         |
| 16        | -1.7124 | 149         |
| 17        | -1.6607 | 151         |
| 18        | -1.6115 | 152         |
| 19        | -1.5644 | 154         |
| 20        | -1.5192 | 156         |
| 21        | -1.4754 | 157         |
| 22        | -1.4327 | 159         |
| 23        | -1.3910 | 160         |
| 24        | -1.3501 | 162         |
| 25        | -1.3097 | 163         |
| 26        | -1.2698 | 165         |
| 27        | -1.2300 | 166         |
| 28        | -1.1904 | 167         |
| 29        | -1.1507 | 169         |
| 30        | -1.1108 | 170         |
| 31        | -1.0707 | 172         |
| 32        | -1.0301 | 173         |
| 33        | -0.9890 | 175         |

| Raw Score | Theta   | Scale Score |
|-----------|---------|-------------|
| 34        | -0.9473 | 176         |
| 35        | -0.9049 | 178         |
| 36        | -0.8616 | 179         |
| 37        | -0.8175 | 181         |
| 38        | -0.7724 | 182         |
| 39        | -0.7262 | 184         |
| 40        | -0.6790 | 186         |
| 41        | -0.6305 | 187         |
| 42        | -0.5809 | 189         |
| 43        | -0.5301 | 191         |
| 44        | -0.4781 | 193         |
| 45        | -0.4247 | 195         |
| 46        | -0.3702 | 197         |
| 47        | -0.3143 | 199         |
| 48        | -0.2572 | 201         |
| 49        | -0.1988 | 203         |
| 50        | -0.1391 | 205         |
| 51        | -0.0780 | 207         |
| 52        | -0.0156 | 209         |
| 53        | 0.0483  | 212         |
| 54        | 0.1135  | 214         |
| 55        | 0.1803  | 216         |
| 56        | 0.2487  | 219         |
| 57        | 0.3186  | 221         |
| 58        | 0.3903  | 224         |
| 59        | 0.4636  | 226         |
| 60        | 0.5388  | 229         |
| 61        | 0.6156  | 232         |
| 62        | 0.6943  | 235         |
| 63        | 0.7747  | 238         |
| 64        | 0.8568  | 240         |
| 65        | 0.9405  | 243         |
| 66        | 1.0257  | 246         |
| 67        | 1.1122  | 250         |

| Raw Score | Theta  | Scale Score |
|-----------|--------|-------------|
| 68        | 1.1999 | 253         |
| 69        | 1.2886 | 256         |
| 70        | 1.3780 | 259         |
| 71        | 1.4679 | 262         |
| 72        | 1.5581 | 265         |
| 73        | 1.6486 | 269         |
| 74        | 1.7390 | 272         |
| 75        | 1.8294 | 275         |
| 76        | 1.9198 | 278         |
| 77        | 2.0102 | 282         |
| 78        | 2.1007 | 285         |
| 79        | 2.1916 | 288         |
| 80        | 2.2828 | 291         |
| 81        | 2.3750 | 295         |
| 82        | 2.4681 | 298         |
| 83        | 2.5628 | 301         |
| 84        | 2.6595 | 305         |
| 85        | 2.7586 | 308         |
| 86        | 2.8608 | 312         |
| 87        | 2.9667 | 316         |
| 88        | 3.0772 | 320         |
| 89        | 3.1934 | 324         |
| 90        | 3.3165 | 328         |
| 91        | 3.4482 | 333         |
| 92        | 3.5907 | 338         |
| 93        | 3.7472 | 344         |
| 94        | 3.9223 | 350         |
| 95        | 4.1232 | 357         |
| 96        | 4.3621 | 366         |
| 97        | 4.6622 | 376         |
| 98        | 5.0758 | 391         |
| 99        | 5.7716 | 400         |
| 100       | 6.9732 | 400         |

**Appendix D: 2007 Vertical Scaling Design**

**Step 1: Grades 5 and 4**

|                 |         | Items   |             |             |         |         |         |
|-----------------|---------|---------|-------------|-------------|---------|---------|---------|
|                 |         | Grade 3 | Grade 4     | Grade 5     | Grade 6 | Grade 7 | Grade 8 |
| <b>Students</b> | Grade 3 |         |             |             |         |         |         |
|                 | Grade 4 |         | <b>OP44</b> | SU45        |         |         |         |
|                 | Grade 5 |         | SU54        | <b>OP55</b> |         |         |         |
|                 | Grade 6 |         |             |             |         |         |         |
|                 | Grade 7 |         |             |             |         |         |         |
|                 | Grade 8 |         |             |             |         |         |         |

**Step 2: Grades 4 and 3**

|                 |         | Items       |             |         |         |         |         |
|-----------------|---------|-------------|-------------|---------|---------|---------|---------|
|                 |         | Grade 3     | Grade 4     | Grade 5 | Grade 6 | Grade 7 | Grade 8 |
| <b>Students</b> | Grade 3 | <b>OP33</b> | SU34        |         |         |         |         |
|                 | Grade 4 | SU43        | <b>OP44</b> |         |         |         |         |
|                 | Grade 5 |             |             |         |         |         |         |
|                 | Grade 6 |             |             |         |         |         |         |
|                 | Grade 7 |             |             |         |         |         |         |
|                 | Grade 8 |             |             |         |         |         |         |

**Step 3: Grades 5 and 6**

|                 |         | Items   |         |         |         |         |         |
|-----------------|---------|---------|---------|---------|---------|---------|---------|
|                 |         | Grade 3 | Grade 4 | Grade 5 | Grade 6 | Grade 7 | Grade 8 |
| <b>Students</b> | Grade 3 |         |         |         |         |         |         |
|                 | Grade 4 |         |         |         |         |         |         |
|                 | Grade 5 |         |         | OP55    | SU56    |         |         |
|                 | Grade 6 |         |         | SU65    | OP66    |         |         |
|                 | Grade 7 |         |         |         |         |         |         |
|                 | Grade 8 |         |         |         |         |         |         |

**Step 4: Grades 6 and 7**

|                 |         | Items   |         |         |         |         |         |
|-----------------|---------|---------|---------|---------|---------|---------|---------|
|                 |         | Grade 3 | Grade 4 | Grade 5 | Grade 6 | Grade 7 | Grade 8 |
| <b>Students</b> | Grade 3 |         |         |         |         |         |         |
|                 | Grade 4 |         |         |         |         |         |         |
|                 | Grade 5 |         |         |         |         |         |         |
|                 | Grade 6 |         |         |         | OP66    | SU67    |         |
|                 | Grade 7 |         |         |         | SU76    | OP77    |         |
|                 | Grade 8 |         |         |         |         |         |         |

**Step 5: Grades 7 and 8**

|                 |         | Items   |         |         |         |         |         |
|-----------------|---------|---------|---------|---------|---------|---------|---------|
|                 |         | Grade 3 | Grade 4 | Grade 5 | Grade 6 | Grade 7 | Grade 8 |
| <b>Students</b> | Grade 3 |         |         |         |         |         |         |
|                 | Grade 4 |         |         |         |         |         |         |
|                 | Grade 5 |         |         |         |         |         |         |
|                 | Grade 6 |         |         |         |         |         |         |
|                 | Grade 7 |         |         |         |         | OP77    | SU78    |
|                 | Grade 8 |         |         |         |         | SU87    | OP88    |
|                 |         |         |         |         |         |         |         |

**Appendix E: 2007 Vertical Scaling Item Parameters**

**Mathematics Grade 3**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | -2.8289      | 31          | -1.0542      | 61          | -1.5802      | 91          | -1.6397      |
| 2           | -2.8289      | 32          | -1.9134      | 62          | -1.9039      | 92          | -1.3445      |
| 3           | -2.3674      | 33          | -2.3248      | 63          | -3.2659      | 93          | 0.5030       |
| 4           | -1.9349      | 34          | -0.5533      | 64          | -3.1784      | 94          | 0.0523       |
| 5           | -3.1565      | 35          | -0.5234      | 65          | -3.6727      |             |              |
| 6           | -1.9165      | 36          | -1.6831      | 66          | -2.1237      |             |              |
| 7           | -2.9605      | 37          | -2.2273      | 67          | -2.4766      |             |              |
| 8           | -3.5134      | 38          | -0.7116      | 68          | -2.8326      |             |              |
| 9           | -2.7590      | 39          | -0.0255      | 69          | -2.1604      |             |              |
| 10          | -3.5899      | 40          | -0.3118      | 70          | -2.0956      |             |              |
| 11          | -2.9749      | 41          | -0.6549      | 71          | -1.5840      |             |              |
| 12          | -2.4750      | 42          | -0.5423      | 72          | -2.2827      |             |              |
| 13          | -2.2828      | 43          | -0.3999      | 73          | -1.9825      |             |              |
| 14          | -1.4639      | 44          | -2.3204      | 74          | -2.7443      |             |              |
| 15          | -2.6452      | 45          | -0.5826      | 75          | -0.2788      |             |              |
| 16          | -2.6303      | 46          | -3.7232      | 76          | -1.2143      |             |              |
| 17          | -4.1474      | 47          | -3.6099      | 77          | -1.8231      |             |              |
| 18          | -2.2995      | 48          | -3.1113      | 78          | -2.1420      |             |              |
| 19          | -3.1516      | 49          | -2.7093      | 79          | -2.8222      |             |              |
| 20          | -1.3555      | 50          | -0.5573      | 80          | -1.5169      |             |              |
| 21          | -1.6911      | 51          | -1.8210      | 81          | -1.6199      |             |              |
| 22          | -2.1563      | 52          | -1.7251      | 82          | -1.5752      |             |              |
| 23          | -3.5267      | 53          | -1.3208      | 83          | -1.7558      |             |              |
| 24          | -1.4084      | 54          | -1.1930      | 84          | -0.7891      |             |              |
| 25          | -2.6770      | 55          | -1.6570      | 85          | -0.3757      |             |              |
| 26          | -1.9881      | 56          | -0.9115      | 86          | -1.2356      |             |              |
| 27          | -1.7598      | 57          | -2.1981      | 87          | 0.1570       |             |              |
| 28          | -0.9878      | 58          | -2.1344      | 88          | -2.2464      |             |              |
| 29          | -1.4148      | 59          | -1.4836      | 89          | -1.6672      |             |              |
| 30          | -1.6346      | 60          | -2.1705      | 90          | -1.4303      |             |              |

**Mathematics Grade 4**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | -1.3568      | 31          | -1.5592      | 61          | -1.8457      | 91          | -0.0013      |
| 2           | -1.2408      | 32          | -1.8041      | 62          | -1.5735      | 92          | -0.7767      |
| 3           | -0.8814      | 33          | -0.0663      | 63          | -2.7019      | 93          | 0.6334       |
| 4           | -0.2297      | 34          | -1.1577      | 64          | -1.9994      | 94          | -0.1058      |
| 5           | -0.4677      | 35          | -0.1147      | 65          | -2.6518      | 95          | 0.0392       |
| 6           | -0.6352      | 36          | -1.1128      | 66          | -1.5477      | 96          | 1.4420       |
| 7           | -2.8457      | 37          | -1.4850      | 67          | -2.1216      |             |              |
| 8           | -1.0952      | 38          | -0.7946      | 68          | -1.5919      |             |              |
| 9           | -1.9060      | 39          | -1.0541      | 69          | -1.2198      |             |              |
| 10          | -0.9105      | 40          | -1.3542      | 70          | 0.2857       |             |              |
| 11          | 0.4287       | 41          |              | 71          | -1.1513      |             |              |
| 12          | 0.6741       | 42          | -0.0857      | 72          | -0.7915      |             |              |
| 13          | 0.5269       | 43          | -1.6381      | 73          | -0.6878      |             |              |
| 14          | -0.4459      | 44          | -0.6923      | 74          | -0.6521      |             |              |
| 15          | -0.5082      | 45          | -1.5974      | 75          | -0.4266      |             |              |
| 16          | 0.1620       | 46          | -0.2013      | 76          | -0.7894      |             |              |
| 17          | -0.1681      | 47          | -2.9179      | 77          | -0.9344      |             |              |
| 18          | 0.5636       | 48          | -1.7287      | 78          | -0.5967      |             |              |
| 19          | -1.3851      | 49          | -1.2675      | 79          | -1.9560      |             |              |
| 20          | -0.3557      | 50          | -1.1861      | 80          | 0.4345       |             |              |
| 21          | -1.1024      | 51          | -0.4039      | 81          | -0.9651      |             |              |
| 22          | -0.6729      | 52          | -0.1272      | 82          | -0.0384      |             |              |
| 23          | -1.3184      | 53          | -1.2915      | 83          | -1.5419      |             |              |
| 24          | -2.1129      | 54          | -0.7645      | 84          | -0.9469      |             |              |
| 25          | 0.6601       | 55          | -0.2368      | 85          | 0.4911       |             |              |
| 26          |              | 56          | 0.0142       | 86          | 0.4323       |             |              |
| 27          | 0.1883       | 57          | -2.5592      | 87          | 0.5196       |             |              |
| 28          | -0.0949      | 58          | 0.6236       | 88          | 1.0539       |             |              |
| 29          | 0.9666       | 59          | -2.4591      | 89          | 0.6946       |             |              |
| 30          | 0.1688       | 60          | 1.3347       | 90          | -2.1113      |             |              |

**Mathematics Grade 5**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | 0.2430       | 31          | 0.2563       | 61          | -1.2513      | 91          | -2.5352      |
| 2           | -1.1374      | 32          | 0.2721       | 62          | 0.1707       | 92          | 0.9364       |
| 3           | -1.4107      | 33          | 1.0004       | 63          | 0.5742       | 93          | -0.4448      |
| 4           | -0.6478      | 34          | 1.1034       | 64          | 0.7699       | 94          | -1.6185      |
| 5           | -1.4418      | 35          | 1.5466       | 65          | 0.3421       | 95          | 1.6568       |
| 6           | -0.7330      | 36          | 0.8918       | 66          | 1.0528       | 96          |              |
| 7           | 0.0795       | 37          | -0.6235      | 67          | -0.1787      | 97          | -2.3061      |
| 8           | -1.3261      | 38          | -0.5573      | 68          | 0.6137       | 98          | -1.7419      |
| 9           | -1.8281      | 39          | -1.0064      | 69          | 0.9084       | 99          | 0.0980       |
| 10          | -1.7528      | 40          | -0.5668      | 70          | 0.4264       | 100         | 0.7395       |
| 11          | 0.4860       | 41          | -0.5533      | 71          | 1.4481       | 101         | 0.1134       |
| 12          | -0.2347      | 42          | -0.7844      | 72          | 0.7345       | 102         | -0.0673      |
| 13          | -0.7828      | 43          | 1.0470       | 73          | 2.1093       | 103         | 0.3062       |
| 14          | -0.9799      | 44          | 1.7387       | 74          | -0.1804      | 104         | 0.6890       |
| 15          | -0.6139      | 45          | 0.4207       | 75          | 0.3146       | 105         |              |
| 16          | 0.4722       | 46          | 0.9318       | 76          | -1.0892      | 106         | -0.7996      |
| 17          | 0.8383       | 47          | 1.1792       | 77          | -1.9681      | 107         | -0.3627      |
| 18          | 0.0323       | 48          | 1.2777       | 78          | 0.0812       | 108         | 0.1124       |
| 19          | 0.7017       | 49          | 0.6913       | 79          | -2.1912      | 109         |              |
| 20          | 0.5022       | 50          |              | 80          | 0.0181       | 110         | 1.1478       |
| 21          | -0.2339      | 51          | -0.7644      | 81          | 0.7413       | 111         | 0.2395       |
| 22          | 0.2839       | 52          | -0.4867      | 82          | 1.7422       | 112         | 0.7315       |
| 23          | -1.6341      | 53          | -1.0874      | 83          | 0.8614       | 113         | 0.7131       |
| 24          | -1.1040      | 54          | -0.1301      | 84          | 0.1272       |             |              |
| 25          | 0.5426       | 55          | -1.8012      | 85          | 1.4567       |             |              |
| 26          | -1.5710      | 56          | -1.5072      | 86          | 0.1992       |             |              |
| 27          | 0.5407       | 57          | -1.1452      | 87          | 1.1201       |             |              |
| 28          | 0.5169       | 58          | 1.9280       | 88          | 0.6921       |             |              |
| 29          | -0.3732      | 59          | -0.6823      | 89          | 2.0091       |             |              |
| 30          | -0.4858      | 60          | 0.1865       | 90          | 1.0146       |             |              |

**Mathematics Grade 6**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           |              | 31          | -0.7939      | 61          | 0.6704       | 91          | -0.5719      |
| 2           |              | 32          | 0.0366       | 62          | 1.1852       | 92          |              |
| 3           |              | 33          | -0.5048      | 63          | 1.5758       | 93          | -0.6010      |
| 4           | 0.4495       | 34          | -0.1615      | 64          | 1.6527       | 94          | 1.2601       |
| 5           |              | 35          | 1.3895       | 65          | -0.2652      | 95          | 0.4007       |
| 6           | 0.0215       | 36          | 1.0923       | 66          | 1.6452       | 96          | 0.8343       |
| 7           | 0.3735       | 37          | 1.0030       | 67          | 1.2201       | 97          | -0.3165      |
| 8           | 0.3375       | 38          | 1.3515       | 68          | -0.6254      | 98          | -0.3921      |
| 9           | -0.5731      | 39          | 0.8677       | 69          | -0.3384      | 99          | 1.6105       |
| 10          | -0.5632      | 40          | 0.5838       | 70          | 1.8522       | 100         | 0.8216       |
| 11          | 1.9470       | 41          | 0.2909       | 71          | 0.9939       | 101         | 1.4601       |
| 12          |              | 42          | 1.0855       | 72          | 0.0884       | 102         | 2.3511       |
| 13          | 2.3273       | 43          | 2.1570       | 73          | 1.3038       | 103         | 1.2280       |
| 14          | 1.9761       | 44          | 1.2492       | 74          | 0.5231       | 104         | 0.1563       |
| 15          | 2.1892       | 45          | 1.4157       | 75          | 1.5465       | 105         | 2.9840       |
| 16          | 4.0231       | 46          | 1.9082       | 76          | 1.0031       | 106         | 0.7693       |
| 17          | 1.3887       | 47          | 1.3593       | 77          | 2.7053       | 107         | -0.1900      |
| 18          | 0.8666       | 48          | 1.0128       | 78          | 2.5778       | 108         | -0.4902      |
| 19          | 0.2592       | 49          | -0.9193      | 79          | 1.1900       | 109         | 1.1349       |
| 20          | 0.7919       | 50          | 1.4976       | 80          | 1.1546       | 110         | 0.7909       |
| 21          | 0.9325       | 51          | 1.6723       | 81          | 1.2215       | 111         | 0.1987       |
| 22          | 1.3947       | 52          | -0.0015      | 82          | 0.8889       | 112         |              |
| 23          | -0.8950      | 53          | 0.7809       | 83          | 0.8497       | 113         | 0.8111       |
| 24          | 0.4462       | 54          | -0.3470      | 84          | 1.3505       | 114         | 2.3412       |
| 25          | 0.4503       | 55          | 0.1295       | 85          | 0.9314       | 115         | 1.7668       |
| 26          |              | 56          | -1.1697      | 86          | 2.3232       | 116         | 2.3128       |
| 27          | 0.9129       | 57          | -1.7431      | 87          | 0.9812       |             |              |
| 28          | 2.4046       | 58          | 0.3350       | 88          | 1.6998       |             |              |
| 29          | 0.1812       | 59          | 2.3287       | 89          | 2.3203       |             |              |
| 30          | 0.0879       | 60          | 1.6443       | 90          | 1.8628       |             |              |

**Mathematics Grade 7**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | 1.6452       | 31          | 2.7910       | 61          | 0.6478       | 91          | 1.6412       |
| 2           | 0.9978       | 32          | 0.6919       | 62          | 2.1939       | 92          | 0.5607       |
| 3           | 1.3189       | 33          | 2.0991       | 63          | 1.0881       | 93          | 1.5911       |
| 4           | -0.0182      | 34          | 0.4326       | 64          | 1.3910       | 94          | 1.2450       |
| 5           | 0.3476       | 35          | 0.9154       | 65          | 1.6935       | 95          | -0.1923      |
| 6           | 1.3623       | 36          | 2.6043       | 66          | 1.1128       | 96          | 0.4864       |
| 7           | 1.4797       | 37          | 2.8881       | 67          | 1.7952       | 97          | 1.1370       |
| 8           | 1.3931       | 38          | 1.4167       | 68          | 2.2867       | 98          | 3.2034       |
| 9           | 1.0928       | 39          | 1.3385       | 69          | 0.4971       | 99          | 0.3455       |
| 10          | 2.0582       | 40          | 1.2454       | 70          | 1.0727       | 100         | -0.3284      |
| 11          |              | 41          | 0.8032       | 71          | 1.1418       | 101         | 1.2226       |
| 12          | -0.4667      | 42          | 2.2834       | 72          | 1.5024       | 102         | 0.7798       |
| 13          |              | 43          | 1.0035       | 73          | 2.1359       | 103         | 0.8478       |
| 14          | 0.8611       | 44          | 1.2344       | 74          | 1.9791       | 104         | 1.8159       |
| 15          | 1.2069       | 45          | 2.3294       | 75          | 0.6566       | 105         | 2.1487       |
| 16          | 1.1550       | 46          |              | 76          | 1.6999       | 106         | 1.9329       |
| 17          | 1.7152       | 47          | 2.2300       | 77          | 3.1412       | 107         | 2.8423       |
| 18          | 2.1062       | 48          | 2.1005       | 78          | 3.6413       | 108         | 1.6330       |
| 19          |              | 49          | 1.1848       | 79          | 2.6361       | 109         | 1.9439       |
| 20          | 0.7116       | 50          | 1.8001       | 80          | 2.7781       | 110         | 1.5873       |
| 21          | 1.7317       | 51          | -0.5794      | 81          | 4.1535       | 111         | 1.4191       |
| 22          | 2.2566       | 52          | 2.1742       | 82          | 3.3380       | 112         | 1.5634       |
| 23          | 1.7549       | 53          | 2.0938       | 83          | 1.3214       | 113         | 2.2074       |
| 24          | 1.4677       | 54          | 1.7031       | 84          | 2.2025       | 114         | 0.9626       |
| 25          | 1.9449       | 55          | 1.5473       | 85          | 3.2240       | 115         | 1.9166       |
| 26          | 1.3225       | 56          | 2.0468       | 86          | 1.7455       | 116         | 2.8778       |
| 27          | 2.9138       | 57          | 1.4236       | 87          | 1.2290       | 117         | 1.0076       |
| 28          | 1.2778       | 58          | 0.4976       | 88          | 2.5369       | 118         | 1.6561       |
| 29          | 0.6929       | 59          | 1.5459       | 89          | 2.7677       | 119         | 2.3484       |
| 30          | 1.9322       | 60          | 1.4187       | 90          | 2.2121       | 120         | 1.4833       |

**Mathematics Grade 8**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | 0.7142       | 31          | 2.4179       | 61          | 2.0525       | 91          | 1.3803       |
| 2           | -0.1553      | 32          | 3.7860       | 62          | 2.1408       | 92          | 2.4175       |
| 3           | 1.5577       | 33          | 2.6466       | 63          | 1.5228       | 93          | 1.1683       |
| 4           | 1.2378       | 34          | 1.8214       | 64          | 2.8161       | 94          | 2.3084       |
| 5           | 2.4511       | 35          | 1.4226       | 65          | 1.5893       | 95          | 1.9837       |
| 6           | 1.4852       | 36          | 1.4770       | 66          | 3.0423       | 96          | 2.2688       |
| 7           | 2.2539       | 37          | 2.6153       | 67          | 2.8613       | 97          | 0.2606       |
| 8           | 2.1423       | 38          | 2.3687       | 68          | 2.7289       | 98          | 1.0831       |
| 9           | 1.2587       | 39          | 3.6861       | 69          | 3.1240       | 99          | 1.5549       |
| 10          | 2.1683       | 40          | 2.2154       | 70          | 3.5272       | 100         | 2.3493       |
| 11          | 2.4212       | 41          | 2.0238       | 71          | 1.6793       | 101         | 2.4743       |
| 12          | 2.1638       | 42          | 1.7555       | 72          | 2.0206       | 102         | 3.4871       |
| 13          | 1.2769       | 43          | 1.2808       | 73          | 1.6825       | 103         | 2.8794       |
| 14          | 3.3054       | 44          | 1.8446       | 74          | 2.8544       | 104         | 1.5141       |
| 15          | 1.0512       | 45          | 1.8863       | 75          | 3.3514       | 105         | 1.5069       |
| 16          | 3.2360       | 46          | 1.8680       | 76          | 2.2902       | 106         | 3.3533       |
| 17          | 4.0854       | 47          | 1.1331       | 77          | 3.0849       | 107         | 0.9235       |
| 18          | 2.0304       | 48          | 1.5075       | 78          | 2.1684       | 108         | 2.6986       |
| 19          | 2.2099       | 49          | 1.6237       | 79          | 2.8776       | 109         | 1.3295       |
| 20          | 1.7169       | 50          | 2.2365       | 80          | 1.6935       | 110         | 1.5370       |
| 21          | 2.0504       | 51          | 1.6284       | 81          | 2.6452       | 111         | 2.6014       |
| 22          | 1.9332       | 52          | 1.3946       | 82          | -0.3455      | 112         | 3.0736       |
| 23          | 1.8264       | 53          | 1.6339       | 83          | 2.4389       | 113         | 2.5804       |
| 24          | 2.2983       | 54          | 2.1826       | 84          | 0.6018       | 114         | 0.9604       |
| 25          | 1.1153       | 55          | 1.3707       | 85          | 0.8505       | 115         | 2.3058       |
| 26          | 1.0233       | 56          | 3.1479       | 86          | 0.2512       | 116         | 3.2384       |
| 27          | 1.7201       | 57          | 1.4934       | 87          | 1.3091       | 117         | 3.8168       |
| 28          | 1.9424       | 58          | 1.6362       | 88          | 2.7917       |             |              |
| 29          | 3.3517       | 59          | 1.8087       | 89          | 1.1807       |             |              |
| 30          | 3.1742       | 60          | 2.0301       | 90          | 0.9951       |             |              |

### Reading Grade 3

| Item | Rasch   | Item | Rasch   | Item | Rasch   |
|------|---------|------|---------|------|---------|
| 1    | -2.2752 | 31   | -1.2373 | 61   | -0.6064 |
| 2    | -1.6975 | 32   | -2.2198 | 62   | 0.0588  |
| 3    | -1.8020 | 33   | -3.4067 | 63   | 0.2450  |
| 4    | -1.7297 | 34   | 0.1471  | 64   | 2.0209  |
| 5    | -2.9475 | 35   | -3.0766 | 65   | -0.1800 |
| 6    | -0.9245 | 36   | -2.2975 | 66   | -0.4630 |
| 7    | -0.2724 | 37   | -2.2905 | 67   | -0.0562 |
| 8    | -2.6627 | 38   | -2.0748 | 68   | 0.3684  |
| 9    | -0.7832 | 39   | -0.4722 | 69   | 0.6888  |
| 10   | -1.7056 | 40   | -2.1046 | 70   | -0.2298 |
| 11   | 0.0274  | 41   | -0.3336 | 71   | 0.1948  |
| 12   | -1.1025 | 42   | -0.2262 | 72   | 2.9546  |
| 13   | -0.7582 | 43   | -1.3892 | 73   | 0.0359  |
| 14   | -0.8707 | 44   | -2.0555 |      |         |
| 15   | -2.7154 | 45   | -2.4293 |      |         |
| 16   | -2.2477 | 46   | 0.1517  |      |         |
| 17   | -1.3746 | 47   | -1.1577 |      |         |
| 18   | -1.2063 | 48   | -1.2690 |      |         |
| 19   | 0.3762  | 49   | -2.5622 |      |         |
| 20   | -1.6417 | 50   | -1.0729 |      |         |
| 21   | -0.2227 | 51   | -0.4442 |      |         |
| 22   | -0.9508 | 52   | 1.8735  |      |         |
| 23   | -1.8797 | 53   | -0.5480 |      |         |
| 24   | -2.2929 | 54   | 0.1520  |      |         |
| 25   | -1.1315 | 55   | -0.9777 |      |         |
| 26   | -2.9637 | 56   | -0.5158 |      |         |
| 27   | -0.9948 | 57   | -0.9274 |      |         |
| 28   | -0.0592 | 58   | 0.5213  |      |         |
| 29   | 0.0879  | 59   | 0.6859  |      |         |
| 30   | 0.6637  | 60   | -0.1596 |      |         |

**Reading Grade 4**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | -0.7089      | 31          | 0.1402       | 61          | -0.6392      |
| 2           | -0.1836      | 32          | 0.3316       | 62          | -1.2143      |
| 3           | -1.6700      | 33          | -2.7555      | 63          | 0.0138       |
| 4           | -0.4203      | 34          | -0.4246      | 64          | 0.6999       |
| 5           | -0.3009      | 35          | -2.5469      | 65          | 0.9780       |
| 6           | -0.9574      | 36          | -2.4156      | 66          | 0.6070       |
| 7           | -2.5057      | 37          | -2.9201      | 67          | -0.3407      |
| 8           | 0.4718       | 38          | 0.7037       | 68          | 1.3876       |
| 9           | 0.0449       | 39          | -1.3012      | 69          | 1.0430       |
| 10          | 0.6372       | 40          | -0.8776      | 70          | 1.2334       |
| 11          | -0.2606      | 41          | -0.3881      | 71          | 0.1436       |
| 12          | -1.6258      | 42          | -0.6515      | 72          | 0.2120       |
| 13          | -0.9046      | 43          | -1.9602      | 73          | 0.6090       |
| 14          | -1.7263      | 44          | -1.2707      | 74          | 0.7324       |
| 15          | 0.7509       | 45          | -2.0750      |             |              |
| 16          | -0.0586      | 46          | -1.3029      |             |              |
| 17          | -2.1638      | 47          | -0.4253      |             |              |
| 18          | 0.6454       | 48          | -1.9542      |             |              |
| 19          | -0.3429      | 49          | -0.4621      |             |              |
| 20          | -1.0316      | 50          | -0.9550      |             |              |
| 21          | -1.6007      | 51          | 0.1880       |             |              |
| 22          | -0.8506      | 52          | -1.3278      |             |              |
| 23          | -0.6032      | 53          | -1.1946      |             |              |
| 24          | 0.2684       | 54          | -0.2376      |             |              |
| 25          | -1.0976      | 55          | -0.9079      |             |              |
| 26          | -0.9530      | 56          | 0.1344       |             |              |
| 27          | -1.3296      | 57          | -0.3709      |             |              |
| 28          | -2.0063      | 58          | -0.8250      |             |              |
| 29          | -0.3332      | 59          | 0.1093       |             |              |
| 30          | 0.2858       | 60          | 0.2162       |             |              |

### Reading Grade 5

| Item | Rasch   | Item | Rasch   | Item | Rasch   |
|------|---------|------|---------|------|---------|
| 1    | 0.4761  | 31   | 0.0701  | 61   | -0.4597 |
| 2    | -1.2916 | 32   | -0.9537 | 62   | 0.6785  |
| 3    | 0.0686  | 33   | -0.0553 | 63   | 1.3191  |
| 4    | -0.6705 | 34   | -0.4766 | 64   | 1.1737  |
| 5    | -0.4715 | 35   | -1.9012 | 65   | 0.0610  |
| 6    | -1.0044 | 36   | -0.6014 | 66   | -0.3632 |
| 7    | -1.0657 | 37   | -2.1300 | 67   | 0.7273  |
| 8    | -1.0273 | 38   | 0.0412  | 68   | 2.7605  |
| 9    | -0.0134 | 39   | -0.1381 | 69   | 1.0828  |
| 10   | 0.5252  | 40   | -0.8039 | 70   | 2.1633  |
| 11   | -1.0322 | 41   | -0.4789 | 71   | 0.3668  |
| 12   | -0.7421 | 42   | 0.4830  | 72   | 0.1463  |
| 13   | 0.2260  | 43   | -0.6770 | 73   | 1.7036  |
| 14   | -0.0905 | 44   | -1.1085 | 74   | 2.7479  |
| 15   | -1.1737 | 45   | -0.0930 | 75   | 0.0783  |
| 16   | 0.4392  | 46   | -0.2227 | 76   | 0.9983  |
| 17   | 0.3024  | 47   | -0.5283 | 77   | 0.6077  |
| 18   | -0.8568 | 48   | -1.2816 | 78   | 1.5340  |
| 19   | -0.2929 | 49   | 0.5868  | 79   | 2.5326  |
| 20   | -0.5229 | 50   | 0.3920  | 80   | 1.0631  |
| 21   | -1.2249 | 51   | 0.1618  |      |         |
| 22   | -0.6656 | 52   | -0.5918 |      |         |
| 23   | 1.3514  | 53   | -0.1984 |      |         |
| 24   | 0.3625  | 54   | 0.0811  |      |         |
| 25   | -0.4868 | 55   | -0.3852 |      |         |
| 26   | -0.3425 | 56   | 0.7193  |      |         |
| 27   | -0.6531 | 57   | 0.6612  |      |         |
| 28   | 0.1220  | 58   | -0.5023 |      |         |
| 29   | -0.1804 | 59   | 0.3689  |      |         |
| 30   | 0.8700  | 60   | -0.2702 |      |         |

**Reading Grade 6**

| <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> | <b>Item</b> | <b>Rasch</b> |
|-------------|--------------|-------------|--------------|-------------|--------------|
| 1           | 0.3440       | 31          |              | 60          | -0.0156      |
| 2           | 0.2273       | 32          | -0.8286      | 61          | -0.1455      |
| 3           | -0.2147      | 33          | -0.9278      | 62          | -0.3798      |
| 4           | -0.1598      | 34          | -1.5433      | 63          | 1.9635       |
| 5           | -1.3337      | 35          | -2.1579      | 64          | -0.1416      |
| 6           | -0.7368      | 36          | 0.8403       | 65          | 0.7694       |
| 7           |              | 37          | 0.2109       | 66          | 1.1086       |
| 8           |              | 38          | -0.0994      | 67          | 2.4647       |
| 9           |              | 39          | -0.2018      | 68          | 0.1839       |
| 10          |              | 40          | 0.2185       | 69          | 1.5365       |
| 11          | -0.3305      | 41          | -1.6415      | 70          | 1.9504       |
| 12          | 0.6884       | 42          | -0.5216      | 71          | 0.7398       |
| 13          | 1.4165       | 43          | 1.2414       | 72          | 0.7333       |
| 14          | 0.4371       | 44          | -0.8555      | 73          | 1.9378       |
| 15          | 0.9828       | 45          | 0.1595       | 74          | 1.7457       |
| 16          | -0.1848      | 46          | 0.0015       | 75          | 2.5750       |
| 17          |              | 47          | 0.9341       | 76          | 1.7614       |
| 18          |              | 48          | -0.0080      | 77          | 1.1785       |
| 19          | -0.6227      | 49          | 0.4917       | 78          | 1.6963       |
| 20          |              | 50          | -0.1116      | 79          | 1.3511       |
| 21          | -0.3355      | 51          | -0.6936      | 80          | 0.7651       |
| 22          | -0.9129      | 52          | -0.2615      |             |              |
| 23          |              | 53          | -0.9350      |             |              |
| 24          | 0.3786       | 54          | -0.4850      |             |              |
| 25          | -0.1675      | 55          | -0.0487      |             |              |
| 26          | 1.5991       | 56          | 0.4576       |             |              |
| 27          | 0.6001       | 57          | 0.4803       |             |              |
| 28          | 0.3259       | 58          | 0.9775       |             |              |
| 29          | 0.6243       | 59          | 2.5622       |             |              |
| 30          |              |             |              |             |              |

### Reading Grade 7

| Item | Rasch   | Item | Rasch   | Item | Rasch   |
|------|---------|------|---------|------|---------|
| 1    | 0.8380  | 31   | -0.8242 | 61   | 0.7137  |
| 2    | -0.1030 | 32   | 2.0739  | 62   | 0.7800  |
| 3    | 0.2115  | 33   | -0.7778 | 63   | 0.5800  |
| 4    | -0.5060 | 34   | 0.0685  | 64   | 0.8840  |
| 5    | 0.9224  | 35   | -1.0503 | 65   | 3.8243  |
| 6    | -0.2342 | 36   | -1.2692 | 66   | 0.9976  |
| 7    | 1.6791  | 37   | -0.6115 | 67   | 3.6574  |
| 8    | 0.9395  | 38   | 0.4427  | 68   | 2.8367  |
| 9    | 1.2416  | 39   | -0.5769 | 69   | 1.1184  |
| 10   | 1.2094  | 40   | -0.8495 | 70   | 0.3200  |
| 11   | 0.6480  | 41   | 1.1862  | 71   | -0.0672 |
| 12   | 1.6882  | 42   | -1.1745 | 72   | 2.0750  |
| 13   | 0.7562  | 43   | -0.9524 | 73   | 2.6772  |
| 14   | 0.0093  | 44   | 2.1948  | 74   | 1.2851  |
| 15   | 1.1575  | 45   | -0.6199 | 75   | 0.7597  |
| 16   |         | 46   | 2.5497  | 76   | 0.9321  |
| 17   | 0.8410  | 47   | -0.0239 | 77   | 2.2661  |
| 18   | 0.4500  | 48   | 0.2340  | 78   | 1.4464  |
| 19   | 0.5534  | 49   | 0.2219  | 79   | 1.3375  |
| 20   | -0.2206 | 50   | 0.2804  |      |         |
| 21   | 1.4109  | 51   | 0.3534  |      |         |
| 22   |         | 52   | 0.0063  |      |         |
| 23   | 1.2756  | 53   | 0.2784  |      |         |
| 24   | -1.0703 | 54   | 0.9002  |      |         |
| 25   | 0.3006  | 55   | 1.0462  |      |         |
| 26   | 0.7926  | 56   | 0.4724  |      |         |
| 27   | -0.0052 | 57   | 0.0568  |      |         |
| 28   | 0.3838  | 58   | 0.3424  |      |         |
| 29   | 0.8190  | 59   | 0.1761  |      |         |
| 30   |         | 60   | 0.2078  |      |         |

### Reading Grade 8

| Item | Rasch   | Item | Rasch   | Item | Rasch   |
|------|---------|------|---------|------|---------|
| 1    | 1.0162  | 31   | 0.4008  | 61   | 2.1807  |
| 2    | -0.1109 | 32   | -0.8264 | 62   | 0.5464  |
| 3    | -0.1922 | 33   | -0.4446 | 63   | 0.9193  |
| 4    | 0.9395  | 34   | -1.1448 | 64   | 1.2376  |
| 5    | -0.5964 | 35   | -1.0438 | 65   | 0.3397  |
| 6    | 0.9717  | 36   | 0.2674  | 66   | 2.1689  |
| 7    | 0.6273  | 37   | 1.6623  | 67   | 0.4247  |
| 8    | 0.6985  | 38   | -1.2522 | 68   | 1.4031  |
| 9    | -0.0418 | 39   | 0.5921  | 69   | -0.2368 |
| 10   | 0.6438  | 40   | -1.2833 | 70   | 1.3233  |
| 11   | 0.9471  | 41   | -0.5995 | 71   | 1.3018  |
| 12   | 2.6963  | 42   | 0.7230  | 72   | 2.9400  |
| 13   | 2.1340  | 43   | 0.0812  | 73   | 1.9515  |
| 14   | 1.5278  | 44   | 0.5894  | 74   | 1.2048  |
| 15   | 1.1405  | 45   | 0.4144  | 75   | 1.7735  |
| 16   | 1.6237  | 46   | -0.2184 | 76   | 1.1724  |
| 17   | 0.8520  | 47   | -0.5136 | 77   | 1.4446  |
| 18   | 1.5780  | 48   | -1.0386 | 78   | 1.8979  |
| 19   | 0.2812  | 49   | -0.0661 | 79   | 2.7678  |
| 20   | 1.7631  | 50   | 0.9103  |      |         |
| 21   | 2.0243  | 51   | -0.1334 |      |         |
| 22   | 0.9542  | 52   | 1.7172  |      |         |
| 23   | 0.5519  | 53   | 0.0844  |      |         |
| 24   | 1.1824  | 54   | 1.1377  |      |         |
| 25   | -0.2073 | 55   | -0.2513 |      |         |
| 26   | 0.3962  | 56   | -0.5704 |      |         |
| 27   | 0.1540  | 57   | 1.1669  |      |         |
| 28   | 0.1187  | 58   | 1.0414  |      |         |
| 29   | 0.9496  | 59   | 1.1940  |      |         |
| 30   | 1.2782  | 60   | 0.5009  |      |         |