Comparability of MAP Growth Tests Administered through Different Technology and Psychometric Infrastructure: A Simulation Study

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Ann Hu, NWEA Psychometric Solutions
May Chien, NWEA Psychometric Solutions
Patrick Meyer, NWEA Psychometric Solutions

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Executive Summary

NWEA® began an initiative dubbed "Project Altair" to enhance the constraint-based engine (CBE) originally designed for state summative assessments so it can also be used to deliver the MAP® Growth™ interim assessments. As part of the Project Altair initiative, new features were added to the CBE between 2018 and 2019 to accommodate requirements for administering MAP Growth tests in a comparable way to the current MAP Growth engine known as COLO. This report summarizes the new features added to the CBE and the results of a mode comparability study conducted via simulations to compare the CBE and COLO for administering the MAP Growth assessments. The new features added to the CBE are as follows:

- Multiple test administrations in an academic school year and longitudinal item exposure
- Historical scores as entry conditions to select the first two items
- User-defined item parameters for fencing items
- Item ordering rules and content balance methods in the item selection algorithm
- Test termination rules
- Test score invalidation rules

Throughout the CBE enhancement process, numerous simulations were conducted to test the new functionalities. After the process was completed in December 2019, final simulations were conducted on both the CBE and COLO to check the mode comparability based on content validity (e.g., meeting the content specifications), construct validity (e.g., recovery of true thetas), test score reliability (e.g., standard error of measurement (SEM) of the overall test and instructional area level scores), adaptivity (e.g., delta value), and item exposure within and across administrations. Below is a summary of the major findings and conclusions.

1. The items administered by the CBE and COLO met the content specifications, and the estimated scores recovered the true scores well for the nine MAP Growth tests investigated in this study. These findings suggest that the two engines are comparable in delivering valid MAP Growth tests to measure what they intend to measure.

2. The ability of the CBE and COLO to adaptively administer the items according to students' ability level and produce reliable scores depends on the tests and the quality of their item pool.
    a. For MAP Growth tests with a large number of items and broad content standards coverage in the item bank, both engines administered items with acceptable adaptivity and produced reliable scores.
    b. For other tests with a shallow item bank in certain instructional areas for the extreme low or high achievement students, both engines administered items with acceptable adaptivity and produced reliable scores for most students except those with extreme low or high achievement. In these extreme cases, the CBE often had better adaptivity and produced more reliable instructional area scores than COLO.

3. The CBE and COLO are not comparable in terms of controlling item exposure.
    a. Within the same administration, more items in the item bank were administered and less items were overexposed by COLO than by the CBE. This is likely due to the randomesque procedure implemented on COLO but not on the CBE to control item exposure.

b. Across administrations, items administered on the CBE can be exposed to the same student even when the longitudinal item exposure control specification (e.g., 14 months) has not been met depending on the depth and breadth of the item bank. For example, an item can be administered again to the same student within the 14-month timespan if and only if the item bank cannot fulfill the test requirements. This is not allowed on COLO but is on the CBE due to the longitudinal item exposure control being changed from a constraint to a guideline to prevent the test crash as a result of item starvation.

While users have more options to specify how to select items and a larger capability of running simulations on the CBE compared to COLO (albeit a sacrifice in simulation speed), the overall results show that the CBE and COLO are comparable under most conditions simulated in this study. In the cases of not showing comparable results of instructional area score SEMs, adaptivity, and item exposure, it is more likely due to (1) a small number of items available in a certain difficulty range or instructional area in the item pool, (2) no randomesque procedure implemented on the CBE to control the item exposure, and (3) different longitudinal item exposure control rules implemented on the CBE and COLO. Given these findings and the enhancements made to the CBE, it is possible to deliver interim assessments such as MAP Growth and those developed for the NWEA through-year solution on the CBE.

1. Introduction

This document presents the results of a mode comparability study conducted by NWEA® through simulations to evaluate how scores from MAP® Growth™ administered on the constraint-based engine (CBE) compare to those administered on the current MAP Growth engine known as COLO. The CBE was originally developed to deliver end-of-year state summative assessments, but it has been enhanced to also deliver interim tests such as MAP Growth multiple times throughout the year. While the CBE and COLO differ in software infrastructure and psychometric adaptive algorithms, these differences should have little impact on test scores when delivering tests built from the same test blueprints. Results from this study will help determine if MAP Growth assessments can be administered on the CBE in their current form without affecting scores.

1.1. Project Altair Overview

In 2018, NWEA developed a new adaptive testing engine known as the CBE to support the state summative assessments. Given that the CBE was originally designed for fixed-length adaptive tests administered to students once a year, an important goal of the Project Altair initiative was to enhance the CBE so it can deliver variable-length interim assessments multiple times a year and produce comparable scores to COLO. New features were added to the CBE to accommodate requirements for administering MAP Growth tests. Although efforts have been made to keep many of the features of the CBE and COLO the same, there are fundamental differences between the item selection algorithms adopted for the two engines. Given the differences, research questions for the mode comparability study include the following:

1. Do the CBE and COLO produce comparable scores for tests designed from the same test blueprints?
2. Do the two engines perform equally well in terms of adaptivity and item exposure control?

Two studies are being conducted as part of Project Altair to investigate mode comparability: (1) a study using simulated data as presented in this report and (2) a study based on empirical student data. Computer simulations have played an important role in studying the properties of item response theory (IRT) models and their applications. Simulation studies can investigate whether the estimated scores are close to the true scores, and the results are not confounded by factors such as student motivation and unexpected issues that could happen during test administration and the data collection process. In the context of Project Altair, the simulation study could also help researchers discover any unexpected factors in the CBE enhancement process that could potentially cause mode incomparability before the empirical data is collected. To conduct the mode comparability using actual student data, NWEA administered the same nine MAP Growth tests used in the simulations on both COLO and the CBE to selected students in Nebraska in Winter 2019/2020. The results from that empirical study were presented in a separate report (Bo & Meyer, 2020). This report focuses on the simulation results.

1.2. Adaptive Testing Process

Under the Rasch model (Rasch, 1980), an adaptive assessment administers items to match the ability level of the student. Students receive different items based on item difficulty and their ability levels. For example, students with lower momentary ability estimates (based on their answers to previous items) receive easier items compared to students with higher momentary ability estimates who receive harder items. While similar in this concept from a psychometric

perspective, the CBE and COLO have fundamentally different approaches in how tests are constructed for adaptivity while also considering content and other operational factors. For example, COLO selects one item at a time quickly but does not look ahead at the remaining assessment, which can lead to constraint conflicts. In contrast, the CBE constructs a whole test to select the next item, which guarantees that the content and other constraints are fulfilled.

1.2.1. Adaptive Algorithm on COLO

COLO employs the algorithm proposed by Kingsbury and Zara (1991) and selects an item based on the maximum Fisher's information, content balance by item count, content balance by standard error of measurement (SEM), item exposure, and item type (e.g., passage-based, operational, or field test). To start the test, the item with a difficulty equal or close to 5 Rasch Units (RITs) below the target student ability is selected. If a student has taken MAP Growth before, the score from the most recent administration is used as the initial target score. If not, the grade-level median is used. After the item is answered, the momentary score is estimated through Owen's Bayesian procedure (Owen, 1975), which becomes the new target selection score for selecting the next item. The adaptive testing goes through three phases as described in Table 1.1.

Table 1.1. MAP Growth Adaptive Test Phases

Phase	Description
Phase 1: Power Selection	The maximum Fisher's information method is used for item selection coupled with a randomesque exposure control procedure that selects one out of a few items that can provide the most information about the student (Kingsbury & Zara, 1989). For the Rasch model implemented for MAP Growth, the item with maximum information is the one with a difficulty that most closely matches the student's ability.
Phase 2: Content Balance by Item Count	To ensure content validity and comparability of sub-scores, the content balance is preferred over the maximum information for item selection. Items from the MAP Growth instructional area with the least proportion of items administered have priority for selection. An item from the preferred instructional area that also meets the maximum item information criterion is randomly selected.
Phase 3: Content Balance by SEM	To improve the sub-score reliability or reduce the score estimation error, items from the instructional area with the highest SEM for sub-scores are preferred to be selected. An item from the preferred instructional area that also meets the maximum item information criterion is randomly selected.

If passaged-based or common stimulus items are specified in the blueprint, the first step for item selection is to decide whether a test event will include these items. The passage set is selected if its median is within 3 RITs of the momentary score estimate. The selection rules for individual items in the passage set follow those in Table 1.1 for the standalone items. The selection of field test items is determined by the prespecified field test item position and the estimated item difficulty.

Many MAP Growth tests are variable-length tests that use two termination criteria: SEM and test length. When a test reaches the intended minimum test length, it ends if the overall score SEM is below a pre-specified benchmark. Otherwise the test continues until the maximum test length is reached. After the test is terminated, maximum likelihood estimation (MLE) is used for final score reporting at both the overall and instructional area levels.

1.2.2. Adaptive Algorithm on the CBE

Like COLO, the principle underlying the CBE is that a reliable score can be achieved with fewer items if the item difficulties match the student ability. However, unlike COLO, the CBE leverages a modified shadow test approach (van der Linden & Reese, 1998) and weighted penalty model (Segall & Davey, 1995) to balance the content and meet the blueprint, psychometric, operational, and test design specifications. Specifically, the CBE has two stages of consideration as it selects the items necessary to conform to the test blueprint while providing the maximum information about the student based on the student's momentary ability estimate. The student-specific plan (SSP), similar to the shadow test approach (van der Linden & Reese, 1998), selects items based on the required aspects of the test blueprint and the student's momentary theta. Item selection for the SSP occurs through a process of choosing multiple feasible SSPs, then choosing the complete SSP that best maximizes guideline adherence and information. Because multiple SSPs can be drawn from an item pool, a variation of the weighted penalty model (Segall & Davey, 1995) selects which SSP is optimal based on additional content guidelines while ensuring the most representative sample for linking and field test items. Only after the best SSP has been chosen are items ordered.

A constraint is an item selection rule given to the CBE when selecting items. Some constraints are "must-haves" and others are considered guidelines, or "nice-to-haves." Examples of constraints include the minimum and maximum number of items in a test, the minimum number of operational items in a test, the minimum number of operational items in an instructional area, and the minimum and maximum number of field test items. Examples of guidelines include the minimum and maximum number of operational items in an instructional area. In this example, the guideline specifies the preferred range, but the engine can select items that may violate this rule but meet other more important rules.

2. CBE Enhancements

Although the fundamental features of the CBE were ready to administer an online adaptive test, more features needed to be added to accommodate the unique requirements of MAP Growth and ensure mode comparability between the CBE and COLO. This section elaborates on the new features added to the CBE in 2018–2019 for the MAP Growth interim tests that are summarized in Table 2.1. Users can select what rules to use when they create their own test models for different projects.

Table 2.1. CBE Enhancements

Enhancement	Description
Longitudinal Item Exposure Control	The CBE was originally designed to administer an adaptive test once a year. It was modified to handle multiple administrations per year and implement longitudinal item exposure control to prevent a student from seeing the same item within a specified time (e.g., 14 months).
Entry Conditions	The CBE used the same initial value specified in the test model to select the first item for all students, but the selection of the first item for MAP Growth depends on the item difficulty and the student ability estimate based on, for example, the score from the prior administration. Therefore, the same entry conditions implemented on COLO were applied to the CBE except that all the values on the RIT scale are converted onto the logit scale.
Ability Estimation: Fencing Items	When student ability cannot be estimated by MLE when all the items are answered either correctly or incorrectly, both engines create an incorrect or correct response to a dichotomous fencing item. The default item discrimination for this fencing item used by the previous version of the CBE is different from the value used by COLO, so the CBE was enhanced to allow users to specify the item parameters to the fencing items.
Item Selection Algorithm	The CBE assembled the SSP based on the maximum number of items in an adaptive test. When the test terminated earlier, there were still items not administered to students, which caused the problem of not meeting the content specifications. Therefore, new item ordering rules were added. To balance the content earlier in the test, the new feature of content balance by item count was also added. To improve the sub-score estimation accuracy, the new feature of content balance by SEM was developed.
Test Termination	The following test termination rules used by COLO were added to the CBE: When a test reaches the intended minimum test length, it ends if the overall score SEM is below a pre-specified benchmark. Otherwise the test continues until its overall score SEM is below the pre-specified benchmark or the maximum test length is reached.
Test Invalidation	After a test is administered, scores are invalidated if the scoring rules are violated. These invalidation rules were not included in the previous version of the CBE, so the CBE was enhanced to include the score invalidation rules for MAP Growth tests.

2.1. Longitudinal Item Exposure Control

The CBE was originally designed to administer an adaptive assessment once a year, but MAP Growth tests are typically administered three times a year in the fall, winter, and spring. Therefore, the CBE was enhanced to handle multiple administrations and longitudinal item exposure control that prevents a student from seeing the same item within a period specified in the blueprint (e.g., 14 months). However, while the longitudinal item exposure control was a strict constraint on COLO, it became a guideline on the CBE. In other words, when there are no items available for selection, a student will receive a repeated item to continue the test. This change of allowing repeated items is different from COLO and can prevent the test from crashing due to item starvation.

2.2. Entry Conditions

The CBE originally used the same initial value specified in the test model to select the first item for all students, which assumes that all students have the same ability to start the test. Since in reality students have different abilities, the starting value was enhanced on the CBE to match COLO, so the selection of the first item depends on the item difficulty and student ability estimate based on, for example, the score from the prior administration.

Although the same entry conditions implemented on COLO were applied to the CBE for MAP Growth, the two engines use different scales for the IRT-based parameters. COLO uses the RIT scale for MAP Growth scores and item difficulties, while the CBE uses the logit scale (with a logit score denoted as θ) that is more general and makes it possible for the CBE to be used with other projects such as Nebraska Student-Centered Assessment System (NSCAS). The values on the RIT scale can be converted to the logit scale by the following linear transformation:

$$\theta = (\mathrm{RIT} - 200)/10 \quad (1)$$

The following list includes entry conditions that can be specified in the test model to guide the first item selection in the operational test. In addition to these conditions, the initial value chosen by the user for the simulated students could be specified in the input student file if needed to give researchers flexibility to check the use of the initial values.

- A starting point for item difficulties is determined using the following criteria:
    - Convert the theta value from the student's last RIT score in the same domain.
    - If not available, look for a score in the next domain in the following order of preference:

When the current domain is:	Examine other domains in this order:
Mathematics	Reading, Language Usage
Reading	Language Usage, Mathematics
Language Usage	Reading, Mathematics
General Sciences	Mathematics

    - If not available, use the grade-level median for the domain being tested.
    - Subtract 0.5 from the starting point and use this as the target student ability to select the first item.
- If not available, use the default value specified in the test model.

2.3. Ability Estimation Methods

COLO uses two ability estimation methods: Owen's Bayesian procedure (Owen, 1975) and MLE with fencing. Owen's Bayesian score is used as a target value to select an item, and MLE is used for the final score reporting at both the overall and instructional area levels. However, given the limitation of Owen's procedure to estimate students' momentary abilities when polytomous-scored items are presented and the potential future use of polytomous items in MAP Growth tests, the MLE method was adopted to estimate the momentary ability for MAP Growth assessments. MLE was an existing feature on the CBE, but it was a new way to estimate momentary ability for MAP Growth. The MLE method is practical with the increased computation speed and, unlike the Bayesian method, does not depend on the prior score distribution.

Although MLE is used as the final scoring method on both engines, the default fencing rules implemented on the CBE were different from the rules applied for MAP Growth tests on COLO. When the ability cannot be estimated by MLE when all the items are answered either correctly or incorrectly, both COLO and the CBE create an incorrect or correct response to a dichotomous fencing item. The default item discrimination for this fencing item used by the CBE is 2 and the item difficulty is 3. In contrast, the default item discrimination used by COLO is 1 and the item difficulty is 3.8. In this study, the default values for each engine were used.

2.4. Item Selection Algorithm

COLO and the CBE employ different item selection algorithms. the SSP approach (i.e., a variation of the shadow test approach) is a fundamental feature of the CBE, administering MAP Growth on the CBE means the item selection algorithm must be different from COLO. When the shadow test approach was originally proposed (van der Linden & Reese, 1998), the test length was assumed to be fixed. For fixed-length tests, studies have shown that the shadow adaptive test performs better than other methods in terms of measurement accuracy and constraint management (e.g., van der Linden, 2005). When the CBE was originally developed by NWEA for state summative assessments such as NSCAS, all the tests were designed to have a fixed length. The Spring 2018 NSCAS test results indicated that the CBE performed well, as expected, to balance the content (Nebraska Department of Education, 2018).

However, when the CBE was used in simulations, the initial simulation results showed that many content constraints were violated. For example, the minimum number of items at the instructional area level was not achieved, the passage-based and field test items appeared at positions not specified in the test model, and the minimum number of items in a passage did not meet the specifications. A closer investigation revealed that the CBE assembled the SSP based on the maximum number of items in an adaptive test. When the test has variable test lengths, there were still items not administered to some students after the test was terminated early, which caused the problem of not meeting the content specifications.

Most MAP Growth tests have variable test lengths, so new item ordering rules were added to prevent the CBE from violating the content constraints (e.g., not administering the passage-based and field test items once the last specified positions for these items are passed). The new feature of content balance by item count was also added to balance the content earlier in the test. To improve the reliability of instructional area scores, the content balance by SEM was developed for MAP Growth. Unlike COLO, the CBE is more flexible in allowing users to choose the exact item range for different procedures. Users can specify the item range in the test model exactly as it is coded on COLO, or they can choose the range that leads to the best results.

2.5. Test Termination

The CBE originally ended a test when a fixed number of items were administered to students. This cannot be applied to most MAP Growth tests with variable test length, so the following test termination rules used by COLO were added to the CBE: When a test reaches the intended minimum test length, it ends if the overall score SEM is below a pre-specified benchmark (e.g., 0.35 on the logit scale). Otherwise the test continues until its overall score SEM is below the pre-specified benchmark or the maximum test length is reached.

2.6. Test Invalidation

After a MAP Growth test is administered, scores are invalidated if the scoring rules are violated. These invalidation rules were not included in the previous version of the CBE, so the CBE was enhanced to include the score invalidation rules for MAP Growth. According to the MAP Growth blueprint for each test, a score is invalidated if one or more of the following occur:

- The final RIT score is less than the minimum RIT or greater than the maximum RIT.
- Its SEM is equal to or less than the minimum SEM.
- Its SEM is greater than the maximum SEM and the scale score is less than the predefined high achievement limit.
- Test duration is less than six minutes or greater than 28 days.

Table 2.2 presents the invalidation rule thresholds for each MAP Growth test included in this study. Some rules were modified to achieve a consistent implementation across content areas and grades. The CBE truncates any scores less than 100 to 100 and any scores greater than 350 to 350. Therefore, no scores estimated by the CBE will violate the RIT minimum and maximum value rule. The third rule may result in different invalidation decisions between the two engines.

Table 2.2. MAP Growth Invalidation Rules

MAP Growth Test	RIT		SEM		High Achievement Limit	Test Duration
	Min.	Max.	Min.	Max.		
Reading K–2	100	350*	1	5.5	100	6 minutes - 28 days
Reading 2–5	100	350*	1	5.5	230**	6 minutes - 28 days
Reading 6+	100	350*	1	5.5	230**	6 minutes - 28 days
Math K–2	100	350	1	5.5	100	6 minutes - 28 days
Math 2–5	100	350	1	5.5	230**	6 minutes - 28 days
Math 6+	100	350	1	5.5	230**	6 minutes - 28 days
Language 2–12	100	350	1	5.5	230**	6 minutes - 28 days
Science 3–5	100	350	1	5.5	230	6 minutes - 28 days
Science 6–8	100	350	1	5.5	230	6 minutes - 28 days

*320 is used to invalidate scores estimated by COLO.
**240 is used to invalidate scores estimated by COLO.

3. Methods

In the CBE enhancement process, numerous simulations were conducted to test the new functionalities. For example, the simulation results were used to check the score estimation accuracy and whether the items were selected as expected. Errors or bugs discovered in implementing the new features of the CBE and its simulator were all fixed. After the development was completed in December 2019, final simulations as described in this report were conducted on both the CBE and COLO to check the mode comparability.

3.1. Simulator

The simulator used in this study was enhanced in 2018–2019 in Assessment Integration Management (AIM), the web interface communication tool for the CBE used to create the test and upload the test model, item pool, and student sample to run simulations. Although a CBE simulator had already been developed for NSCAS, it could not be used by MAP Growth given the newly added CBE enhancements. Therefore, major changes were made to the test model, item pool, and simulated student input files needed by the simulator:

- Test model: Users can now specify the longitudinal item exposure control, item selection method to balance the content, test termination rules, test invalidation rules, and Lexile® table or other features related to score reporting.
- Item pool: Users can now convert an existing MAP Growth test in AIM to the CBE version without uploading the item IDs like what is needed for NSCAS. This change reduces the amount of work for the users but involves code changes to the simulator.
- Simulated student file: Users can now provide the testing dates, true thetas, and student attributes (e.g., grade, gender, ethnicity) for multiple administrations. The probability of pausing a test can also be specified in the student file.

New developments were made to the simulator for downloading the simulation results for multiple administrations. Other new features were also added to improve the performance of the simulator that could benefit both MAP Growth and other assessments that use the CBE. For example, the simulator capacity was scaled up to administer items to up to 8,000 simulees concurrently, with a maximum of 2,000 simulees allowed in each simulation. In contrast, the CBE previously only allowed 1,000 simulees in one simulation, and COLO only allows 400 simulees.

For comparability analyses, the simulations were also conducted on COLO through a different simulator called the Jenkins-Validator-Runner. To run this simulator, users need to enter the key for a test, a list of the true thetas, and an email address for receiving the link to download the output file. Depending on the specification of the longitudinal item exposure control, the user can choose whether to reuse the same student across true thetas that represent different administrations. For example, if the longitudinal item exposure control is three months, the reuse of student option should not be selected. In other scenarios such as 10 or 14 months, the reuse of student should be selected.

3.2. Simulated MAP Growth Tests

Table 3.1 presents the MAP Growth tests administered to Nebraska students that were selected for this study, along with the number of items in the item pool for each test. An analysis of test events by test name from Winter 2018/2019 showed that these nine tests were taken by most students and were therefore chosen to represent different content areas and ensure that enough data could be collected for the empirical study.

Table 3.1. Simulated MAP Growth Tests

Test	#Items		
	Total	Operational	Field Test
Growth: Reading K–2 NE 2014	2,923	2,922	1
Growth: Reading 2–5 NE 2014 V2	3,475	3,474	1
Growth: Reading 6+ NE 2014 V2	3,715	3,714	1
Growth: Math K–2 NE 2015	1,758	1,758	–
Growth: Math 2–5 NE 2015	2,883	2,883	–
Growth: Math 6+ NE 2015	5,114	5,114	–
Growth: Language 2–12 NE 2014 V2	3,879	3,879	–
Growth: Science 3–5 NE 2017	1,376	1,365	11
Growth: Science 6–8 NE 2017	2,002	1,986	16

3.3. True Thetas

The Greek letter theta (θ) is commonly used in IRT models to designate a student's ability level. As such, "theta" is synonymous for a student's score. A goal of an assessment is to estimate a student's theta value. In a simulation, theta can be set to a known value called a "true theta" that is used to generate item responses. A theta value is estimated from the responses and compared to the true theta. A purpose of simulations is to determine if the estimated theta is sufficiently close to the true theta. To simulate a realistic assessment, six or eight administrations were simulated for each MAP Growth test based on the blueprint. Traditionally, two true theta points were selected for running simulations on COLO for each MAP Growth test administration. One represents the low-ability student (e.g., 10th percentile), whereas the other represents the high-ability student (e.g., 90th percentile). The same true theta points were adopted for running simulations on the CBE.

Table 3.2 presents the true thetas selected for this study. These values were originally on the RIT scale, but they were converted to the logit scale for the CBE simulations. The time points represent the test administrations. For example, if a test is administered three times a year, time points 1–6 would represent fall, winter, and spring for the first school year and then fall, winter, and spring for the next school year. Similarly, if a test is administered four times a year, time points 1–8 would represent fall, winter, spring, and summer for the two consecutive years.

The true thetas for the first administration represent the scores that correspond to the 10th percentile (low achievement) and 90th percentile (high achievement) for the assumed starting grade according to the 2015 NWEA norms (Thum & Hauser, 2015). The true thetas for the second administration and beyond were derived from the values for the fall administration and the 2015 NWEA growth norms (Thum & Hauser, 2015). For tests with summer administrations, the true theta values stayed the same as the ones for the spring administration. Each true theta was replicated 50 times. As a result, each administration had 100 simulees, 50 of which had the same true theta values that represented low achievement (e.g., the theta is -4.5 for Reading 2–5 at time point 1, or the fall administration of the first year). The other 50 simulees had the same true theta values that represented high achievement (e.g., 1.8 for Reading 2–5 at time point 1, or the fall administration of the first year).

These same 100 simulees were simulated for the rest of the six or eight administrations again but with true thetas that reflect the growth scores students gained across administrations. In total, there were either 600 or 800 test events simulated for each test:

- 600 simulated events: 2 thetas x 50 replications x 6 administrations = 600
- 800 simulated events: 2 thetas x 50 replications x 8 administrations = 800

The true theta values in Table 3.2 were used to simulate students' true total scores on each test. Given the unidimensionality is assumed by the IRT model adopted for this study, it is expected that the simulee's true thetas in each instructional area would be the same as the true thetas on the total test.

Table 3.2. True Thetas Selected for Simulations

Test	Assumed Starting Grade	Ability Level	True Theta by Time Points*							
			1	2	3	4	5	6	7	8
Reading K–2	K	Low	-7.6	-6.3	-4.2	-3.7	-2.6	-2.0	–	–
	1	High	-2.3	-1.3	-0.8	-0.8	-0.1	0.2	–	–
Reading 2–5	2	Low	-4.5	-3.3	-2.8	-2.8	-2.8	-1.9	-1.5	-1.5
	4	High	1.8	2.1	2.3	2.3	2.4	2.7	2.9	3.0
Reading 6+	6	low	-0.8	-0.3	-0.1	-0.1	-0.1	0.3	0.5	0.5
	8	High	3.7	3.7	3.8	3.8	4.1	4.1	4.1	4.2
Mathematics K–2	K	Low	-7.9	-6.6	-5.6	-5.0	-3.8	-3.1	–	–
	1	High	-2.1	-1.1	-0.5	-0.5	0.3	0.8	–	–
Mathematics 2–5	2	Low	-4.0	-2.9	-2.3	-2.3	-2.3	-1.4	–	–
	4	High	2.0	2.6	3.1	3.1	3.1	3.6	–	–
Mathematics 6+	6	Low	-0.2	0.3	0.6	0.6	0.6	1.0	–	–
	8	High	4.9	5.2	5.3	5.3	5.4	5.5	–	–
Language Usage 2–12	2	Low	-4.7	-3.3	-2.7	-2.7	-2.7	-1.8	-1.4	-1.4
	8	High	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.8
General Science 3–5	3	Low	-2.8	-2.0	-1.6	-1.6	-1.6	-1.0	-0.6	-0.6
	4	High	0.9	1.0	1.2	1.3	1.4	1.6	1.7	1.8
General Science 6–8	6	Low	-1.0	-0.6	-0.4	-0.4	-0.3	0.1	0.2	0.2
	7	High	2.2	2.3	2.4	2.4	2.5	2.5	2.7	2.8

*The time points represent the test administrations. For a test administered three times a year, time points 1–6 represent fall, winter, and spring for the first year and then fall, winter, and spring for the next year. For a test administered four times a year, time points 1–8 represent fall, winter, spring, and summer for the two consecutive years.

3.4. Evaluation Criteria

Mode comparability was evaluated by five criteria:

1. Content validity (e.g., meeting the content specifications)
2. Construct validity (e.g., recovery of true thetas)
3. Test score reliability (e.g., SEM of the overall test and instructional area level scores)
4. Adaptivity (e.g., delta value)
5. Item exposure within and across administrations

3.4.1. Content Validity

Content validity evidence rests greatly on establishing the link between the items and what students should know and be able to do as prescribed by the content standards. To support the content validity of an assessment, the alignment between the items and content specifications (an important component of the test blueprint) can be evaluated to ensure representativeness (Lane, 1999). For the MAP Growth tests, the number of operational and field test items in the total test are used as either constraints or guidelines for item selection.

In the blueprints for tests administered on COLO, the item selection specifications (e.g., instructional area balance by item count) were intended to balance the number of items at the instructional area level and improve the instructional area score estimation accuracy. This intention can be clearly specified in the test model for the CBE. For example, a range of the number of items at the instructional area level can be specified as a guideline, and the minimum number of items at the instructional area level can be specified as a constraint. Other content constraints include the passage positions, number of passages, number of items in a passage, and field test item positions.

Table 3.3 presents the MAP Growth content specifications for each test. To compare COLO and the CBE in terms of meeting the content specifications, the number of items and passages from the simulation results were checked against the numbers in this table.

Table 3.3. MAP Growth Content Constraints and Guidelines

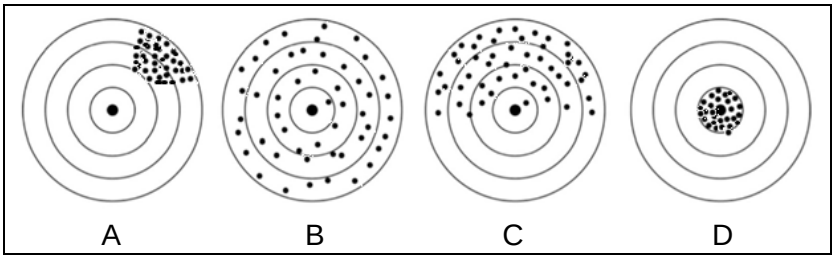
	#Items* (Constraints)			#Items per Instructional Area		Passage (Constraints)	
Test	Total	OP	FT	Min. #Items (Constraint)	Range #Items (Guideline)	#Passages	#Items per Passage
Reading K–2	43	40–43	0–3	10	10–13	–	–
Reading 2–5	40–43	36–43	0–4	7	7–15	0–3	3–5
Reading 6+	40–43	36–43	0–4	7	7–15	0–3	3–5
Math K–2	43	40–43	0–3	10	10–13	–	–
Math 2–5	50–53	47–53	0–3	11	12–17	–	–
Math 6+	50–53	47–53	0–3	11	12–17	–	–
Language 2–12	50–53	47–53	0–3	15	15–21	–	–
Science 3–5	45	36–45	0–9	12	12–15	–	–
Science 6–8	45	36–45	0–9	12	12–15	–	–

*OP = operational. FT = field test.

3.4.2. Construct Validity

Construct validity is the degree to which a test measures what it claims to be measuring. One type of construct validity evidence concerns the recovery of true thetas in simulations. When the simulated data are generated, the true theta (i.e., score) is known. This is illustrated by the target diagram in Figure 3.1. The center of the target represents the true theta, and the smaller dots represent the estimated thetas. Scores on Plots B and D are more valid than the scores on Plots A and C because they are targeted at the center where the test is supposed to measure (i.e., unbiased). Plot D is better than B because the scores are less variable (i.e., lower error).

Figure 3.1. Target Diagram of True and Estimated Thetas



Overall summary indices are often used to evaluate the simulation results in terms of how the estimated thetas recover the true theta. These indices typically include bias and root mean square error (RMSE). Bias is the mean difference between the estimated thetas and true theta. RMSE is used to remove the sign of the bias (positive or negative) and show only the variability of the estimates around the true value. It is defined as follows:

$$RMSE = \sqrt{\frac{\sum_{r=1}^{50}(\hat{\theta}_r - \theta)^2}{50}} \quad (2)$$

where *r* is the index of a replication, $\hat{\theta}_r$ is the estimated theta for replication r, and θ is the true theta value.

3.4.3. Reliability

According to the *Standards for Educational and Psychological Testing* (AERA et al., 2014), reliability refers to the degree to which test scores for a group of students are consistent over repeated applications of a measurement procedure and are inferred to be dependable and consistent for an individual student (p. 222). For example, although the estimated scores on Plot B in Figure 3.1 are valid, they are more scattered, which means they are less reliable. In contrast, the scores on Plots A and D are less variable and therefore more reliable than the scores on Plots B and C.

A popular reliability index for achievement tests is coefficient alpha, an index of internal consistency that indicates the degree to which differences in test scores reflect true differences in the attribute being tested rather than random fluctuations. The traditional reliability coefficient depends on all students taking the same items. However, different students receive different sets of items in an adaptive test. Samejima (1994) proposed using the marginal reliability coefficient to estimate the reliability of an adaptive test.

The reliability coefficient is a unit-free indicator that reflects the degree to which scores are free of measurement error. It best reflects the extent to which measurement inconsistencies may be present or absent in a group. However, the reliability indices are not that useful for interpreting the accuracy of test scores. Instead, the SEM is an indicator of test score precision that uses the same metric as the test itself. It is better than reliability for determining the effect of measurement inconsistencies on the scores obtained by individual students. The SEM is defined as the standard deviation of the distribution of observed scores for students with identical true scores, as shown below:

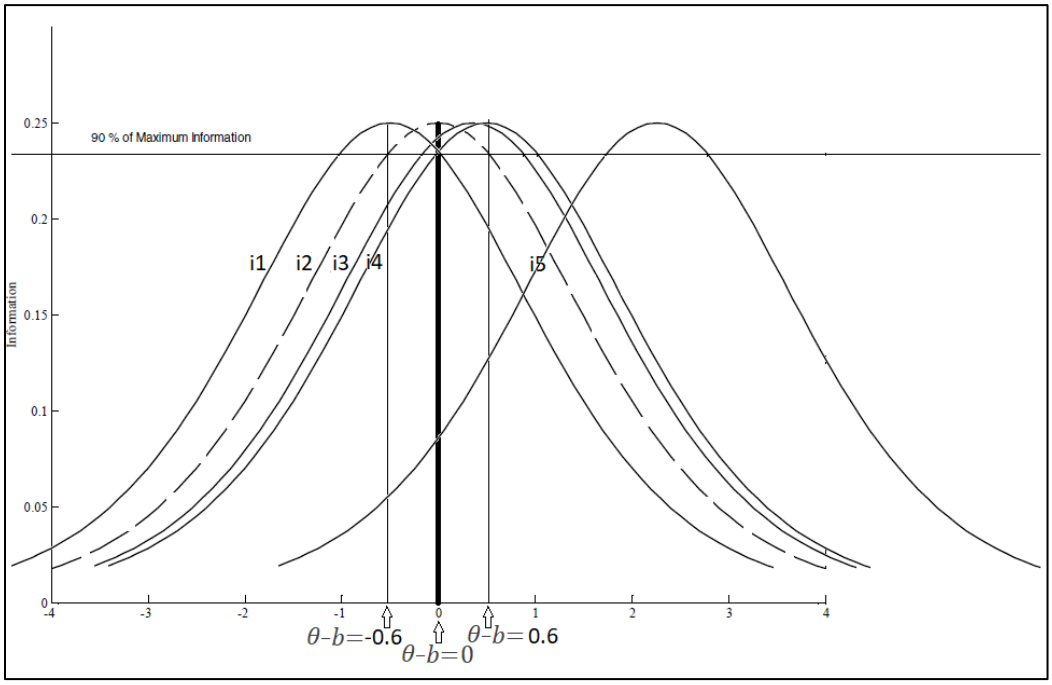
$$SEM = SD\sqrt{1 - reliability} \quad (3)$$

The SEM allows statements regarding the precision of test scores. For example, students with a given true score will have observed scores that fall between ±1 standard error about 66% of the time. This SEM approach only provides a single numerical estimate for constructing the confidence intervals for all students regardless of their scores. However, score precision in IRT varies according to each student's score. For example, the SEM based on the Rasch model is an alternative approach that conditions the SEM on a student's score estimate. In other words, each scale score has its own SEM defined as the reciprocal of the square toot of the test information function (TIF). For the Rasch model it is given by:

$$SEM(\hat{\theta}) = 1/\sqrt{TIF(\hat{\theta})} \tag{4}$$

When the TIF is maximized at a given $\hat{\theta}$, the SEM at the same theta location is minimized. Test information is the sum of the item information functions of all the items administered to a student. Item information depends on each item's difficulty and conditional item score variance. For the Rasch model, the item information takes on a maximum value of 0.25 when the difference between the item difficulty and estimated theta is 0. As illustrated in Figure 3.2, if a student's ability estimate θ is 0, the information of Item 2 (i2) is optimal at this theta point.

Figure 3.2. Illustration of Item Information



To improve the reliability of each score for adaptive assessments, the difficulty of the item administered to a student should ideally match the selection or momentary theta. However, in practice, the difficulty of the item selected may not match the theta exactly given the limitation of the item pool. Reckase (2010) proposed that an item is acceptable if its information is within 90% of the maximum possible. For example, in Figure 3.2, Items 1, 2, 3, and 4 are all acceptable at theta = 0. In contrast, Item 5 is not ideal to be selected given its low information at theta = 0. The rule used to determine if a MAP Growth item is acceptable is $|\theta - b| \leq 0.6$, which means the item information is within 91.51% of the maximum possible. Once the number of items is known, the maximum acceptable SEM can be calculated by Equation 4.

Table 3.4 presents the acceptable SEMs of the overall and instructional area scores for each test. These values can be used as important criteria or benchmarks to evaluate the score reliability for mode comparability purposes.

Table 3.4. SEM Benchmarks

MAP Growth Test	SEM Benchmarks	
	Overall	Instructional Area
Reading K–2	0.33	0.66
Reading 2–5	0.35	0.79
Reading 6+	0.35	0.79
Math K–2	0.33	0.66
Math 2–5	0.29	0.63
Math 6+	0.29	0.63
Language 2–12	0.29	0.54
Science 3–5	0.35	0.60
Science 6–8	0.35	0.60

3.4.4. Adaptivity

When the difficulty of an item presented to a student matches the student's ability, the final score estimation can be reliable. Therefore, the adaptivity of items to abilities can be used to evaluate the performance of an adaptive test. In this study, the adaptivity of COLO and the CBE can be compared to evaluate the mode comparability. For the adaptive tests developed based on the Rasch models, the delta value was used to indicate the adaptivity as shown below:

$$Delta = Selection\ Theta - Item\ Difficulty \tag{5}$$

The selection theta is the estimated score the engine uses to determine the next item given to a student at that moment. For example, the selection theta for the first item could be a student's score from a prior test. After the first item is administered, a momentary score can be calculated. For COLO, the momentary theta is then used as the selection theta to select the second item. In contrast, the selection theta for the second item on the CBE is the same as the one for the first item. The momentary theta estimated after the first item is answered is used as the selection theta to choose the third item for the CBE. Using the momentary theta based on the previous N (for COLO) or N-1 (for the CBE) items as selection score continues until the adaptive assessment is terminated. When the absolute delta value is equal to or less than 0.6 (i.e., the rule selected for MAP Growth tests), the adaptivity of the adaptive test is considered acceptable to ensure a reliable score.

3.4.5. Item Exposure

Item exposure can be checked from two perspectives: (1) the same item is exposed to different students within one administration, and (2) the same item is presented to the same student across administrations. The item exposure rate within one administration can be calculated for each item in the item pool as follows:

$$Exposure\ Rate = \frac{Frequency\ of\ Item}{Total\ Number\ of\ Student} \tag{6}$$

In the blueprints for the MAP Growth tests investigated in this study, there is a longitudinal item exposure control specified for each test. For example, the longitudinal specification for the Mathematics and Reading K–2 tests is three months, which means the same item is not preferred to be presented to the same student if the student retakes the test within three months. The longitudinal specification is 10 months for the Language test and 14 months for the remaining tests. To check the longitudinal item exposure across administrations, any two administrations are selected, and the number of items given to the same student repeatedly are counted.

4. Results

This section presents the simulation results based on the evaluation criteria described in the previous section. Appendix A presents the detailed summary statistics for all results at the overall and instructional area levels. All values on the RIT scale were converted onto the logit scale for comparisons involving item difficulties, scores, and measurement errors.

4.1. Content Validity: Meeting Content Specifications

The content validity of MAP Growth tests administered on COLO and the CBE were compared by checking if the content specifications provided in Table 3.3 were met during the simulations. Table 4.1, Table 4.2, and Table 4.3 summarize the results, including the number of items (both operational and field test) given to simulees, the number of items at the instructional area level, and the number of passages and the number of items in a passage for the two MAP Growth Reading tests. The constraints and guidelines from Table 3.3 are included in these tables for easy comparison.

As shown in the tables, the number of items students received from both engines are within the constraints. The minimum number of items students received at the instructional area level from the CBE also met the constraint, but the number of items delivered on the CBE was not always in the specified range for the item range guideline. For COLO, the number of items students received at the instructional area level does not meet the constraint and falls outside of the preferred range, although this is not surprising since the instructional area constraints and guidelines are not explicitly specified on COLO. The passage constraints are met by both engines, although some students received the maximum number of passages from the CBE, which is preferred for a reading test from a content perspective. In contrast, no student received three passages in the reading tests administered on COLO.

Table 4.1. Content Constraint and Guideline Results—Number of Items

MAP Growth Test	#Items*								
	Total			OP			FT		
	Constraint	COLO	CBE	Constraint	COLO	CBE	Constraint	COLO	CBE
Reading K–2	*43*	43	43	*40–43*	42–43	43	*0–3*	0–1	0
Reading 2–5	*40–43*	40–43	40–43	*36–43*	39–43	39–43	*0–4*	0–1	0–1
Reading 6+	*40–43*	40–43	41–43	*36–43*	39–43	41–43	*0–4*	0–1	0
Math K–2	*43*	43	43	*40–43*	43	43	*0–3*	0	0
Math 2–5	*50–53*	50–53	51–53	*47–53*	50–53	51–53	*0–3*	0	0
Math 6+	*50–53*	50–53	51–53	*47–53*	50–53	51–53	*0–3*	0	0
Language 2–12	*50–53*	50–53	51–53	*47–53*	50–53	51–53	*0–3*	0	0
Science 3–5	*45*	45	45	*36–45*	37–45	40–44	*0–9*	0–8	1–5
Science 6–8	*45*	45	45	*36–45*	36–45	43–45	*0–9*	1–9	0–2

*OP = operational. FT = field test.

Table 4.2. Content Constraint and Guideline Results—Number of Items per Instructional Area

MAP Growth Test	#Items per Instructional Area					
	Min. #Items			Range #Items		
	Constraint	COLO	CBE	Guideline	COLO	CBE
Reading K–2	*10*	9	10	*10–13*	9–15	10–13
Reading 2–5	*7*	5	7	*7–15*	5–18	7–15
Reading 6+	*7*	5	7	*7–15*	5–18	7–15
Math K–2	*10*	9	10	*10–13*	9–15	10–13
Math 2–5	*11*	12	11	*12–17*	12–17	11–20
Math 6+	*11*	12	11	*12–17*	12–17	11–17
Language 2–12	*15*	16	15	*15–21*	16–21	15–22
Science 3–5	*12*	10	12	*12–15*	10–20	12–17
Science 6–8	*12*	10	13	*12–15*	10–21	13–17

Table 4.3. Content Constraint and Guideline Results—Passages

MAP Growth Test	#Passages			#Items per Passage		
	Constraint	COLO	CBE	Constraint	COLO	CBE
Reading 2–5	*0–3*	0–2	0–3	*3–5*	3–5	3–5
Reading 6+	*0–3*	0–2	0–3	*3–5*	3–5	3–4

Table 4.4 presents the percentage of students who received a different number of passages and the passage positions. For example, 47% and 23% of students received three passages in the Reading 2–5 and Reading 6+ tests, respectively, administered on the CBE, whereas no students received three passages on COLO. This suggests that the CBE is better at delivering MAP Growth Reading tests with passages.

For the passage position, the results show that the CBE orders items differently than COLO. According to the MAP Growth blueprints, Positions 7–11, 12–14, 15–18 could be passage-based items. For COLO, the results show that if a passage is selected, the first item in the passage always starts at Positions 7, 12, or 15. In contrast, once a passage is selected on the CBE, it can start from any position in or close to the specified range. From a content perspective, where to start the passage in the specified range should not have any impact on a student's performance. Being flexible with item position makes it more possible for the engine to select items adaptively.

Table 4.4. Percent of Students Receiving a Specific Number of Passages

MAP Growth Test	Engine	%Students Receiving Each #Passages				Passage Position
		0	1	2	3	
Reading 2–5	COLO	47.0	36.0	17.0	0.0	[7, 15]
	CBE	47.0	3.0	3.0	47.0	[7, 8, 9, 10, 11, 12, 13, 14, 15, 18]
Reading 6+	COLO	33.0	18.0	49.0	0.0	[7, 15]
	CBE	23.0	31.0	23.0	23.0	[7, 8, 9, 10, 15, 18,19]

4.2. Construct Validity: Recovery of True Thetas

Table 4.5 presents the Reading K–2 results to show an example of the recovery of true thetas investigated for each administration. Appendix A presents these results for all nine tests. For all tests, the estimated thetas (ET) at the total test level produced by both COLO and the CBE can recover the true thetas well because the difference between the true and estimated thetas (i.e., bias and RMSE) are small.

Table 4.5. Summary Statistics to Evaluate the Recovery of True Thetas: Reading K–2

Admin.	True Theta	COLO			CBE		
		ET	Bias	RMSE	ET	Bias	RMSE
1	-7.6	-7.63	-0.03	0.34	-7.59	0.01	0.37
	-2.3	-2.27	0.03	0.32	-2.34	-0.04	0.32
2	-6.3	-6.27	0.03	0.33	-6.24	0.06	0.25
	-1.3	-1.26	0.04	0.29	-1.33	-0.03	0.29
3	-4.2	-4.21	-0.01	0.35	-4.22	-0.02	0.32
	-0.8	-0.81	-0.01	0.34	-0.79	0.01	0.34
4	-3.7	-3.70	0.00	0.38	-3.70	0.00	0.30
	-0.8	-0.81	-0.01	0.37	-0.75	0.05	0.35
5	-2.6	-2.57	0.03	0.28	-2.63	-0.03	0.32
	-0.1	-0.08	0.02	0.27	-0.06	0.04	0.35
6	-2.0	-1.98	0.02	0.29	-1.97	0.03	0.40
	0.2	0.21	0.01	0.29	0.22	0.02	0.30

Figure 4.1 and Figure 4.2 illustrate the Reading K–2 bias and RMSE for a direct comparison of COLO and the CBE. Appendix B presents the plots for all nine MAP Growth tests investigated in Project Altair. The y-axis is bias or RMSE, and the x-axis represents the true theta points selected for each administration. The left half of the x-axis has all the true theta points corresponding to low achievers' abilities. For example, "10-1" represents the true theta corresponding to the 10th percentile for the first administration. The right half of the x-axis has all the true theta points corresponding to high achievers' abilities in the 90th percentile. The shorter the distance between the point that represents the bias or RMSE and the green line, the better the true theta recovers. The lines intertwined together indicates that no engine produced the estimated scores that can consistently recover the true scores better than its counterpart. This observation holds true for all other tests in Appendix B.

Figure 4.1. Plot for Bias: Reading K–2

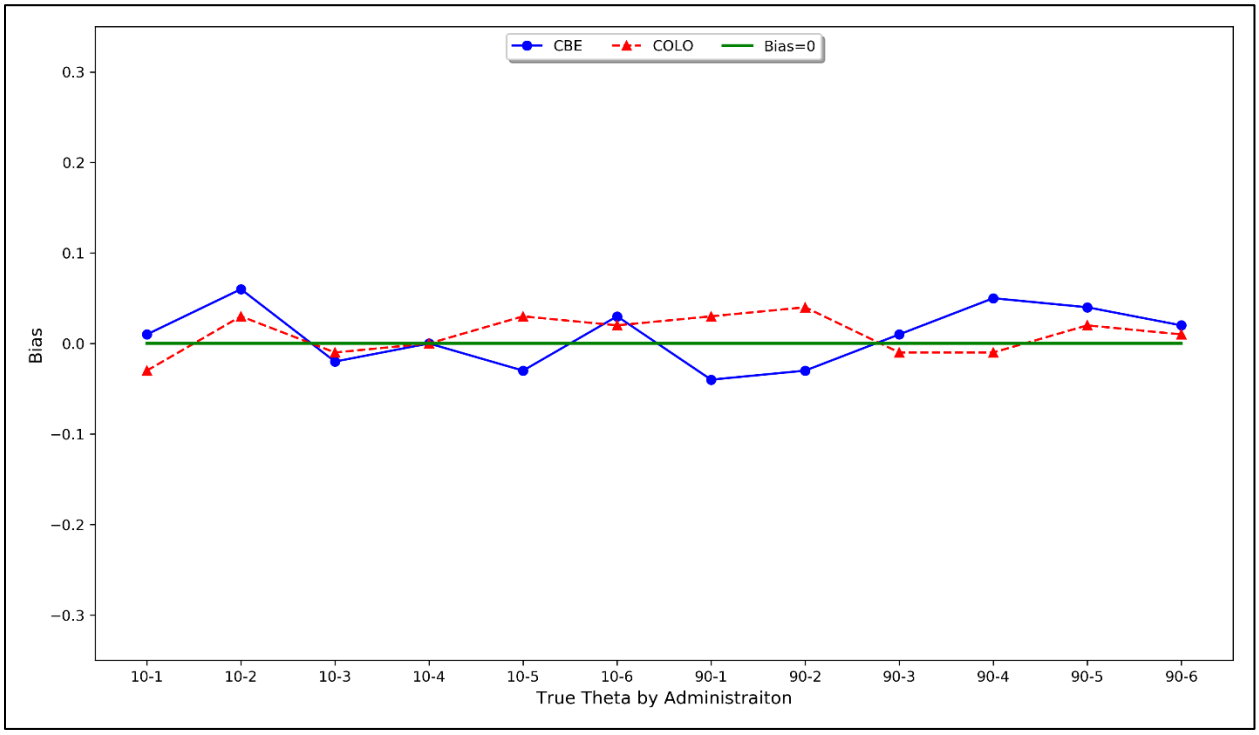
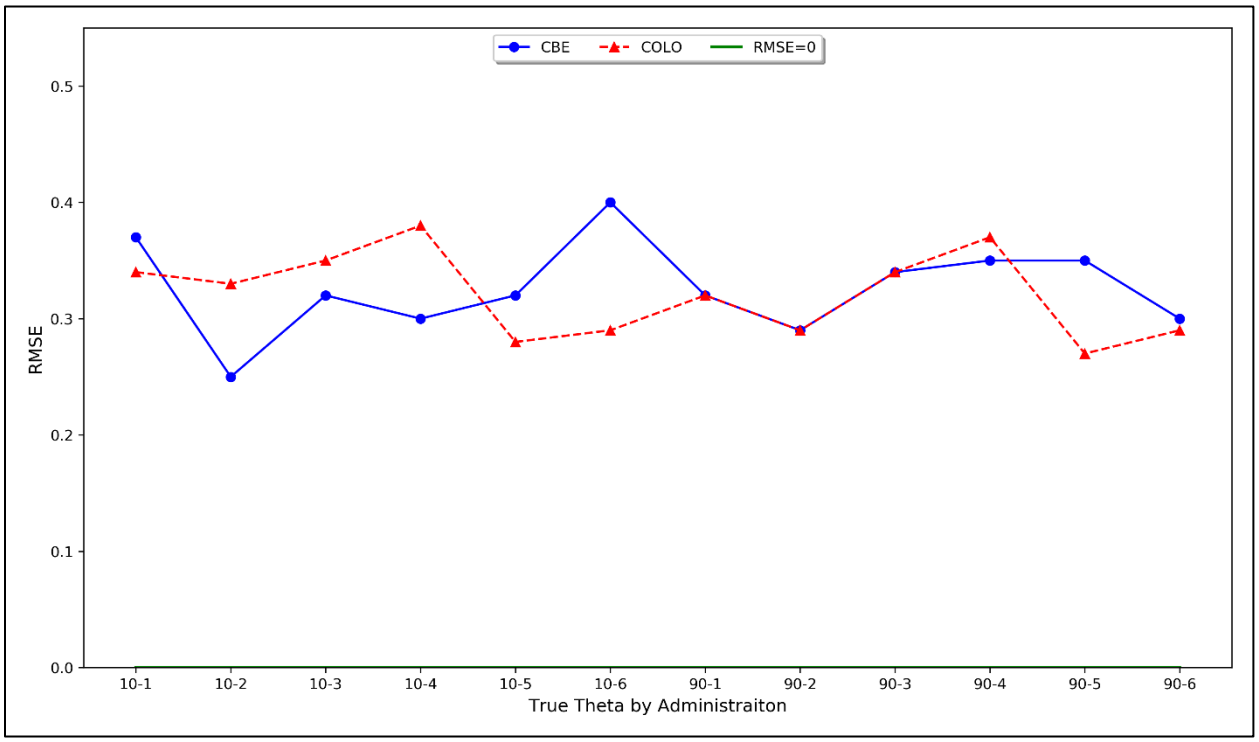


Figure 4.2. Plot for RMSE: Reading K–2



4.3. Reliability: Standard Error of Measurement (SEM)

According to the invalidation rules, if the SEM of the total RIT score is greater than 5.5, it could be invalidated unless the RIT is greater than the high achievement limit. On the theta scale, the SEM threshold for the total score is 0.55. Any total score with an SEM greater than 0.55 is flagged. The simulation results showed that no total scores produced by either engine have an SEM greater than 0.55, which indicates that both engines can produce scores that do not get invalidated. A closer look at the SEM of instructional area scores in Table 4.6 reveals that more scores produced by COLO (with the exception of Math 6+) are flagged than those produced by the CBE, suggesting that the CBE tends to provide more reliable instructional area scores than COLO.

Table 4.6. Percent of Instructional Area Score SEM Greater than Benchmark

	%Instructional Area Score SEMs > Benchmark*	
Test	COLO	CBE
Reading K–2	46.3	31.8
Reading 2–5	39.8	24.4
Reading 6+	46.3	26.2
Math K–2	50.0	32.5
Math 2–5	17.3	15.0
Math 6+	3.2	5.5
Language 2–12	21.1	9.8
Science 3–5	12.0	7.2
Science 6–8	13.3	4.0

*Benchmark is the maximum acceptable SEM for the instructional area scores (see details in Table 3.4).

Figure 4.3 – Figure 4.11 provide a visual of the total and instructional area score SEMs for the CBE and COLO at each true theta point on the x-axis. The green line represents the benchmark SEMs (see Table 3.4) for the total and instructional area scores. The benchmarks for the total score SEM shown in these figures are more rigorous than the threshold 0.55. If the SEM of a score estimated by the CBE and COLO is equal to or less than the benchmark, it suggests the score is reliable.

Whether an engine can produce reliable scores (i.e., small SEM) for an adaptive test depends on the number of items, item difficulty distributions, item distribution within different instructional areas in the item bank, and the item selection algorithm. Given the depth of the MAP Growth item pool, most total, or overall, and instructional area level scores are expected to have acceptable SEMs regardless of the engine. The SEMs in Figure 4.3 – Figure 4.11 support this expectation. However, at some extreme low or high true theta points, the SEM plots are different for COLO and the CBE even though the item pools are the same. At the total test level, the SEMs of higher scores produced by COLO are greater than the benchmarks in Reading 2–5, Reading 6+, Math 2–5, and Language 2–12. In contrast, the SEMs of scores produced by the CBE stay close to or under the benchmarks. This suggests that the CBE can select items difficult enough for high-ability students and, ultimately, can produce precise scores for these students. This is not true for COLO. For the lower end of the true thetas in Language 2–12, both COLO and the CBE cannot produce precise total scores given the existing item bank. These observations seem to be true for some of the instructional area SEMs in these four tests as well. Overall, the CBE produced sub-scores with more acceptable SEMs than COLO.

Figure 4.3. Plot for SEM: Reading K–2

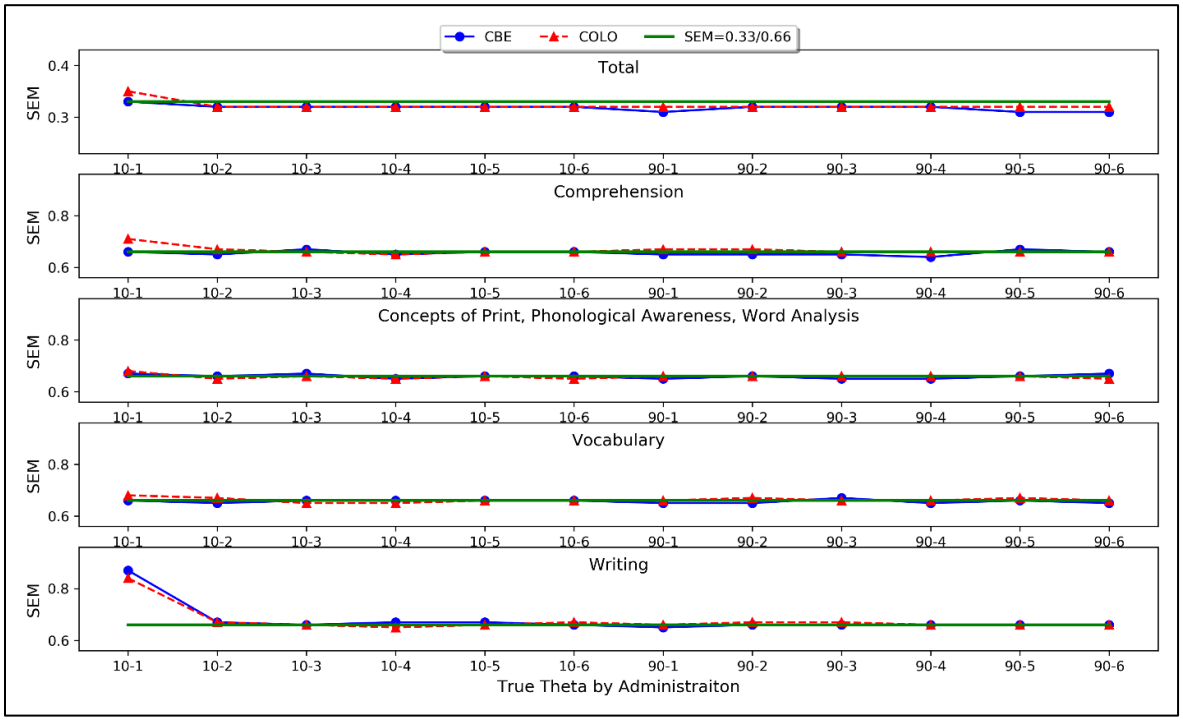


Figure 4.4. Plot for SEM: Reading 2–5

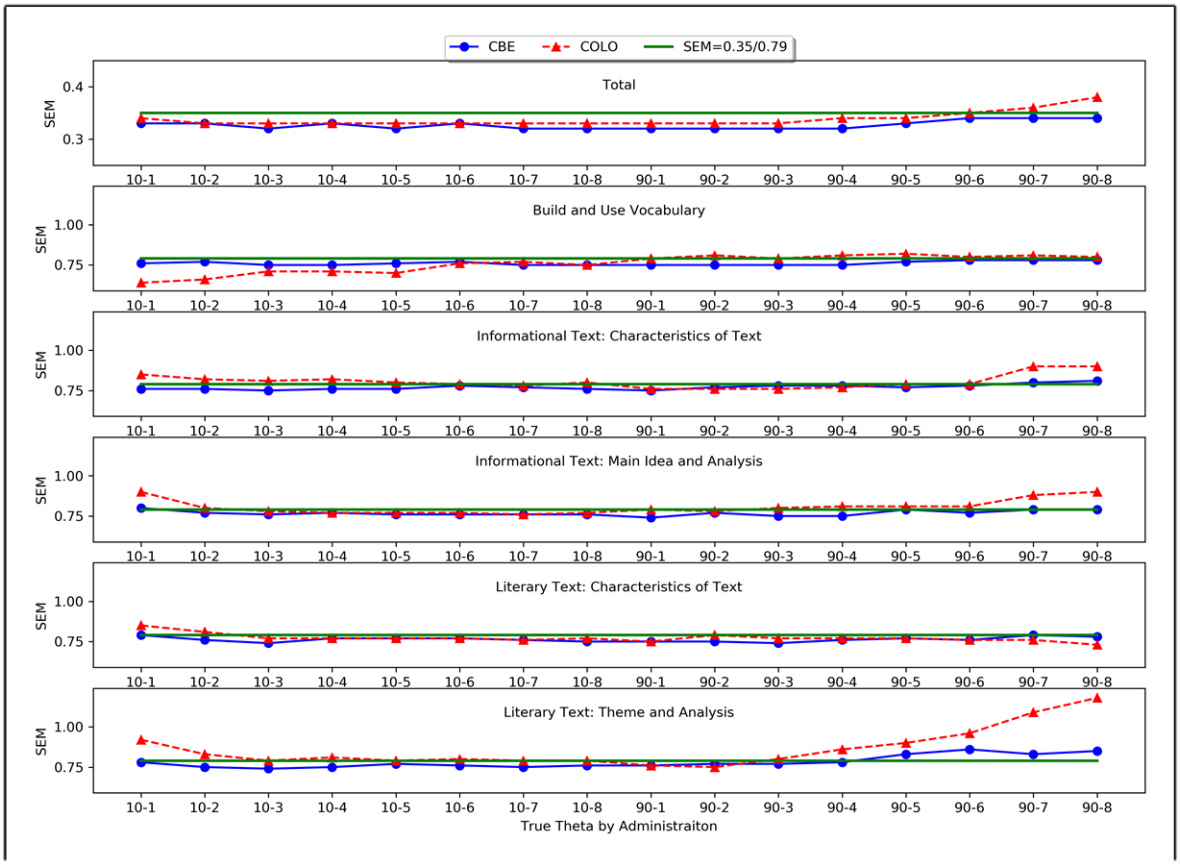


Figure 4.5. Plot for SEM: Reading 6+

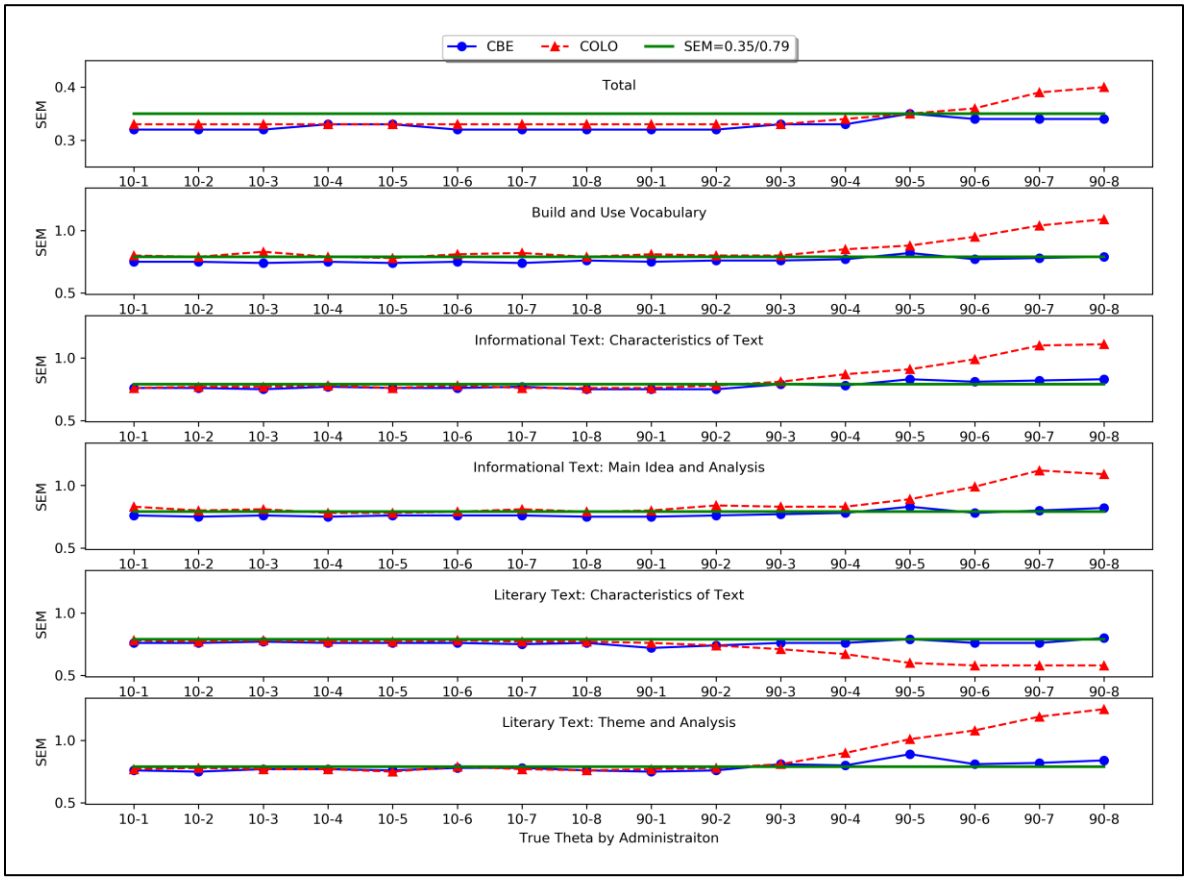


Figure 4.6. Plot for SEM: Mathematics K–2

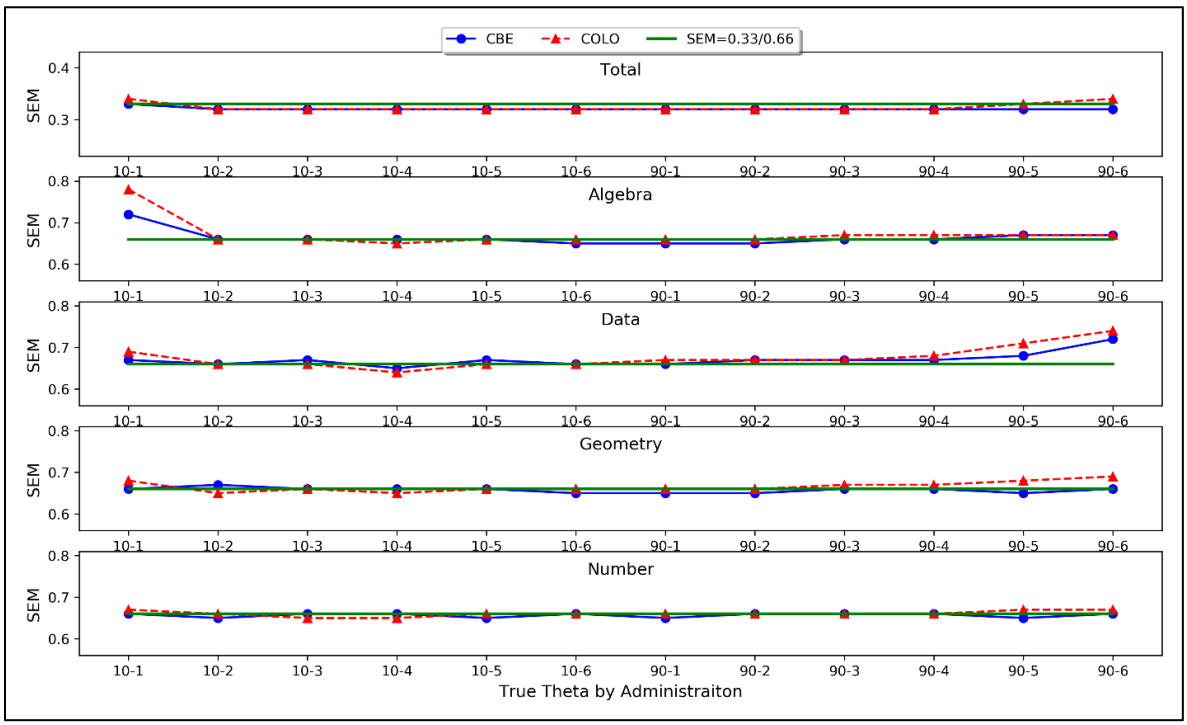


Figure 4.7. Plot for SEM: Mathematics 2–5

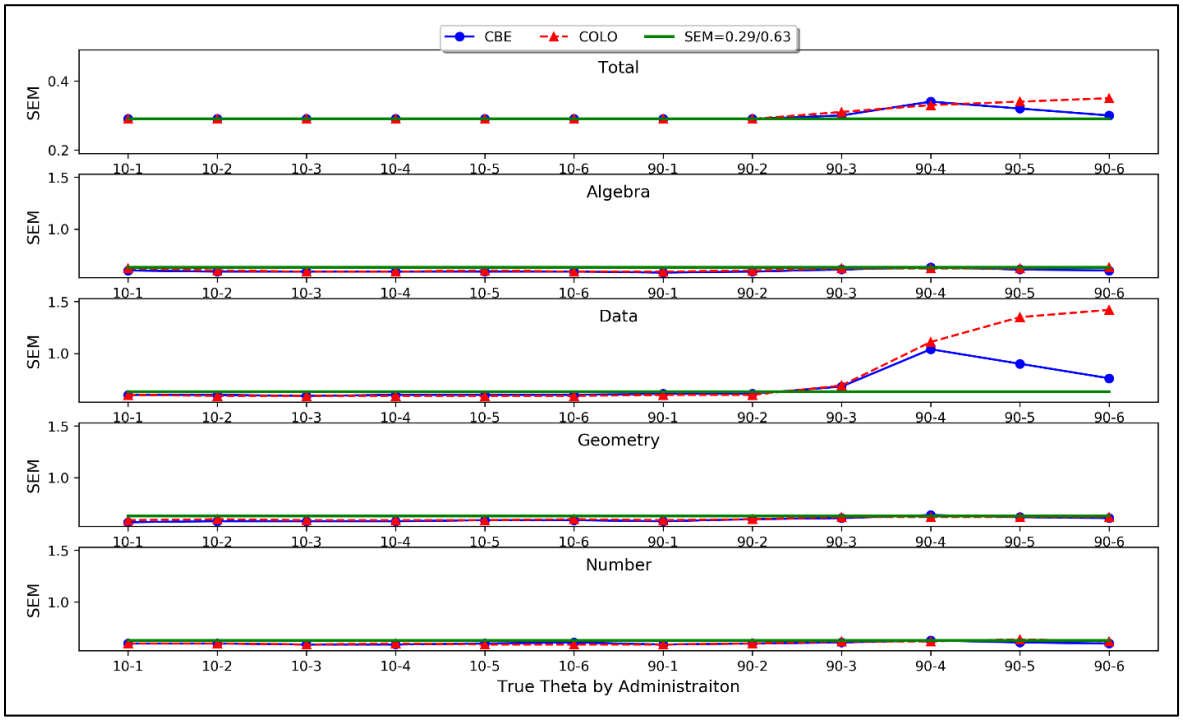


Figure 4.8. Plot for SEM: Mathematics 6+

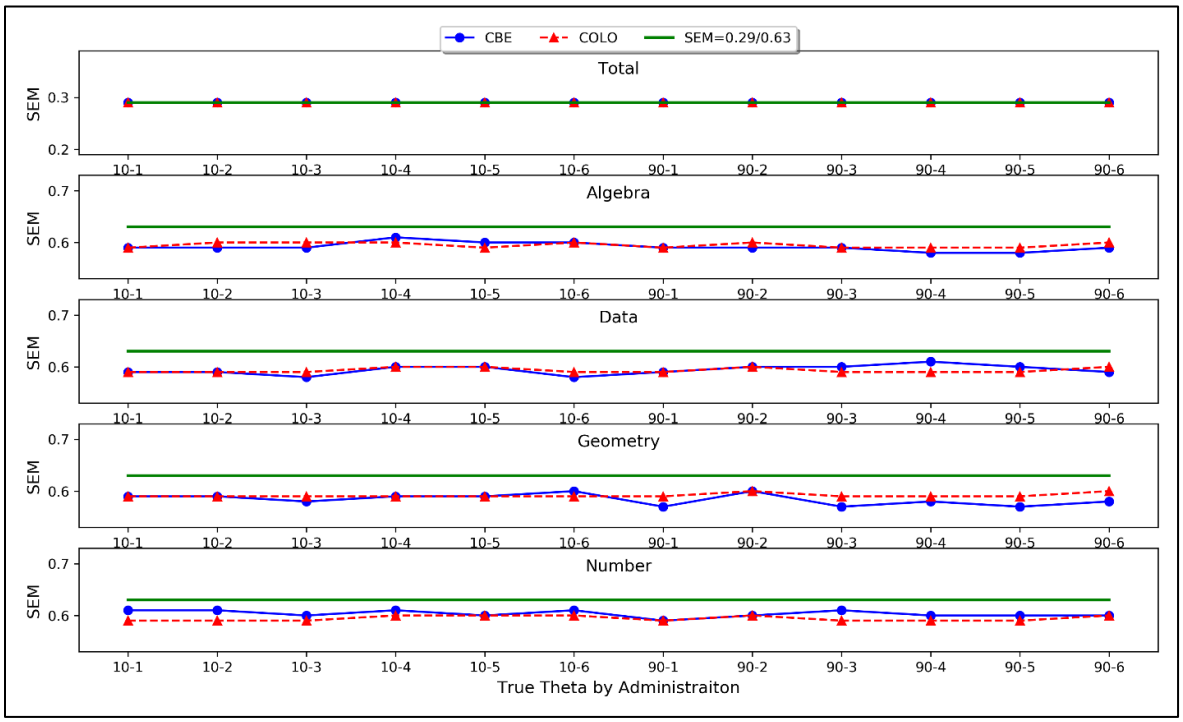


Figure 4.9. Plot for SEM: Language 2–12

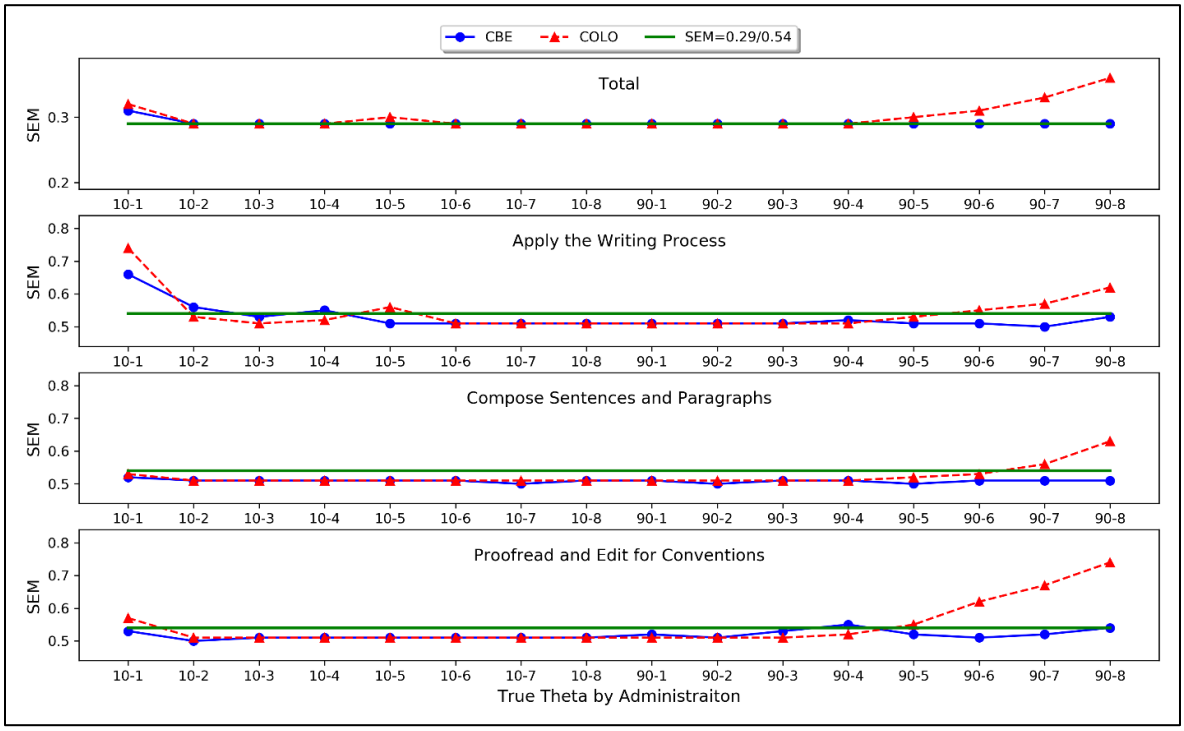


Figure 4.10. Plot for SEM: Science 3–5

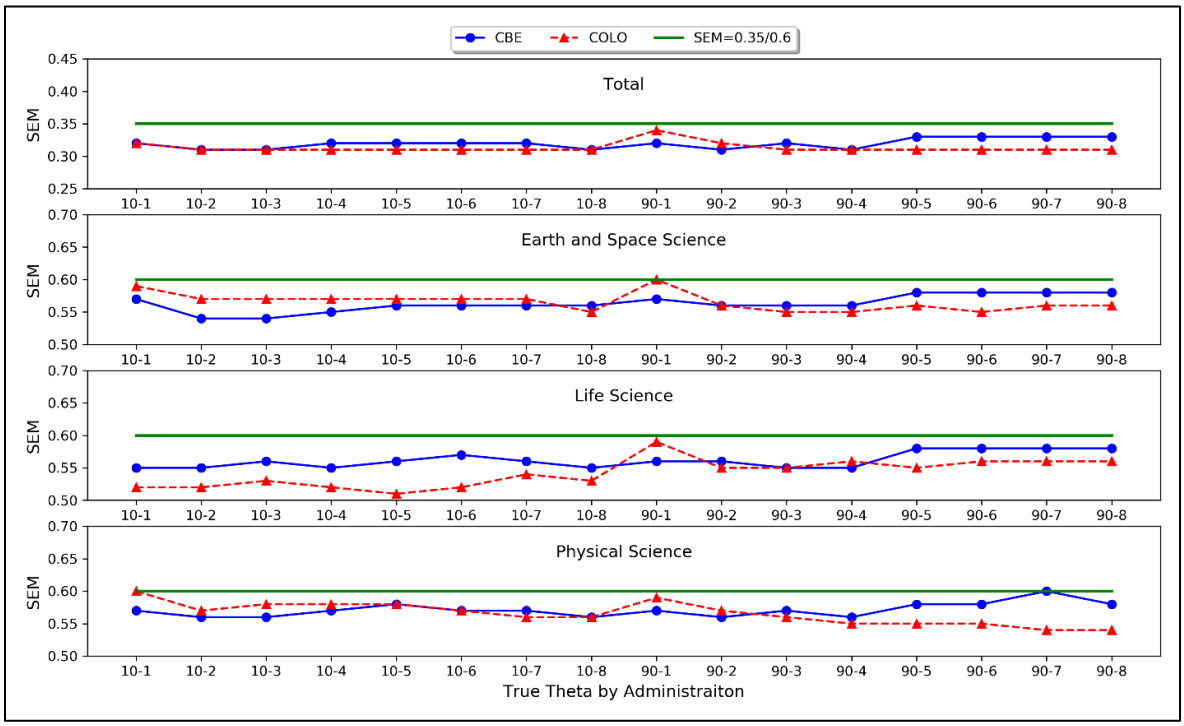
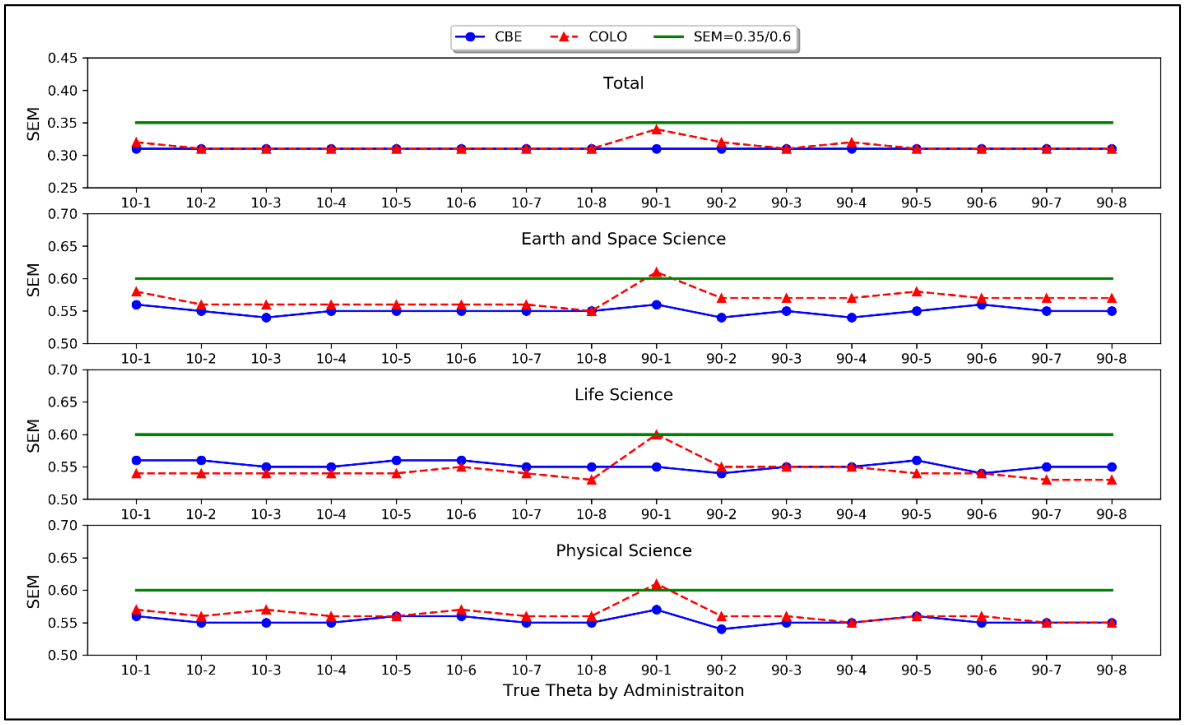


Figure 4.11. Plot for SEM: Science 6–8



4.4. Adaptivity: Delta

Delta value is the difference between the item difficulty and selection theta. If the absolute delta value is less than 0.6, it is acceptable to claim that the item is selected adaptively to the student's ability. Figure 4.12 – Figure 4.20 illustrate the absolute delta for COLO, the CBE, and the benchmark (i.e., 0.6) at the true theta point selected for each administration. Overall, the absolute delta values for the CBE are smaller than those for COLO. At most true theta points, the absolute values of delta for both COLO and the CBE are smaller than 0.6. At the lower theta end of Reading K–2 and Language 2–12 and at the higher theta end of Reading 2–5, Reading 6+, Math 2–5, and Language 2–12, the absolute delta values for COLO are much greater than 0.6. Although the absolute delta values for the CBE at some theta points of Reading 6+, Math 2–5, and Language 2–12 are greater than 0.6, they are still smaller than the delta value for COLO. This suggests the items selected by the CBE are more adaptive than those by COLO, even for students with very low or high achievement.

Figure 4.12. Plot for Delta: Reading K–2

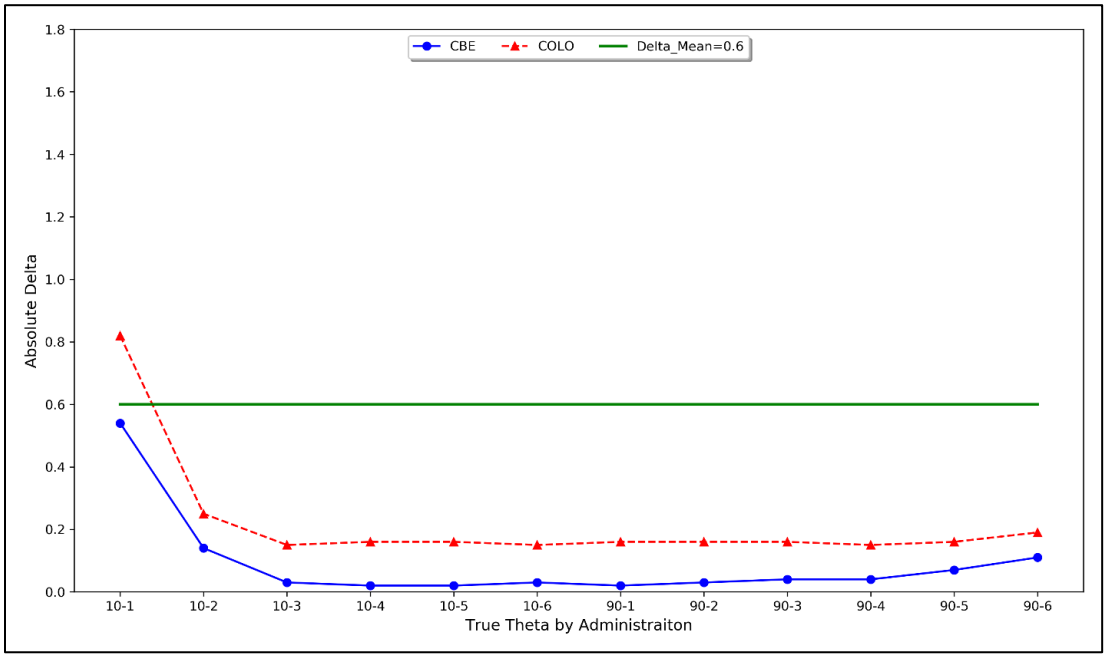


Figure 4.13. Plot for Delta: Reading 2–5

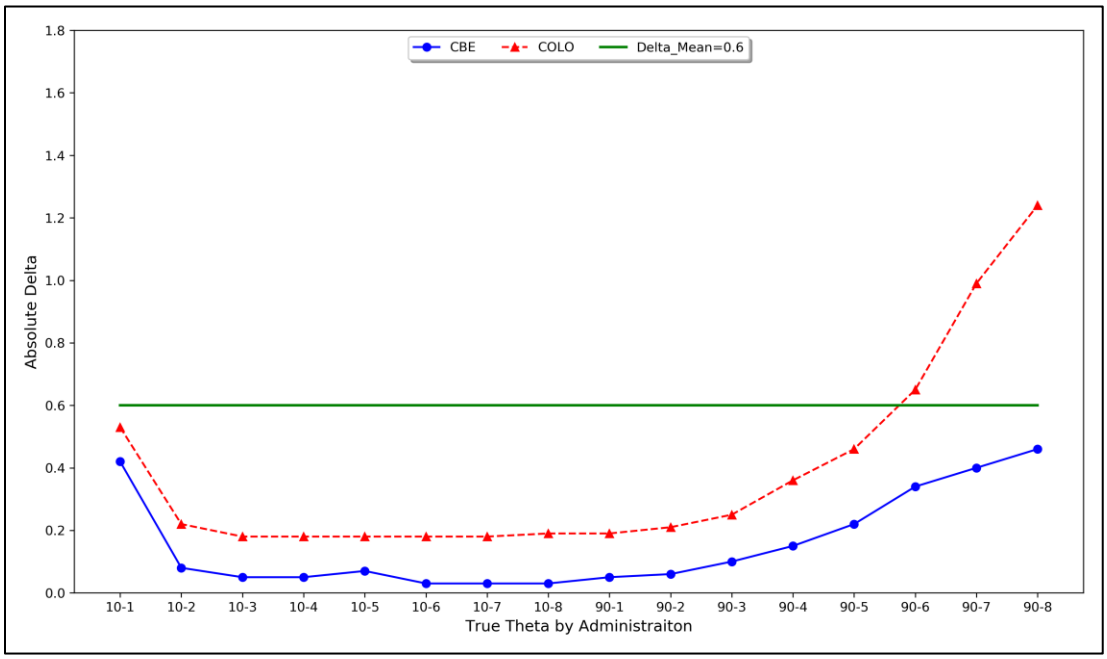


Figure 4.14. Plot for Delta: Reading 6+

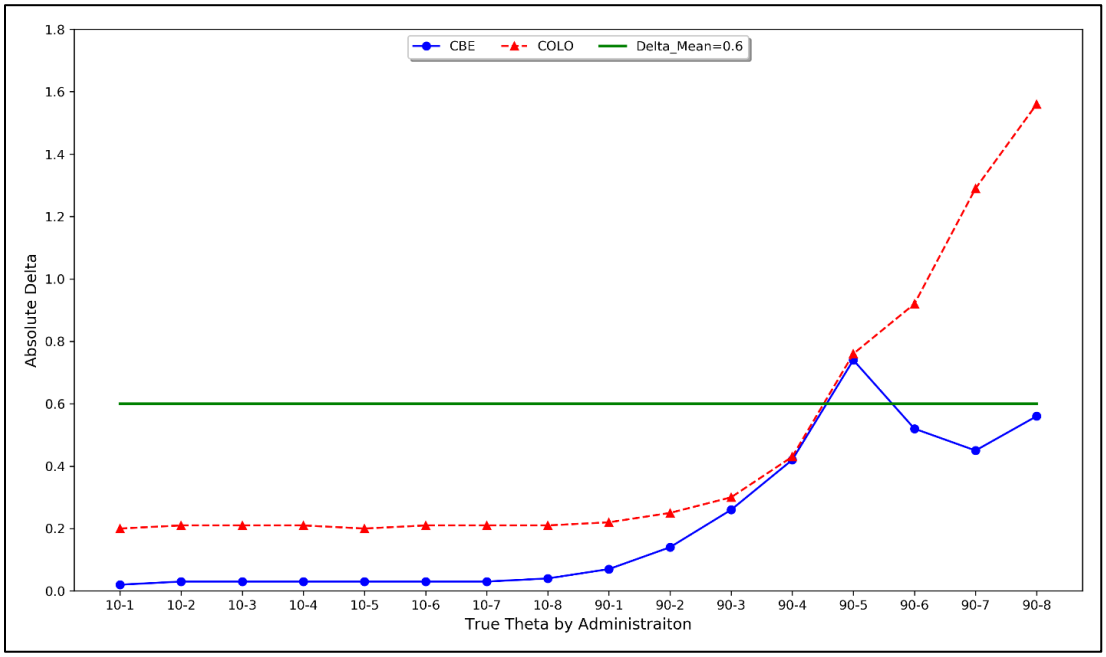


Figure 4.15. Plot for Delta: Mathematics K–2

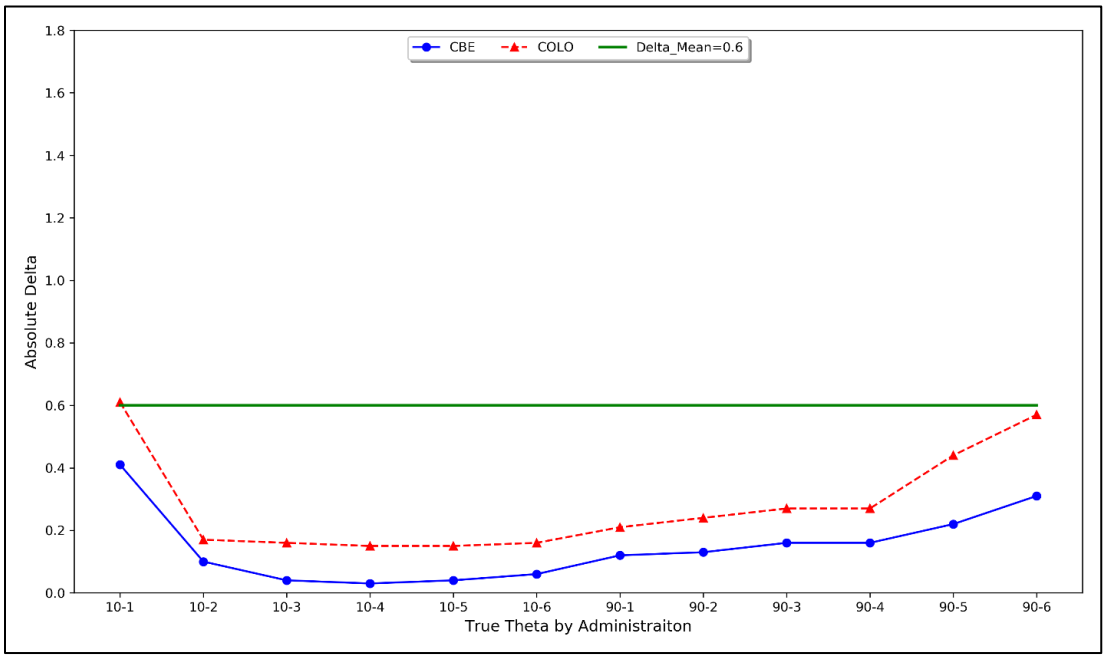


Figure 4.16. Plot for Delta: Mathematics 2–5

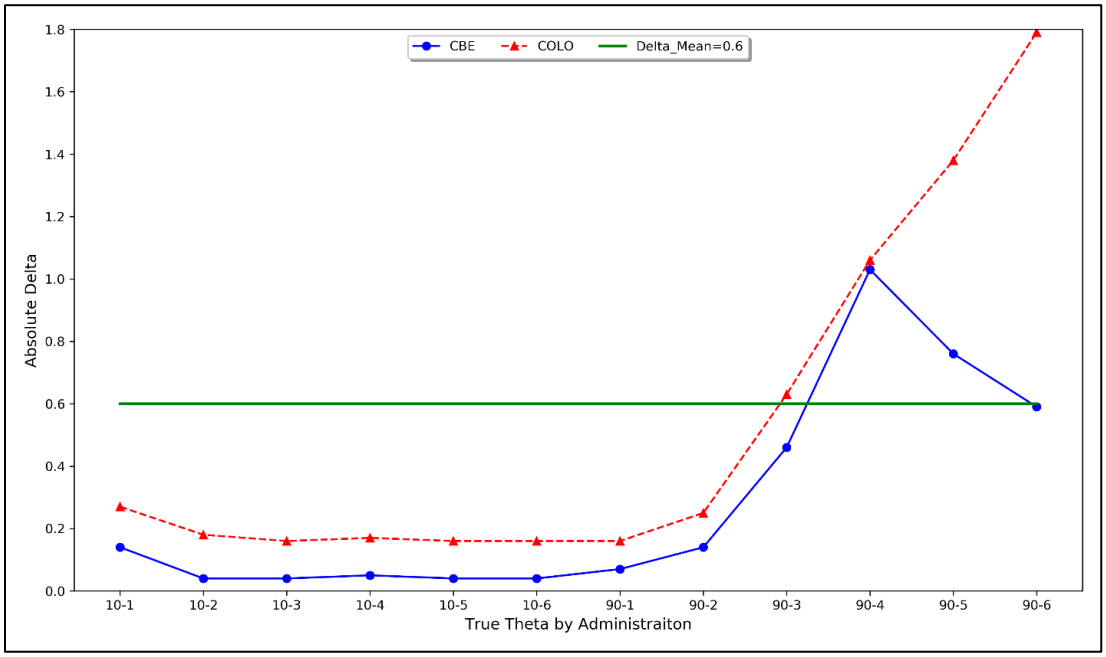


Figure 4.17. Plot for Delta: Mathematics 6+

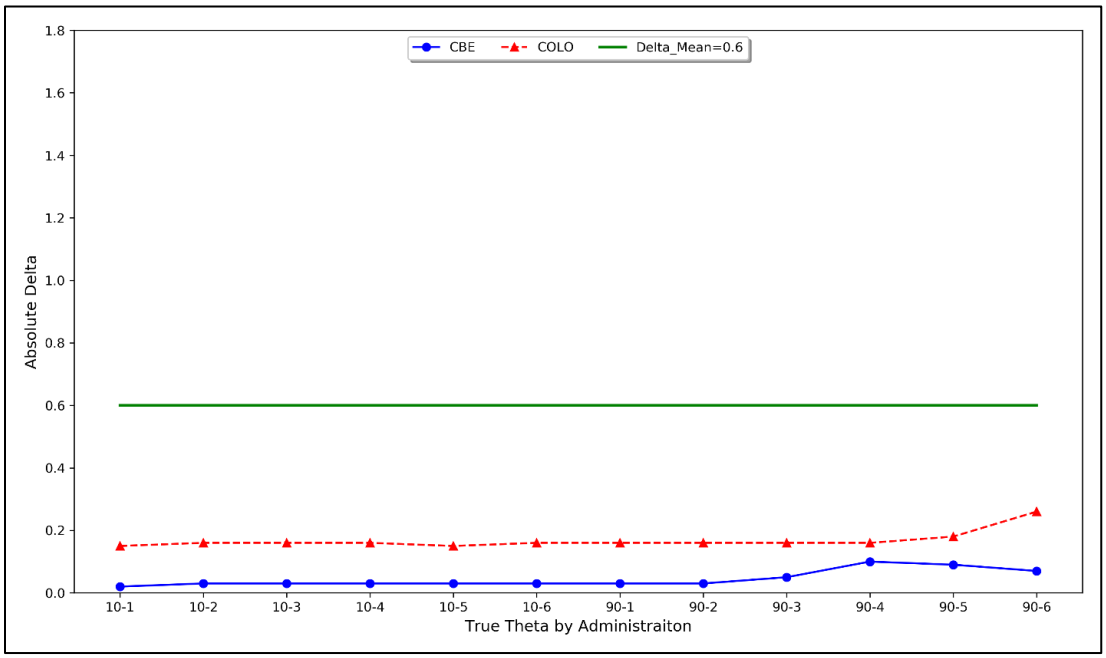


Figure 4.18. Plot for Delta: Language 2–12

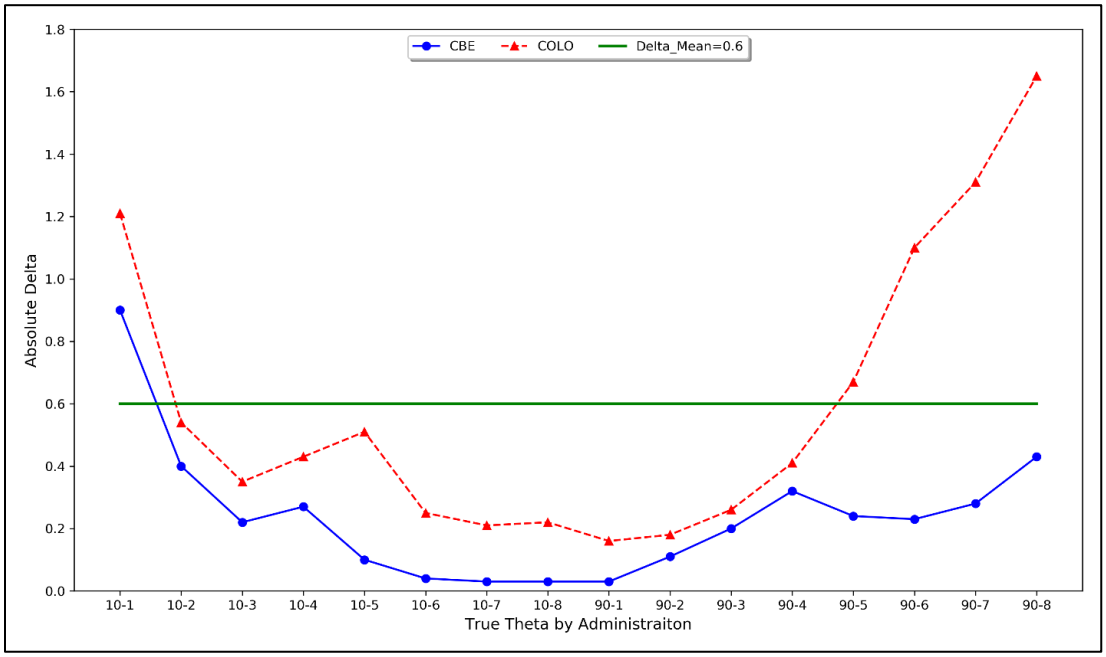


Figure 4.19. Plot for Delta: Science 3–5

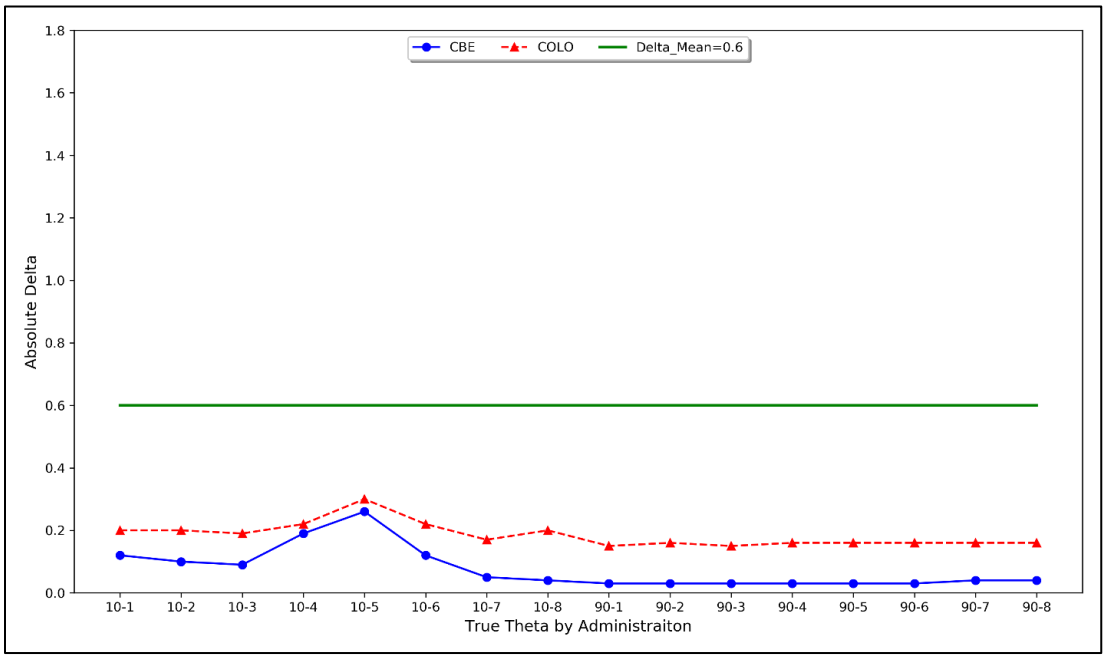
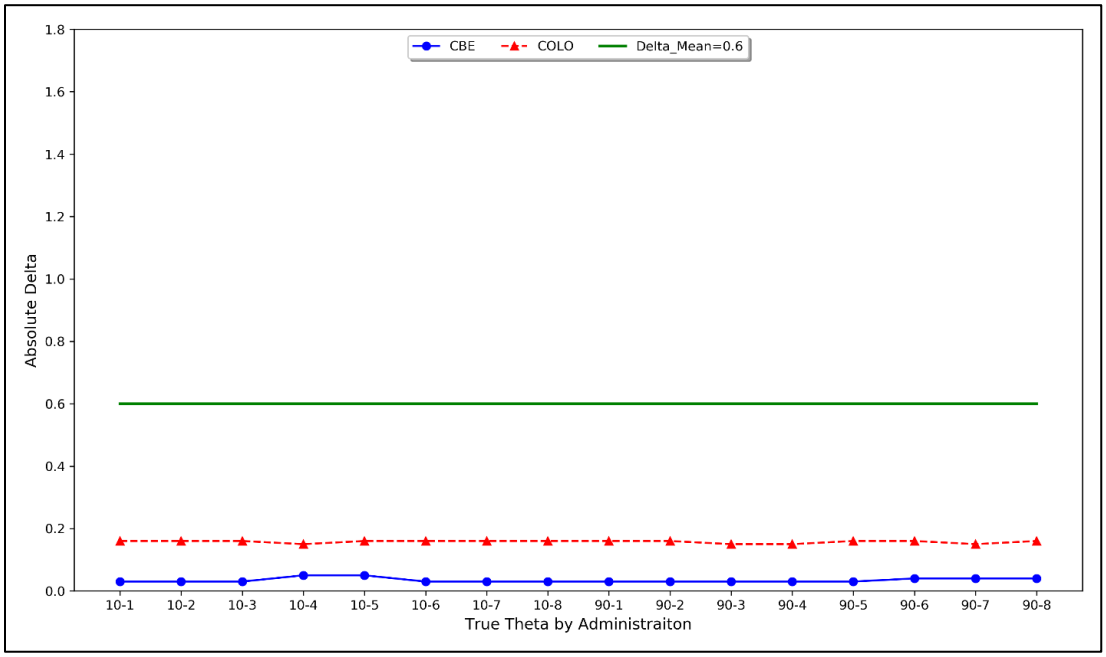


Figure 4.20. Plot for Delta: Science 6–8



4.5. Item Exposure

4.5.1. Within an Administration

Table 4.7 – Table 4.15 summarize the item exposure rates within an administration for each test. The number and percentage of items falling into each item exposure group were calculated. The item exposure rate of 0 means the item is not selected. For all MAP Growth tests, more items in the bank were not exposed by the CBE than by COLO. For example, 68.9% of the Reading K–2 items were not exposed to students by the CBE compared to 58.8% for COLO in the first administration. However, for the items exposed to students, more items delivered by COLO have lower exposure rate (e.g., in range (0.0, 0.1]). In contrast, more items delivered by the CBE have higher exposure rate.

These observations suggest that COLO has better item exposure control than the CBE within a test administration. However, the item exposure rates can be affected by the simulated true theta distributions. In the current study, only two true theta points that represent low and high achievement and each with 50 replications were simulated. In the item pool, it is common to see less extremely easy or difficult items available for the students simulated in the current study. This may explain why some items were overexposed. If a normal distribution of true thetas were simulated, the exposure rates could look differently from what were reported in this simulation study.

Table 4.7. Item Exposure Rates within an Administration—Reading K–2

Reading K–2					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	1,718	58.8	2,014	68.9
	(0.0, 0.1]	1,140	39.0	827	28.3
	(0.1, 0.2]	29	1.0	52	1.8
	(0.2, 0.3]	25	0.9	4	0.1
	(0.3, 0.4]	5	0.2	5	0.2
	(0.4, 0.5]	5	0.2	20	0.7
	>0.5	0	0.0	0	0.0
2	0	1,721	58.9	1,899	65.0
	(0.0, 0.1]	1,140	39.0	924	31.6
	(0.1, 0.2]	50	1.7	75	2.6
	(0.2, 0.3]	3	0.1	14	0.5
	(0.3, 0.4]	2	0.1	2	0.1
	(0.4, 0.5]	6	0.2	8	0.3
	>0.5	0	0.0	0	0.0
3	0	1,421	48.6	1,596	54.6
	(0.0, 0.1]	1,445	49.5	1,253	42.9
	(0.1, 0.2]	56	1.9	59	2.0
	(0.2, 0.3]	0	0.0	13	0.4
	(0.3, 0.4]	0	0.0	1	0.0
	>0.4	0	0.0	0	0.0
4	0	1,412	48.3	1,599	54.7
	(0.0, 0.1]	1,453	49.7	1,250	42.8
	(0.1, 0.2]	57	2.0	63	2.2
	(0.2, 0.3]	0	0.0	10	0.3
	>0.3	0	0.0	0	0.0
5	0	1,791	61.3	1,853	63.4
	(0.0, 0.1]	1,062	36.3	981	33.6
	(0.1, 0.2]	47	1.6	63	2.2
	(0.2, 0.3]	17	0.6	19	0.7
	(0.3, 0.4]	3	0.1	5	0.2
	(0.4, 0.5]	2	0.1	1	0.0
	>0.5	0	0.0	0	0.0
6	0	2,057	70.4	2,064	70.6
	(0.0, 0.1]	780	26.7	751	25.7
	(0.1, 0.2]	51	1.7	67	2.3
	(0.2, 0.3]	26	0.9	31	1.1
	(0.3, 0.4]	7	0.2	7	0.2
	(0.4, 0.5]	1	0.0	2	0.1
	>0.5	0	0.0	0	0.0

Table 4.8. Item Exposure Rates within an Administration—Reading 2–5

Reading 2–5					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	2377	68.4	2,636	75.9
	(0.0, 0.1]	1014	29.2	764	22.0
	(0.1, 0.2]	58	1.7	40	1.2
	(0.2, 0.3]	12	0.3	7	0.2
	(0.3, 0.4]	7	0.2	6	0.2
	(0.4, 0.5]	6	0.2	21	0.6
	>0.5	0	0.0	0	0.0
2	0	2133	61.4	2,411	69.4
	(0.0, 0.1]	1291	37.2	989	28.5
	(0.1, 0.2]	46	1.3	62	1.8
	(0.2, 0.3]	4	0.1	10	0.3
	(0.3, 0.4]	0	0.0	2	0.1
	>0.4	0	0.0	0	0.0
3	0	2089	60.1	2,280	65.6
	(0.0, 0.1]	1362	39.2	1,149	33.1
	(0.1, 0.2]	21	0.6	42	1.2
	(0.2, 0.3]	2	0.1	3	0.1
	>0.3	0	0.0	0	0.0
4	0	2156	62.1	2,237	64.4
	(0.0, 0.1]	1294	37.2	1,192	34.3
	(0.1, 0.2]	24	0.7	44	1.3
	(0.2, 0.3]	0	0.0	1	0.0
	>0.3	0	0.0	0	0.0
5	0	2126	61.2	2,268	65.3
	(0.0, 0.1]	1321	38.0	1,159	33.4
	(0.1, 0.2]	27	0.8	45	1.3
	(0.2, 0.3]	0	0.0	2	0.1
	>0.3	0	0.0	0	0.0
6	0	2005	57.7	2,227	64.1
	(0.0, 0.1]	1423	41.0	1,200	34.5
	(0.1, 0.2]	44	1.3	47	1.4
	(0.2, 0.3]	2	0.1	0	0.0
	>0.3	0	0.0	0	0.0
7	0	2045	58.9	2,158	62.1
	(0.0, 0.1]	1386	39.9	1,267	36.5
	(0.1, 0.2]	39	1.1	45	1.3
	(0.2, 0.3]	4	0.1	4	0.1
	>0.3	0	0.0	0	0.0

Reading 2–5					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
8	0	2064	59.4	2,228	64.1
	(0.0, 0.1]	1371	39.5	1,188	34.2
	(0.1, 0.2]	34	1.0	55	1.6
	(0.2, 0.3]	5	0.1	3	0.1
	>0.3	0	0.0	0	0.0

Table 4.9. Item Exposure Rates within an Administration—Reading 6+

Reading 6+					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	2,309	62.2	2,584	69.6
	(0.0, 0.1]	1,351	36.4	1,047	28.2
	(0.1, 0.2]	48	1.3	68	1.8
	(0.2, 0.3]	5	0.1	11	0.3
	(0.3, 0.4]	1	0.0	4	0.1
	>0.4	0	0.0	0	0.0
2	0	2,191	59.0	2,437	65.6
	(0.0, 0.1]	1,476	39.7	1,204	32.4
	(0.1, 0.2]	46	1.2	65	1.8
	(0.2, 0.3]	1	0.0	8	0.2
	>0.3	0	0.0	0	0.0
3	0	2,128	57.3	2,334	62.8
	(0.0, 0.1]	1,528	41.1	1,319	35.5
	(0.1, 0.2]	57	1.5	56	1.5
	(0.2, 0.3]	1	0.0	5	0.1
	>0.3	0	0.0	0	0.0
4	0	2,110	56.8	2,332	62.8
	(0.0, 0.1]	1,566	42.2	1,328	35.8
	(0.1, 0.2]	38	1.0	43	1.2
	(0.2, 0.3]	0	0.0	9	0.2
	(0.3, 0.4]	0	0.0	2	0.1
	>0.4	0	0.0	0	0.0
5	0	2,210	59.5	2,340	63.0
	(0.0, 0.1]	1,452	39.1	1,312	35.3
	(0.1, 0.2]	52	1.4	51	1.4
	(0.2, 0.3]	0	0.0	9	0.2
	(0.3, 0.4]	0	0.0	2	0.1
	>0.4	0	0.0	0	0.0

Reading 6+					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
6	0	2,098	56.5	2,357	63.5
	(0.0, 0.1]	1,571	42.3	1,296	34.9
	(0.1, 0.2]	44	1.2	51	1.4
	(0.2, 0.3]	1	0.0	6	0.2
	(0.3, 0.4]	0	0.0	4	0.1
	>0.4	0	0.0	0	0.0
7	0	2,147	57.8	2,278	61.3
	(0.0, 0.1]	1,516	40.8	1,378	37.1
	(0.1, 0.2]	50	1.3	48	1.3
	(0.2, 0.3]	1	0.0	10	0.3
	>0.3	0	0.0	0	0.0
8	0	2,151	57.9	2,405	64.8
	(0.0, 0.1]	1,504	40.5	1,246	33.5
	(0.1, 0.2]	55	1.5	59	1.6
	(0.2, 0.3]	4	0.1	4	0.1
	>0.3	0	0.0	0	0.0

Table 4.10. Item Exposure Rates within an Administration—Mathematics K–2

Mathematics K–2					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	929	52.8	1,121	63.8
	(0.0, 0.1]	747	42.5	536	30.5
	(0.1, 0.2]	40	2.3	56	3.2
	(0.2, 0.3]	15	0.9	11	0.6
	(0.3, 0.4]	12	0.7	11	0.6
	(0.4, 0.5]	15	0.9	23	1.3
	>0.5	0	0.0	0	0.0
2	0	837	47.6	917	52.2
	(0.0, 0.1]	869	49.4	763	43.4
	(0.1, 0.2]	15	0.9	42	2.4
	(0.2, 0.3]	18	1.0	9	0.5
	(0.3, 0.4]	12	0.7	9	0.5
	(0.4, 0.5]	7	0.4	18	1
	>0.5	0	0.0	0	0.0

Mathematics K–2					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
3	0	739	42.0	824	46.9
	(0.0, 0.1]	937	53.3	828	47.1
	(0.1, 0.2]	65	3.7	76	4.3
	(0.2, 0.3]	8	0.5	20	1.1
	(0.3, 0.4]	4	0.2	1	0.1
	(0.4, 0.5]	5	0.3	9	0.5
	>0.5	0	0.0	0	0.0
4	0	749	42.6	823	46.8
	(0.0, 0.1]	919	52.3	836	47.6
	(0.1, 0.2]	77	4.4	72	4.1
	(0.2, 0.3]	4	0.2	17	1.0
	(0.3, 0.4]	3	0.2	2	0.1
	(0.4, 0.5]	6	0.3	8	0.5
	>0.5	0	0.0	0	0.0
5	0	788	44.8	868	49.4
	(0.0, 0.1]	884	50.3	780	44.4
	(0.1, 0.2]	50	2.8	71	4.0
	(0.2, 0.3]	23	1.3	19	1.1
	(0.3, 0.4]	5	0.3	10	0.6
	(0.4, 0.5]	8	0.5	10	0.6
	>0.5	0	0.0	0	0.0
6	0	916	52.1	919	52.3
	(0.0, 0.1]	763	43.4	750	42.7
	(0.1, 0.2]	39	2.2	46	2.6
	(0.2, 0.3]	15	0.9	15	0.9
	(0.3, 0.4]	10	0.6	9	0.5
	(0.4, 0.5]	9	0.5	17	1.0
	(0.5, 0.6]	6	0.3	2	0.1
	>0.6	0	0.0	0	0.0

Table 4.11. Item Exposure Rates within an Administration—Mathematics 2–5

Mathematics 2–5					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	1,563	54.2	1,822	63.2
	(0.0, 0.1]	1,227	42.6	964	33.4
	(0.1, 0.2]	61	2.1	59	2.0
	(0.2, 0.3]	16	0.6	16	0.6
	(0.3, 0.4]	6	0.2	7	0.2
	(0.4, 0.5]	10	0.3	15	0.5
	>0.5	0	0.0	0	0.0
2	0	1,317	45.7	1,514	52.5
	(0.0, 0.1]	1,490	51.7	1,291	44.8
	(0.1, 0.2]	59	2.0	48	1.7
	(0.2, 0.3]	11	0.4	19	0.7
	(0.3, 0.4]	6	0.2	6	0.2
	(0.4, 0.5]	0	0.0	5	0.2
	>0.5	0	0.0	0	0.0
3	0	1,338	46.4	1,478	51.3
	(0.0, 0.1]	1,467	50.9	1,322	45.9
	(0.1, 0.2]	60	2.1	60	2.1
	(0.2, 0.3]	13	0.5	10	0.3
	(0.3, 0.4]	5	0.2	7	0.2
	(0.4, 0.5]	0	0.0	6	0.2
	>0.5	0	0.0	0	0.0
4	0	1,377	47.8	1,502	52.1
	(0.0, 0.1]	1,431	49.6	1,295	44.9
	(0.1, 0.2]	58	2.0	65	2.3
	(0.2, 0.3]	11	0.4	5	0.2
	(0.3, 0.4]	6	0.2	3	0.1
	(0.4, 0.5]	0	0.0	13	0.5
	>0.5	0	0.0	0	0.0
5	0	1,380	47.9	1,512	52.4
	(0.0, 0.1]	1,443	50.1	1,286	44.6
	(0.1, 0.2]	33	1.1	61	2.1
	(0.2, 0.3]	13	0.5	14	0.5
	(0.3, 0.4]	10	0.3	4	0.1
	(0.4, 0.5]	4	0.1	6	0.2
	>0.5	0	0.0	0	0.0
6	0	1,565	54.3	1,595	55.3
	(0.0, 0.1]	1,240	43.0	1,198	41.6
	(0.1, 0.2]	46	1.6	66	2.3
	(0.2, 0.3]	13	0.5	15	0.5
	(0.3, 0.4]	11	0.4	4	0.1
	(0.4, 0.5]	8	0.3	5	0.2
	>0.5	0	0.0	0	0.0

Table 4.12. Item Exposure Rates within an Administration—Mathematics 6+

Mathematics 6+					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	3,091	60.4	3,456	67.6
	(0.0, 0.1]	1,987	38.9	1,583	31.0
	(0.1, 0.2]	36	0.7	70	1.4
	(0.2, 0.3]	0	0.0	5	0.1
	>0.3	0	0.0	0	0.0
2	0	2,936	57.4	3,313	64.8
	(0.0, 0.1]	2,142	41.9	1,735	33.9
	(0.1, 0.2]	36	0.7	62	1.2
	(0.2, 0.3]	0	0.0	4	0.1
	>0.3	0	0.0	0	0.0
3	0	3,058	59.8	3,311	64.7
	(0.0, 0.1]	2,019	39.5	1,747	34.2
	(0.1, 0.2]	37	0.7	55	1.1
	(0.2, 0.3]	0	0.0	1	0.0
	>0.3	0	0.0	0	0.0
4	0	3,062	59.9	3,243	63.4
	(0.0, 0.1]	2,016	39.4	1,822	35.6
	(0.1, 0.2]	36	0.7	47	0.9
	(0.2, 0.3]	0	0.0	2	0.0
	>0.3	0	0.0	0	0.0
5	0	2,948	57.6	3,231	63.2
	(0.0, 0.1]	2,135	41.7	1,842	36.0
	(0.1, 0.2]	31	0.6	41	0.8
	>0.2	0	0.0	0	0.0
6	0	3,034	59.3	3,150	61.6
	(0.0, 0.1]	2,036	39.8	1,918	37.5
	(0.1, 0.2]	42	0.8	46	0.9
	(0.2, 0.3]	2	0.0	0	0.0
	>0.3	0	0.0	0	0.0

Table 4.13. Item Exposure Rates within an Administration—Language Usage 2–12

Language Usage 2–12					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	3,215	82.9	3,340	86.1
	(0.0, 0.1]	506	13.0	392	10.1
	(0.1, 0.2]	86	2.2	72	1.9
	(0.2, 0.3]	32	0.8	22	0.6
	(0.3, 0.4]	27	0.7	10	0.3
	(0.4, 0.5]	13	0.3	43	1.1
	>0.5	0	0.0	0	0.0
2	0	2,859	73.7	3,015	77.7
	(0.0, 0.1]	857	22.1	699	18.0
	(0.1, 0.2]	132	3.4	131	3.4
	(0.2, 0.3]	31	0.8	21	0.5
	(0.3, 0.4]	0	0.0	2	0.1
	(0.4, 0.5]	0	0.0	11	0.3
	>0.5	0	0.0	0	0.0
3	0	2,653	68.4	2,775	71.5
	(0.0, 0.1]	1,100	28.4	980	25.3
	(0.1, 0.2]	108	2.8	95	2.4
	(0.2, 0.3]	18	0.5	15	0.4
	(0.3, 0.4]	0	0.0	6	0.2
	(0.4, 0.5]	0	0.0	8	0.2
	>0.5	0	0.0	0	0.0
4	0	2,676	69.0	2,799	72.2
	(0.0, 0.1]	1,076	27.7	962	24.8
	(0.1, 0.2]	101	2.6	81	2.1
	(0.2, 0.3]	24	0.6	12	0.3
	(0.3, 0.4]	2	0.1	22	0.6
	(0.4, 0.5]	0	0.0	3	0.1
	>0.5	0	0.0	0	0.0
5	0	2,701	69.6	2,759	71.1
	(0.0, 0.1]	1,046	27.0	1,005	25.9
	(0.1, 0.2]	103	2.7	86	2.2
	(0.2, 0.3]	29	0.7	15	0.4
	(0.3, 0.4]	0	0.0	6	0.2
	(0.4, 0.5]	0	0.0	8	0.2
	>0.5	0	0.0	0	0.0

Language Usage 2–12					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
6	0	2,398	61.8	2,575	66.4
	(0.0, 0.1]	1,346	34.7	1,179	30.4
	(0.1, 0.2]	118	3.0	114	2.9
	(0.2, 0.3]	15	0.4	11	0.3
	(0.3, 0.4]	2	0.1	0	0.0
	>0.4	0	0.0	0	0.0
7	0	2,370	61.1	2,366	61.0
	(0.0, 0.1]	1,389	35.8	1,412	36.4
	(0.1, 0.2]	93	2.4	92	2.4
	(0.2, 0.3]	26	0.7	8	0.2
	(0.3, 0.4]	1	0.0	1	0.0
	>0.4	0	0.0	0	0.0
8	0	2,471	63.7	2,545	65.6
	(0.0, 0.1]	1,271	32.8	1,227	31.6
	(0.1, 0.2]	108	2.8	90	2.3
	(0.2, 0.3]	27	0.7	10	0.3
	(0.3, 0.4]	2	0.1	7	0.2
	>0.4	0	0.0	0	0.0

Table 4.14. Item Exposure Rates within an Administration—Science 3–5

Science 3–5					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	384	28.1	595	43.6
	(0.0, 0.1]	902	66.1	689	50.5
	(0.1, 0.2]	42	3.1	39	2.9
	(0.2, 0.3]	22	1.6	17	1.2
	(0.3, 0.4]	14	1.0	16	1.2
	(0.4, 0.5]	1	0.1	9	0.7
	>0.5	0	0.0	0	0.0
2	0	251	18.4	412	30.2
	(0.0, 0.1]	1,032	75.6	875	64.1
	(0.1, 0.2]	72	5.3	53	3.9
	(0.2, 0.3]	10	0.7	14	1.0
	(0.3, 0.4]	0	0.0	9	0.7
	(0.4, 0.5]	0	0.0	2	0.1
	>0.5	0	0.0	0	0.0

Science 3–5					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
3	0	218	16.0	304	22.3
	(0.0, 0.1]	1,098	80.4	991	72.6
	(0.1, 0.2]	49	3.6	63	4.6
	(0.2, 0.3]	0	0.0	7	0.5
	>0.3	0	0.0	0	0.0
4	0	210	15.4	308	22.6
	(0.0, 0.1]	1,107	81.1	988	72.4
	(0.1, 0.2]	47	3.4	56	4.1
	(0.2, 0.3]	1	0.1	13	1.0
	>0.3	0	0.0	0	0.0
5	0	222	16.3	307	22.5
	(0.0, 0.1]	1,090	79.9	1,008	73.8
	(0.1, 0.2]	53	3.9	30	2.2
	(0.2, 0.3]	0	0.0	20	1.5
	>0.3	0	0.0	0	0.0
6	0	200	14.7	289	21.2
	(0.0, 0.1]	1,140	83.5	1,037	76.0
	(0.1, 0.2]	25	1.8	36	2.6
	(0.2, 0.3]	0	0.0	3	0.2
	>0.3	0	0.0	0	0.0
7	0	194	14.2	230	16.8
	(0.0, 0.1]	1,158	84.8	1,097	80.4
	(0.1, 0.2]	13	1.0	38	2.8
	>0.2	0	0.0	0	0.0
8	0	202	14.8	274	20.1
	(0.0, 0.1]	1,145	83.9	1,066	78.1
	(0.1, 0.2]	18	1.3	25	1.8
	>0.2	0	0.0	0	0.0

Table 4.15. Item Exposure Rates within an Administration—Science 6–8

Science 6–8					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
1	0	630	31.7	898	45.2
	(0.0, 0.1]	1,318	66.4	1,008	50.8
	(0.1, 0.2]	38	1.9	77	3.9
	(0.2, 0.3]	0	0.0	3	0.2
	>0.3	0	0.0	0	0.0

Science 6–8					
		#Items by Mode			
		COLO		CBE	
Administration	Exposure Rate	N	%	N	%
2	0	511	25.7	700	35.2
	(0.0, 0.1]	1,460	73.5	1,230	61.9
	(0.1, 0.2]	15	0.8	55	2.8
	(0.2, 0.3]	0	0.0	1	0.1
	>0.3	0	0.0	0	0.0
3	0	450	22.7	639	32.2
	(0.0, 0.1]	1,533	77.2	1,315	66.2
	(0.1, 0.2]	3	0.2	32	1.6
	>0.2	0	0.0	0	0.0
4	0	447	22.5	605	30.5
	(0.0, 0.1]	1,536	77.3	1,355	68.2
	(0.1, 0.2]	3	0.2	26	1.3
	>0.2	0	0.0	0	0.0
5	0	478	24.1	537	27.0
	(0.0, 0.1]	1,504	75.7	1,442	72.6
	(0.1, 0.2]	4	0.2	7	0.4
	>0.2	0	0.0	0	0.0
6	0	363	18.3	560	28.2
	(0.0, 0.1]	1,621	81.6	1,417	71.3
	(0.1, 0.2]	2	0.1	9	0.5
	>0.2	0	0.0	0	0.0
7	0	433	21.8	490	24.7
	(0.0, 0.1]	1,547	77.9	1,488	74.9
	(0.1, 0.2]	6	0.3	8	0.4
	>0.2	0	0.0	0	0.0
8	0	393	19.8	490	24.7
	(0.0, 0.1]	1,587	79.9	1,488	74.9
	(0.1, 0.2]	6	0.3	8	0.4
	>0.2	0	0.0	0	0.0

4.5.2. Across Administrations

Table 4.16 –Table 4.19 summarize the number of items given to the same student across administrations. For the two MAP Growth K–2 tests, the longitudinal item exposure control is three months. Given the simulated adjacent administrations are designed to be three months apart, it is expected to see some students receive repeated items across administrations. The CBE results meet this expectation. For example, there were 671 occurrences of repeated items given to same students between Administrations 1 and 2 by the CBE for Reading K–2. However, this cannot be checked directly in COLO simulation results because no repeated student IDs were generated across administrations for the K–2 tests.

The COLO simulator allows users to check or uncheck a button called “reuseStudent” that indicates whether student IDs can be reused. If this button is checked, no repeated items are administered to the same student across administrations regardless if the longitudinal exposure constraint is met. If this button is unchecked, the generated student IDs across different administrations will be different. When the longitudinal item exposure control is three months, the “reuseStudent” button should not be checked to allow all the simulated students to receive any eligible item regardless if they have seen the item in a previous administration. The CBE simulator takes a different approach by allowing users to specify the exact date of each administration. When the longitudinal item exposure control is three months, it still allows a simulation with the same students in multiple administrations. The CBE simulator can monitor the longitudinal item exposure directly based on the test administration dates and student IDs.

For the remaining MAP Growth tests that have a longitudinal item exposure control of either 10 or 14 months, no items were repeated across administrations in the COLO simulation results because the “reuseStudent” button was checked. In contrast, repeated items were observed in the results for the CBE. When to see the repeated items depends on the test. For example, the longitudinal item exposure control preference is 14 months for Reading 2–5. The gap between Administrations 1 and 6, 1 and 7, 1 and 8, 2 and 7, 2 and 8, and 3 and 8 are purposely designed to be more than 14 months, so it is expected to see repeated items across these administrations. As expected, there were 374 occurrences of repeated items given to the same students between Administrations 1 and 6. The gap between Administrations 4 and 6, 4 and 7, 4 and 8, and 5 and 8 are still within 14 months, and a small number of items are repeated because the CBE uses the longitudinal item exposure control as a guideline instead of a constraint. In other words, when there are no items available to meet other constraints and guidelines, the CBE will select the item that has been used in prior administration regardless of how far apart it is from the current administration.

Table 4.16. Longitudinal Item Exposure Counts Across Administrations—Reading

	K–2		2–5		6+	
Administration	COLO	CBE	COLO	CBE	COLO	CBE
[1, 2]	–	671	0	0	0	0
[1, 3]	–	68	0	0	0	0
[1, 4]	–	35	0	0	0	0
[1, 5]	–	11	0	0	0	0
[1, 6]	–	3	0	374	0	1,225
[1, 7]	–	0	0	144	0	273
[1, 8]	–	0	0	85	0	139
[2, 3]	–	306	0	0	0	0
[2, 4]	–	256	0	0	0	0
[2, 5]	–	103	0	0	0	0
[2, 6]	–	42	0	0	0	0
[2, 7]	–	0	0	570	0	1,192
[2, 8]	–	0	0	214	0	352
[3, 4]	–	579	0	0	0	0
[3, 5]	–	371	0	0	0	0
[3, 6]	–	264	0	0	0	0
[3, 7]	–	0	0	0	0	0
[3, 8]	–	0	0	742	0	1,214
[4, 5]	–	375	0	0	0	0

Administration	K–2		2–5		6+	
	COLO	CBE	COLO	CBE	COLO	CBE
[4, 6]	–	349	0	1	0	0
[4, 7]	–	0	0	1	0	0
[4, 8]	–	0	0	2	0	1
[5, 6]	–	726	0	0	0	0
[5, 7]	–	0	0	0	0	0
[5, 8]	–	0	0	16	0	0
[6, 7]	–	0	0	0	0	0
[6, 8]	–	0	0	0	0	0
[7, 8]	–	0	0	0	0	0

Table 4.17. Longitudinal Item Exposure Counts Across Administrations—Mathematics

Administration	K–2		2–5		6+	
	COLO	CBE	COLO	CBE	COLO	CBE
[1, 2]	–	935	0	0	0	0
[1, 3]	–	311	0	0	0	0
[1, 4]	–	210	0	0	0	0
[1, 5]	–	83	0	663	0	567
[1, 6]	–	69	0	16	0	181
[2, 3]	–	760	0	0	0	0
[2, 4]	–	536	0	0	0	0
[2, 5]	–	329	0	0	0	0
[2, 6]	–	289	0	701	0	649
[3, 4]	–	1,044	0	0	0	0
[3, 5]	–	620	0	0	0	0
[3, 6]	–	516	0	0	0	0
[4, 5]	–	703	0	0	0	0
[4, 6]	–	590	0	0	0	0
[5, 6]	–	1,168	0	0	0	0

Table 4.18. Longitudinal Item Exposure Counts Across Administrations—Language Usage

Administration	2–12	
	COLO	CBE
[1, 2]	0	0
[1, 3]	0	0
[1, 4]	0	120
[1, 5]	0	2,173
[1, 6]	0	392
[1, 7]	0	241
[1, 8]	0	190
[2, 3]	0	0
[2, 4]	0	0
[2, 5]	0	9
[2, 6]	0	1,872
[2, 7]	0	461
[2, 8]	0	225
[3, 4]	0	0
[3, 5]	0	0

Administration	2–12	
	COLO	CBE
[3, 6]	0	1
[3, 7]	0	1,565
[3, 8]	0	621
[4, 5]	0	0
[4, 6]	0	0
[4, 7]	0	10
[4, 8]	0	1,499
[5, 6]	0	0
[5, 7]	0	0
[5, 8]	0	75
[6, 7]	0	0
[6, 8]	0	0
[7, 8]	0	0

Table 4.19. Longitudinal Item Exposure Counts Across Administrations—Science

Administration	3–5		6–8	
	COLO	CBE	COLO	CBE
[1, 2]	0	0	0	0
[1, 3]	0	0	0	0
[1, 4]	0	0	0	0
[1, 5]	0	0	0	0
[1, 6]	0	482	0	516
[1, 7]	0	185	0	286
[1, 8]	0	123	0	286
[2, 3]	0	0	0	0
[2, 4]	0	0	0	0
[2, 5]	0	0	0	0
[2, 6]	0	0	0	0
[2, 7]	0	414	0	486
[2, 8]	0	224	0	486
[3, 4]	0	0	0	0
[3, 5]	0	0	0	0
[3, 6]	0	0	0	0
[3, 7]	0	0	0	0
[3, 8]	0	575	0	0
[4, 5]	0	0	0	0
[4, 6]	0	0	0	0
[4, 7]	0	0	0	0
[4, 8]	0	0	0	0
[5, 6]	0	0	0	0
[5, 7]	0	0	0	0
[5, 8]	0	0	0	0
[6, 7]	0	0	0	0
[6, 8]	0	0	0	0
[7, 8]	0	0	0	4,496

5. Conclusion

Overall, the mode comparability findings suggest MAP Growth tests can be administered on the CBE. The items delivered by the enhanced CBE and COLO met the content specifications, and the estimated scores (i.e., thetas) from both engines recovered the true scores well for the nine tests simulated in this study. These findings suggest that the CBE and COLO are comparable in delivering a valid MAP Growth test to measure what it intends to measure. However, whether the CBE and COLO can adaptively administer the items according to students' ability estimate and produce reliable scores (i.e., with small SEM) depends on the tests and the quality of their item pool. The differences in adaptivity and score SEM are related to the depth and richness of the item bank. When the item bank was deep and covered a wide range of content standards, both engines administered items adaptively to match students' abilities and produced reliable overall and instructional area scores. Conversely, when the item bank was shallow in some instructional areas for the extremely low or high achievement students (i.e., Reading K–2, Reading 2–5, Reading 6+, Math K–2, Math 2–5, and Language 2–12), the two engines performed differently for these students.

For example, in Reading 6+, most SEMs of the overall and instructional area scores produced by the CBE are acceptable for the high achievement students. However, the corresponding SEMs produced by COLO are greater than the acceptable SEM thresholds. A closer investigation revealed that a small number of items had difficulties within 0.6 of the selection thetas for high-ability students. In this case, COLO administered new items with difficulties farther away from the selection theta but had never been exposed to the same student. In contrast, the CBE selected items with item difficulties closer to the selection thetas but had been used in previous administrations. This explains why scores from the CBE have smaller SEMs than those from COLO. It also explains why there are many repeated items in the later administrations on the CBE. Not presenting the same item repeatedly to the same student across administrations, especially when the gap between administrations is beyond the months specified for the longitudinal exposure control, is a design limitation of the COLO simulator.

The CBE and COLO are not comparable regarding item exposure. Within the same administration, more items in the item bank were administered and less items were overexposed by COLO than by the CBE. This is likely due to the randomesque procedure implemented on COLO but not on CBE to control the item exposure. Across administrations, the items administered on the CBE can be exposed to the same student even when the gap between administrations was within the period specified for the longitudinal item exposure control (e.g., 14 months). This was not observed on COLO. The longitudinal item exposure specification on the CBE was changed from a content constraint to guideline to prevent the test crash due to item starvation.

Another difference between the engines is that the test model for the CBE provides users flexibility to change the test entry conditions, test lengths, content and psychometric constraints and guidelines, item selection methods, and test termination rules. In contrast, users do not have many options to tell COLO how to select items. The capability of running simulations on the CBE is also much larger than COLO, although the simulation speed is sacrificed.

To summarize, the two engines are comparable under most conditions simulated in this study. In the cases of not showing comparable results of instructional area score SEMs, adaptivity, and item exposure, it is more likely due to reasons such as (1) a small number of items available in a certain difficulty range or instructional area, (2) no randomesque procedure implemented on the CBE, and (3) different longitudinal item exposure control rules implemented. Enhancing the CBE with a flexible test model design and key features such as multiple administrations in a school year, longitudinal item exposure control, and using students' historical scores to start a test make it possible to deliver interim assessments such as MAP Growth and those developed for the NWEA through-year solution. While the results of this study indicate that interim tests can be administered on the CBE, item exposure needs to be monitored for high-stakes uses of the test results, especially if the item pool is not deep and broad enough. Overexposure to items in a high-stakes setting can undermine the score reliability and test validity.

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Appendix A: Instructional Area Summary Results

Table A.1. Definition of Variables

Variable	Definition
Level	Score level includes overall score or instructional area score
Admin.	Test administration
TPt	True theta point that either represents low achievers or high achievers
TT	True theta
ET	Estimated theta
SD_ET	Standard deviation of the estimated theta
Bias	Difference between the estimated and true theta
RMSE	Root mean square error
SEM	Standard error of measurement
Min. SEM	Minimum standard error of measurement
Max. SEM	Maximum standard error of measurement
Delta	Difference between the item difficulty and selection theta
Min. Total	Minimum number of items in the test
Max. Total	Maximum number of items in the test
Min. OP	Minimum number of operational items in the test
Max. OP	Maximum number of operational items in the test
Min. FT	Minimum number of field test items in the test
Max. FT	Maximum number of field test items in the test

Table A.2. Instructional Areas by MAP Growth Test

Level	Instructional Area
Reading K–2	
IA 1	Concepts of Print, Phonological Awareness, Word Analysis
IA 2	Vocabulary
IA 3	Comprehension
IA 4	Writing
Reading 2–5 and 6+	
IA 1	Build and Use Vocabulary
IA 2	Literary Text: Theme and Analysis
IA 3	Informational Text: Main Idea and Analysis
IA 4	Literary Text: Characteristics of Text
IA 5	Informational Text: Characteristics of Text

Level	Instructional Area
Math K–2, 2–5, and 6+	
IA 1	Number
IA 2	Algebra
IA 3	Geometry
IA 4	Data
Language Usage 2–12	
IA 1	Apply the Writing Process
IA 2	Compose Sentences and Paragraphs
IA 3	Proofread and Edit for Conventions
Science 3–5 and 6–8	
IA 1	Physical Science
IA 2	Life Science
IA 3	Earth and Space Science

Table A.3. Summary Statistics—Reading K–2, COLO

Reading K–2, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-7.60	-7.63	0.34	-0.03	0.34	0.35	0.33	0.38	0.82	43	43	43	43	0	0
Overall	1	High	-2.30	-2.27	0.32	0.03	0.32	0.32	0.31	0.35	0.16	43	43	42	43	1	1
Overall	2	Low	-6.30	-6.27	0.33	0.03	0.33	0.32	0.32	0.35	0.25	43	43	43	43	0	0
Overall	2	High	-1.30	-1.26	0.29	0.04	0.29	0.32	0.32	0.33	0.16	43	43	42	42	1	1
Overall	3	Low	-4.20	-4.21	0.35	-0.01	0.35	0.32	0.31	0.35	0.15	43	43	42	43	1	1
Overall	3	High	-0.80	-0.81	0.34	-0.01	0.34	0.32	0.31	0.35	0.16	43	43	42	42	1	1
Overall	4	Low	-3.70	-3.70	0.38	0.00	0.38	0.32	0.31	0.33	0.16	43	43	42	43	1	1
Overall	4	High	-0.80	-0.81	0.37	-0.01	0.37	0.32	0.32	0.34	0.15	43	43	42	42	1	1
Overall	5	Low	-2.60	-2.57	0.28	0.03	0.28	0.32	0.31	0.33	0.16	43	43	42	43	1	1
Overall	5	High	-0.10	-0.08	0.27	0.02	0.27	0.32	0.31	0.34	0.16	43	43	42	42	1	1
Overall	6	Low	-2.00	-1.98	0.29	0.02	0.29	0.32	0.31	0.34	0.15	43	43	42	43	1	1
Overall	6	High	0.20	0.21	0.29	0.01	0.29	0.32	0.31	0.33	0.19	43	43	42	43	1	1
IA 1	1	Low	-7.60	-7.76	0.69	-0.16	0.71	0.71	0.64	0.82	0.45	9	14	9	14	0	0
IA 1	1	High	-2.30	-2.33	0.68	-0.03	0.68	0.67	0.62	0.76	0.15	10	14	9	13	1	1
IA 1	2	Low	-6.30	-6.19	0.60	0.11	0.61	0.67	0.62	0.81	0.16	9	12	9	12	0	0
IA 1	2	High	-1.30	-1.40	0.78	-0.10	0.79	0.67	0.62	0.78	0.16	10	15	9	14	1	1
IA 1	3	Low	-4.20	-4.24	0.64	-0.04	0.64	0.66	0.61	0.78	0.16	10	13	9	13	1	1
IA 1	3	High	-0.80	-0.79	0.66	0.01	0.66	0.66	0.62	0.75	0.15	10	14	9	13	1	1
IA 1	4	Low	-3.70	-3.66	0.64	0.04	0.64	0.65	0.61	0.70	0.15	9	12	9	12	1	1
IA 1	4	High	-0.80	-0.64	0.61	0.16	0.63	0.66	0.62	0.73	0.16	10	14	9	13	1	1
IA 1	5	Low	-2.60	-2.58	0.64	0.02	0.64	0.66	0.62	0.72	0.15	9	13	9	12	1	1
IA 1	5	High	-0.10	-0.18	0.57	-0.08	0.57	0.66	0.63	0.73	0.15	10	13	9	12	1	1
IA 1	6	Low	-2.00	-2.04	0.62	-0.04	0.63	0.66	0.62	0.78	0.16	10	14	9	13	1	1
IA 1	6	High	0.20	0.23	0.52	0.03	0.52	0.66	0.62	0.70	0.18	9	13	9	12	1	1
IA 2	1	Low	-7.60	-7.55	0.70	0.05	0.70	0.68	0.63	0.82	0.19	10	11	10	11	0	0
IA 2	1	High	-2.30	-2.24	0.58	0.06	0.59	0.66	0.62	0.72	0.16	10	12	10	12	0	0
IA 2	2	Low	-6.30	-6.29	0.70	0.01	0.70	0.65	0.58	0.71	0.16	10	13	10	13	0	0

Reading K–2, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	2	High	-1.30	-1.30	0.59	0.00	0.59	0.66	0.62	0.80	0.16	10	12	10	12	0	0
IA 2	3	Low	-4.20	-4.20	0.60	0.00	0.60	0.66	0.60	0.72	0.15	10	12	10	12	0	0
IA 2	3	High	-0.80	-0.73	0.57	0.07	0.57	0.66	0.62	0.82	0.16	10	13	10	13	0	0
IA 2	4	Low	-3.70	-3.63	0.63	0.07	0.63	0.65	0.61	0.70	0.16	10	13	10	13	0	0
IA 2	4	High	-0.80	-0.83	0.62	-0.03	0.62	0.66	0.61	0.77	0.15	10	13	10	13	0	0
IA 2	5	Low	-2.60	-2.59	0.56	0.01	0.56	0.66	0.62	0.72	0.16	10	13	10	13	0	0
IA 2	5	High	-0.10	-0.11	0.54	-0.01	0.54	0.66	0.62	0.71	0.18	10	12	10	12	0	0
IA 2	6	Low	-2.00	-1.90	0.55	0.10	0.56	0.65	0.62	0.70	0.15	10	13	10	13	0	0
IA 2	6	High	0.20	0.17	0.53	-0.03	0.53	0.65	0.62	0.70	0.20	10	12	10	12	0	0
IA 3	1	Low	-7.60	-7.68	0.77	-0.08	0.78	0.68	0.64	0.81	0.21	9	12	9	12	0	0
IA 3	1	High	-2.30	-2.36	0.59	-0.06	0.59	0.66	0.63	0.73	0.16	9	12	9	12	0	0
IA 3	2	Low	-6.30	-6.35	0.82	-0.05	0.82	0.67	0.62	0.80	0.15	9	14	9	14	0	0
IA 3	2	High	-1.30	-1.33	0.65	-0.03	0.65	0.67	0.63	0.79	0.16	9	14	9	14	0	0
IA 3	3	Low	-4.20	-4.23	0.72	-0.03	0.72	0.65	0.61	0.79	0.15	10	13	10	13	0	0
IA 3	3	High	-0.80	-0.69	0.66	0.11	0.67	0.66	0.62	0.82	0.15	9	12	9	12	0	0
IA 3	4	Low	-3.70	-3.84	0.56	-0.14	0.58	0.65	0.62	0.72	0.16	9	13	9	13	0	0
IA 3	4	High	-0.80	-0.89	0.62	-0.09	0.62	0.66	0.62	0.79	0.15	9	13	9	13	0	0
IA 3	5	Low	-2.60	-2.56	0.65	0.04	0.65	0.66	0.62	0.71	0.16	9	12	9	12	0	0
IA 3	5	High	-0.10	0.06	0.68	0.16	0.70	0.67	0.62	0.79	0.16	9	13	9	13	0	0
IA 3	6	Low	-2.00	-1.94	0.59	0.06	0.59	0.66	0.63	0.78	0.15	9	12	9	12	0	0
IA 3	6	High	0.20	0.14	0.58	-0.06	0.58	0.66	0.62	0.70	0.20	9	12	9	12	0	0
IA 4	1	Low	-7.60	-7.65	0.79	-0.05	0.79	0.84	0.64	1.63	2.03	9	14	9	14	0	0
IA 4	1	High	-2.30	-2.15	0.61	0.15	0.63	0.66	0.62	0.73	0.15	9	13	9	13	0	0
IA 4	2	Low	-6.30	-6.25	0.65	0.05	0.65	0.67	0.62	0.82	0.53	9	14	9	14	0	0
IA 4	2	High	-1.30	-1.00	0.60	0.30	0.67	0.67	0.62	0.80	0.15	9	14	9	14	0	0
IA 4	3	Low	-4.20	-4.16	0.60	0.04	0.60	0.66	0.62	0.79	0.16	9	13	9	13	0	0
IA 4	3	High	-0.80	-1.02	0.64	-0.22	0.67	0.67	0.62	0.82	0.16	9	13	9	13	0	0
IA 4	4	Low	-3.70	-3.68	0.65	0.02	0.65	0.65	0.61	0.70	0.16	9	12	9	12	0	0

Reading K–2, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 4	4	High	-0.80	-0.89	0.69	-0.09	0.70	0.66	0.63	0.79	0.15	9	13	9	13	0	0
IA 4	5	Low	-2.60	-2.52	0.52	0.08	0.53	0.66	0.62	0.72	0.16	9	14	9	14	0	0
IA 4	5	High	-0.10	-0.08	0.60	0.02	0.60	0.66	0.62	0.80	0.16	9	12	9	12	0	0
IA 4	6	Low	-2.00	-2.04	0.65	-0.04	0.65	0.67	0.62	0.81	0.15	9	13	9	13	0	0
IA 4	6	High	0.20	0.32	0.71	0.12	0.72	0.66	0.62	0.72	0.17	9	13	9	13	0	0

Table A.4. Summary Statistics—Reading K–2, CBE

Reading K–2, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-7.60	-7.59	0.37	0.01	0.37	0.33	0.32	0.37	0.54	43	43	43	43	0	0
Overall	1	High	-2.30	-2.34	0.31	-0.04	0.32	0.31	0.31	0.34	0.02	43	43	43	43	0	0
Overall	2	Low	-6.30	-6.24	0.24	0.06	0.25	0.32	0.31	0.34	0.14	43	43	43	43	0	0
Overall	2	High	-1.30	-1.33	0.29	-0.03	0.29	0.32	0.31	0.34	0.03	43	43	43	43	0	0
Overall	3	Low	-4.20	-4.22	0.32	-0.02	0.32	0.32	0.31	0.38	0.03	43	43	43	43	0	0
Overall	3	High	-0.80	-0.79	0.34	0.01	0.34	0.32	0.31	0.34	0.04	43	43	43	43	0	0
Overall	4	Low	-3.70	-3.70	0.30	0.00	0.30	0.32	0.31	0.35	0.02	43	43	43	43	0	0
Overall	4	High	-0.80	-0.75	0.35	0.05	0.35	0.32	0.31	0.34	0.04	43	43	43	43	0	0
Overall	5	Low	-2.60	-2.63	0.32	-0.03	0.32	0.32	0.31	0.34	0.02	43	43	43	43	0	0
Overall	5	High	-0.10	-0.06	0.35	0.04	0.35	0.31	0.31	0.33	0.07	43	43	43	43	0	0
Overall	6	Low	-2.00	-1.97	0.40	0.03	0.40	0.32	0.31	0.35	0.03	43	43	43	43	0	0
Overall	6	High	0.20	0.22	0.30	0.02	0.30	0.31	0.31	0.33	0.11	43	43	43	43	0	0
IA 1	1	Low	-7.60	-7.61	0.56	-0.01	0.56	0.66	0.63	0.79	0.25	10	12	10	12	0	0
IA 1	1	High	-2.30	-2.42	0.56	-0.12	0.57	0.65	0.61	0.79	0.02	10	13	10	13	0	0
IA 1	2	Low	-6.30	-6.22	0.59	0.08	0.59	0.65	0.61	0.78	0.03	10	13	10	13	0	0
IA 1	2	High	-1.30	-1.35	0.59	-0.05	0.59	0.65	0.61	0.79	0.03	10	12	10	12	0	0
IA 1	3	Low	-4.20	-4.19	0.62	0.01	0.61	0.67	0.61	1.07	0.02	10	13	10	13	0	0

Reading K–2, CBE																	
												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	3	High	-0.80	-0.77	0.51	0.03	0.51	0.65	0.61	0.78	0.03	10	13	10	13	0	0
IA 1	4	Low	-3.70	-3.72	0.69	-0.02	0.69	0.65	0.61	0.78	0.02	10	13	10	13	0	0
IA 1	4	High	-0.80	-0.77	0.63	0.03	0.63	0.64	0.61	0.79	0.03	10	13	10	13	0	0
IA 1	5	Low	-2.60	-2.59	0.68	0.01	0.68	0.66	0.61	0.73	0.02	10	13	10	13	0	0
IA 1	5	High	-0.10	-0.01	0.84	0.09	0.85	0.67	0.61	1.45	0.03	10	13	10	13	0	0
IA 1	6	Low	-2.00	-2.06	0.78	-0.06	0.78	0.66	0.61	0.81	0.02	10	13	10	13	0	0
IA 1	6	High	0.20	0.32	0.70	0.12	0.71	0.66	0.61	0.78	0.06	10	13	10	13	0	0
IA 2	1	Low	-7.60	-7.54	0.67	0.06	0.67	0.67	0.61	0.81	0.13	10	12	10	12	0	0
IA 2	1	High	-2.30	-2.32	0.66	-0.02	0.66	0.65	0.59	0.78	0.02	10	12	10	12	0	0
IA 2	2	Low	-6.30	-6.30	0.54	0.00	0.54	0.66	0.61	0.74	0.05	10	12	10	12	0	0
IA 2	2	High	-1.30	-1.42	0.62	-0.12	0.63	0.66	0.61	1.05	0.03	10	13	10	13	0	0
IA 2	3	Low	-4.20	-4.17	0.70	0.03	0.70	0.67	0.62	0.82	0.02	10	13	10	13	0	0
IA 2	3	High	-0.80	-0.74	0.60	0.06	0.60	0.65	0.61	0.73	0.05	10	13	10	13	0	0
IA 2	4	Low	-3.70	-3.73	0.57	-0.03	0.57	0.65	0.61	0.88	0.02	10	13	10	13	0	0
IA 2	4	High	-0.80	-0.68	0.67	0.12	0.68	0.65	0.61	0.71	0.06	10	13	10	13	0	0
IA 2	5	Low	-2.60	-2.68	0.62	-0.08	0.62	0.66	0.61	0.80	0.02	10	12	10	12	0	0
IA 2	5	High	-0.10	-0.03	0.71	0.07	0.72	0.66	0.62	1.05	0.14	10	13	10	13	0	0
IA 2	6	Low	-2.00	-1.83	0.65	0.17	0.67	0.66	0.61	0.80	0.03	10	13	10	13	0	0
IA 2	6	High	0.20	0.46	0.73	0.26	0.78	0.67	0.61	1.05	0.19	10	13	10	13	0	0
IA 3	1	Low	-7.60	-7.53	0.69	0.07	0.69	0.66	0.61	0.80	0.06	10	12	10	12	0	0
IA 3	1	High	-2.30	-2.31	0.65	-0.01	0.65	0.65	0.60	0.79	0.03	10	13	10	13	0	0
IA 3	2	Low	-6.30	-6.17	0.50	0.13	0.52	0.65	0.61	0.72	0.03	10	13	10	13	0	0
IA 3	2	High	-1.30	-1.19	0.64	0.11	0.65	0.65	0.61	0.78	0.03	10	13	10	13	0	0
IA 3	3	Low	-4.20	-4.24	0.64	-0.04	0.64	0.66	0.62	0.82	0.03	10	13	10	13	0	0
IA 3	3	High	-0.80	-0.75	0.85	0.05	0.85	0.67	0.61	1.05	0.03	10	13	10	13	0	0
IA 3	4	Low	-3.70	-3.70	0.60	0.00	0.59	0.66	0.61	0.78	0.02	10	12	10	12	0	0
IA 3	4	High	-0.80	-0.76	0.59	0.04	0.59	0.65	0.61	0.78	0.03	10	13	10	13	0	0
IA 3	5	Low	-2.60	-2.61	0.65	-0.01	0.65	0.66	0.62	0.79	0.03	10	13	10	13	0	0

Reading K–2, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	5	High	-0.10	0.06	0.71	0.16	0.73	0.66	0.61	0.77	0.05	10	13	10	13	0	0
IA 3	6	Low	-2.00	-2.06	0.75	-0.06	0.75	0.66	0.62	0.71	0.03	10	12	10	12	0	0
IA 3	6	High	0.20	0.17	0.61	-0.03	0.61	0.65	0.61	0.78	0.10	10	13	10	13	0	0
IA 4	1	Low	-7.60	-7.84	0.89	-0.24	0.92	0.87	0.65	1.70	1.55	10	13	10	13	0	0
IA 4	1	High	-2.30	-2.33	0.67	-0.03	0.67	0.65	0.61	0.78	0.02	10	13	10	13	0	0
IA 4	2	Low	-6.30	-6.28	0.62	0.02	0.62	0.67	0.63	0.80	0.47	10	13	10	13	0	0
IA 4	2	High	-1.30	-1.37	0.64	-0.07	0.64	0.66	0.61	0.74	0.03	10	12	10	12	0	0
IA 4	3	Low	-4.20	-4.26	0.67	-0.06	0.68	0.66	0.61	1.06	0.03	10	13	10	13	0	0
IA 4	3	High	-0.80	-0.88	0.66	-0.08	0.67	0.66	0.62	0.71	0.05	10	12	10	12	0	0
IA 4	4	Low	-3.70	-3.66	0.71	0.04	0.71	0.67	0.61	1.04	0.02	10	13	10	13	0	0
IA 4	4	High	-0.80	-0.79	0.65	0.01	0.65	0.66	0.61	0.80	0.05	10	13	10	13	0	0
IA 4	5	Low	-2.60	-2.66	0.70	-0.06	0.71	0.67	0.61	1.05	0.03	10	13	10	13	0	0
IA 4	5	High	-0.10	-0.20	0.67	-0.10	0.68	0.66	0.61	0.80	0.06	10	12	10	12	0	0
IA 4	6	Low	-2.00	-1.93	0.67	0.07	0.67	0.66	0.61	0.80	0.03	10	12	10	12	0	0
IA 4	6	High	0.20	0.01	0.82	-0.19	0.84	0.66	0.61	0.79	0.09	10	13	10	13	0	0

Table A.5. Summary Statistics—Reading 2–5, COLO

Reading 2–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-4.50	-4.52	0.35	-0.02	0.94	0.35	0.34	0.33	0.36	0.53	40	43	40	43	0
Overall	1	High	1.80	1.80	0.32	0.00	1.00	0.32	0.33	0.32	0.34	0.19	40	40	39	40	1
Overall	2	Low	-3.30	-3.38	0.36	-0.08	0.81	0.37	0.33	0.32	0.35	0.22	40	40	40	40	0
Overall	2	High	2.10	2.01	0.34	-0.09	0.78	0.36	0.33	0.32	0.34	0.21	40	40	40	40	0
Overall	3	Low	-2.80	-2.79	0.39	0.01	0.98	0.39	0.33	0.32	0.34	0.18	40	40	40	40	0
Overall	3	High	2.30	2.34	0.35	0.04	0.91	0.35	0.33	0.32	0.35	0.25	40	40	40	40	0
Overall	4	Low	-2.80	-2.78	0.27	0.02	0.96	0.27	0.33	0.32	0.35	0.18	40	40	40	40	0

Reading 2–5, COLO												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	4	High	2.30	2.37	0.32	0.07	0.82	0.33	0.34	0.32	0.35	0.36	40	41	40	41	0
Overall	5	Low	-2.80	-2.83	0.33	-0.03	0.94	0.33	0.33	0.32	0.35	0.18	40	41	40	41	0
Overall	5	High	2.40	2.34	0.40	-0.06	0.87	0.40	0.34	0.33	0.38	0.46	40	43	40	43	0
Overall	6	Low	-1.90	-1.92	0.36	-0.02	0.95	0.36	0.33	0.32	0.35	0.18	40	43	40	43	0
Overall	6	High	2.70	2.67	0.33	-0.03	0.94	0.33	0.35	0.33	0.39	0.65	40	43	40	43	0
Overall	7	Low	-1.50	-1.48	0.34	0.02	0.95	0.34	0.33	0.32	0.35	0.18	40	41	40	41	0
Overall	7	High	2.90	2.92	0.41	0.02	0.95	0.41	0.36	0.34	0.47	0.99	40	43	40	43	0
Overall	8	Low	-1.50	-1.45	0.32	0.05	0.88	0.32	0.33	0.32	0.35	0.19	40	42	40	42	0
Total	8	High	3.00	3.04	0.36	0.04	0.91	0.37	0.38	0.34	0.44	1.24	40	43	40	43	0
IA 1	1	Low	-4.50	-4.44	0.64	0.06	0.86	0.64	0.64	0.52	0.82	0.17	8	16	8	16	0
IA 1	1	High	1.80	1.76	0.81	-0.04	0.90	0.81	0.79	0.73	1.10	0.21	7	9	7	9	1
IA 1	2	Low	-3.30	-3.27	0.71	0.03	0.93	0.71	0.66	0.53	0.86	0.16	8	16	8	16	0
IA 1	2	High	2.10	2.12	0.75	0.02	0.95	0.75	0.81	0.73	1.11	0.23	7	9	7	9	0
IA 1	3	Low	-2.80	-2.85	0.75	-0.05	0.90	0.76	0.71	0.53	1.10	0.17	8	15	8	15	0
IA 1	3	High	2.30	2.33	0.81	0.03	0.94	0.80	0.79	0.72	0.92	0.19	7	10	7	10	0
IA 1	4	Low	-2.80	-2.78	0.65	0.02	0.95	0.65	0.71	0.54	0.86	0.16	8	15	8	15	0
IA 1	4	High	2.30	2.44	0.92	0.14	0.67	0.93	0.81	0.73	1.29	0.22	6	9	6	9	0
IA 1	5	Low	-2.80	-2.93	0.66	-0.13	0.70	0.68	0.70	0.54	0.84	0.16	8	15	8	15	0
IA 1	5	High	2.40	2.21	0.81	-0.19	0.64	0.83	0.82	0.73	1.08	0.20	7	9	7	9	0
IA 1	6	Low	-1.90	-1.93	0.97	-0.03	0.93	0.97	0.76	0.49	1.09	0.18	8	18	8	18	0
IA 1	6	High	2.70	2.73	0.88	0.03	0.93	0.88	0.80	0.66	0.90	0.18	6	10	6	10	0
IA 1	7	Low	-1.50	-1.47	0.83	0.03	0.92	0.83	0.77	0.62	1.09	0.20	8	11	8	11	0
IA 1	7	High	2.90	2.88	0.81	-0.02	0.95	0.81	0.81	0.65	1.12	0.25	6	11	6	11	0
IA 1	8	Low	-1.50	-1.24	0.74	0.26	0.42	0.78	0.75	0.66	1.07	0.22	8	12	8	12	0
IA 1	8	High	3.00	3.01	0.75	0.01	0.98	0.75	0.80	0.64	1.11	0.32	6	11	6	11	0
IA 2	1	Low	-4.50	-4.47	0.84	0.03	0.93	0.84	0.85	0.75	1.13	0.19	5	9	5	9	0
IA 2	1	High	1.80	1.81	0.64	0.01	0.97	0.64	0.76	0.71	1.06	0.17	7	10	7	10	0
IA 2	2	Low	-3.30	-3.43	0.76	-0.13	0.72	0.77	0.82	0.73	1.11	0.16	6	9	6	9	0

Reading 2–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	2	High	2.10	1.80	0.66	-0.30	0.37	0.73	0.76	0.72	0.84	0.21	8	9	8	9	0
IA 2	3	Low	-2.80	-2.59	0.81	0.21	0.59	0.84	0.81	0.73	1.09	0.16	6	9	6	9	0
IA 2	3	High	2.30	2.19	0.63	-0.11	0.76	0.64	0.76	0.71	1.07	0.17	7	10	7	10	0
IA 2	4	Low	-2.80	-2.84	0.88	-0.04	0.88	0.88	0.82	0.73	1.44	0.16	6	9	6	9	0
IA 2	4	High	2.30	2.32	0.75	0.02	0.96	0.75	0.77	0.71	1.08	0.20	7	9	7	9	0
IA 2	5	Low	-2.80	-2.88	0.86	-0.08	0.82	0.86	0.80	0.72	1.12	0.16	6	9	6	9	0
IA 2	5	High	2.40	2.46	0.93	0.06	0.87	0.93	0.79	0.72	1.09	0.22	8	10	8	10	0
IA 2	6	Low	-1.90	-1.97	0.71	-0.07	0.85	0.71	0.79	0.72	1.08	0.16	5	9	5	9	0
IA 2	6	High	2.70	2.72	0.76	0.02	0.94	0.76	0.79	0.70	1.08	0.38	7	10	7	10	0
IA 2	7	Low	-1.50	-1.45	0.71	0.05	0.89	0.71	0.78	0.72	1.07	0.16	7	9	7	9	0
IA 2	7	High	2.90	3.25	1.12	0.35	0.42	1.18	0.90	0.71	1.43	0.81	7	12	7	12	0
IA 2	8	Low	-1.50	-1.46	0.78	0.04	0.90	0.78	0.80	0.74	1.11	0.17	6	10	6	10	0
IA 2	8	High	3.00	3.27	0.69	0.27	0.46	0.74	0.90	0.74	1.38	1.07	7	13	7	13	0
IA 3	1	Low	-4.50	-4.78	1.01	-0.28	0.43	1.04	0.90	0.75	1.59	0.83	6	12	6	12	0
IA 3	1	High	1.80	1.72	0.80	-0.08	0.80	0.81	0.79	0.71	1.09	0.18	7	9	7	9	0
IA 3	2	Low	-3.30	-3.39	0.71	-0.09	0.81	0.71	0.80	0.72	1.07	0.28	6	10	6	10	0
IA 3	2	High	2.10	1.98	0.79	-0.12	0.72	0.80	0.78	0.68	0.86	0.21	7	9	7	9	0
IA 3	3	Low	-2.80	-2.70	0.74	0.10	0.81	0.75	0.78	0.72	1.07	0.18	6	9	6	9	0
IA 3	3	High	2.30	2.39	0.86	0.09	0.79	0.86	0.80	0.71	1.07	0.22	7	10	7	10	0
IA 3	4	Low	-2.80	-2.80	0.68	0.00	1.00	0.68	0.77	0.71	1.07	0.19	6	9	6	9	0
IA 3	4	High	2.30	2.16	0.88	-0.14	0.65	0.89	0.81	0.73	1.51	0.23	6	9	6	9	0
IA 3	5	Low	-2.80	-2.86	0.68	-0.06	0.85	0.68	0.77	0.71	0.88	0.19	6	10	6	10	0
IA 3	5	High	2.40	2.33	0.95	-0.07	0.86	0.95	0.81	0.72	1.07	0.26	7	9	7	9	0
IA 3	6	Low	-1.90	-1.82	0.78	0.08	0.83	0.79	0.77	0.71	0.93	0.18	5	9	5	9	0
IA 3	6	High	2.70	2.67	0.73	-0.03	0.93	0.73	0.81	0.72	1.07	0.32	6	9	6	9	0
IA 3	7	Low	-1.50	-1.46	0.78	0.04	0.90	0.78	0.76	0.71	1.07	0.16	7	10	7	10	0
IA 3	7	High	2.90	2.96	0.79	0.06	0.87	0.79	0.88	0.74	1.10	0.67	6	12	6	12	0
IA 3	8	Low	-1.50	-1.50	0.72	0.00	0.99	0.72	0.77	0.72	1.07	0.19	7	10	7	10	0

Reading 2–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	8	High	3.00	3.02	0.79	0.02	0.95	0.79	0.90	0.75	1.43	0.96	6	11	6	11	0
IA 4	1	Low	-4.50	-4.49	0.80	0.01	0.98	0.80	0.85	0.74	1.13	0.89	6	10	6	10	0
IA 4	1	High	1.80	1.81	0.77	0.01	0.97	0.77	0.75	0.66	0.86	0.22	7	11	7	11	0
IA 4	2	Low	-3.30	-3.48	0.73	-0.18	0.62	0.75	0.81	0.71	1.10	0.33	6	9	6	9	0
IA 4	2	High	2.10	2.16	0.88	0.06	0.85	0.89	0.79	0.71	1.20	0.20	7	10	7	10	0
IA 4	3	Low	-2.80	-2.85	0.66	-0.05	0.90	0.66	0.77	0.71	0.87	0.21	6	9	6	9	0
IA 4	3	High	2.30	2.36	0.78	0.06	0.86	0.78	0.77	0.68	0.92	0.20	7	10	7	10	0
IA 4	4	Low	-2.80	-2.74	0.76	0.06	0.82	0.76	0.77	0.71	1.09	0.21	7	9	7	9	0
IA 4	4	High	2.30	2.45	0.83	0.15	0.64	0.84	0.77	0.63	1.08	0.21	7	13	7	13	0
IA 4	5	Low	-2.80	-2.55	0.74	0.25	0.45	0.78	0.77	0.71	1.07	0.20	6	10	6	10	0
IA 4	5	High	2.40	2.31	0.68	-0.09	0.82	0.69	0.77	0.65	1.10	0.19	7	10	7	10	0
IA 4	6	Low	-1.90	-2.02	0.75	-0.12	0.74	0.76	0.77	0.71	1.10	0.20	7	10	7	10	0
IA 4	6	High	2.70	2.75	0.76	0.05	0.88	0.76	0.76	0.61	1.07	0.18	7	12	7	12	0
IA 4	7	Low	-1.50	-1.57	0.76	-0.07	0.85	0.76	0.76	0.70	0.85	0.21	7	10	7	10	0
IA 4	7	High	2.90	2.89	0.79	-0.01	0.99	0.79	0.76	0.59	1.07	0.21	7	13	7	13	0
IA 4	8	Low	-1.50	-1.61	0.76	-0.11	0.73	0.77	0.77	0.71	1.08	0.19	7	10	7	10	0
IA 4	8	High	3.00	3.05	0.69	0.05	0.90	0.69	0.73	0.59	1.14	0.33	7	14	7	14	0
IA 5	1	Low	-4.50	-4.83	1.04	-0.33	0.35	1.09	0.92	0.75	1.46	0.72	6	11	6	11	0
IA 5	1	High	1.80	1.89	0.56	0.09	0.79	0.57	0.76	0.72	0.87	0.18	7	9	7	9	0
IA 5	2	Low	-3.30	-3.48	0.89	-0.18	0.62	0.91	0.83	0.71	1.08	0.22	5	9	5	9	0
IA 5	2	High	2.10	1.98	0.71	-0.12	0.73	0.72	0.75	0.71	0.86	0.22	7	9	7	9	0
IA 5	3	Low	-2.80	-2.91	0.71	-0.11	0.79	0.72	0.79	0.71	0.88	0.17	6	9	6	9	0
IA 5	3	High	2.30	2.56	0.88	0.26	0.46	0.91	0.80	0.71	1.09	0.48	7	10	7	10	0
IA 5	4	Low	-2.80	-2.82	1.00	-0.02	0.95	1.00	0.81	0.71	1.44	0.16	5	9	5	9	0
IA 5	4	High	2.30	2.61	0.88	0.31	0.33	0.94	0.86	0.71	1.41	0.88	7	11	7	11	0
IA 5	5	Low	-2.80	-2.89	0.74	-0.09	0.78	0.75	0.79	0.72	1.10	0.17	6	9	6	9	0
IA 5	5	High	2.40	2.50	0.93	0.10	0.80	0.94	0.90	0.72	1.44	1.30	7	13	7	13	0
IA 5	6	Low	-1.90	-1.83	0.75	0.07	0.84	0.75	0.80	0.71	0.93	0.17	5	9	5	9	0

Reading 2–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 5	6	High	2.70	2.70	0.93	0.00	0.99	0.93	0.96	0.71	1.50	1.89	7	13	7	13	0
IA 5	7	Low	-1.50	-1.43	0.67	0.07	0.85	0.67	0.79	0.73	1.08	0.18	7	9	7	9	0
IA 5	7	High	2.90	2.99	0.90	0.09	0.82	0.90	1.09	0.71	1.51	2.50	7	13	7	13	0
IA 5	8	Low	-1.50	-1.45	0.74	0.05	0.87	0.75	0.79	0.72	1.08	0.18	6	10	6	10	0
IA 5	8	High	3.00	3.09	0.84	0.09	0.79	0.84	1.18	0.73	1.45	2.93	7	13	7	13	0

Table A.6. Summary Statistics—Reading 2–5, CBE

Reading 2–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-4.50	-4.51	0.29	-0.01	0.29	0.33	0.32	0.35	0.42	40	43	40	43	0	0
Overall	1	High	1.80	1.74	0.30	-0.06	0.30	0.32	0.32	0.34	0.05	41	42	41	42	0	0
Overall	2	Low	-3.30	-3.25	0.26	0.05	0.27	0.33	0.32	0.34	0.08	41	41	41	41	0	0
Overall	2	High	2.10	2.11	0.32	0.01	0.32	0.32	0.32	0.34	0.06	41	41	41	41	0	0
Overall	3	Low	-2.80	-2.79	0.34	0.01	0.34	0.32	0.32	0.34	0.05	41	41	41	41	0	0
Overall	3	High	2.30	2.32	0.32	0.02	0.32	0.32	0.32	0.35	0.10	41	43	41	43	0	0
Overall	4	Low	-2.80	-2.86	0.34	-0.06	0.34	0.33	0.32	0.35	0.05	41	43	41	43	0	0
Overall	4	High	2.30	2.31	0.37	0.01	0.37	0.32	0.32	0.35	0.15	41	42	41	42	0	0
Overall	5	Low	-2.80	-2.77	0.29	0.03	0.29	0.32	0.32	0.35	0.07	40	43	40	43	0	0
Overall	5	High	2.40	2.46	0.34	0.06	0.35	0.33	0.32	0.35	0.22	40	43	39	43	1	1
Overall	6	Low	-1.90	-1.91	0.30	-0.01	0.30	0.33	0.32	0.35	0.03	41	42	41	42	0	0
Overall	6	High	2.70	2.76	0.40	0.06	0.40	0.34	0.32	0.36	0.34	41	43	40	42	1	1
Overall	7	Low	-1.50	-1.51	0.43	-0.01	0.43	0.32	0.32	0.35	0.03	41	42	41	42	0	0
Overall	7	High	2.90	2.87	0.32	-0.03	0.32	0.34	0.32	0.36	0.40	41	43	40	43	1	1
Overall	8	Low	-1.50	-1.44	0.34	0.06	0.35	0.32	0.32	0.37	0.03	41	43	41	43	0	0
Overall	8	High	3.00	2.97	0.34	-0.03	0.34	0.34	0.32	0.36	0.46	41	43	40	43	1	1
IA 1	1	Low	-4.50	-4.47	0.70	0.03	0.70	0.76	0.68	1.07	0.08	7	10	7	10	0	0

Reading 2–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	1	High	1.80	1.60	0.64	-0.20	0.67	0.75	0.67	0.85	0.05	7	12	7	12	0	0
IA 1	2	Low	-3.30	-3.15	0.65	0.15	0.66	0.77	0.69	1.07	0.04	7	11	7	11	0	0
IA 1	2	High	2.10	2.04	0.74	-0.06	0.74	0.75	0.67	0.86	0.04	7	12	7	12	0	0
IA 1	3	Low	-2.80	-2.81	0.77	-0.01	0.76	0.75	0.67	0.87	0.03	7	11	7	11	0	0
IA 1	3	High	2.30	2.31	0.72	0.01	0.72	0.75	0.67	0.85	0.05	7	10	7	10	0	0
IA 1	4	Low	-2.80	-2.81	0.76	-0.01	0.76	0.75	0.66	0.88	0.03	7	13	7	13	0	0
IA 1	4	High	2.30	2.23	0.73	-0.07	0.74	0.75	0.67	1.11	0.07	7	10	7	10	0	0
IA 1	5	Low	-2.80	-2.81	0.80	-0.01	0.80	0.76	0.68	0.86	0.03	7	10	7	10	0	0
IA 1	5	High	2.40	2.49	0.86	0.09	0.87	0.77	0.67	1.09	0.06	7	13	7	12	1	1
IA 1	6	Low	-1.90	-1.92	0.64	-0.02	0.64	0.77	0.68	0.87	0.02	7	12	7	12	0	0
IA 1	6	High	2.70	2.83	0.79	0.13	0.80	0.78	0.67	1.07	0.09	7	12	7	12	1	1
IA 1	7	Low	-1.50	-1.53	0.76	-0.03	0.76	0.75	0.67	0.87	0.03	7	11	7	11	0	0
IA 1	7	High	2.90	2.93	0.66	0.03	0.66	0.78	0.68	0.86	0.11	7	13	7	12	1	1
IA 1	8	Low	-1.50	-1.43	0.80	0.07	0.81	0.75	0.67	0.92	0.03	7	11	7	11	0	0
IA 1	8	High	3.00	3.02	0.71	0.02	0.71	0.78	0.68	1.08	0.15	7	11	7	10	1	1
IA 2	1	Low	-4.50	-4.56	0.67	-0.06	0.67	0.76	0.68	0.86	0.16	7	10	7	10	0	0
IA 2	1	High	1.80	1.98	0.61	0.18	0.63	0.75	0.68	0.83	0.03	7	11	7	11	0	0
IA 2	2	Low	-3.30	-3.59	0.77	-0.29	0.82	0.76	0.68	1.07	0.06	7	12	7	12	0	0
IA 2	2	High	2.10	2.07	0.96	-0.03	0.96	0.77	0.67	1.04	0.04	7	13	7	13	0	0
IA 2	3	Low	-2.80	-2.68	0.73	0.12	0.74	0.75	0.67	0.85	0.03	7	13	7	13	0	0
IA 2	3	High	2.30	2.38	0.84	0.08	0.84	0.78	0.71	1.05	0.04	7	13	7	13	0	0
IA 2	4	Low	-2.80	-2.97	0.78	-0.17	0.80	0.76	0.68	1.07	0.03	7	12	7	12	0	0
IA 2	4	High	2.30	2.49	0.96	0.19	0.98	0.78	0.68	1.07	0.08	7	13	7	13	0	0
IA 2	5	Low	-2.80	-2.90	0.79	-0.10	0.79	0.76	0.66	1.06	0.07	7	13	7	13	0	0
IA 2	5	High	2.40	2.44	0.75	0.04	0.75	0.77	0.65	0.87	0.10	7	11	7	11	0	0
IA 2	6	Low	-1.90	-1.87	0.88	0.03	0.88	0.78	0.70	1.06	0.03	7	13	7	13	0	0
IA 2	6	High	2.70	2.87	0.82	0.17	0.84	0.78	0.67	1.05	0.28	7	12	7	12	0	0
IA 2	7	Low	-1.50	-1.59	0.94	-0.09	0.94	0.77	0.67	1.06	0.03	7	13	7	13	0	0

Reading 2–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	7	High	2.90	2.90	0.82	0.00	0.82	0.80	0.66	1.06	0.34	7	11	7	11	0	0
IA 2	8	Low	-1.50	-1.41	0.76	0.09	0.77	0.76	0.67	0.88	0.03	7	12	7	12	0	0
IA 2	8	High	3.00	3.04	0.79	0.04	0.79	0.81	0.71	1.07	0.49	7	12	7	12	0	0
IA 3	1	Low	-4.50	-4.63	0.77	-0.13	0.78	0.80	0.71	1.06	0.62	7	13	7	13	0	0
IA 3	1	High	1.80	1.76	0.76	-0.04	0.76	0.74	0.67	0.87	0.05	7	12	7	12	0	0
IA 3	2	Low	-3.30	-3.19	0.72	0.11	0.73	0.77	0.71	0.85	0.09	7	10	7	10	0	0
IA 3	2	High	2.10	2.25	0.87	0.15	0.88	0.77	0.61	1.07	0.04	7	13	7	13	0	0
IA 3	3	Low	-2.80	-2.82	0.61	-0.02	0.61	0.76	0.71	0.84	0.06	7	10	7	10	0	0
IA 3	3	High	2.30	2.23	0.59	-0.07	0.59	0.75	0.67	0.86	0.06	7	13	7	13	0	0
IA 3	4	Low	-2.80	-2.85	0.68	-0.05	0.69	0.77	0.67	0.88	0.07	7	11	7	11	0	0
IA 3	4	High	2.30	2.27	0.65	-0.03	0.65	0.75	0.67	0.86	0.11	7	11	7	11	0	0
IA 3	5	Low	-2.80	-2.78	0.70	0.02	0.70	0.76	0.67	1.05	0.10	7	12	7	12	0	0
IA 3	5	High	2.40	2.46	0.76	0.06	0.76	0.79	0.70	1.09	0.18	7	11	7	11	0	0
IA 3	6	Low	-1.90	-1.85	0.81	0.05	0.81	0.76	0.67	0.86	0.03	7	13	7	13	0	0
IA 3	6	High	2.70	2.65	0.75	-0.05	0.75	0.77	0.70	0.87	0.37	7	13	7	13	0	0
IA 3	7	Low	-1.50	-1.34	0.85	0.16	0.86	0.76	0.68	0.88	0.03	7	13	7	13	0	0
IA 3	7	High	2.90	2.82	0.82	-0.08	0.82	0.79	0.69	1.06	0.43	7	11	7	11	0	0
IA 3	8	Low	-1.50	-1.39	0.76	0.11	0.77	0.76	0.67	0.84	0.03	7	13	7	13	0	0
IA 3	8	High	3.00	3.10	0.62	0.10	0.63	0.79	0.70	1.04	0.60	7	14	7	14	0	0
IA 4	1	Low	-4.50	-4.46	0.63	0.04	0.63	0.79	0.70	1.07	0.65	7	13	7	13	0	0
IA 4	1	High	1.80	1.77	0.83	-0.03	0.83	0.75	0.66	0.85	0.03	7	11	7	11	0	0
IA 4	2	Low	-3.30	-3.02	0.71	0.28	0.76	0.76	0.69	0.84	0.14	7	10	7	10	0	0
IA 4	2	High	2.10	2.11	0.72	0.01	0.72	0.75	0.65	0.85	0.04	7	11	7	11	0	0
IA 4	3	Low	-2.80	-2.79	0.59	0.01	0.59	0.74	0.67	0.84	0.08	7	12	7	12	0	0
IA 4	3	High	2.30	2.34	0.64	0.04	0.64	0.74	0.67	0.85	0.05	7	12	7	12	0	0
IA 4	4	Low	-2.80	-2.86	0.82	-0.06	0.82	0.77	0.67	0.82	0.09	7	12	7	12	0	0
IA 4	4	High	2.30	2.35	0.75	0.05	0.75	0.76	0.67	1.08	0.06	7	10	7	10	0	0
IA 4	5	Low	-2.80	-2.71	0.77	0.09	0.78	0.77	0.67	1.04	0.12	7	13	7	13	0	0

Reading 2–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 4	5	High	2.40	2.61	0.73	0.21	0.76	0.77	0.68	0.86	0.06	7	10	7	10	0	0
IA 4	6	Low	-1.90	-1.86	0.75	0.04	0.75	0.77	0.67	0.87	0.03	7	13	7	13	0	0
IA 4	6	High	2.70	2.75	0.67	0.05	0.67	0.76	0.67	0.85	0.08	7	11	7	11	0	0
IA 4	7	Low	-1.50	-1.53	0.73	-0.03	0.73	0.76	0.67	1.06	0.03	7	10	7	10	0	0
IA 4	7	High	2.90	2.85	0.79	-0.05	0.79	0.79	0.70	0.90	0.14	7	10	7	10	0	0
IA 4	8	Low	-1.50	-1.53	0.77	-0.03	0.77	0.75	0.67	1.08	0.03	7	11	7	11	0	0
IA 4	8	High	3.00	2.87	0.72	-0.13	0.73	0.78	0.68	0.87	0.18	7	12	7	12	0	0
IA 5	1	Low	-4.50	-4.58	0.75	-0.08	0.75	0.78	0.66	1.06	0.57	7	13	7	13	0	0
IA 5	1	High	1.80	1.60	0.65	-0.20	0.68	0.76	0.68	0.85	0.09	7	12	7	12	0	0
IA 5	2	Low	-3.30	-3.31	0.69	-0.01	0.69	0.75	0.66	1.07	0.06	7	13	7	13	0	0
IA 5	2	High	2.10	2.13	0.73	0.03	0.73	0.77	0.67	0.85	0.16	7	12	7	12	0	0
IA 5	3	Low	-2.80	-2.88	0.77	-0.08	0.77	0.74	0.66	0.86	0.03	7	13	7	13	0	0
IA 5	3	High	2.30	2.40	0.84	0.10	0.84	0.77	0.69	0.87	0.29	7	12	7	12	0	0
IA 5	4	Low	-2.80	-2.82	0.72	-0.02	0.72	0.75	0.68	0.90	0.04	7	10	7	10	0	0
IA 5	4	High	2.30	2.27	0.64	-0.03	0.64	0.78	0.69	1.09	0.46	7	10	7	10	0	0
IA 5	5	Low	-2.80	-2.75	0.92	0.05	0.92	0.77	0.67	1.06	0.04	7	13	7	13	0	0
IA 5	5	High	2.40	2.40	0.98	0.00	0.98	0.83	0.71	1.97	0.71	7	12	7	12	0	0
IA 5	6	Low	-1.90	-2.02	0.81	-0.12	0.82	0.76	0.67	0.84	0.02	7	12	7	12	0	0
IA 5	6	High	2.70	2.88	0.91	0.18	0.92	0.86	0.71	1.98	0.86	7	13	7	13	0	0
IA 5	7	Low	-1.50	-1.58	0.65	-0.08	0.65	0.75	0.67	0.87	0.03	7	12	7	12	0	0
IA 5	7	High	2.90	3.05	0.73	0.15	0.74	0.83	0.67	1.07	0.91	7	15	7	15	0	0
IA 5	8	Low	-1.50	-1.47	0.64	0.03	0.64	0.76	0.67	1.09	0.02	7	10	7	10	0	0
IA 5	8	High	3.00	3.02	0.83	0.02	0.83	0.85	0.72	1.52	0.86	7	13	7	13	0	0

Table A.7. Summary Statistics—Reading 6+, COLO

Reading 6+, COLO												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-0.80	-0.78	0.31	0.02	0.31	0.33	0.32	0.34	0.20	40	40	40	40	0	0
Overall	1	High	3.70	3.72	0.30	0.02	0.30	0.33	0.32	0.35	0.22	40	40	40	40	0	0
Overall	2	Low	-0.30	-0.36	0.32	-0.06	0.33	0.33	0.32	0.35	0.21	40	41	40	41	0	0
Overall	2	High	3.70	3.65	0.28	-0.05	0.29	0.33	0.32	0.35	0.25	40	40	40	40	0	0
Overall	3	Low	-0.10	-0.06	0.36	0.04	0.37	0.33	0.32	0.35	0.21	40	40	40	40	0	0
Overall	3	High	3.80	3.80	0.35	0.00	0.35	0.33	0.32	0.35	0.30	40	40	40	40	0	0
Overall	4	Low	-0.10	-0.04	0.32	0.06	0.33	0.33	0.32	0.34	0.21	40	40	39	40	1	1
Overall	4	High	3.80	3.86	0.33	0.06	0.34	0.34	0.33	0.36	0.43	40	43	40	43	0	0
Overall	5	Low	-0.10	-0.14	0.34	-0.04	0.34	0.33	0.32	0.35	0.20	40	43	40	43	0	0
Overall	5	High	4.10	4.04	0.35	-0.06	0.36	0.35	0.33	0.42	0.76	40	43	40	43	0	0
Overall	6	Low	0.30	0.18	0.39	-0.12	0.41	0.33	0.32	0.35	0.21	40	42	40	42	0	0
Overall	6	High	4.10	4.03	0.36	-0.07	0.36	0.36	0.33	0.42	0.92	40	43	40	43	0	0
Overall	7	Low	0.50	0.56	0.31	0.06	0.32	0.33	0.32	0.35	0.21	40	41	40	41	0	0
Overall	7	High	4.10	4.27	0.49	0.17	0.52	0.39	0.34	0.73	1.29	40	43	40	43	0	0
Overall	8	Low	0.50	0.54	0.33	0.04	0.33	0.33	0.32	0.35	0.21	40	40	40	40	0	0
Overall	8	High	4.20	4.27	0.48	0.07	0.49	0.40	0.34	0.60	1.56	40	43	40	43	0	0
IA 1	1	Low	-0.80	-0.92	0.76	-0.12	0.77	0.80	0.70	1.10	0.23	7	9	7	9	0	0
IA 1	1	High	3.70	3.75	0.83	0.05	0.83	0.81	0.72	1.12	0.16	7	9	7	9	0	0
IA 1	2	Low	-0.30	-0.41	0.74	-0.11	0.75	0.79	0.73	1.09	0.22	7	9	7	9	0	0
IA 1	2	High	3.70	3.74	0.69	0.04	0.69	0.80	0.72	1.09	0.16	7	9	7	9	0	0
IA 1	3	Low	-0.10	0.23	1.12	0.33	1.17	0.83	0.66	1.52	0.22	7	10	7	10	0	0
IA 1	3	High	3.80	3.89	0.76	0.09	0.77	0.80	0.72	1.07	0.17	6	9	6	9	0	0
IA 1	4	Low	-0.10	-0.04	0.76	0.06	0.76	0.79	0.69	1.07	0.23	6	9	6	9	1	1
IA 1	4	High	3.80	4.03	0.84	0.23	0.88	0.85	0.72	1.12	0.25	5	11	5	11	0	0
IA 1	5	Low	-0.10	-0.33	0.75	-0.23	0.79	0.78	0.71	1.11	0.22	7	9	7	9	0	0
IA 1	5	High	4.10	4.18	0.71	0.08	0.72	0.88	0.73	1.28	0.40	5	9	5	9	0	0
IA 1	6	Low	0.30	0.30	1.03	0.00	1.03	0.81	0.70	1.52	0.26	7	11	7	11	0	0

Reading 6+, COLO												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	6	High	4.10	3.98	1.06	-0.12	1.07	0.95	0.78	1.49	0.59	5	8	5	8	0	0
IA 1	7	Low	0.50	0.69	0.76	0.19	0.78	0.82	0.70	1.08	0.23	7	9	7	9	0	0
IA 1	7	High	4.10	4.53	1.10	0.43	1.18	1.04	0.77	1.47	1.03	5	11	5	11	0	0
IA 1	8	Low	0.50	0.51	0.74	0.01	0.74	0.79	0.71	1.08	0.20	7	9	7	9	0	0
IA 1	8	High	4.20	4.45	0.94	0.25	0.97	1.09	0.77	1.50	1.30	5	10	5	10	0	0
IA 2	1	Low	-0.80	-0.82	0.57	-0.02	0.57	0.76	0.71	1.08	0.17	8	10	8	10	0	0
IA 2	1	High	3.70	3.93	0.58	0.23	0.62	0.76	0.71	0.84	0.19	7	10	7	10	0	0
IA 2	2	Low	-0.30	-0.50	0.80	-0.20	0.83	0.77	0.72	1.07	0.20	8	10	8	10	0	0
IA 2	2	High	3.70	3.63	0.67	-0.07	0.67	0.78	0.71	1.10	0.22	6	9	6	9	0	0
IA 2	3	Low	-0.10	-0.06	0.77	0.04	0.77	0.77	0.71	1.09	0.19	7	10	7	10	0	0
IA 2	3	High	3.80	3.92	0.94	0.12	0.95	0.81	0.72	1.09	0.32	6	10	6	10	0	0
IA 2	4	Low	-0.10	0.11	0.83	0.21	0.85	0.78	0.70	1.08	0.19	7	10	7	10	0	0
IA 2	4	High	3.80	4.00	1.08	0.20	1.09	0.87	0.71	1.46	0.52	6	12	6	12	0	0
IA 2	5	Low	-0.10	-0.13	0.77	-0.03	0.77	0.76	0.71	0.84	0.20	8	10	8	10	0	0
IA 2	5	High	4.10	4.12	0.91	0.02	0.91	0.91	0.74	1.49	0.99	6	13	6	13	0	0
IA 2	6	Low	0.30	0.10	0.79	-0.20	0.82	0.78	0.72	1.07	0.18	7	9	7	9	0	0
IA 2	6	High	4.10	4.33	1.04	0.23	1.07	0.99	0.73	1.49	1.17	6	11	6	11	0	0
IA 2	7	Low	0.50	0.50	0.72	0.00	0.72	0.76	0.71	1.07	0.21	8	10	8	10	0	0
IA 2	7	High	4.10	4.62	1.15	0.52	1.26	1.10	0.77	1.45	1.68	5	12	5	12	0	0
IA 2	8	Low	0.50	0.67	0.56	0.17	0.58	0.76	0.71	0.85	0.19	7	10	7	10	0	0
IA 2	8	High	4.20	4.43	0.91	0.23	0.94	1.11	0.74	1.53	1.90	5	12	5	12	0	0
IA 3	1	Low	-0.80	-0.84	0.98	-0.04	0.98	0.83	0.72	1.12	0.18	7	9	7	9	0	0
IA 3	1	High	3.70	3.72	0.82	0.02	0.82	0.80	0.72	0.86	0.29	7	9	7	9	0	0
IA 3	2	Low	-0.30	-0.28	0.85	0.02	0.85	0.80	0.70	1.11	0.22	7	9	7	9	0	0
IA 3	2	High	3.70	3.51	1.10	-0.19	1.11	0.84	0.72	1.61	0.28	7	9	7	9	0	0
IA 3	3	Low	-0.10	0.06	0.92	0.16	0.93	0.81	0.70	1.09	0.21	7	9	7	9	0	0
IA 3	3	High	3.80	3.69	0.93	-0.11	0.94	0.83	0.73	1.08	0.34	5	9	5	9	0	0
IA 3	4	Low	-0.10	0.02	0.63	0.12	0.64	0.78	0.61	1.08	0.19	7	12	7	12	0	0

Reading 6+, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	4	High	3.80	3.74	0.71	-0.06	0.71	0.83	0.71	1.08	0.39	5	9	5	9	0	0
IA 3	5	Low	-0.10	-0.09	0.65	0.01	0.65	0.78	0.72	1.09	0.20	7	9	7	9	0	0
IA 3	5	High	4.10	4.04	0.67	-0.06	0.67	0.89	0.76	1.19	0.85	5	11	5	11	0	0
IA 3	6	Low	0.30	0.13	0.70	-0.17	0.72	0.79	0.70	1.10	0.22	7	9	7	9	0	0
IA 3	6	High	4.10	4.18	1.08	0.08	1.08	0.99	0.79	1.58	0.98	5	10	5	10	0	0
IA 3	7	Low	0.50	0.63	1.04	0.13	1.05	0.81	0.69	1.46	0.20	7	9	7	9	0	0
IA 3	7	High	4.10	4.49	1.27	0.39	1.32	1.12	0.82	1.72	1.34	5	11	5	11	0	0
IA 3	8	Low	0.50	0.36	0.74	-0.14	0.75	0.79	0.67	1.09	0.21	7	10	7	10	0	0
IA 3	8	High	4.20	4.38	1.00	0.18	1.02	1.09	0.84	1.53	1.57	5	10	5	10	0	0
IA 4	1	Low	-0.80	-0.72	0.96	0.08	0.96	0.78	0.70	1.08	0.24	7	10	7	10	0	0
IA 4	1	High	3.70	3.68	0.80	-0.02	0.80	0.76	0.65	1.08	0.18	7	11	7	11	0	0
IA 4	2	Low	-0.30	-0.33	0.80	-0.03	0.80	0.77	0.69	0.85	0.20	7	10	7	10	0	0
IA 4	2	High	3.70	3.66	0.63	-0.04	0.63	0.74	0.56	0.85	0.18	8	14	8	14	0	0
IA 4	3	Low	-0.10	-0.26	0.86	-0.16	0.88	0.78	0.69	1.08	0.22	7	10	7	10	0	0
IA 4	3	High	3.80	3.79	0.72	-0.01	0.72	0.71	0.53	0.85	0.17	7	15	7	15	0	0
IA 4	4	Low	-0.10	-0.09	0.76	0.01	0.76	0.77	0.68	0.88	0.21	7	10	7	10	0	0
IA 4	4	High	3.80	3.83	0.66	0.03	0.66	0.67	0.52	0.93	0.16	7	16	7	16	0	0
IA 4	5	Low	-0.10	-0.07	0.85	0.03	0.85	0.77	0.71	1.08	0.18	7	10	7	10	0	0
IA 4	5	High	4.10	4.05	0.59	-0.05	0.59	0.60	0.51	0.83	0.21	8	16	8	16	0	0
IA 4	6	Low	0.30	0.38	0.84	0.08	0.84	0.78	0.69	1.07	0.22	7	10	7	10	0	0
IA 4	6	High	4.10	4.04	0.58	-0.06	0.58	0.58	0.50	0.76	0.27	8	18	8	18	0	0
IA 4	7	Low	0.50	0.51	0.72	0.01	0.72	0.77	0.72	0.88	0.22	7	10	7	10	0	0
IA 4	7	High	4.10	4.28	0.66	0.18	0.69	0.58	0.48	1.03	0.52	8	18	8	18	0	0
IA 4	8	Low	0.50	0.56	0.81	0.06	0.81	0.77	0.65	1.43	0.22	7	11	7	11	0	0
IA 4	8	High	4.20	4.29	0.64	0.09	0.65	0.58	0.49	0.81	0.81	8	18	8	18	0	0
IA 5	1	Low	-0.80	-0.64	0.79	0.16	0.80	0.77	0.70	1.07	0.20	7	10	7	10	0	0
IA 5	1	High	3.70	3.54	0.75	-0.16	0.76	0.77	0.71	0.87	0.27	7	9	7	9	0	0
IA 5	2	Low	-0.30	-0.27	0.76	0.03	0.76	0.78	0.71	1.09	0.22	8	10	8	10	0	0

Reading 6+, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 5	2	High	3.70	3.67	0.75	-0.03	0.75	0.78	0.71	1.08	0.39	6	9	6	9	0	0
IA 5	3	Low	-0.10	-0.15	0.74	-0.05	0.75	0.77	0.71	0.96	0.23	7	10	7	10	0	0
IA 5	3	High	3.80	3.86	0.69	0.06	0.69	0.81	0.71	1.09	0.51	6	10	6	10	0	0
IA 5	4	Low	-0.10	-0.15	0.88	-0.05	0.88	0.77	0.72	1.07	0.21	7	10	7	10	0	0
IA 5	4	High	3.80	4.05	1.06	0.25	1.09	0.90	0.72	1.47	0.89	6	13	6	13	0	0
IA 5	5	Low	-0.10	-0.10	0.59	0.00	0.59	0.75	0.71	0.84	0.19	8	11	8	11	0	0
IA 5	5	High	4.10	4.17	1.08	0.07	1.08	1.01	0.74	1.53	1.61	6	12	6	12	0	0
IA 5	6	Low	0.30	0.09	1.00	-0.21	1.02	0.79	0.71	1.07	0.18	7	10	7	10	0	0
IA 5	6	High	4.10	4.19	0.92	0.09	0.93	1.08	0.78	1.52	1.98	6	12	6	12	0	0
IA 5	7	Low	0.50	0.55	0.76	0.05	0.76	0.77	0.71	1.09	0.21	7	10	7	10	0	0
IA 5	7	High	4.10	4.19	1.00	0.09	1.01	1.19	0.78	1.56	2.55	5	13	5	13	0	0
IA 5	8	Low	0.50	0.61	0.70	0.11	0.70	0.76	0.71	1.07	0.21	7	10	7	10	0	0
IA 5	8	High	4.20	4.30	1.04	0.10	1.04	1.25	0.83	1.64	2.85	5	12	5	12	0	0

Table A.8. Summary Statistics—Reading 6+, CBE

Reading 6+, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-0.80	-0.82	0.34	-0.02	0.34	0.32	0.32	0.34	0.02	41	41	41	41	0	0
Overall	1	High	3.70	3.66	0.31	-0.04	0.31	0.32	0.32	0.34	0.07	41	41	41	41	0	0
Overall	2	Low	-0.30	-0.26	0.27	0.04	0.28	0.32	0.32	0.34	0.03	41	42	41	42	0	0
Overall	2	High	3.70	3.74	0.32	0.04	0.32	0.32	0.32	0.34	0.14	41	41	41	41	0	0
Overall	3	Low	-0.10	-0.09	0.33	0.01	0.33	0.32	0.32	0.35	0.03	41	42	41	42	0	0
Overall	3	High	3.80	3.82	0.37	0.02	0.37	0.33	0.32	0.35	0.26	41	43	41	43	0	0
Overall	4	Low	-0.10	-0.11	0.36	-0.01	0.36	0.33	0.32	0.35	0.03	41	41	41	41	0	0
Overall	4	High	3.80	3.82	0.40	0.02	0.40	0.33	0.32	0.38	0.42	41	43	41	43	0	0
Overall	5	Low	-0.10	-0.07	0.30	0.03	0.30	0.33	0.32	0.35	0.03	41	43	41	43	0	0

Reading 6+, CBE												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	5	High	4.10	4.14	0.41	0.04	0.42	0.35	0.33	0.46	0.74	41	43	41	43	0	0
Overall	6	Low	0.30	0.29	0.32	-0.01	0.32	0.32	0.32	0.35	0.03	41	41	41	41	0	0
Overall	6	High	4.10	4.16	0.36	0.06	0.36	0.34	0.32	0.38	0.52	41	43	41	43	0	0
Overall	7	Low	0.50	0.46	0.42	-0.04	0.42	0.32	0.32	0.34	0.03	41	41	41	41	0	0
Overall	7	High	4.10	4.11	0.32	0.01	0.32	0.34	0.32	0.36	0.45	41	43	41	43	0	0
Overall	8	Low	0.50	0.53	0.33	0.03	0.33	0.32	0.32	0.37	0.04	41	43	41	43	0	0
Overall	8	High	4.20	4.16	0.36	-0.04	0.36	0.34	0.32	0.39	0.56	41	43	41	43	0	0
IA 1	1	Low	-0.80	-0.71	0.72	0.09	0.72	0.75	0.68	0.86	0.02	7	11	7	11	0	0
IA 1	1	High	3.70	3.69	0.71	-0.01	0.71	0.75	0.67	0.82	0.04	7	13	7	13	0	0
IA 1	2	Low	-0.30	-0.39	0.68	-0.09	0.69	0.75	0.67	0.86	0.03	7	10	7	10	0	0
IA 1	2	High	3.70	3.71	0.77	0.01	0.77	0.76	0.68	0.85	0.08	7	10	7	10	0	0
IA 1	3	Low	-0.10	0.04	0.81	0.14	0.82	0.74	0.67	0.86	0.03	7	13	7	13	0	0
IA 1	3	High	3.80	3.80	0.69	0.00	0.69	0.76	0.68	1.07	0.15	7	11	7	11	0	0
IA 1	4	Low	-0.10	-0.28	0.85	-0.18	0.87	0.75	0.67	1.04	0.03	7	13	7	13	0	0
IA 1	4	High	3.80	3.84	0.88	0.04	0.88	0.77	0.68	1.04	0.32	7	13	7	13	0	0
IA 1	5	Low	-0.10	-0.10	0.64	0.00	0.64	0.74	0.67	0.86	0.03	7	13	7	13	0	0
IA 1	5	High	4.10	4.27	0.88	0.17	0.89	0.82	0.69	1.05	0.58	7	13	7	13	0	0
IA 1	6	Low	0.30	0.23	0.67	-0.07	0.67	0.75	0.67	0.90	0.03	7	10	7	10	0	0
IA 1	6	High	4.10	4.10	0.61	0.00	0.60	0.77	0.68	0.88	0.45	7	13	7	13	0	0
IA 1	7	Low	0.50	0.35	0.73	-0.15	0.74	0.74	0.67	0.86	0.03	7	9	7	9	0	0
IA 1	7	High	4.10	4.11	0.70	0.01	0.69	0.78	0.67	0.89	0.33	7	13	7	13	0	0
IA 1	8	Low	0.50	0.55	0.66	0.05	0.66	0.76	0.67	1.05	0.03	7	13	7	13	0	0
IA 1	8	High	4.20	4.23	0.68	0.03	0.68	0.79	0.69	1.07	0.44	7	12	7	12	0	0
IA 2	1	Low	-0.80	-0.89	0.70	-0.09	0.70	0.76	0.67	0.86	0.02	7	11	7	11	0	0
IA 2	1	High	3.70	3.71	0.58	0.01	0.58	0.75	0.68	0.85	0.04	7	11	7	11	0	0
IA 2	2	Low	-0.30	-0.25	0.65	0.05	0.65	0.76	0.68	0.84	0.03	7	10	7	10	0	0
IA 2	2	High	3.70	3.86	0.70	0.16	0.72	0.75	0.67	0.84	0.11	7	12	7	12	0	0
IA 2	3	Low	-0.10	-0.24	0.72	-0.14	0.73	0.75	0.67	0.85	0.03	7	12	7	12	0	0

Reading 6+, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	3	High	3.80	3.98	0.95	0.18	0.97	0.79	0.68	1.06	0.25	7	13	7	13	0	0
IA 2	4	Low	-0.10	-0.02	0.76	0.08	0.76	0.77	0.67	1.04	0.03	7	13	7	13	0	0
IA 2	4	High	3.80	3.84	0.75	0.04	0.75	0.78	0.67	1.08	0.40	7	14	7	14	0	0
IA 2	5	Low	-0.10	-0.03	0.70	0.07	0.70	0.76	0.68	1.06	0.03	7	12	7	12	0	0
IA 2	5	High	4.10	4.24	0.69	0.14	0.70	0.83	0.69	1.12	0.79	7	13	7	13	0	0
IA 2	6	Low	0.30	0.22	0.81	-0.08	0.81	0.76	0.68	0.86	0.03	7	12	7	12	0	0
IA 2	6	High	4.10	4.43	0.77	0.33	0.84	0.81	0.71	1.40	0.61	7	13	7	13	0	0
IA 2	7	Low	0.50	0.43	0.79	-0.07	0.79	0.77	0.69	1.07	0.03	7	11	7	11	0	0
IA 2	7	High	4.10	4.11	1.06	0.01	1.06	0.82	0.69	1.46	0.56	7	15	7	15	0	0
IA 2	8	Low	0.50	0.50	0.72	0.00	0.72	0.75	0.67	1.06	0.03	7	13	7	13	0	0
IA 2	8	High	4.20	4.25	0.92	0.05	0.92	0.83	0.67	1.28	0.67	7	14	7	14	0	0
IA 3	1	Low	-0.80	-0.83	0.75	-0.03	0.75	0.76	0.67	0.87	0.02	7	12	7	12	0	0
IA 3	1	High	3.70	3.71	0.67	0.01	0.67	0.75	0.69	0.81	0.10	7	11	7	11	0	0
IA 3	2	Low	-0.30	-0.13	0.81	0.17	0.82	0.75	0.67	1.04	0.03	7	13	7	13	0	0
IA 3	2	High	3.70	3.57	0.70	-0.13	0.71	0.76	0.68	0.84	0.17	7	12	7	12	0	0
IA 3	3	Low	-0.10	-0.12	0.67	-0.02	0.67	0.76	0.68	0.86	0.03	7	10	7	10	0	0
IA 3	3	High	3.80	3.98	0.73	0.18	0.75	0.77	0.69	0.89	0.37	7	12	7	12	0	0
IA 3	4	Low	-0.10	-0.16	0.68	-0.06	0.68	0.75	0.67	0.85	0.03	7	10	7	10	0	0
IA 3	4	High	3.80	3.71	0.76	-0.09	0.76	0.78	0.71	0.86	0.58	7	13	7	13	0	0
IA 3	5	Low	-0.10	-0.08	0.81	0.02	0.80	0.76	0.67	0.86	0.02	7	11	7	11	0	0
IA 3	5	High	4.10	4.02	0.92	-0.08	0.92	0.83	0.71	1.10	0.85	7	14	7	14	0	0
IA 3	6	Low	0.30	0.33	0.63	0.03	0.63	0.76	0.68	0.90	0.03	7	10	7	10	0	0
IA 3	6	High	4.10	4.13	0.69	0.03	0.69	0.78	0.69	0.91	0.60	7	10	7	10	0	0
IA 3	7	Low	0.50	0.51	0.79	0.01	0.79	0.76	0.67	1.07	0.03	7	10	7	10	0	0
IA 3	7	High	4.10	4.18	0.75	0.08	0.75	0.80	0.67	1.05	0.53	7	13	7	13	0	0
IA 3	8	Low	0.50	0.50	0.89	0.00	0.89	0.75	0.68	0.87	0.02	7	12	7	12	0	0
IA 3	8	High	4.20	4.18	1.03	-0.02	1.03	0.82	0.68	1.15	0.61	7	14	7	14	0	0
IA 4	1	Low	-0.80	-0.94	0.91	-0.14	0.92	0.76	0.67	1.06	0.02	7	13	7	13	0	0

Reading 6+, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 4	1	High	3.70	3.51	0.56	-0.19	0.59	0.72	0.67	0.82	0.03	7	11	7	11	0	0
IA 4	2	Low	-0.30	-0.18	0.64	0.12	0.65	0.76	0.67	1.04	0.03	7	13	7	13	0	0
IA 4	2	High	3.70	3.90	0.78	0.20	0.80	0.74	0.68	0.85	0.04	7	13	7	13	0	0
IA 4	3	Low	-0.10	-0.13	0.79	-0.03	0.79	0.77	0.68	1.05	0.03	7	14	7	14	0	0
IA 4	3	High	3.80	3.64	0.74	-0.16	0.75	0.76	0.69	1.05	0.05	7	12	7	12	0	0
IA 4	4	Low	-0.10	0.17	0.70	0.27	0.75	0.76	0.68	0.88	0.03	7	12	7	12	0	0
IA 4	4	High	3.80	4.01	0.69	0.21	0.72	0.76	0.67	0.85	0.06	7	10	7	10	0	0
IA 4	5	Low	-0.10	0.06	0.68	0.16	0.70	0.76	0.67	0.86	0.03	7	13	7	13	0	0
IA 4	5	High	4.10	4.09	0.67	-0.01	0.67	0.79	0.71	0.89	0.13	7	10	7	10	0	0
IA 4	6	Low	0.30	0.32	0.89	0.02	0.89	0.76	0.67	0.87	0.03	7	11	7	11	0	0
IA 4	6	High	4.10	4.18	0.61	0.08	0.61	0.76	0.68	0.87	0.14	7	10	7	10	0	0
IA 4	7	Low	0.50	0.44	0.81	-0.06	0.82	0.75	0.67	0.85	0.03	7	13	7	13	0	0
IA 4	7	High	4.10	4.06	0.67	-0.04	0.67	0.76	0.68	0.88	0.10	7	10	7	10	0	0
IA 4	8	Low	0.50	0.45	0.72	-0.05	0.72	0.76	0.67	1.32	0.04	7	12	7	12	0	0
IA 4	8	High	4.20	3.96	0.85	-0.24	0.88	0.80	0.68	1.09	0.08	7	9	7	9	0	0
IA 5	1	Low	-0.80	-0.77	0.71	0.03	0.71	0.76	0.68	0.84	0.03	7	11	7	11	0	0
IA 5	1	High	3.70	3.70	0.66	0.00	0.65	0.75	0.68	0.83	0.13	7	11	7	11	0	0
IA 5	2	Low	-0.30	-0.32	0.62	-0.02	0.62	0.75	0.66	0.85	0.05	7	13	7	13	0	0
IA 5	2	High	3.70	3.68	0.70	-0.02	0.70	0.76	0.70	0.86	0.31	7	10	7	10	0	0
IA 5	3	Low	-0.10	-0.02	0.75	0.08	0.75	0.77	0.70	1.07	0.05	7	11	7	11	0	0
IA 5	3	High	3.80	3.84	0.94	0.04	0.94	0.81	0.70	1.20	0.51	7	14	7	14	0	0
IA 5	4	Low	-0.10	-0.22	0.70	-0.12	0.71	0.77	0.69	0.86	0.05	7	10	7	10	0	0
IA 5	4	High	3.80	3.84	0.72	0.04	0.72	0.80	0.72	1.10	0.74	7	13	7	13	0	0
IA 5	5	Low	-0.10	-0.22	0.73	-0.12	0.74	0.76	0.68	1.06	0.05	7	12	7	12	0	0
IA 5	5	High	4.10	4.38	0.69	0.28	0.74	0.89	0.77	1.34	1.24	7	15	7	15	0	0
IA 5	6	Low	0.30	0.44	0.81	0.14	0.82	0.78	0.71	1.05	0.04	7	13	7	13	0	0
IA 5	6	High	4.10	4.13	0.84	0.03	0.84	0.81	0.70	1.09	0.77	7	15	7	15	0	0
IA 5	7	Low	0.50	0.60	0.93	0.10	0.93	0.78	0.71	1.07	0.06	7	13	7	13	0	0

Reading 6+, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 5	7	High	4.10	4.29	0.85	0.19	0.87	0.82	0.71	1.06	0.73	7	15	7	15	0	0
IA 5	8	Low	0.50	0.68	0.79	0.18	0.81	0.76	0.68	0.87	0.06	7	12	7	12	0	0
IA 5	8	High	4.20	4.42	0.75	0.22	0.79	0.84	0.70	1.37	0.93	7	15	7	15	0	0

Table A.9. Summary Statistics—Mathematics K–2, COLO

Mathematics K–2, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-7.90	-7.91	0.34	-0.01	0.34	0.34	0.32	0.38	0.61	43	43	43	43	0	0
Overall	1	High	-2.10	-2.02	0.31	0.08	0.32	0.32	0.31	0.34	0.21	43	43	43	43	0	0
Overall	2	Low	-6.60	-6.60	0.34	0.00	0.34	0.32	0.31	0.33	0.17	43	43	43	43	0	0
Overall	2	High	-1.10	-1.12	0.32	-0.02	0.32	0.32	0.32	0.34	0.24	43	43	43	43	0	0
Overall	3	Low	-5.60	-5.62	0.37	-0.02	0.37	0.32	0.31	0.34	0.16	43	43	43	43	0	0
Overall	3	High	-0.50	-0.47	0.37	0.03	0.37	0.32	0.31	0.34	0.27	43	43	43	43	0	0
Overall	4	Low	-5.00	-5.01	0.33	-0.01	0.33	0.32	0.31	0.34	0.15	43	43	43	43	0	0
Overall	4	High	-0.50	-0.48	0.35	0.02	0.35	0.32	0.32	0.34	0.27	43	43	43	43	0	0
Overall	5	Low	-3.80	-3.77	0.30	0.03	0.30	0.32	0.31	0.33	0.15	43	43	43	43	0	0
Overall	5	High	0.30	0.37	0.31	0.07	0.32	0.33	0.32	0.35	0.44	43	43	43	43	0	0
Overall	6	Low	-3.10	-3.09	0.28	0.01	0.28	0.32	0.31	0.33	0.16	43	43	43	43	0	0
Overall	6	High	0.80	0.81	0.28	0.01	0.28	0.34	0.32	0.35	0.57	43	43	43	43	0	0
IA 1	1	Low	-7.90	-8.02	0.97	-0.12	0.98	0.78	0.62	1.63	1.41	10	15	10	15	0	0
IA 1	1	High	-2.10	-2.00	0.64	0.10	0.64	0.66	0.63	0.79	0.15	10	14	10	14	0	0
IA 1	2	Low	-6.60	-6.63	0.60	-0.03	0.60	0.66	0.62	0.78	0.23	10	13	10	13	0	0
IA 1	2	High	-1.10	-1.11	0.72	-0.01	0.72	0.66	0.62	0.79	0.16	10	15	10	15	0	0
IA 1	3	Low	-5.60	-5.74	0.68	-0.14	0.70	0.66	0.62	0.80	0.16	10	13	10	13	0	0
IA 1	3	High	-0.50	-0.37	0.67	0.13	0.68	0.67	0.63	0.72	0.16	10	14	10	14	0	0
IA 1	4	Low	-5.00	-5.02	0.62	-0.02	0.62	0.65	0.61	0.78	0.16	10	13	10	13	0	0

Mathematics K–2, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	4	High	-0.50	-0.29	0.82	0.21	0.84	0.67	0.62	0.81	0.16	10	14	10	14	0	0
IA 1	5	Low	-3.80	-3.76	0.71	0.04	0.71	0.66	0.62	0.77	0.15	9	14	9	14	0	0
IA 1	5	High	0.30	0.42	0.63	0.12	0.64	0.67	0.64	0.81	0.16	10	13	10	13	0	0
IA 1	6	Low	-3.10	-3.11	0.71	-0.01	0.70	0.66	0.62	0.83	0.15	10	13	10	13	0	0
IA 1	6	High	0.80	0.75	0.56	-0.05	0.56	0.67	0.64	0.80	0.20	9	13	9	13	0	0
IA 2	1	Low	-7.90	-7.90	0.63	0.00	0.63	0.69	0.62	0.83	0.40	9	13	9	13	0	0
IA 2	1	High	-2.10	-1.91	0.72	0.19	0.74	0.67	0.63	0.73	0.37	9	13	9	13	0	0
IA 2	2	Low	-6.60	-6.57	0.57	0.03	0.57	0.66	0.61	0.72	0.16	9	13	9	13	0	0
IA 2	2	High	-1.10	-1.02	0.58	0.08	0.58	0.67	0.63	0.73	0.49	9	14	9	14	0	0
IA 2	3	Low	-5.60	-5.49	0.57	0.11	0.58	0.66	0.61	0.72	0.16	9	13	9	13	0	0
IA 2	3	High	-0.50	-0.54	0.66	-0.04	0.67	0.67	0.63	0.73	0.58	10	14	10	14	0	0
IA 2	4	Low	-5.00	-4.98	0.57	0.02	0.57	0.64	0.61	0.73	0.15	9	14	9	14	0	0
IA 2	4	High	-0.50	-0.57	0.65	-0.07	0.66	0.68	0.63	0.82	0.60	9	14	9	14	0	0
IA 2	5	Low	-3.80	-3.78	0.72	0.02	0.72	0.66	0.61	0.78	0.16	9	14	9	14	0	0
IA 2	5	High	0.30	0.51	0.68	0.21	0.71	0.71	0.64	0.84	1.14	10	14	10	14	0	0
IA 2	6	Low	-3.10	-3.22	0.61	-0.12	0.62	0.66	0.62	0.73	0.18	9	12	9	12	0	0
IA 2	6	High	0.80	0.88	0.72	0.08	0.72	0.74	0.65	1.07	1.47	10	14	10	14	0	0
IA 3	1	Low	-7.90	-7.92	0.62	-0.02	0.62	0.68	0.61	0.83	0.17	9	12	9	12	0	0
IA 3	1	High	-2.10	-2.06	0.64	0.04	0.64	0.66	0.62	0.72	0.17	9	13	9	13	0	0
IA 3	2	Low	-6.60	-6.57	0.78	0.03	0.78	0.65	0.62	0.73	0.16	9	14	9	14	0	0
IA 3	2	High	-1.10	-1.24	0.49	-0.14	0.51	0.66	0.62	0.73	0.16	9	12	9	12	0	0
IA 3	3	Low	-5.60	-5.63	0.69	-0.03	0.69	0.66	0.61	0.78	0.16	9	14	9	14	0	0
IA 3	3	High	-0.50	-0.51	0.77	-0.01	0.77	0.67	0.62	0.80	0.16	9	12	9	12	0	0
IA 3	4	Low	-5.00	-5.01	0.65	-0.01	0.65	0.65	0.61	0.76	0.16	9	13	9	13	0	0
IA 3	4	High	-0.50	-0.38	0.58	0.12	0.59	0.67	0.62	0.73	0.16	9	13	9	13	0	0
IA 3	5	Low	-3.80	-3.79	0.65	0.01	0.65	0.66	0.63	0.73	0.15	9	12	9	12	0	0
IA 3	5	High	0.30	0.25	0.61	-0.05	0.61	0.68	0.63	0.73	0.16	9	12	9	12	0	0
IA 3	6	Low	-3.10	-3.07	0.62	0.03	0.62	0.66	0.62	0.72	0.16	9	13	9	13	0	0

Mathematics K–2, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	6	High	0.80	0.81	0.59	0.01	0.59	0.69	0.63	0.73	0.18	9	12	9	12	0	0
IA 4	1	Low	-7.90	-7.97	0.60	-0.07	0.60	0.67	0.63	0.81	0.25	9	13	9	13	0	0
IA 4	1	High	-2.10	-2.10	0.61	0.00	0.61	0.66	0.62	0.73	0.16	10	13	10	13	0	0
IA 4	2	Low	-6.60	-6.64	0.66	-0.04	0.66	0.66	0.62	0.70	0.15	10	13	10	13	0	0
IA 4	2	High	-1.10	-1.07	0.73	0.03	0.73	0.66	0.62	0.77	0.15	10	15	10	15	0	0
IA 4	3	Low	-5.60	-5.60	0.76	0.00	0.76	0.65	0.61	0.79	0.16	10	14	10	14	0	0
IA 4	3	High	-0.50	-0.46	0.70	0.04	0.70	0.66	0.62	0.74	0.16	10	13	10	13	0	0
IA 4	4	Low	-5.00	-5.04	0.54	-0.04	0.54	0.65	0.62	0.71	0.15	10	13	10	13	0	0
IA 4	4	High	-0.50	-0.66	0.70	-0.16	0.72	0.66	0.62	0.78	0.16	10	13	10	13	0	0
IA 4	5	Low	-3.80	-3.76	0.71	0.04	0.71	0.66	0.61	0.71	0.15	10	13	10	13	0	0
IA 4	5	High	0.30	0.35	0.58	0.05	0.58	0.67	0.63	0.72	0.16	10	12	10	12	0	0
IA 4	6	Low	-3.10	-2.94	0.72	0.16	0.74	0.66	0.61	1.04	0.16	10	15	10	15	0	0
IA 4	6	High	0.8	0.84	0.64	0.04	0.64	0.67	0.62	0.71	0.17	10	13	10	13	0	0

Table A.10. Summary Statistics—Mathematics K–2, CBE

Mathematics K–2, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-7.90	-7.88	0.35	0.02	0.35	0.33	0.32	0.35	0.41	43	43	43	43	0	0
Overall	1	High	-2.10	-2.14	0.31	-0.04	0.32	0.32	0.31	0.34	0.12	43	43	43	43	0	0
Overall	2	Low	-6.60	-6.56	0.25	0.04	0.25	0.32	0.31	0.34	0.10	43	43	43	43	0	0
Overall	2	High	-1.10	-1.15	0.31	-0.05	0.31	0.32	0.31	0.35	0.13	43	43	43	43	0	0
Overall	3	Low	-5.60	-5.60	0.35	0.00	0.35	0.32	0.31	0.36	0.04	43	43	43	43	0	0
Overall	3	High	-0.50	-0.52	0.29	-0.02	0.29	0.32	0.31	0.35	0.16	43	43	43	43	0	0
Overall	4	Low	-5.00	-4.98	0.32	0.02	0.32	0.32	0.31	0.35	0.03	43	43	43	43	0	0
Overall	4	High	-0.50	-0.45	0.35	0.05	0.36	0.32	0.31	0.34	0.16	43	43	43	43	0	0
Overall	5	Low	-3.80	-3.84	0.31	-0.04	0.31	0.32	0.31	0.35	0.04	43	43	43	43	0	0

Mathematics K–2, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	5	High	0.30	0.34	0.35	0.04	0.35	0.32	0.31	0.34	0.22	43	43	43	43	0	0
Overall	6	Low	-3.10	-3.11	0.41	-0.01	0.41	0.32	0.31	0.34	0.06	43	43	43	43	0	0
Overall	6	High	0.80	0.80	0.29	0.00	0.29	0.32	0.31	0.34	0.31	43	43	43	43	0	0
IA 1	1	Low	-7.90	-7.86	0.70	0.04	0.70	0.72	0.62	1.07	1.03	10	13	10	13	0	0
IA 1	1	High	-2.10	-2.23	0.50	-0.13	0.52	0.65	0.61	0.77	0.02	10	13	10	13	0	0
IA 1	2	Low	-6.60	-6.81	0.60	-0.21	0.64	0.66	0.61	0.80	0.20	10	13	10	13	0	0
IA 1	2	High	-1.10	-1.20	0.56	-0.10	0.56	0.65	0.61	0.75	0.03	10	13	10	13	0	0
IA 1	3	Low	-5.60	-5.65	0.68	-0.05	0.68	0.66	0.61	0.78	0.07	10	13	10	13	0	0
IA 1	3	High	-0.50	-0.49	0.62	0.01	0.62	0.66	0.61	0.78	0.04	10	13	10	13	0	0
IA 1	4	Low	-5.00	-4.92	0.67	0.08	0.67	0.66	0.61	0.80	0.04	10	13	10	13	0	0
IA 1	4	High	-0.50	-0.44	0.61	0.06	0.61	0.66	0.61	0.71	0.05	10	13	10	13	0	0
IA 1	5	Low	-3.80	-3.90	0.57	-0.10	0.58	0.66	0.61	0.80	0.03	10	12	10	12	0	0
IA 1	5	High	0.30	0.40	0.72	0.10	0.72	0.67	0.61	1.05	0.11	10	13	10	13	0	0
IA 1	6	Low	-3.10	-3.04	0.81	0.06	0.82	0.65	0.61	0.78	0.02	10	13	10	13	0	0
IA 1	6	High	0.80	0.97	0.66	0.17	0.68	0.67	0.62	1.05	0.20	10	13	10	13	0	0
IA 2	1	Low	-7.90	-8.06	0.66	-0.16	0.67	0.67	0.62	1.00	0.37	10	13	10	13	0	0
IA 2	1	High	-2.10	-2.00	0.63	0.10	0.64	0.66	0.62	0.81	0.40	10	12	10	12	0	0
IA 2	2	Low	-6.60	-6.38	0.62	0.22	0.66	0.66	0.61	0.79	0.13	10	13	10	13	0	0
IA 2	2	High	-1.10	-1.25	0.73	-0.15	0.75	0.67	0.64	1.07	0.46	10	13	10	13	0	0
IA 2	3	Low	-5.60	-5.59	0.73	0.01	0.73	0.67	0.61	1.05	0.05	10	13	10	13	0	0
IA 2	3	High	-0.50	-0.58	0.61	-0.08	0.61	0.67	0.64	0.72	0.53	10	13	10	13	0	0
IA 2	4	Low	-5.00	-5.13	0.64	-0.13	0.65	0.65	0.61	0.78	0.04	10	13	10	13	0	0
IA 2	4	High	-0.50	-0.36	0.64	0.14	0.65	0.67	0.64	0.71	0.54	10	13	10	13	0	0
IA 2	5	Low	-3.80	-3.67	0.68	0.13	0.69	0.67	0.61	1.05	0.07	10	13	10	13	0	0
IA 2	5	High	0.30	0.42	0.72	0.12	0.73	0.68	0.64	0.81	0.67	10	13	10	13	0	0
IA 2	6	Low	-3.10	-3.19	0.71	-0.09	0.72	0.66	0.62	0.79	0.18	10	12	10	12	0	0
IA 2	6	High	0.80	0.84	0.78	0.04	0.78	0.72	0.65	1.07	0.89	10	13	10	13	0	0
IA 3	1	Low	-7.90	-7.83	0.61	0.07	0.61	0.66	0.61	0.80	0.08	10	12	10	12	0	0

Mathematics K–2, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	1	High	-2.10	-2.21	0.66	-0.11	0.67	0.65	0.61	0.78	0.02	10	13	10	13	0	0
IA 3	2	Low	-6.60	-6.44	0.66	0.16	0.68	0.67	0.62	0.80	0.04	10	13	10	13	0	0
IA 3	2	High	-1.10	-1.02	0.57	0.08	0.57	0.65	0.61	0.79	0.03	10	13	10	13	0	0
IA 3	3	Low	-5.60	-5.71	0.78	-0.11	0.78	0.66	0.61	0.87	0.03	10	13	10	13	0	0
IA 3	3	High	-0.50	-0.53	0.62	-0.03	0.62	0.66	0.61	0.80	0.03	10	12	10	12	0	0
IA 3	4	Low	-5.00	-4.88	0.67	0.12	0.68	0.66	0.61	0.88	0.03	10	13	10	13	0	0
IA 3	4	High	-0.50	-0.43	0.64	0.07	0.65	0.66	0.61	0.73	0.03	10	12	10	12	0	0
IA 3	5	Low	-3.80	-3.87	0.62	-0.07	0.62	0.66	0.61	0.84	0.03	10	13	10	13	0	0
IA 3	5	High	0.30	0.37	0.70	0.07	0.70	0.65	0.61	0.78	0.04	10	13	10	13	0	0
IA 3	6	Low	-3.10	-3.11	0.78	-0.01	0.78	0.65	0.61	0.79	0.02	10	13	10	13	0	0
IA 3	6	High	0.80	0.74	0.58	-0.06	0.58	0.66	0.61	0.73	0.05	10	11	10	11	0	0
IA 4	1	Low	-7.90	-7.86	0.66	0.04	0.66	0.66	0.61	0.83	0.11	10	13	10	13	0	0
IA 4	1	High	-2.10	-2.11	0.67	-0.01	0.67	0.65	0.61	0.72	0.02	10	13	10	13	0	0
IA 4	2	Low	-6.60	-6.62	0.62	-0.02	0.62	0.65	0.61	0.70	0.02	10	13	10	13	0	0
IA 4	2	High	-1.10	-1.13	0.66	-0.03	0.66	0.66	0.61	0.78	0.03	10	13	10	13	0	0
IA 4	3	Low	-5.60	-5.47	0.71	0.13	0.73	0.66	0.61	0.79	0.03	10	13	10	13	0	0
IA 4	3	High	-0.50	-0.47	0.65	0.03	0.65	0.66	0.62	0.78	0.03	10	13	10	13	0	0
IA 4	4	Low	-5.00	-4.96	0.65	0.04	0.65	0.66	0.61	0.81	0.02	10	12	10	12	0	0
IA 4	4	High	-0.50	-0.54	0.70	-0.04	0.70	0.66	0.62	0.77	0.03	10	12	10	12	0	0
IA 4	5	Low	-3.80	-3.90	0.70	-0.10	0.70	0.65	0.61	0.80	0.02	10	12	10	12	0	0
IA 4	5	High	0.30	0.21	0.56	-0.09	0.57	0.65	0.62	0.72	0.03	10	13	10	13	0	0
IA 4	6	Low	-3.10	-3.08	0.62	0.02	0.62	0.66	0.62	0.79	0.02	10	12	10	12	0	0
IA 4	6	High	0.80	0.76	0.66	-0.04	0.66	0.66	0.62	0.78	0.06	10	12	10	12	0	0

Table A.11. Summary Statistics—Mathematics 2–5, COLO

Mathematics 2–5, COLO																	
												#Items					
								SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-4.00	-4.00	0.26	0.00	0.26	0.29	0.29	0.30	0.27	51	53	51	53	0	0
Overall	1	High	2.00	2.00	0.23	0.00	0.23	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	2	Low	-2.90	-2.94	0.36	-0.04	0.36	0.29	0.29	0.30	0.18	50	53	50	53	0	0
Overall	2	High	2.60	2.54	0.37	-0.06	0.37	0.29	0.29	0.30	0.25	50	53	50	53	0	0
Overall	3	Low	-2.30	-2.31	0.28	-0.01	0.28	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	3	High	3.10	3.13	0.30	0.03	0.30	0.31	0.30	0.33	0.63	53	53	53	53	0	0
Overall	4	Low	-2.30	-2.33	0.29	-0.03	0.29	0.29	0.29	0.30	0.17	50	53	50	53	0	0
Overall	4	High	3.10	3.12	0.33	0.02	0.33	0.33	0.32	0.35	1.06	53	53	53	53	0	0
Overall	5	Low	-1.40	-1.37	0.30	0.03	0.30	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	5	High	3.60	3.57	0.33	-0.03	0.33	0.34	0.33	0.35	1.38	53	53	53	53	0	0
Overall	6	Low	-0.90	-0.84	0.27	0.06	0.27	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	6	High	4.10	4.17	0.33	0.07	0.34	0.35	0.34	0.37	1.79	53	53	53	53	0	0
IA 1	1	Low	-4.00	-4.12	0.76	-0.12	0.77	0.62	0.56	1.04	0.58	12	17	12	17	0	0
IA 1	1	High	2.00	1.96	0.49	-0.04	0.49	0.59	0.57	0.64	0.15	12	15	12	15	0	0
IA 1	2	Low	-2.90	-2.99	0.57	-0.09	0.58	0.60	0.56	0.76	0.24	12	15	12	15	0	0
IA 1	2	High	2.60	2.53	0.59	-0.07	0.60	0.60	0.57	0.63	0.15	12	15	12	15	0	0
IA 1	3	Low	-2.30	-2.38	0.56	-0.08	0.56	0.59	0.56	0.63	0.17	12	16	12	16	0	0
IA 1	3	High	3.10	3.14	0.63	0.04	0.63	0.62	0.59	0.70	0.15	12	15	12	15	0	0
IA 1	4	Low	-2.30	-2.25	0.52	0.05	0.53	0.59	0.57	0.64	0.18	12	14	12	14	0	0
IA 1	4	High	3.10	3.10	0.60	0.00	0.60	0.62	0.58	0.69	0.15	12	13	12	13	0	0
IA 1	5	Low	-1.40	-1.43	0.60	-0.03	0.60	0.60	0.57	0.63	0.15	12	15	12	15	0	0
IA 1	5	High	3.60	3.64	0.54	0.04	0.54	0.62	0.59	0.80	0.15	12	12	12	12	0	0
IA 1	6	Low	-0.90	-0.78	0.57	0.12	0.59	0.59	0.57	0.67	0.15	12	15	12	15	0	0
IA 1	6	High	4.10	4.15	0.64	0.05	0.64	0.63	0.58	0.70	0.16	12	12	12	12	0	0
IA 2	1	Low	-4.00	-3.86	0.58	0.14	0.60	0.60	0.57	0.68	0.16	12	16	12	16	0	0
IA 2	1	High	2.00	2.04	0.51	0.04	0.52	0.60	0.57	0.67	0.19	12	15	12	15	0	0
IA 2	2	Low	-2.90	-3.01	0.52	-0.11	0.53	0.59	0.56	0.64	0.16	12	16	12	16	0	0

Mathematics 2–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	2	High	2.60	2.51	0.59	-0.09	0.60	0.60	0.56	0.67	0.52	12	16	12	16	0	0
IA 2	3	Low	-2.30	-2.16	0.55	0.14	0.57	0.59	0.56	0.66	0.16	12	17	12	17	0	0
IA 2	3	High	3.10	3.20	0.60	0.10	0.61	0.69	0.61	0.91	1.66	13	17	13	17	0	0
IA 2	4	Low	-2.30	-2.28	0.50	0.02	0.50	0.59	0.57	0.66	0.17	12	14	12	14	0	0
IA 2	4	High	3.10	3.29	0.82	0.19	0.84	1.11	0.61	1.59	2.97	15	17	15	17	0	0
IA 2	5	Low	-1.40	-1.32	0.62	0.08	0.62	0.59	0.56	0.64	0.15	12	16	12	16	0	0
IA 2	5	High	3.60	3.46	0.79	-0.14	0.80	1.35	0.76	2.01	3.98	17	17	17	17	0	0
IA 2	6	Low	-0.90	-0.89	0.52	0.01	0.52	0.59	0.57	0.66	0.16	12	14	12	14	0	0
IA 2	6	High	4.10	3.07	0.71	-1.03	1.25	1.42	0.78	2.07	5.24	17	17	17	17	0	0
IA 3	1	Low	-4.00	-4.09	0.54	-0.09	0.55	0.59	0.57	0.63	0.16	12	16	12	16	0	0
IA 3	1	High	2.00	1.94	0.66	-0.06	0.67	0.59	0.57	0.76	0.15	12	17	12	17	0	0
IA 3	2	Low	-2.90	-2.90	0.61	0.00	0.61	0.60	0.56	0.66	0.15	12	16	12	16	0	0
IA 3	2	High	2.60	2.44	0.57	-0.16	0.59	0.60	0.57	0.67	0.15	12	15	12	15	0	0
IA 3	3	Low	-2.30	-2.35	0.53	-0.05	0.54	0.59	0.57	0.62	0.15	12	16	12	16	0	0
IA 3	3	High	3.10	3.11	0.57	0.01	0.57	0.62	0.59	0.76	0.15	12	16	12	16	0	0
IA 3	4	Low	-2.30	-2.41	0.64	-0.11	0.65	0.59	0.56	0.78	0.16	12	17	12	17	0	0
IA 3	4	High	3.10	3.07	0.66	-0.03	0.66	0.62	0.59	0.69	0.16	12	13	12	13	0	0
IA 3	5	Low	-1.40	-1.33	0.58	0.07	0.59	0.59	0.57	0.63	0.16	12	16	12	16	0	0
IA 3	5	High	3.60	3.49	0.56	-0.11	0.57	0.62	0.59	0.78	0.16	12	12	12	12	0	0
IA 3	6	Low	-0.90	-0.77	0.51	0.13	0.52	0.60	0.57	0.67	0.16	12	17	12	17	0	0
IA 3	6	High	4.10	4.19	0.63	0.09	0.64	0.62	0.59	0.70	0.15	12	12	12	12	0	0
IA 4	1	Low	-4.00	-3.98	0.62	0.02	0.62	0.60	0.56	0.78	0.16	12	15	12	15	0	0
IA 4	1	High	2.00	2.05	0.49	0.05	0.49	0.59	0.56	0.63	0.15	12	16	12	16	0	0
IA 4	2	Low	-2.90	-2.88	0.80	0.02	0.80	0.60	0.56	0.66	0.15	12	16	12	16	0	0
IA 4	2	High	2.60	2.70	0.70	0.10	0.70	0.60	0.57	0.77	0.16	12	16	12	16	0	0
IA 4	3	Low	-2.30	-2.34	0.46	-0.04	0.46	0.59	0.57	0.61	0.16	12	14	12	14	0	0
IA 4	3	High	3.10	3.09	0.64	-0.01	0.64	0.62	0.59	0.69	0.16	12	13	12	13	0	0
IA 4	4	Low	-2.30	-2.38	0.73	-0.08	0.73	0.60	0.56	0.78	0.15	12	17	12	17	0	0

Mathematics 2–5, COLO												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 4	4	High	3.10	3.19	0.65	0.09	0.66	0.62	0.59	0.79	0.16	12	12	12	12	0	0
IA 4	5	Low	-1.40	-1.38	0.56	0.02	0.56	0.59	0.56	0.63	0.16	12	15	12	15	0	0
IA 4	5	High	3.60	3.57	0.79	-0.03	0.79	0.64	0.59	1.05	0.16	12	12	12	12	0	0
IA 4	6	Low	-0.90	-0.91	0.62	-0.01	0.62	0.59	0.57	0.63	0.16	12	15	12	15	0	0
IA 4	6	High	4.10	4.19	0.61	0.09	0.61	0.62	0.58	0.80	0.17	12	12	12	12	0	0

Table A.12. Summary Statistics—Mathematics 2–5, CBE

Mathematics 2–5, CBE												#Items					
									SEM			Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-4.00	-3.99	0.29	0.01	0.29	0.29	0.28	0.30	0.14	51	53	51	53	0	0
Overall	1	High	2.00	1.97	0.29	-0.03	0.29	0.29	0.28	0.30	0.07	51	53	51	53	0	0
Overall	2	Low	-2.90	-2.85	0.26	0.05	0.26	0.29	0.28	0.30	0.04	51	53	51	53	0	0
Overall	2	High	2.60	2.60	0.26	0.00	0.26	0.29	0.28	0.30	0.14	51	53	51	53	0	0
Overall	3	Low	-2.30	-2.27	0.32	0.03	0.32	0.29	0.28	0.31	0.04	51	53	51	53	0	0
Overall	3	High	3.10	3.09	0.26	-0.01	0.26	0.30	0.29	0.33	0.46	51	53	51	53	0	0
Overall	4	Low	-2.30	-2.28	0.25	0.02	0.25	0.29	0.28	0.30	0.05	51	53	51	53	0	0
Overall	4	High	3.10	3.09	0.33	-0.01	0.33	0.34	0.31	0.37	1.03	53	53	53	53	0	0
Overall	5	Low	-1.40	-1.42	0.28	-0.02	0.28	0.29	0.28	0.31	0.04	51	53	51	53	0	0
Overall	5	High	3.60	3.65	0.36	0.05	0.36	0.32	0.29	0.35	0.76	51	53	51	53	0	0
Overall	6	Low	-0.90	-0.91	0.32	-0.01	0.32	0.29	0.28	0.30	0.04	51	53	51	53	0	0
Overall	6	High	4.10	4.11	0.29	0.01	0.29	0.30	0.29	0.34	0.59	51	53	51	53	0	0
IA 1	1	Low	-4.00	-3.94	0.51	0.06	0.51	0.60	0.57	0.69	0.43	11	17	11	17	0	0
IA 1	1	High	2.00	1.90	0.57	-0.10	0.58	0.58	0.53	0.65	0.02	12	17	12	17	0	0
IA 1	2	Low	-2.90	-2.78	0.58	0.12	0.59	0.59	0.54	0.66	0.07	12	15	12	15	0	0
IA 1	2	High	2.60	2.59	0.60	-0.01	0.60	0.59	0.52	0.63	0.02	12	15	12	15	0	0
IA 1	3	Low	-2.30	-2.28	0.51	0.02	0.51	0.59	0.53	0.66	0.05	12	16	12	16	0	0

Mathematics 2–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	3	High	3.10	3.05	0.52	-0.05	0.53	0.61	0.54	0.67	0.03	11	16	11	16	0	0
IA 1	4	Low	-2.30	-2.16	0.53	0.14	0.54	0.59	0.54	0.64	0.05	11	16	11	16	0	0
IA 1	4	High	3.10	3.04	0.59	-0.06	0.60	0.63	0.59	0.70	0.03	11	12	11	12	0	0
IA 1	5	Low	-1.40	-1.52	0.55	-0.12	0.56	0.59	0.55	0.65	0.03	12	15	12	15	0	0
IA 1	5	High	3.60	3.62	0.49	0.02	0.49	0.61	0.52	0.70	0.03	11	15	11	15	0	0
IA 1	6	Low	-0.90	-0.97	0.76	-0.07	0.76	0.59	0.53	0.67	0.02	11	17	11	17	0	0
IA 1	6	High	4.10	4.03	0.55	-0.07	0.55	0.60	0.50	0.69	0.03	11	17	11	17	0	0
IA 2	1	Low	-4.00	-3.96	0.63	0.04	0.63	0.60	0.54	0.67	0.06	12	16	12	16	0	0
IA 2	1	High	2.00	2.02	0.58	0.02	0.58	0.61	0.57	0.77	0.22	12	15	12	15	0	0
IA 2	2	Low	-2.90	-2.88	0.63	0.02	0.63	0.60	0.52	0.71	0.06	12	16	12	16	0	0
IA 2	2	High	2.60	2.49	0.57	-0.11	0.58	0.61	0.58	0.71	0.48	11	15	11	15	0	0
IA 2	3	Low	-2.30	-2.28	0.53	0.02	0.53	0.59	0.53	0.63	0.07	11	15	11	15	0	0
IA 2	3	High	3.10	3.06	0.65	-0.04	0.65	0.68	0.59	0.86	1.51	12	18	12	18	0	0
IA 2	4	Low	-2.30	-2.43	0.58	-0.13	0.59	0.60	0.55	0.76	0.11	12	18	12	18	0	0
IA 2	4	High	3.10	3.09	0.64	-0.01	0.64	1.04	0.58	1.50	2.88	13	20	13	20	0	0
IA 2	5	Low	-1.40	-1.39	0.58	0.01	0.58	0.60	0.54	0.65	0.07	12	15	12	15	0	0
IA 2	5	High	3.60	3.92	0.78	0.32	0.84	0.90	0.60	1.75	2.30	12	20	12	20	0	0
IA 2	6	Low	-0.90	-0.76	0.60	0.14	0.62	0.60	0.55	0.76	0.08	11	17	11	17	0	0
IA 2	6	High	4.10	4.28	0.79	0.18	0.81	0.76	0.58	1.36	1.90	12	20	12	20	0	0
IA 3	1	Low	-4.00	-4.11	0.59	-0.11	0.60	0.57	0.52	0.67	0.03	11	16	11	16	0	0
IA 3	1	High	2.00	2.03	0.62	0.03	0.62	0.58	0.52	0.66	0.02	12	17	12	17	0	0
IA 3	2	Low	-2.90	-2.94	0.49	-0.04	0.49	0.58	0.52	0.64	0.03	12	16	12	16	0	0
IA 3	2	High	2.60	2.53	0.54	-0.07	0.55	0.60	0.54	0.76	0.03	12	16	12	16	0	0
IA 3	3	Low	-2.30	-2.31	0.60	-0.01	0.60	0.58	0.53	0.65	0.03	12	16	12	16	0	0
IA 3	3	High	3.10	3.10	0.57	0.00	0.57	0.61	0.55	0.67	0.03	11	15	11	15	0	0
IA 3	4	Low	-2.30	-2.25	0.52	0.05	0.52	0.58	0.52	0.65	0.03	12	17	12	17	0	0
IA 3	4	High	3.10	3.13	0.60	0.03	0.60	0.64	0.56	0.82	0.03	11	15	11	15	0	0
IA 3	5	Low	-1.40	-1.33	0.60	0.07	0.60	0.59	0.54	0.67	0.03	12	16	12	16	0	0

Mathematics 2–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	5	High	3.60	3.61	0.60	0.01	0.60	0.62	0.56	0.82	0.03	11	15	11	15	0	0
IA 3	6	Low	-0.90	-0.94	0.59	-0.04	0.59	0.59	0.53	0.64	0.02	12	15	12	15	0	0
IA 3	6	High	4.10	4.18	0.66	0.08	0.67	0.61	0.54	0.81	0.04	11	16	11	16	0	0
IA 4	1	Low	-4.00	-3.97	0.58	0.03	0.58	0.60	0.54	0.68	0.03	12	15	12	15	0	0
IA 4	1	High	2.00	1.93	0.52	-0.07	0.53	0.59	0.54	0.67	0.02	12	15	12	15	0	0
IA 4	2	Low	-2.90	-2.80	0.55	0.10	0.56	0.60	0.53	0.65	0.02	12	15	12	15	0	0
IA 4	2	High	2.60	2.77	0.66	0.17	0.68	0.60	0.53	0.76	0.03	12	17	12	17	0	0
IA 4	3	Low	-2.30	-2.22	0.54	0.08	0.55	0.59	0.53	0.65	0.02	12	15	12	15	0	0
IA 4	3	High	3.10	3.14	0.63	0.04	0.63	0.61	0.54	0.69	0.03	12	15	12	15	0	0
IA 4	4	Low	-2.30	-2.30	0.49	0.00	0.49	0.59	0.52	0.64	0.02	11	15	11	15	0	0
IA 4	4	High	3.10	3.09	0.54	-0.01	0.54	0.63	0.58	0.79	0.03	11	13	11	13	0	0
IA 4	5	Low	-1.40	-1.44	0.53	-0.04	0.53	0.60	0.52	0.67	0.02	12	16	12	16	0	0
IA 4	5	High	3.60	3.63	0.68	0.03	0.68	0.61	0.57	0.69	0.03	11	15	11	15	0	0
IA 4	6	Low	-0.90	-0.97	0.65	-0.07	0.65	0.61	0.53	0.82	0.02	12	18	12	18	0	0
IA 4	6	High	4.10	4.10	0.54	0.00	0.54	0.60	0.54	0.68	0.04	11	17	11	17	0	0

Table A.13. Summary Statistics—Mathematics 6+, COLO

Mathematics 6+, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-0.20	-0.20	0.25	0.00	0.25	0.29	0.29	0.30	0.15	50	53	50	53	0	0
Overall	1	High	4.90	4.88	0.29	-0.02	0.29	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	2	Low	0.30	0.30	0.35	0.00	0.35	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	2	High	5.20	5.20	0.37	0.00	0.37	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	3	Low	0.60	0.65	0.24	0.05	0.25	0.29	0.29	0.29	0.16	50	53	50	53	0	0
Overall	3	High	5.30	5.30	0.28	0.00	0.28	0.29	0.29	0.29	0.16	50	53	50	53	0	0
Overall	4	Low	0.60	0.59	0.32	-0.01	0.32	0.29	0.29	0.30	0.16	50	53	50	53	0	0

Mathematics 6+, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	4	High	5.40	5.39	0.30	-0.01	0.30	0.29	0.29	0.31	0.16	50	53	50	53	0	0
Overall	5	Low	1.00	0.97	0.34	-0.03	0.34	0.29	0.29	0.30	0.15	50	53	50	53	0	0
Overall	5	High	5.50	5.51	0.32	0.01	0.32	0.29	0.29	0.30	0.18	50	53	50	53	0	0
Overall	6	Low	1.30	1.34	0.28	0.04	0.28	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	6	High	5.70	5.72	0.29	0.02	0.29	0.29	0.29	0.30	0.26	51	53	51	53	0	0
IA 1	1	Low	-0.20	-0.19	0.62	0.01	0.62	0.59	0.56	0.67	0.16	12	15	12	15	0	0
IA 1	1	High	4.90	4.88	0.66	-0.02	0.66	0.59	0.56	0.77	0.16	12	16	12	16	0	0
IA 1	2	Low	0.30	0.25	0.58	-0.05	0.58	0.60	0.57	0.67	0.16	12	15	12	15	0	0
IA 1	2	High	5.20	5.27	0.58	0.07	0.59	0.60	0.57	0.77	0.16	12	15	12	15	0	0
IA 1	3	Low	0.60	0.72	0.68	0.12	0.69	0.60	0.57	0.66	0.16	12	15	12	15	0	0
IA 1	3	High	5.30	5.23	0.59	-0.07	0.59	0.59	0.56	0.67	0.16	12	15	12	15	0	0
IA 1	4	Low	0.60	0.66	0.58	0.06	0.58	0.60	0.56	0.68	0.16	12	15	12	15	0	0
IA 1	4	High	5.40	5.48	0.50	0.08	0.51	0.59	0.56	0.64	0.15	12	17	12	17	0	0
IA 1	5	Low	1.00	0.99	0.59	-0.01	0.59	0.59	0.57	0.63	0.15	12	16	12	16	0	0
IA 1	5	High	5.50	5.49	0.56	-0.01	0.56	0.59	0.57	0.66	0.15	12	14	12	14	0	0
IA 1	6	Low	1.30	1.32	0.72	0.02	0.72	0.60	0.57	0.67	0.16	12	15	12	15	0	0
IA 1	6	High	5.70	5.68	0.69	-0.02	0.69	0.60	0.57	0.68	0.15	12	15	12	15	0	0
IA 2	1	Low	-0.20	-0.15	0.46	0.05	0.46	0.59	0.56	0.63	0.16	12	15	12	15	0	0
IA 2	1	High	4.90	4.90	0.43	0.00	0.43	0.59	0.57	0.64	0.15	12	15	12	15	0	0
IA 2	2	Low	0.30	0.30	0.54	0.00	0.54	0.59	0.57	0.63	0.16	12	15	12	15	0	0
IA 2	2	High	5.20	5.11	0.66	-0.09	0.66	0.60	0.57	0.66	0.16	12	15	12	15	0	0
IA 2	3	Low	0.60	0.73	0.45	0.13	0.47	0.59	0.56	0.64	0.16	12	15	12	15	0	0
IA 2	3	High	5.30	5.33	0.48	0.03	0.48	0.59	0.56	0.66	0.16	12	15	12	15	0	0
IA 2	4	Low	0.60	0.58	0.67	-0.02	0.67	0.60	0.56	0.78	0.16	12	16	12	16	0	0
IA 2	4	High	5.40	5.37	0.59	-0.03	0.59	0.59	0.56	0.66	0.16	12	16	12	16	0	0
IA 2	5	Low	1.00	1.10	0.64	0.10	0.64	0.60	0.57	0.69	0.16	12	15	12	15	0	0
IA 2	5	High	5.50	5.64	0.56	0.14	0.57	0.59	0.57	0.66	0.22	12	16	12	16	0	0
IA 2	6	Low	1.30	1.44	0.39	0.14	0.41	0.59	0.57	0.63	0.16	12	14	12	14	0	0

Mathematics 6+, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	6	High	5.70	5.66	0.60	-0.04	0.60	0.60	0.57	0.65	0.39	12	16	12	16	0	0
IA 3	1	Low	-0.20	-0.26	0.56	-0.06	0.57	0.59	0.57	0.67	0.15	12	15	12	15	0	0
IA 3	1	High	4.90	4.93	0.65	0.03	0.65	0.59	0.57	0.67	0.16	12	17	12	17	0	0
IA 3	2	Low	0.30	0.40	0.68	0.10	0.69	0.59	0.56	0.65	0.15	12	16	12	16	0	0
IA 3	2	High	5.20	5.32	0.70	0.12	0.71	0.60	0.57	0.66	0.16	12	16	12	16	0	0
IA 3	3	Low	0.60	0.45	0.56	-0.15	0.58	0.59	0.57	0.66	0.15	12	17	12	17	0	0
IA 3	3	High	5.30	5.35	0.54	0.05	0.54	0.59	0.56	0.62	0.16	12	16	12	16	0	0
IA 3	4	Low	0.60	0.51	0.67	-0.09	0.68	0.59	0.56	0.67	0.15	12	15	12	15	0	0
IA 3	4	High	5.40	5.41	0.60	0.01	0.60	0.59	0.56	0.67	0.16	12	15	12	15	0	0
IA 3	5	Low	1.00	0.92	0.63	-0.08	0.63	0.59	0.56	0.64	0.16	12	15	12	15	0	0
IA 3	5	High	5.50	5.44	0.62	-0.06	0.62	0.59	0.57	0.63	0.15	12	15	12	15	0	0
IA 3	6	Low	1.30	1.27	0.57	-0.03	0.57	0.59	0.57	0.66	0.15	12	16	12	16	0	0
IA 3	6	High	5.70	5.78	0.54	0.08	0.55	0.60	0.57	0.68	0.16	12	15	12	15	0	0
IA 4	1	Low	-0.20	-0.20	0.49	0.00	0.49	0.59	0.56	0.62	0.15	12	15	12	15	0	0
IA 4	1	High	4.90	4.79	0.56	-0.11	0.58	0.59	0.56	0.65	0.16	12	14	12	14	0	0
IA 4	2	Low	0.30	0.26	0.70	-0.04	0.70	0.59	0.57	0.66	0.16	12	15	12	15	0	0
IA 4	2	High	5.20	5.11	0.66	-0.09	0.67	0.60	0.57	0.66	0.16	12	15	12	15	0	0
IA 4	3	Low	0.60	0.69	0.49	0.09	0.50	0.59	0.57	0.64	0.16	12	15	12	15	0	0
IA 4	3	High	5.30	5.33	0.46	0.03	0.46	0.59	0.56	0.62	0.16	12	15	12	15	0	0
IA 4	4	Low	0.60	0.61	0.60	0.01	0.60	0.60	0.57	0.68	0.16	12	15	12	15	0	0
IA 4	4	High	5.40	5.31	0.59	-0.09	0.59	0.59	0.56	0.62	0.16	12	16	12	16	0	0
IA 4	5	Low	1.00	0.91	0.70	-0.09	0.71	0.60	0.57	0.66	0.15	12	16	12	16	0	0
IA 4	5	High	5.50	5.48	0.49	-0.02	0.49	0.59	0.57	0.63	0.19	12	15	12	15	0	0
IA 4	6	Low	1.30	1.34	0.58	0.04	0.58	0.60	0.57	0.70	0.15	12	15	12	15	0	0
IA 4	6	High	5.70	5.78	0.56	0.08	0.57	0.60	0.57	0.63	0.33	12	15	12	15	0	0

Table A.14. Summary Statistics—Mathematics 6+, CBE

Mathematics 6+, CBE																	
									SEM		#Items						
											Total		OP		FT		
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-0.20	-0.22	0.32	-0.02	0.32	0.29	0.28	0.30	0.02	51	53	51	53	0	0
Overall	1	High	4.90	4.88	0.28	-0.02	0.28	0.29	0.28	0.30	0.03	51	53	51	53	0	0
Overall	2	Low	0.30	0.34	0.27	0.04	0.27	0.29	0.28	0.29	0.03	51	53	51	53	0	0
Overall	2	High	5.20	5.22	0.26	0.02	0.26	0.29	0.28	0.30	0.03	51	53	51	53	0	0
Overall	3	Low	0.60	0.64	0.32	0.04	0.32	0.29	0.28	0.29	0.03	51	53	51	53	0	0
Overall	3	High	5.30	5.29	0.25	-0.01	0.25	0.29	0.28	0.32	0.05	51	53	51	53	0	0
Overall	4	Low	0.60	0.60	0.27	0.00	0.27	0.29	0.28	0.30	0.03	51	53	51	53	0	0
Overall	4	High	5.40	5.44	0.32	0.04	0.32	0.29	0.28	0.31	0.10	51	53	51	53	0	0
Overall	5	Low	1.00	0.98	0.31	-0.02	0.31	0.29	0.28	0.30	0.03	51	53	51	53	0	0
Overall	5	High	5.50	5.53	0.35	0.03	0.35	0.29	0.28	0.29	0.09	51	53	51	53	0	0
Overall	6	Low	1.30	1.28	0.34	-0.02	0.34	0.29	0.28	0.32	0.03	51	53	51	53	0	0
Overall	6	High	5.70	5.69	0.30	-0.01	0.30	0.29	0.28	0.31	0.07	51	53	51	53	0	0
IA 1	1	Low	-0.20	-0.18	0.60	0.02	0.60	0.59	0.55	0.63	0.02	12	16	12	16	0	0
IA 1	1	High	4.90	4.84	0.50	-0.06	0.50	0.59	0.52	0.62	0.02	12	15	12	15	0	0
IA 1	2	Low	0.30	0.39	0.51	0.09	0.52	0.59	0.55	0.64	0.03	11	15	11	15	0	0
IA 1	2	High	5.20	5.20	0.65	0.00	0.65	0.59	0.52	0.66	0.02	12	17	12	17	0	0
IA 1	3	Low	0.60	0.60	0.57	0.00	0.57	0.59	0.54	0.67	0.02	12	15	12	15	0	0
IA 1	3	High	5.30	5.36	0.57	0.06	0.58	0.59	0.53	0.69	0.02	11	15	11	15	0	0
IA 1	4	Low	0.60	0.79	0.69	0.19	0.71	0.61	0.56	0.77	0.02	12	15	12	15	0	0
IA 1	4	High	5.40	5.52	0.54	0.12	0.55	0.58	0.52	0.67	0.03	12	17	12	17	0	0
IA 1	5	Low	1.00	1.23	0.62	0.23	0.65	0.60	0.54	0.76	0.02	11	17	11	17	0	0
IA 1	5	High	5.50	5.46	0.48	-0.04	0.48	0.58	0.53	0.66	0.03	12	15	12	15	0	0
IA 1	6	Low	1.30	1.28	0.63	-0.02	0.63	0.60	0.56	0.78	0.02	12	15	12	15	0	0
IA 1	6	High	5.70	5.74	0.56	0.04	0.56	0.59	0.54	0.76	0.02	12	16	12	16	0	0
IA 2	1	Low	-0.20	-0.24	0.71	-0.04	0.72	0.59	0.53	0.66	0.03	12	15	12	15	0	0
IA 2	1	High	4.90	4.92	0.62	0.02	0.62	0.59	0.52	0.65	0.03	12	16	12	16	0	0
IA 2	2	Low	0.30	0.24	0.70	-0.06	0.70	0.59	0.54	0.77	0.03	11	16	11	16	0	0

Mathematics 6+, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	2	High	5.20	5.25	0.62	0.05	0.62	0.60	0.54	0.69	0.05	11	15	11	15	0	0
IA 2	3	Low	0.60	0.67	0.58	0.07	0.58	0.58	0.53	0.65	0.03	12	17	12	17	0	0
IA 2	3	High	5.30	5.15	0.61	-0.15	0.63	0.60	0.56	0.76	0.10	12	15	12	15	0	0
IA 2	4	Low	0.60	0.57	0.66	-0.03	0.66	0.60	0.52	0.76	0.04	11	17	11	17	0	0
IA 2	4	High	5.40	5.31	0.61	-0.09	0.62	0.61	0.54	0.76	0.20	11	16	11	16	0	0
IA 2	5	Low	1.00	0.85	0.59	-0.15	0.61	0.60	0.52	0.76	0.05	12	17	12	17	0	0
IA 2	5	High	5.50	5.53	0.66	0.03	0.66	0.60	0.54	0.63	0.17	12	16	12	16	0	0
IA 2	6	Low	1.30	1.37	0.57	0.07	0.58	0.58	0.52	0.67	0.04	12	17	12	17	0	0
IA 2	6	High	5.70	5.75	0.57	0.05	0.57	0.59	0.51	0.68	0.13	12	17	12	17	0	0
IA 3	1	Low	-0.20	-0.20	0.53	0.00	0.53	0.59	0.52	0.68	0.02	12	15	12	15	0	0
IA 3	1	High	4.90	4.87	0.53	-0.03	0.54	0.57	0.52	0.67	0.02	12	15	12	15	0	0
IA 3	2	Low	0.30	0.30	0.62	0.00	0.62	0.59	0.52	0.68	0.02	11	16	11	16	0	0
IA 3	2	High	5.20	5.20	0.65	0.00	0.65	0.60	0.52	0.76	0.02	11	17	11	17	0	0
IA 3	3	Low	0.60	0.65	0.56	0.05	0.57	0.58	0.53	0.63	0.03	12	16	12	16	0	0
IA 3	3	High	5.30	5.30	0.54	0.00	0.54	0.57	0.52	0.64	0.03	12	17	12	17	0	0
IA 3	4	Low	0.60	0.55	0.60	-0.05	0.60	0.59	0.53	0.77	0.03	11	16	11	16	0	0
IA 3	4	High	5.40	5.44	0.57	0.04	0.57	0.58	0.53	0.64	0.03	11	15	11	15	0	0
IA 3	5	Low	1.00	0.99	0.74	-0.01	0.74	0.59	0.54	0.70	0.03	11	17	11	17	0	0
IA 3	5	High	5.50	5.50	0.46	0.00	0.46	0.57	0.51	0.65	0.02	12	17	12	17	0	0
IA 3	6	Low	1.30	1.35	0.63	0.05	0.63	0.60	0.54	0.77	0.03	12	16	12	16	0	0
IA 3	6	High	5.70	5.58	0.62	-0.12	0.63	0.58	0.52	0.65	0.03	12	17	12	17	0	0
IA 4	1	Low	-0.20	-0.28	0.55	-0.08	0.55	0.61	0.56	0.65	0.02	12	16	12	16	0	0
IA 4	1	High	4.90	4.88	0.36	-0.02	0.36	0.59	0.55	0.63	0.02	12	16	12	16	0	0
IA 4	2	Low	0.30	0.46	0.62	0.16	0.64	0.61	0.56	0.77	0.02	12	15	12	15	0	0
IA 4	2	High	5.20	5.26	0.63	0.06	0.64	0.60	0.56	0.67	0.03	11	15	11	15	0	0
IA 4	3	Low	0.60	0.64	0.51	0.04	0.51	0.60	0.56	0.64	0.02	12	16	12	16	0	0
IA 4	3	High	5.30	5.34	0.46	0.04	0.46	0.61	0.58	0.67	0.07	11	15	11	15	0	0
IA 4	4	Low	0.60	0.53	0.61	-0.07	0.61	0.61	0.54	0.69	0.03	11	17	11	17	0	0

Mathematics 6+, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 4	4	High	5.40	5.46	0.63	0.06	0.64	0.60	0.57	0.76	0.14	12	17	12	17	0	0
IA 4	5	Low	1.00	0.85	0.57	-0.15	0.59	0.60	0.54	0.77	0.02	11	15	11	15	0	0
IA 4	5	High	5.50	5.62	0.64	0.12	0.65	0.60	0.55	0.63	0.15	12	15	12	15	0	0
IA 4	6	Low	1.30	1.10	0.71	-0.20	0.74	0.61	0.52	0.81	0.02	12	17	12	17	0	0
IA 4	6	High	5.70	5.71	0.62	0.01	0.62	0.60	0.56	0.66	0.13	12	16	12	16	0	0

Table A.15. Summary Statistics—Language Usage 2–12, COLO

Language Usage 2–12, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-4.7	-4.70	0.35	0.00	0.35	0.32	0.30	0.42	1.21	53	53	53	53	0	0
Overall	1	High	3.4	3.40	0.26	0.00	0.26	0.29	0.29	0.30	0.16	50	53	50	53	0	0
Overall	2	Low	-3.3	-3.35	0.35	-0.05	0.36	0.29	0.29	0.31	0.54	51	53	51	53	0	0
Overall	2	High	3.5	3.50	0.36	0.00	0.36	0.29	0.29	0.30	0.18	50	53	50	53	0	0
Overall	3	Low	-2.7	-2.67	0.25	0.03	0.25	0.29	0.29	0.30	0.35	51	53	51	53	0	0
Overall	3	High	3.5	3.52	0.22	0.02	0.22	0.29	0.29	0.30	0.26	50	53	50	53	0	0
Overall	4	Low	-2.7	-2.73	0.28	-0.03	0.28	0.29	0.29	0.30	0.43	51	53	51	53	0	0
Overall	4	High	3.5	3.47	0.31	-0.03	0.31	0.29	0.29	0.32	0.41	51	53	51	53	0	0
Overall	5	Low	-2.7	-2.67	0.34	0.03	0.34	0.30	0.29	0.32	0.51	51	53	51	53	0	0
Overall	5	High	3.6	3.58	0.32	-0.02	0.32	0.30	0.29	0.33	0.67	50	53	50	53	0	0
Overall	6	Low	-1.8	-1.74	0.26	0.06	0.27	0.29	0.29	0.30	0.25	51	53	51	53	0	0
Overall	6	High	3.6	3.71	0.30	0.11	0.32	0.31	0.29	0.38	1.10	52	53	52	53	0	0
Overall	7	Low	-1.4	-1.42	0.31	-0.02	0.31	0.29	0.29	0.30	0.21	50	53	50	53	0	0
Overall	7	High	3.6	3.65	0.38	0.05	0.38	0.33	0.29	0.39	1.31	51	53	51	53	0	0
Overall	8	Low	-1.4	-1.42	0.29	-0.02	0.30	0.29	0.29	0.30	0.22	50	53	50	53	0	0
Overall	8	High	3.8	3.83	0.37	0.03	0.37	0.36	0.29	0.49	1.65	53	53	53	53	0	0
IA 1	1	Low	-4.7	-4.92	0.87	-0.22	0.90	0.74	0.50	1.31	1.97	16	21	16	21	0	0

Language Usage 2–12, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	1	High	3.4	3.40	0.44	0.00	0.44	0.51	0.49	0.54	0.16	16	20	16	20	0	0
IA 1	2	Low	-3.3	-3.36	0.49	-0.06	0.49	0.53	0.49	0.75	1.02	16	21	16	21	0	0
IA 1	2	High	3.5	3.42	0.54	-0.08	0.55	0.51	0.50	0.55	0.18	16	19	16	19	0	0
IA 1	3	Low	-2.7	-2.70	0.43	0.00	0.43	0.51	0.49	0.57	0.68	16	21	16	21	0	0
IA 1	3	High	3.5	3.37	0.44	-0.13	0.46	0.51	0.49	0.57	0.20	16	19	16	19	0	0
IA 1	4	Low	-2.7	-2.71	0.49	-0.01	0.49	0.52	0.48	0.62	0.92	16	21	16	21	0	0
IA 1	4	High	3.5	3.55	0.44	0.05	0.44	0.51	0.49	0.55	0.28	16	20	16	20	0	0
IA 1	5	Low	-2.7	-2.75	0.68	-0.05	0.68	0.56	0.49	1.03	1.10	16	21	16	21	0	0
IA 1	5	High	3.6	3.56	0.55	-0.04	0.55	0.53	0.50	0.67	0.48	16	21	16	21	0	0
IA 1	6	Low	-1.8	-1.66	0.48	0.14	0.50	0.51	0.49	0.57	0.43	16	20	16	20	0	0
IA 1	6	High	3.6	3.76	0.46	0.16	0.48	0.55	0.50	0.69	0.87	16	21	16	21	0	0
IA 1	7	Low	-1.4	-1.40	0.47	0.00	0.47	0.51	0.49	0.54	0.34	16	19	16	19	0	0
IA 1	7	High	3.6	3.64	0.63	0.04	0.63	0.57	0.49	1.02	1.08	16	21	16	21	0	0
IA 1	8	Low	-1.4	-1.60	0.42	-0.20	0.46	0.51	0.49	0.57	0.35	16	20	16	20	0	0
IA 1	8	High	3.8	3.88	0.65	0.08	0.66	0.62	0.50	1.03	1.42	16	21	16	21	0	0
IA 2	1	Low	-4.7	-4.67	0.53	0.03	0.53	0.53	0.50	0.63	0.65	16	20	16	20	0	0
IA 2	1	High	3.4	3.42	0.52	0.02	0.52	0.51	0.49	0.53	0.16	16	19	16	19	0	0
IA 2	2	Low	-3.3	-3.33	0.50	-0.03	0.51	0.51	0.49	0.54	0.29	16	19	16	19	0	0
IA 2	2	High	3.5	3.57	0.64	0.07	0.64	0.51	0.49	0.54	0.16	16	19	16	19	0	0
IA 2	3	Low	-2.7	-2.60	0.42	0.10	0.43	0.51	0.48	0.56	0.19	16	20	16	20	0	0
IA 2	3	High	3.5	3.60	0.50	0.10	0.51	0.51	0.49	0.57	0.18	16	19	16	19	0	0
IA 2	4	Low	-2.7	-2.77	0.46	-0.07	0.46	0.51	0.49	0.55	0.17	16	19	16	19	0	0
IA 2	4	High	3.5	3.47	0.54	-0.03	0.54	0.51	0.49	0.58	0.23	16	20	16	20	0	0
IA 2	5	Low	-2.7	-2.70	0.50	0.00	0.50	0.51	0.49	0.56	0.18	16	19	16	19	0	0
IA 2	5	High	3.6	3.66	0.55	0.06	0.55	0.52	0.49	0.59	0.42	16	21	16	21	0	0
IA 2	6	Low	-1.8	-1.85	0.40	-0.05	0.41	0.51	0.49	0.56	0.16	16	20	16	20	0	0
IA 2	6	High	3.6	3.69	0.52	0.09	0.53	0.53	0.50	0.63	0.83	16	21	16	21	0	0
IA 2	7	Low	-1.4	-1.48	0.51	-0.08	0.51	0.51	0.49	0.54	0.15	16	19	16	19	0	0

Language Usage 2–12, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	7	High	3.6	3.71	0.52	0.11	0.53	0.56	0.50	0.74	1.06	16	21	16	21	0	0
IA 2	8	Low	-1.4	-1.33	0.58	0.07	0.58	0.51	0.49	0.55	0.16	16	20	16	20	0	0
IA 2	8	High	3.8	3.93	0.70	0.13	0.71	0.63	0.50	1.03	1.39	16	21	16	21	0	0
IA 3	1	Low	-4.7	-4.80	0.69	-0.10	0.69	0.57	0.50	1.03	0.83	16	21	16	21	0	0
IA 3	1	High	3.4	3.37	0.45	-0.03	0.45	0.51	0.49	0.54	0.16	16	19	16	19	0	0
IA 3	2	Low	-3.3	-3.38	0.50	-0.08	0.51	0.51	0.49	0.54	0.26	16	19	16	19	0	0
IA 3	2	High	3.5	3.51	0.46	0.01	0.46	0.51	0.50	0.54	0.20	16	20	16	20	0	0
IA 3	3	Low	-2.7	-2.72	0.49	-0.02	0.49	0.51	0.48	0.54	0.16	16	18	16	18	0	0
IA 3	3	High	3.5	3.60	0.40	0.10	0.41	0.51	0.49	0.57	0.41	16	21	16	21	0	0
IA 3	4	Low	-2.7	-2.75	0.55	-0.05	0.55	0.51	0.49	0.55	0.17	16	19	16	19	0	0
IA 3	4	High	3.5	3.45	0.57	-0.05	0.57	0.52	0.49	0.74	0.70	16	21	16	21	0	0
IA 3	5	Low	-2.7	-2.64	0.53	0.06	0.53	0.51	0.49	0.56	0.18	16	19	16	19	0	0
IA 3	5	High	3.6	3.60	0.51	0.00	0.51	0.55	0.49	0.75	1.06	16	21	16	21	0	0
IA 3	6	Low	-1.8	-1.73	0.53	0.07	0.53	0.51	0.48	0.56	0.16	16	20	16	20	0	0
IA 3	6	High	3.6	3.84	0.70	0.24	0.74	0.62	0.49	1.03	1.52	16	21	16	21	0	0
IA 3	7	Low	-1.4	-1.38	0.49	0.02	0.50	0.51	0.49	0.54	0.15	16	19	16	19	0	0
IA 3	7	High	3.6	3.83	0.80	0.23	0.83	0.67	0.50	1.22	1.72	16	21	16	21	0	0
IA 3	8	Low	-1.4	-1.33	0.47	0.07	0.48	0.51	0.50	0.57	0.15	16	19	16	19	0	0
IA 3	8	High	3.8	3.97	0.71	0.17	0.73	0.74	0.51	1.23	2.10	16	21	16	21	0	0

Table A.16. Summary Statistics—Language Usage 2–12, CBE

Language Usage 2–12, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	1	-4.7	-4.65	0.30	0.05	0.31	0.31	0.29	0.39	0.90	53	53	53	53	0	0
Overall	1	2	3.4	3.38	0.28	-0.02	0.28	0.29	0.28	0.30	0.03	51	53	51	53	0	0
Overall	2	1	-3.3	-3.24	0.29	0.06	0.29	0.29	0.29	0.31	0.40	51	53	51	53	0	0

Language Usage 2–12, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	2	2	3.5	3.50	0.27	0.00	0.27	0.29	0.28	0.30	0.11	51	53	51	53	0	0
Overall	3	1	-2.7	-2.68	0.31	0.02	0.31	0.29	0.28	0.30	0.22	51	53	51	53	0	0
Overall	3	2	3.5	3.50	0.26	0.00	0.26	0.29	0.29	0.31	0.20	51	53	51	53	0	0
Overall	4	1	-2.7	-2.69	0.31	0.01	0.31	0.29	0.28	0.31	0.27	51	53	51	53	0	0
Overall	4	2	3.5	3.50	0.31	0.00	0.31	0.29	0.28	0.31	0.32	51	53	51	53	0	0
Overall	5	1	-2.7	-2.67	0.24	0.03	0.24	0.29	0.28	0.30	0.10	51	53	51	53	0	0
Overall	5	2	3.6	3.60	0.28	0.00	0.28	0.29	0.28	0.30	0.24	51	53	51	53	0	0
Overall	6	1	-1.8	-1.82	0.29	-0.02	0.29	0.29	0.28	0.31	0.04	51	53	51	53	0	0
Overall	6	2	3.6	3.62	0.34	0.02	0.34	0.29	0.28	0.31	0.23	51	53	51	53	0	0
Overall	7	1	-1.4	-1.41	0.34	-0.01	0.34	0.29	0.28	0.30	0.03	51	53	51	53	0	0
Overall	7	2	3.6	3.58	0.28	-0.02	0.28	0.29	0.28	0.31	0.28	51	53	51	53	0	0
Overall	8	1	-1.4	-1.38	0.29	0.02	0.30	0.29	0.28	0.33	0.03	51	53	51	53	0	0
Overall	8	2	3.8	3.78	0.32	-0.02	0.32	0.29	0.28	0.32	0.43	51	53	51	53	0	0
IA 1	1	1	-4.7	-4.69	0.66	0.01	0.66	0.66	0.50	1.21	1.60	17	22	17	22	0	0
IA 1	1	2	3.4	3.41	0.54	0.01	0.54	0.51	0.48	0.57	0.03	16	19	16	19	0	0
IA 1	2	1	-3.3	-3.39	0.61	-0.09	0.61	0.56	0.49	0.74	0.89	16	21	16	21	0	0
IA 1	2	2	3.5	3.59	0.46	0.09	0.47	0.51	0.49	0.55	0.07	16	18	16	18	0	0
IA 1	3	1	-2.7	-2.80	0.59	-0.10	0.59	0.53	0.49	0.75	0.58	15	21	15	21	0	0
IA 1	3	2	3.5	3.56	0.45	0.06	0.45	0.51	0.48	0.58	0.09	16	18	16	18	0	0
IA 1	4	1	-2.7	-2.88	0.57	-0.18	0.59	0.55	0.49	0.75	0.69	16	21	16	21	0	0
IA 1	4	2	3.5	3.66	0.62	0.16	0.64	0.52	0.48	0.63	0.20	15	20	15	20	0	0
IA 1	5	1	-2.7	-2.58	0.47	0.12	0.49	0.51	0.49	0.63	0.24	16	20	16	20	0	0
IA 1	5	2	3.6	3.67	0.43	0.07	0.44	0.51	0.48	0.58	0.19	15	19	15	19	0	0
IA 1	6	1	-1.8	-1.84	0.54	-0.04	0.55	0.51	0.49	0.58	0.07	15	19	15	19	0	0
IA 1	6	2	3.6	3.67	0.52	0.07	0.52	0.51	0.49	0.57	0.18	17	19	17	19	0	0
IA 1	7	1	-1.4	-1.43	0.53	-0.03	0.53	0.51	0.49	0.58	0.04	15	19	15	19	0	0
IA 1	7	2	3.6	3.57	0.44	-0.03	0.44	0.50	0.48	0.54	0.19	16	18	16	18	0	0
IA 1	8	1	-1.4	-1.28	0.51	0.12	0.53	0.51	0.48	0.63	0.03	16	19	16	19	0	0

Language Usage 2–12, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	8	2	3.8	3.76	0.66	-0.04	0.66	0.53	0.48	1.02	0.31	16	22	16	22	0	0
IA 2	1	1	-4.7	-4.77	0.56	-0.07	0.56	0.52	0.48	0.64	0.42	15	19	15	19	0	0
IA 2	1	2	3.4	3.36	0.41	-0.04	0.41	0.51	0.49	0.54	0.03	16	19	16	19	0	0
IA 2	2	1	-3.3	-3.19	0.50	0.11	0.51	0.51	0.48	0.58	0.22	16	18	16	18	0	0
IA 2	2	2	3.5	3.52	0.52	0.02	0.52	0.50	0.48	0.54	0.05	17	18	17	18	0	0
IA 2	3	1	-2.7	-2.60	0.57	0.10	0.58	0.51	0.48	0.58	0.05	15	18	15	18	0	0
IA 2	3	2	3.5	3.41	0.46	-0.09	0.47	0.51	0.48	0.54	0.09	16	18	16	18	0	0
IA 2	4	1	-2.7	-2.52	0.48	0.18	0.51	0.51	0.48	0.59	0.05	15	19	15	19	0	0
IA 2	4	2	3.5	3.31	0.55	-0.19	0.58	0.51	0.48	0.58	0.15	15	20	15	20	0	0
IA 2	5	1	-2.7	-2.68	0.46	0.02	0.46	0.51	0.48	0.55	0.03	16	19	16	19	0	0
IA 2	5	2	3.6	3.51	0.51	-0.09	0.52	0.50	0.48	0.56	0.16	17	18	17	18	0	0
IA 2	6	1	-1.8	-1.76	0.47	0.04	0.47	0.51	0.49	0.57	0.02	16	19	16	19	0	0
IA 2	6	2	3.6	3.54	0.54	-0.06	0.54	0.51	0.48	0.55	0.15	16	18	16	18	0	0
IA 2	7	1	-1.4	-1.50	0.46	-0.10	0.47	0.50	0.49	0.58	0.03	15	19	15	19	0	0
IA 2	7	2	3.6	3.66	0.47	0.06	0.47	0.51	0.48	0.54	0.14	16	18	16	18	0	0
IA 2	8	1	-1.4	-1.46	0.54	-0.06	0.54	0.51	0.49	0.59	0.03	16	18	16	18	0	0
IA 2	8	2	3.8	3.82	0.56	0.02	0.56	0.51	0.48	0.58	0.24	15	18	15	18	0	0
IA 3	1	1	-4.7	-4.60	0.53	0.10	0.54	0.53	0.48	0.63	0.58	15	20	15	20	0	0
IA 3	1	2	3.4	3.37	0.64	-0.03	0.64	0.52	0.49	0.64	0.05	15	20	15	20	0	0
IA 3	2	1	-3.3	-3.22	0.44	0.08	0.45	0.50	0.48	0.54	0.06	15	18	15	18	0	0
IA 3	2	2	3.5	3.39	0.44	-0.11	0.45	0.51	0.49	0.56	0.20	16	19	16	19	0	0
IA 3	3	1	-2.7	-2.67	0.56	0.03	0.56	0.51	0.47	0.58	0.03	15	19	15	19	0	0
IA 3	3	2	3.5	3.56	0.53	0.06	0.53	0.53	0.49	0.63	0.42	16	20	16	20	0	0
IA 3	4	1	-2.7	-2.71	0.50	-0.01	0.50	0.51	0.47	0.58	0.04	15	19	15	19	0	0
IA 3	4	2	3.5	3.61	0.61	0.11	0.62	0.55	0.49	1.05	0.61	15	22	15	22	0	0
IA 3	5	1	-2.7	-2.75	0.38	-0.05	0.38	0.51	0.49	0.58	0.03	15	19	15	19	0	0
IA 3	5	2	3.6	3.65	0.49	0.05	0.49	0.52	0.49	0.65	0.38	16	19	16	19	0	0
IA 3	6	1	-1.8	-1.86	0.49	-0.06	0.50	0.51	0.49	0.57	0.03	16	19	16	19	0	0

Language Usage 2–12, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	6	2	3.6	3.67	0.45	0.07	0.46	0.51	0.49	0.57	0.35	16	19	16	19	0	0
IA 3	7	1	-1.4	-1.30	0.55	0.10	0.56	0.51	0.49	0.59	0.03	16	21	16	21	0	0
IA 3	7	2	3.6	3.55	0.53	-0.05	0.53	0.52	0.49	0.61	0.50	17	19	17	19	0	0
IA 3	8	1	-1.4	-1.41	0.60	-0.01	0.60	0.51	0.49	0.66	0.03	16	19	16	19	0	0
IA 3	8	2	3.8	3.84	0.54	0.04	0.54	0.54	0.49	0.66	0.73	16	21	16	21	0	0

Table A.17. Summary Statistics—Science 3–5, COLO

Science 3–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-2.8	-2.82	0.31	-0.02	0.31	0.32	0.31	0.34	0.20	45	45	43	43	2	2
Overall	1	High	0.9	0.92	0.35	0.02	0.35	0.34	0.33	0.36	0.15	45	45	37	40	5	8
Overall	2	Low	-2.0	-2.10	0.37	-0.10	0.38	0.31	0.30	0.33	0.20	45	45	43	45	1	2
Overall	2	High	1.0	0.88	0.33	-0.12	0.35	0.32	0.31	0.33	0.16	45	45	42	45	1	3
Overall	3	Low	-1.6	-1.55	0.36	0.05	0.37	0.31	0.30	0.33	0.19	45	45	41	45	1	4
Overall	3	High	1.2	1.22	0.33	0.02	0.33	0.31	0.30	0.33	0.15	45	45	43	45	1	2
Overall	4	Low	-1.6	-1.59	0.27	0.01	0.27	0.31	0.30	0.34	0.22	45	45	43	45	1	2
Overall	4	High	1.3	1.32	0.29	0.02	0.29	0.31	0.30	0.34	0.16	45	45	45	45	0	0
Overall	5	Low	-1.6	-1.61	0.34	-0.01	0.34	0.31	0.30	0.35	0.30	45	45	43	45	1	2
Overall	5	High	1.4	1.36	0.36	-0.04	0.36	0.31	0.30	0.33	0.16	45	45	44	45	1	1
Overall	6	Low	-1.0	-0.95	0.35	0.05	0.35	0.31	0.30	0.34	0.22	45	45	43	45	1	2
Overall	6	High	1.6	1.67	0.31	0.07	0.31	0.31	0.30	0.34	0.16	45	45	43	45	1	2
Overall	7	Low	-0.6	-0.54	0.26	0.06	0.27	0.31	0.30	0.33	0.17	45	45	42	45	1	3
Overall	7	High	1.7	1.77	0.29	0.07	0.30	0.31	0.31	0.32	0.16	45	45	44	45	1	1
Overall	8	Low	-0.6	-0.60	0.36	0.00	0.36	0.31	0.30	0.33	0.20	45	45	42	45	1	3
Overall	8	High	1.8	1.78	0.34	-0.02	0.34	0.31	0.30	0.32	0.16	45	45	44	45	1	1
IA 1	1	Low	-2.8	-2.79	0.56	0.01	0.56	0.59	0.53	0.66	0.20	10	16	10	16	0	0

Science 3–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	1	High	0.9	0.88	0.53	-0.02	0.53	0.60	0.55	0.65	0.16	13	17	11	15	1	2
IA 1	2	Low	-2.0	-2.14	0.54	-0.14	0.56	0.57	0.53	0.60	0.21	12	16	12	16	1	1
IA 1	2	High	1.0	0.79	0.51	-0.21	0.56	0.56	0.50	0.65	0.16	12	17	12	17	1	1
IA 1	3	Low	-1.6	-1.53	0.56	0.07	0.56	0.57	0.53	0.69	0.19	11	18	10	17	1	2
IA 1	3	High	1.2	1.14	0.55	-0.06	0.56	0.55	0.49	0.63	0.16	13	19	13	19	1	1
IA 1	4	Low	-1.6	-1.57	0.63	0.03	0.63	0.57	0.52	0.64	0.19	11	17	11	17	1	1
IA 1	4	High	1.3	1.38	0.55	0.08	0.56	0.55	0.49	0.64	0.16	12	18	12	18	0	0
IA 1	5	Low	-1.6	-1.75	0.56	-0.15	0.58	0.57	0.51	0.80	0.27	11	16	11	16	1	1
IA 1	5	High	1.4	1.27	0.60	-0.13	0.61	0.56	0.48	0.63	0.16	13	19	13	19	1	1
IA 1	6	Low	-1.0	-1.01	0.59	-0.01	0.58	0.57	0.50	0.69	0.20	10	17	10	17	1	1
IA 1	6	High	1.6	1.65	0.60	0.05	0.60	0.55	0.49	0.63	0.16	12	18	12	18	1	2
IA 1	7	Low	-0.6	-0.64	0.52	-0.04	0.53	0.57	0.52	0.62	0.17	12	18	12	17	1	1
IA 1	7	High	1.7	1.78	0.58	0.08	0.59	0.56	0.50	0.69	0.16	12	17	12	17	1	1
IA 1	8	Low	-0.6	-0.67	0.51	-0.07	0.51	0.55	0.49	0.61	0.19	12	18	12	18	1	1
IA 1	8	High	1.8	1.74	0.61	-0.06	0.62	0.56	0.50	0.63	0.16	12	17	12	17	1	1
IA 2	1	Low	-2.8	-2.81	0.57	-0.01	0.57	0.52	0.48	0.59	0.16	15	20	14	19	1	1
IA 2	1	High	0.9	0.90	0.61	0.00	0.61	0.59	0.55	0.67	0.15	12	16	11	15	1	1
IA 2	2	Low	-2.0	-2.11	0.61	-0.11	0.61	0.52	0.47	0.61	0.16	12	20	12	20	0	0
IA 2	2	High	1.0	0.94	0.62	-0.06	0.62	0.55	0.51	0.61	0.16	11	18	11	17	1	1
IA 2	3	Low	-1.6	-1.48	0.66	0.12	0.67	0.53	0.47	0.72	0.17	14	20	14	20	0	0
IA 2	3	High	1.2	1.34	0.61	0.14	0.62	0.55	0.50	0.64	0.15	13	17	13	17	0	0
IA 2	4	Low	-1.6	-1.69	0.50	-0.09	0.51	0.52	0.47	0.57	0.19	14	20	14	20	0	0
IA 2	4	High	1.3	1.32	0.57	0.02	0.57	0.56	0.51	0.64	0.15	12	19	12	19	0	0
IA 2	5	Low	-1.6	-1.65	0.52	-0.05	0.52	0.51	0.47	0.57	0.20	13	19	13	19	0	0
IA 2	5	High	1.4	1.35	0.47	-0.05	0.47	0.55	0.49	0.61	0.16	13	18	13	18	0	0
IA 2	6	Low	-1.0	-0.94	0.55	0.06	0.55	0.52	0.48	0.61	0.19	13	20	13	20	0	0
IA 2	6	High	1.6	1.64	0.54	0.04	0.54	0.56	0.50	0.61	0.16	12	18	12	18	0	0
IA 2	7	Low	-0.6	-0.57	0.47	0.03	0.48	0.54	0.47	0.68	0.17	12	19	12	19	0	0

Science 3–5, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	7	High	1.7	1.75	0.44	0.05	0.44	0.56	0.50	0.61	0.16	12	18	12	18	0	0
IA 2	8	Low	-0.6	-0.54	0.55	0.06	0.56	0.53	0.48	0.60	0.18	12	19	12	19	0	0
IA 2	8	High	1.8	1.81	0.59	0.01	0.59	0.56	0.50	0.65	0.16	12	17	12	17	0	0
IA 3	1	Low	-2.8	-2.88	0.60	-0.08	0.61	0.60	0.53	0.67	0.25	12	18	11	17	1	1
IA 3	1	High	0.9	0.98	0.54	0.08	0.55	0.59	0.55	0.65	0.15	15	19	11	15	3	5
IA 3	2	Low	-2.0	-2.07	0.62	-0.07	0.62	0.57	0.53	0.64	0.24	11	17	11	17	1	1
IA 3	2	High	1.0	0.93	0.56	-0.07	0.56	0.57	0.51	0.66	0.15	13	19	12	17	1	2
IA 3	3	Low	-1.6	-1.65	0.60	-0.05	0.60	0.58	0.51	0.76	0.23	11	19	11	18	1	2
IA 3	3	High	1.2	1.20	0.59	0.00	0.59	0.56	0.50	0.63	0.16	13	17	13	17	1	2
IA 3	4	Low	-1.6	-1.51	0.53	0.09	0.54	0.58	0.52	0.66	0.29	12	16	12	16	1	2
IA 3	4	High	1.3	1.26	0.51	-0.04	0.51	0.55	0.50	0.66	0.16	12	18	12	18	0	0
IA 3	5	Low	-1.6	-1.45	0.58	0.15	0.60	0.58	0.49	0.75	0.44	11	17	11	17	1	1
IA 3	5	High	1.4	1.47	0.62	0.07	0.62	0.55	0.49	0.66	0.16	12	18	12	18	0	0
IA 3	6	Low	-1.0	-0.92	0.55	0.08	0.55	0.57	0.51	0.66	0.27	12	17	12	16	1	2
IA 3	6	High	1.6	1.72	0.48	0.12	0.49	0.55	0.50	0.61	0.15	13	18	13	18	0	0
IA 3	7	Low	-0.6	-0.41	0.56	0.19	0.59	0.56	0.49	0.62	0.18	12	19	12	18	1	2
IA 3	7	High	1.7	1.77	0.49	0.07	0.49	0.54	0.48	0.60	0.16	13	19	13	19	0	0
IA 3	8	Low	-0.6	-0.58	0.56	0.02	0.56	0.56	0.50	0.63	0.23	11	18	11	18	1	2
IA 3	8	High	1.8	1.80	0.53	0.00	0.53	0.54	0.49	0.63	0.16	12	19	12	19	0	0

Table A.18. Summary Statistics—Science 3–5, CBE

Science 3–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-2.8	-2.82	0.32	-0.02	0.32	0.32	0.31	0.34	0.12	45	45	43	44	1	2
Overall	1	High	0.9	0.87	0.30	-0.03	0.30	0.32	0.31	0.34	0.03	45	45	42	43	2	3
Overall	2	Low	-2.0	-1.96	0.29	0.04	0.29	0.31	0.31	0.33	0.10	45	45	43	44	1	2

Science 3–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	2	High	1.0	1.01	0.31	0.01	0.31	0.31	0.31	0.34	0.03	45	45	42	43	2	3
Overall	3	Low	-1.6	-1.58	0.33	0.02	0.33	0.31	0.31	0.32	0.09	45	45	44	44	1	1
Overall	3	High	1.2	1.18	0.34	-0.02	0.34	0.32	0.31	0.37	0.03	45	45	43	43	2	2
Overall	4	Low	-1.6	-1.66	0.35	-0.06	0.36	0.32	0.30	0.34	0.19	45	45	44	44	1	1
Overall	4	High	1.3	1.27	0.36	-0.03	0.36	0.31	0.31	0.34	0.03	45	45	43	43	2	2
Overall	5	Low	-1.6	-1.58	0.31	0.02	0.31	0.32	0.31	0.35	0.26	45	45	43	43	2	2
Overall	5	High	1.4	1.44	0.35	0.04	0.36	0.33	0.32	0.37	0.03	45	45	40	40	5	5
Overall	6	Low	-1.0	-1.03	0.37	-0.03	0.37	0.32	0.31	0.34	0.12	45	45	42	43	2	3
Overall	6	High	1.6	1.61	0.38	0.01	0.38	0.33	0.32	0.34	0.03	45	45	40	40	5	5
Overall	7	Low	-0.6	-0.62	0.44	-0.02	0.44	0.32	0.31	0.34	0.05	45	45	42	43	2	3
Overall	7	High	1.7	1.70	0.31	0.00	0.31	0.33	0.32	0.38	0.04	45	45	40	40	5	5
Overall	8	Low	-0.6	-0.55	0.35	0.05	0.36	0.31	0.31	0.33	0.04	45	45	42	43	2	3
Overall	8	High	1.8	1.75	0.34	-0.05	0.34	0.33	0.32	0.36	0.04	45	45	40	40	5	5
IA 1	1	Low	-2.8	-2.73	0.57	0.07	0.57	0.57	0.54	0.67	0.14	13	16	13	16	0	0
IA 1	1	High	0.9	0.85	0.56	-0.05	0.56	0.57	0.54	0.65	0.03	14	16	14	16	0	0
IA 1	2	Low	-2.0	-1.92	0.50	0.08	0.51	0.54	0.52	0.59	0.11	14	15	14	15	0	0
IA 1	2	High	1.0	0.98	0.67	-0.02	0.67	0.56	0.52	0.65	0.03	14	17	14	17	0	0
IA 1	3	Low	-1.6	-1.55	0.50	0.05	0.50	0.54	0.52	0.60	0.09	14	15	14	15	0	0
IA 1	3	High	1.2	1.09	0.49	-0.11	0.51	0.56	0.53	0.77	0.03	13	16	13	16	0	0
IA 1	4	Low	-1.6	-1.63	0.57	-0.03	0.57	0.55	0.52	0.64	0.18	14	16	14	16	0	0
IA 1	4	High	1.3	1.29	0.56	-0.01	0.56	0.56	0.52	0.66	0.03	14	15	14	15	0	0
IA 1	5	Low	-1.6	-1.59	0.50	0.01	0.50	0.56	0.52	0.65	0.27	14	17	14	17	0	0
IA 1	5	High	1.4	1.44	0.62	0.04	0.62	0.58	0.54	0.66	0.03	15	19	12	16	3	3
IA 1	6	Low	-1.0	-1.04	0.57	-0.04	0.57	0.56	0.53	0.65	0.13	13	16	13	16	0	0
IA 1	6	High	1.6	1.56	0.61	-0.04	0.61	0.58	0.54	0.62	0.03	15	18	12	15	3	3
IA 1	7	Low	-0.6	-0.69	0.61	-0.09	0.62	0.56	0.52	0.65	0.05	13	15	13	15	0	0
IA 1	7	High	1.7	1.60	0.48	-0.10	0.49	0.58	0.54	0.71	0.04	15	17	12	14	3	3
IA 1	8	Low	-0.6	-0.58	0.58	0.02	0.58	0.56	0.52	0.66	0.04	13	16	13	16	0	0

Science 3–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	8	High	1.8	1.75	0.58	-0.05	0.58	0.58	0.54	0.67	0.04	15	19	12	16	3	3
IA 2	1	Low	-2.8	-2.95	0.58	-0.15	0.60	0.55	0.52	0.61	0.04	13	15	13	15	0	0
IA 2	1	High	0.9	0.94	0.50	0.04	0.50	0.56	0.54	0.67	0.03	13	15	13	15	0	0
IA 2	2	Low	-2.0	-1.98	0.53	0.02	0.53	0.55	0.53	0.66	0.05	14	16	14	16	0	0
IA 2	2	High	1.0	1.09	0.52	0.09	0.53	0.56	0.52	0.62	0.03	13	15	13	15	0	0
IA 2	3	Low	-1.6	-1.58	0.60	0.02	0.60	0.56	0.52	0.65	0.05	14	16	14	16	0	0
IA 2	3	High	1.2	1.27	0.48	0.07	0.48	0.55	0.52	0.66	0.03	13	15	13	15	0	0
IA 2	4	Low	-1.6	-1.67	0.48	-0.07	0.48	0.55	0.52	0.61	0.06	14	16	14	16	0	0
IA 2	4	High	1.3	1.26	0.51	-0.04	0.51	0.55	0.52	0.60	0.03	14	15	14	15	0	0
IA 2	5	Low	-1.6	-1.52	0.47	0.08	0.47	0.56	0.52	0.61	0.10	13	15	13	15	0	0
IA 2	5	High	1.4	1.45	0.61	0.05	0.61	0.58	0.54	0.66	0.03	13	16	12	15	1	1
IA 2	6	Low	-1.0	-0.93	0.59	0.07	0.59	0.57	0.53	0.68	0.04	13	15	13	15	0	0
IA 2	6	High	1.6	1.66	0.57	0.06	0.57	0.58	0.54	0.65	0.03	13	16	12	15	1	1
IA 2	7	Low	-0.6	-0.59	0.63	0.01	0.63	0.56	0.52	0.62	0.03	13	15	13	15	0	0
IA 2	7	High	1.7	1.76	0.58	0.06	0.58	0.58	0.54	0.68	0.05	13	16	12	15	1	1
IA 2	8	Low	-0.6	-0.48	0.54	0.12	0.55	0.55	0.52	0.66	0.03	14	15	14	15	0	0
IA 2	8	High	1.8	1.83	0.54	0.03	0.54	0.58	0.54	0.65	0.05	13	17	12	16	1	1
IA 3	1	Low	-2.8	-2.77	0.62	0.03	0.62	0.57	0.54	0.65	0.19	15	17	13	15	1	2
IA 3	1	High	0.9	0.84	0.50	-0.06	0.50	0.57	0.54	0.60	0.03	16	18	13	15	2	3
IA 3	2	Low	-2.0	-1.99	0.46	0.01	0.46	0.56	0.52	0.65	0.16	15	17	14	16	1	2
IA 3	2	High	1.0	0.93	0.54	-0.07	0.54	0.56	0.52	0.66	0.03	15	18	13	15	2	3
IA 3	3	Low	-1.6	-1.61	0.51	-0.01	0.51	0.56	0.52	0.60	0.15	15	16	14	15	1	1
IA 3	3	High	1.2	1.18	0.66	-0.02	0.66	0.57	0.53	0.76	0.03	16	19	14	17	2	2
IA 3	4	Low	-1.6	-1.71	0.58	-0.11	0.59	0.57	0.52	0.68	0.34	15	17	14	16	1	1
IA 3	4	High	1.3	1.26	0.62	-0.04	0.62	0.56	0.53	0.66	0.03	16	17	14	15	2	2
IA 3	5	Low	-1.6	-1.68	0.53	-0.08	0.54	0.58	0.53	0.70	0.42	15	18	13	16	2	2
IA 3	5	High	1.4	1.43	0.48	0.03	0.48	0.58	0.55	0.70	0.03	13	16	12	15	1	1
IA 3	6	Low	-1.0	-1.11	0.61	-0.11	0.62	0.57	0.54	0.66	0.18	15	18	13	15	2	3

Science 3–5, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	6	High	1.6	1.61	0.56	0.01	0.56	0.58	0.54	0.65	0.04	13	16	12	15	1	1
IA 3	7	Low	-0.6	-0.57	0.68	0.03	0.68	0.57	0.52	0.66	0.08	16	18	14	16	2	3
IA 3	7	High	1.7	1.74	0.69	0.04	0.69	0.60	0.54	1.04	0.04	13	17	12	16	1	1
IA 3	8	Low	-0.6	-0.57	0.60	0.03	0.60	0.56	0.53	0.60	0.04	15	18	13	15	2	3
IA 3	8	High	1.8	1.70	0.57	-0.10	0.58	0.58	0.55	0.66	0.04	13	15	12	14	1	1

Table A.19. Summary Statistics—Science 6–8, COLO

Science 6–8, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-1.0	-1.01	0.33	-0.01	0.33	0.32	0.31	0.35	0.16	45	45	41	44	1	4
Overall	1	High	2.2	2.22	0.35	0.02	0.35	0.34	0.33	0.35	0.16	45	45	36	39	6	9
Overall	2	Low	-0.6	-0.69	0.35	-0.09	0.36	0.31	0.30	0.34	0.16	45	45	41	45	1	4
Overall	2	High	2.3	2.23	0.35	-0.07	0.36	0.32	0.30	0.35	0.16	45	45	38	45	1	7
Overall	3	Low	-0.4	-0.40	0.33	0.00	0.33	0.31	0.30	0.33	0.16	45	45	42	45	1	3
Overall	3	High	2.4	2.39	0.34	-0.01	0.34	0.31	0.30	0.34	0.15	45	45	41	45	1	4
Overall	4	Low	-0.4	-0.36	0.26	0.04	0.27	0.31	0.30	0.34	0.15	45	45	41	45	1	4
Overall	4	High	2.4	2.41	0.29	0.01	0.29	0.32	0.30	0.37	0.15	45	45	40	45	1	5
Overall	5	Low	-0.3	-0.34	0.35	-0.04	0.35	0.31	0.30	0.33	0.16	45	45	42	45	1	3
Overall	5	High	2.5	2.51	0.37	0.01	0.37	0.31	0.30	0.34	0.16	45	45	40	45	1	5
Overall	6	Low	0.1	0.14	0.35	0.04	0.35	0.31	0.30	0.34	0.16	45	45	41	45	1	4
Overall	6	High	2.5	2.52	0.32	0.02	0.32	0.31	0.31	0.34	0.16	45	45	42	45	1	3
Overall	7	Low	0.2	0.25	0.29	0.05	0.30	0.31	0.31	0.33	0.16	45	45	42	45	1	3
Overall	7	High	2.7	2.78	0.30	0.08	0.31	0.31	0.31	0.33	0.15	45	45	42	45	1	3
Overall	8	Low	0.2	0.17	0.34	-0.03	0.34	0.31	0.30	0.33	0.16	45	45	42	45	1	3
Overall	8	High	2.8	2.80	0.36	0.00	0.36	0.31	0.30	0.33	0.16	45	45	42	45	1	3
IA 1	1	Low	-1.0	-1.02	0.61	-0.02	0.61	0.58	0.53	0.66	0.16	11	16	11	16	1	1

Science 6–8, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	1	High	2.2	2.17	0.67	-0.03	0.67	0.61	0.53	0.69	0.15	12	16	11	15	1	2
IA 1	2	Low	-0.6	-0.62	0.54	-0.02	0.54	0.56	0.51	0.62	0.16	12	18	12	18	1	1
IA 1	2	High	2.3	2.26	0.56	-0.04	0.56	0.57	0.51	0.66	0.15	11	18	11	18	1	2
IA 1	3	Low	-0.4	-0.47	0.51	-0.07	0.52	0.56	0.50	0.62	0.16	12	17	12	17	1	1
IA 1	3	High	2.4	2.45	0.59	0.05	0.59	0.57	0.51	0.62	0.15	12	17	12	17	1	2
IA 1	4	Low	-0.4	-0.37	0.53	0.03	0.53	0.56	0.50	0.66	0.16	11	18	11	18	1	1
IA 1	4	High	2.4	2.36	0.58	-0.04	0.58	0.57	0.51	0.68	0.16	13	17	12	17	1	1
IA 1	5	Low	-0.3	-0.40	0.56	-0.10	0.57	0.56	0.51	0.62	0.16	12	17	12	17	1	1
IA 1	5	High	2.5	2.46	0.65	-0.04	0.65	0.58	0.51	0.67	0.15	12	19	12	18	1	2
IA 1	6	Low	0.1	0.15	0.60	0.05	0.60	0.56	0.49	0.67	0.16	10	18	10	18	1	1
IA 1	6	High	2.5	2.45	0.56	-0.05	0.56	0.57	0.52	0.64	0.16	11	18	11	17	1	2
IA 1	7	Low	0.2	0.14	0.49	-0.06	0.49	0.56	0.49	0.67	0.16	12	19	12	19	0	0
IA 1	7	High	2.7	2.86	0.53	0.16	0.56	0.57	0.53	0.66	0.15	11	16	11	15	1	1
IA 1	8	Low	0.2	0.12	0.46	-0.08	0.47	0.55	0.50	0.65	0.16	11	17	11	17	0	0
IA 1	8	High	2.8	2.70	0.55	-0.10	0.56	0.57	0.51	0.65	0.17	11	19	11	19	1	1
IA 2	1	Low	-1.0	-1.00	0.56	0.00	0.56	0.54	0.47	0.61	0.15	13	20	12	19	1	1
IA 2	1	High	2.2	2.28	0.56	0.08	0.56	0.60	0.55	0.68	0.15	11	16	11	16	1	1
IA 2	2	Low	-0.6	-0.69	0.53	-0.09	0.54	0.54	0.48	0.65	0.16	11	19	11	19	0	0
IA 2	2	High	2.3	2.16	0.61	-0.14	0.62	0.55	0.49	0.62	0.15	12	19	12	19	1	1
IA 2	3	Low	-0.4	-0.33	0.50	0.07	0.51	0.54	0.49	0.61	0.15	12	19	12	19	0	0
IA 2	3	High	2.4	2.42	0.63	0.02	0.63	0.55	0.50	0.62	0.15	12	19	12	19	1	1
IA 2	4	Low	-0.4	-0.38	0.56	0.02	0.56	0.54	0.48	0.62	0.15	11	19	11	19	0	0
IA 2	4	High	2.4	2.44	0.48	0.04	0.48	0.55	0.48	0.62	0.15	12	20	12	20	1	1
IA 2	5	Low	-0.3	-0.44	0.53	-0.14	0.54	0.54	0.48	0.61	0.16	13	19	13	19	0	0
IA 2	5	High	2.5	2.51	0.62	0.01	0.62	0.54	0.49	0.63	0.16	12	20	12	20	1	1
IA 2	6	Low	0.1	0.15	0.57	0.05	0.57	0.55	0.49	0.61	0.15	13	18	13	18	0	0
IA 2	6	High	2.5	2.61	0.57	0.11	0.58	0.54	0.49	0.66	0.15	13	18	13	18	1	1
IA 2	7	Low	0.2	0.31	0.55	0.11	0.56	0.54	0.47	0.66	0.16	13	20	13	20	0	0

Science 6–8, COLO																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 2	7	High	2.7	2.76	0.49	0.06	0.49	0.53	0.49	0.61	0.16	12	18	12	18	0	0
IA 2	8	Low	0.2	0.10	0.48	-0.10	0.49	0.53	0.47	0.61	0.15	13	19	13	19	0	0
IA 2	8	High	2.8	2.76	0.53	-0.04	0.53	0.53	0.47	0.59	0.16	13	19	13	19	1	1
IA 3	1	Low	-1.0	-1.03	0.54	-0.03	0.54	0.57	0.50	0.63	0.16	11	17	11	17	1	2
IA 3	1	High	2.2	2.21	0.73	0.01	0.73	0.61	0.56	0.69	0.16	15	21	10	15	5	8
IA 3	2	Low	-0.6	-0.75	0.64	-0.15	0.65	0.56	0.51	0.62	0.15	13	20	12	17	1	3
IA 3	2	High	2.3	2.29	0.57	-0.01	0.57	0.56	0.50	0.62	0.16	11	18	11	18	1	5
IA 3	3	Low	-0.4	-0.40	0.55	0.00	0.55	0.57	0.52	0.62	0.16	12	18	11	16	1	2
IA 3	3	High	2.4	2.31	0.55	-0.09	0.55	0.56	0.49	0.66	0.15	13	18	12	18	1	3
IA 3	4	Low	-0.4	-0.35	0.55	0.05	0.55	0.56	0.49	0.67	0.15	12	18	11	18	1	3
IA 3	4	High	2.4	2.45	0.54	0.05	0.54	0.55	0.49	0.68	0.16	11	19	11	18	1	3
IA 3	5	Low	-0.3	-0.19	0.59	0.11	0.60	0.56	0.52	0.66	0.16	12	18	12	17	1	3
IA 3	5	High	2.5	2.55	0.64	0.05	0.64	0.56	0.51	0.65	0.16	12	20	12	19	1	3
IA 3	6	Low	0.1	0.13	0.58	0.03	0.58	0.57	0.51	0.63	0.16	11	19	11	17	1	3
IA 3	6	High	2.5	2.48	0.61	-0.02	0.61	0.56	0.50	0.63	0.15	13	17	12	17	1	2
IA 3	7	Low	0.2	0.30	0.49	0.10	0.50	0.56	0.51	0.66	0.15	12	19	12	16	1	3
IA 3	7	High	2.7	2.72	0.53	0.02	0.53	0.55	0.50	0.62	0.15	12	20	12	19	1	2
IA 3	8	Low	0.2	0.28	0.51	0.08	0.51	0.56	0.48	0.62	0.16	12	19	12	19	1	3
IA 3	8	High	2.8	2.96	0.59	0.16	0.61	0.55	0.48	0.62	0.15	12	21	12	21	1	3

Table A.20. Summary Statistics—Science 6–8, CBE

Science 6–8, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	1	Low	-1.0	-1.01	0.34	-0.01	0.34	0.31	0.31	0.33	0.03	45	45	43	44	1	2
Overall	1	High	2.2	2.17	0.30	-0.03	0.30	0.31	0.31	0.34	0.03	45	45	43	45	1	2
Overall	2	Low	-0.6	-0.57	0.25	0.03	0.26	0.31	0.30	0.32	0.03	45	45	44	45	1	1

Science 6–8, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
Overall	2	High	2.3	2.31	0.32	0.01	0.32	0.31	0.30	0.33	0.03	45	45	44	45	1	1
Overall	3	Low	-0.4	-0.40	0.34	0.00	0.34	0.31	0.30	0.32	0.03	45	45	45	45	0	0
Overall	3	High	2.4	2.41	0.31	0.01	0.31	0.31	0.30	0.36	0.03	45	45	44	45	1	1
Overall	4	Low	-0.4	-0.43	0.34	-0.03	0.34	0.31	0.30	0.33	0.05	45	45	45	45	0	0
Overall	4	High	2.4	2.37	0.32	-0.03	0.32	0.31	0.30	0.33	0.03	45	45	45	45	0	0
Overall	5	Low	-0.3	-0.28	0.29	0.02	0.29	0.31	0.30	0.35	0.05	45	45	44	45	1	1
Overall	5	High	2.5	2.54	0.35	0.04	0.35	0.31	0.31	0.34	0.03	45	45	43	45	1	2
Overall	6	Low	0.1	0.09	0.33	-0.01	0.33	0.31	0.30	0.34	0.03	45	45	43	45	1	2
Overall	6	High	2.5	2.53	0.38	0.03	0.38	0.31	0.30	0.34	0.04	45	45	43	45	1	2
Overall	7	Low	0.2	0.17	0.40	-0.03	0.40	0.31	0.30	0.34	0.03	45	45	44	45	1	1
Overall	7	High	2.7	2.69	0.31	-0.01	0.31	0.31	0.30	0.35	0.04	45	45	44	45	1	1
Overall	8	Low	0.2	0.17	0.40	-0.03	0.40	0.31	0.30	0.34	0.03	45	45	44	45	1	1
Overall	8	High	2.7	2.69	0.31	-0.01	0.31	0.31	0.30	0.35	0.04	45	45	44	45	1	1
IA 1	1	Low	-1.0	-1.02	0.52	-0.02	0.52	0.56	0.52	0.61	0.04	14	15	14	15	0	0
IA 1	1	High	2.2	2.19	0.48	-0.01	0.48	0.56	0.52	0.66	0.03	14	15	14	15	0	0
IA 1	2	Low	-0.6	-0.60	0.52	0.00	0.52	0.55	0.52	0.65	0.04	14	17	14	17	0	0
IA 1	2	High	2.3	2.25	0.53	-0.05	0.53	0.54	0.52	0.60	0.03	14	15	14	15	0	0
IA 1	3	Low	-0.4	-0.37	0.47	0.03	0.48	0.54	0.52	0.59	0.04	14	15	14	15	0	0
IA 1	3	High	2.4	2.36	0.58	-0.04	0.58	0.55	0.52	0.65	0.03	14	16	14	16	0	0
IA 1	4	Low	-0.4	-0.48	0.67	-0.08	0.67	0.55	0.52	0.65	0.06	14	16	14	16	0	0
IA 1	4	High	2.4	2.30	0.53	-0.10	0.54	0.54	0.52	0.61	0.04	14	15	14	15	0	0
IA 1	5	Low	-0.3	-0.38	0.47	-0.08	0.48	0.55	0.52	0.62	0.06	14	15	14	15	0	0
IA 1	5	High	2.5	2.51	0.48	0.01	0.48	0.55	0.52	0.61	0.04	14	16	14	16	0	0
IA 1	6	Low	0.1	0.10	0.49	0.00	0.49	0.55	0.52	0.63	0.03	14	15	14	15	0	0
IA 1	6	High	2.5	2.53	0.62	0.03	0.62	0.56	0.52	0.66	0.05	14	16	14	16	0	0
IA 1	7	Low	0.2	0.22	0.66	0.02	0.66	0.55	0.52	0.65	0.03	14	16	14	16	0	0
IA 1	7	High	2.7	2.72	0.56	0.02	0.56	0.55	0.52	0.65	0.05	14	16	14	16	0	0
IA 1	8	Low	0.2	0.22	0.66	0.02	0.66	0.55	0.52	0.65	0.03	14	16	14	16	0	0

Science 6–8, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 1	8	High	2.7	2.72	0.56	0.02	0.56	0.55	0.52	0.65	0.05	14	16	14	16	0	0
IA 2	1	Low	-1.0	-0.99	0.59	0.01	0.59	0.56	0.52	0.65	0.03	13	16	13	16	0	0
IA 2	1	High	2.2	2.13	0.51	-0.07	0.51	0.55	0.52	0.60	0.03	14	15	14	15	0	0
IA 2	2	Low	-0.6	-0.44	0.59	0.16	0.61	0.56	0.52	0.76	0.03	14	17	14	17	0	0
IA 2	2	High	2.3	2.33	0.53	0.03	0.53	0.54	0.52	0.59	0.03	14	15	14	15	0	0
IA 2	3	Low	-0.4	-0.37	0.64	0.03	0.64	0.55	0.52	0.60	0.03	14	16	14	16	0	0
IA 2	3	High	2.4	2.40	0.66	0.00	0.66	0.55	0.52	0.65	0.03	14	16	14	16	0	0
IA 2	4	Low	-0.4	-0.40	0.52	0.00	0.52	0.55	0.52	0.65	0.03	14	16	14	16	0	0
IA 2	4	High	2.4	2.39	0.58	-0.01	0.58	0.55	0.52	0.60	0.03	14	16	14	16	0	0
IA 2	5	Low	-0.3	-0.22	0.60	0.08	0.61	0.56	0.52	0.65	0.03	14	16	14	16	0	0
IA 2	5	High	2.5	2.49	0.66	-0.01	0.65	0.56	0.52	0.65	0.03	14	16	14	16	0	0
IA 2	6	Low	0.1	0.10	0.56	0.00	0.56	0.56	0.52	0.65	0.03	14	15	14	15	0	0
IA 2	6	High	2.5	2.51	0.49	0.01	0.49	0.54	0.52	0.59	0.03	14	15	14	15	0	0
IA 2	7	Low	0.2	0.18	0.61	-0.02	0.61	0.55	0.52	0.64	0.03	14	16	14	16	0	0
IA 2	7	High	2.7	2.73	0.55	0.03	0.55	0.55	0.52	0.66	0.03	14	16	14	16	0	0
IA 2	8	Low	0.2	0.18	0.61	-0.02	0.61	0.55	0.52	0.64	0.03	14	16	14	16	0	0
IA 2	8	High	2.7	2.73	0.55	0.03	0.55	0.55	0.52	0.66	0.03	14	16	14	16	0	0
IA 3	1	Low	-1.0	-1.02	0.63	-0.02	0.63	0.56	0.53	0.60	0.03	15	17	14	16	1	2
IA 3	1	High	2.2	2.22	0.64	0.02	0.64	0.57	0.52	0.76	0.03	15	17	13	17	1	2
IA 3	2	Low	-0.6	-0.67	0.57	-0.07	0.57	0.55	0.52	0.65	0.03	13	16	13	16	1	1
IA 3	2	High	2.3	2.36	0.45	0.06	0.46	0.54	0.52	0.61	0.03	15	16	14	15	1	1
IA 3	3	Low	-0.4	-0.45	0.60	-0.05	0.60	0.55	0.52	0.65	0.04	14	16	14	16	0	0
IA 3	3	High	2.4	2.47	0.53	0.07	0.53	0.55	0.52	0.77	0.03	14	17	14	17	1	1
IA 3	4	Low	-0.4	-0.40	0.58	0.00	0.58	0.55	0.52	0.65	0.05	14	16	14	16	0	0
IA 3	4	High	2.4	2.42	0.57	0.02	0.57	0.55	0.52	0.65	0.03	14	16	14	16	0	0
IA 3	5	Low	-0.3	-0.24	0.60	0.06	0.60	0.56	0.52	0.65	0.06	14	17	14	17	1	1
IA 3	5	High	2.5	2.64	0.54	0.14	0.56	0.56	0.52	0.66	0.03	14	17	14	17	1	2
IA 3	6	Low	0.1	0.07	0.58	-0.03	0.58	0.56	0.52	0.76	0.04	15	17	14	17	1	2

Science 6–8, CBE																	
									SEM			#Items					
												Total		OP		FT	
Level	Admin.	TPt	TT	ET	SD_ET	Bias	RMSE	SEM	Min.	Max.	Delta	Min.	Max.	Min.	Max.	Min.	Max.
IA 3	6	High	2.5	2.55	0.55	0.05	0.55	0.55	0.52	0.61	0.03	15	17	14	16	1	2
IA 3	7	Low	0.2	0.11	0.59	-0.09	0.60	0.55	0.52	0.64	0.03	14	16	14	16	1	1
IA 3	7	High	2.7	2.63	0.59	-0.07	0.59	0.55	0.52	0.61	0.03	14	16	14	16	1	1
IA 3	8	Low	0.2	0.11	0.59	-0.09	0.60	0.55	0.52	0.64	0.03	14	16	14	16	1	1
IA 3	8	High	2.7	2.63	0.59	-0.07	0.59	0.55	0.52	0.61	0.03	14	16	14	16	1	1

Appendix B: Plots for Bias and RMSE

Figure B.1. Plot for Bias: Reading K–2

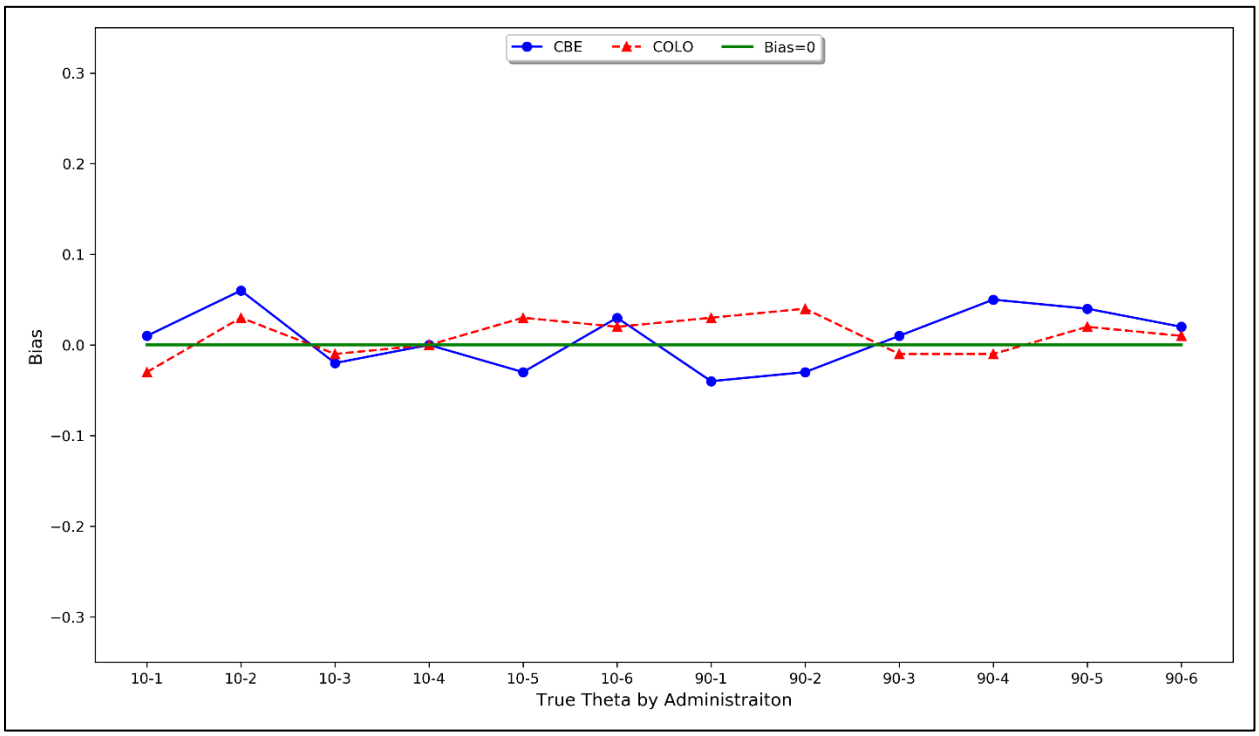

Figure B.2. Plot for RMSE: Reading K–2

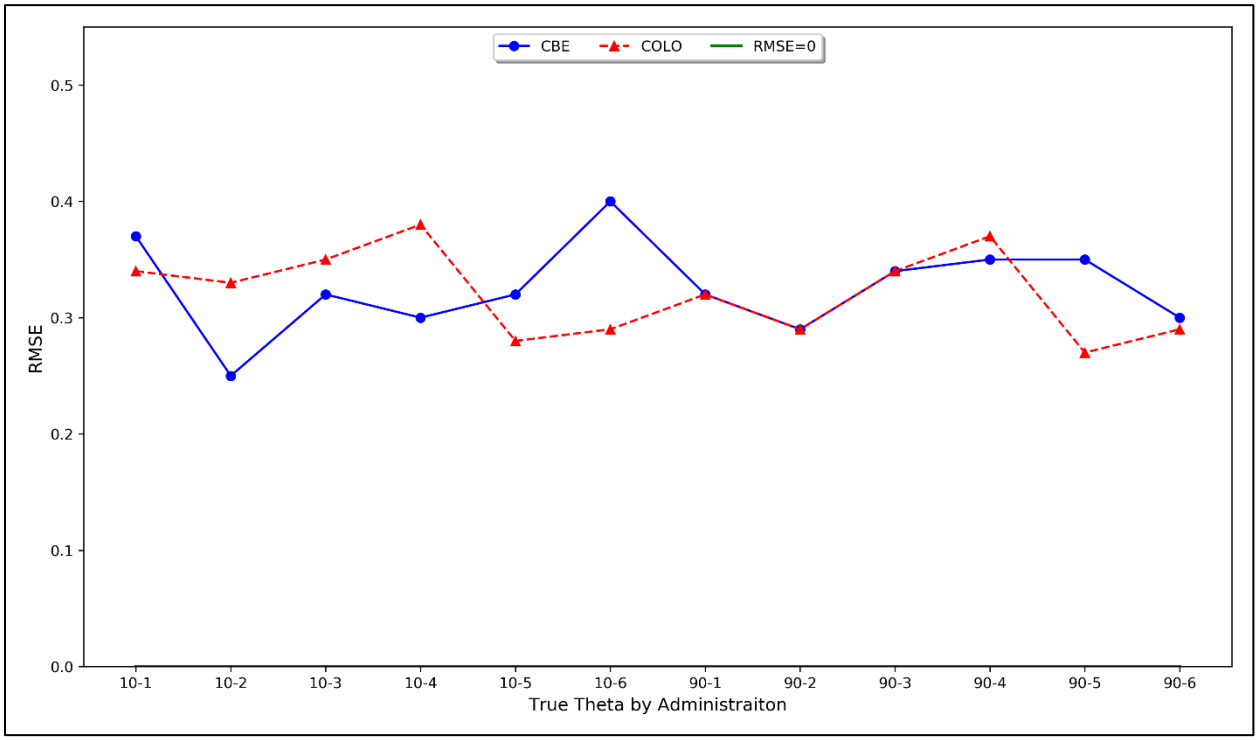

Figure B.3. Plot for Bias: Reading 2–5

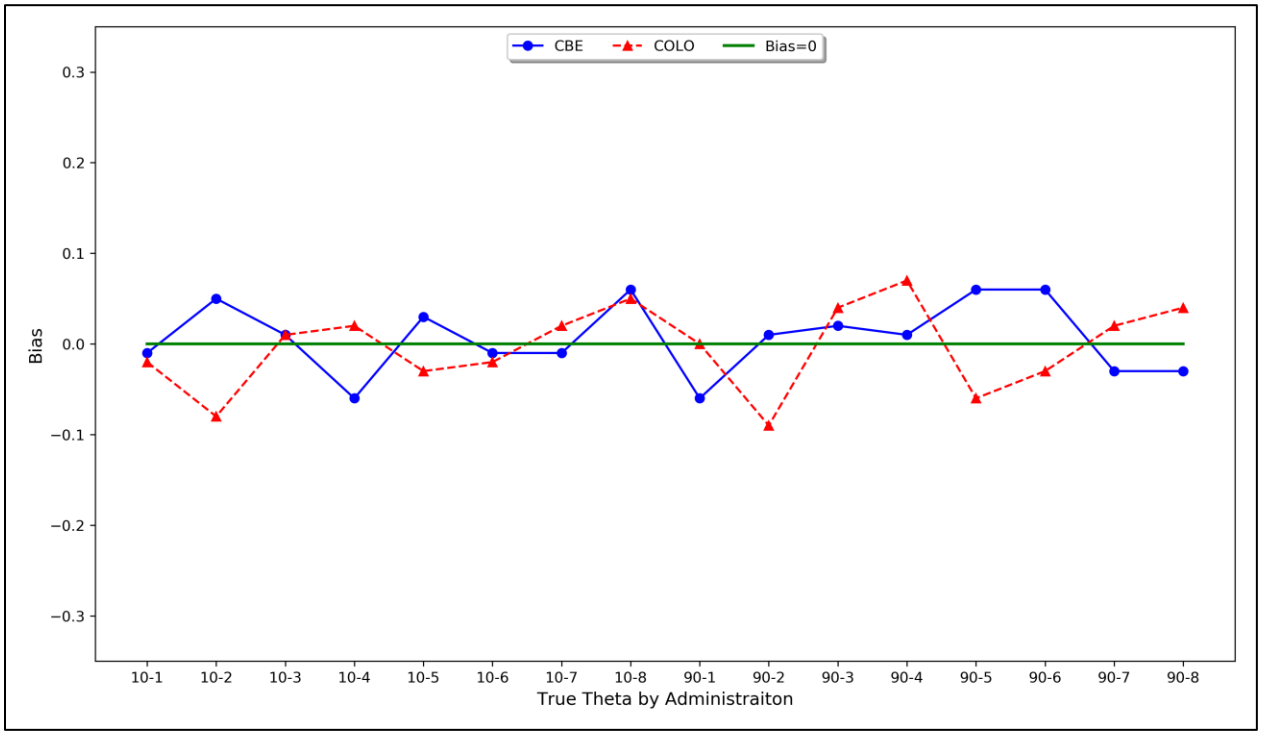

Figure B.4. Plot for RMSE: Reading 2–5

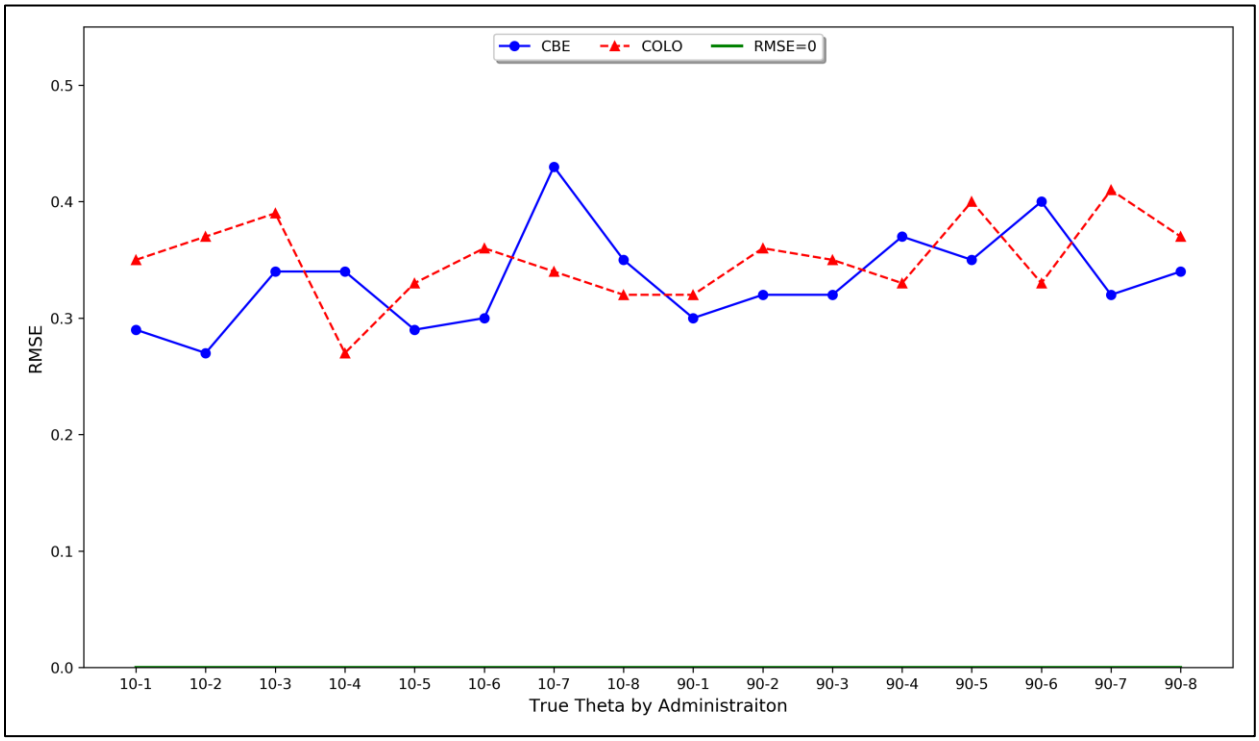

Figure B.5. Plot for Bias: Reading 6+

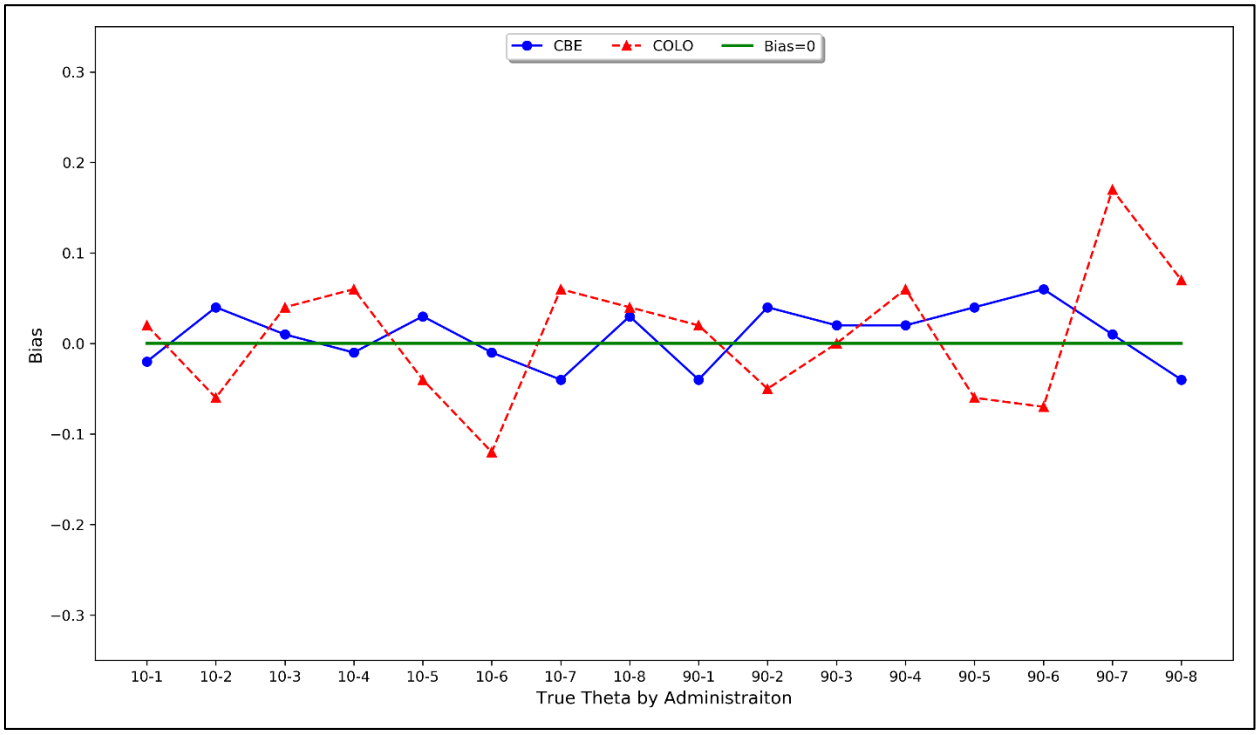

Figure B.6. Plot for RMSE: Reading 6+

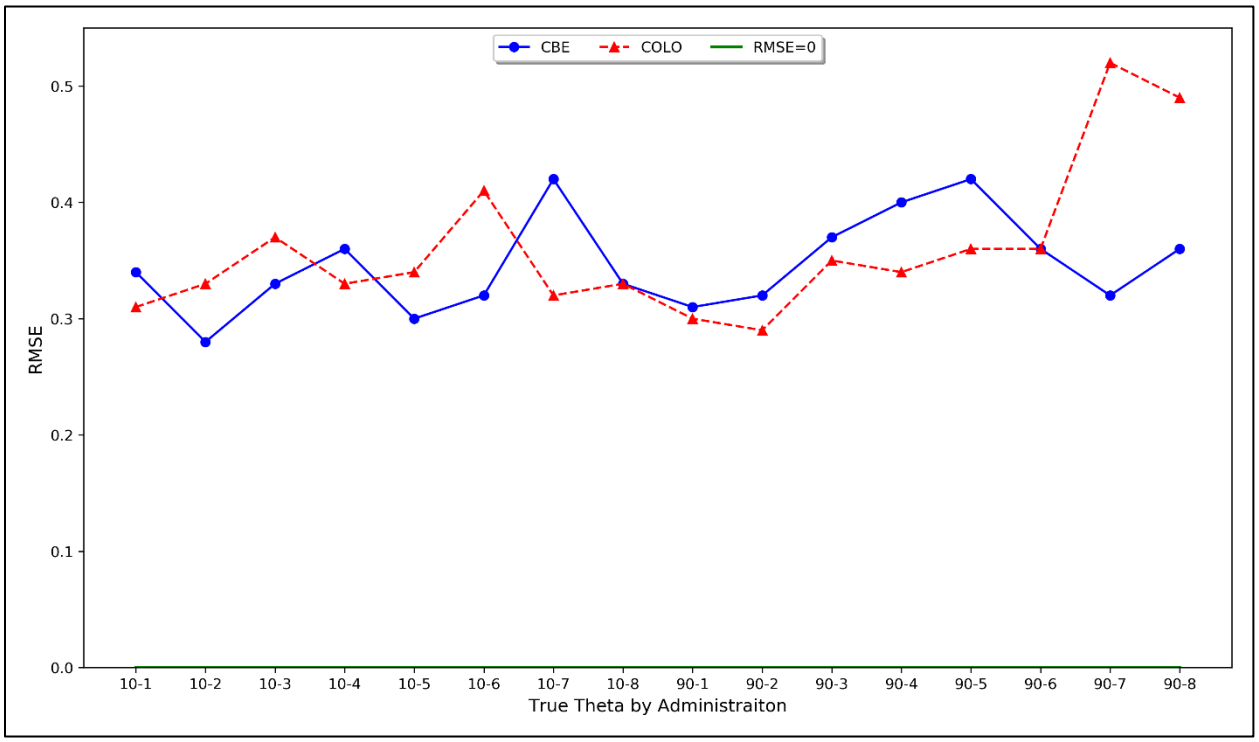

Figure B.7. Plot for Bias: Mathematics K–2

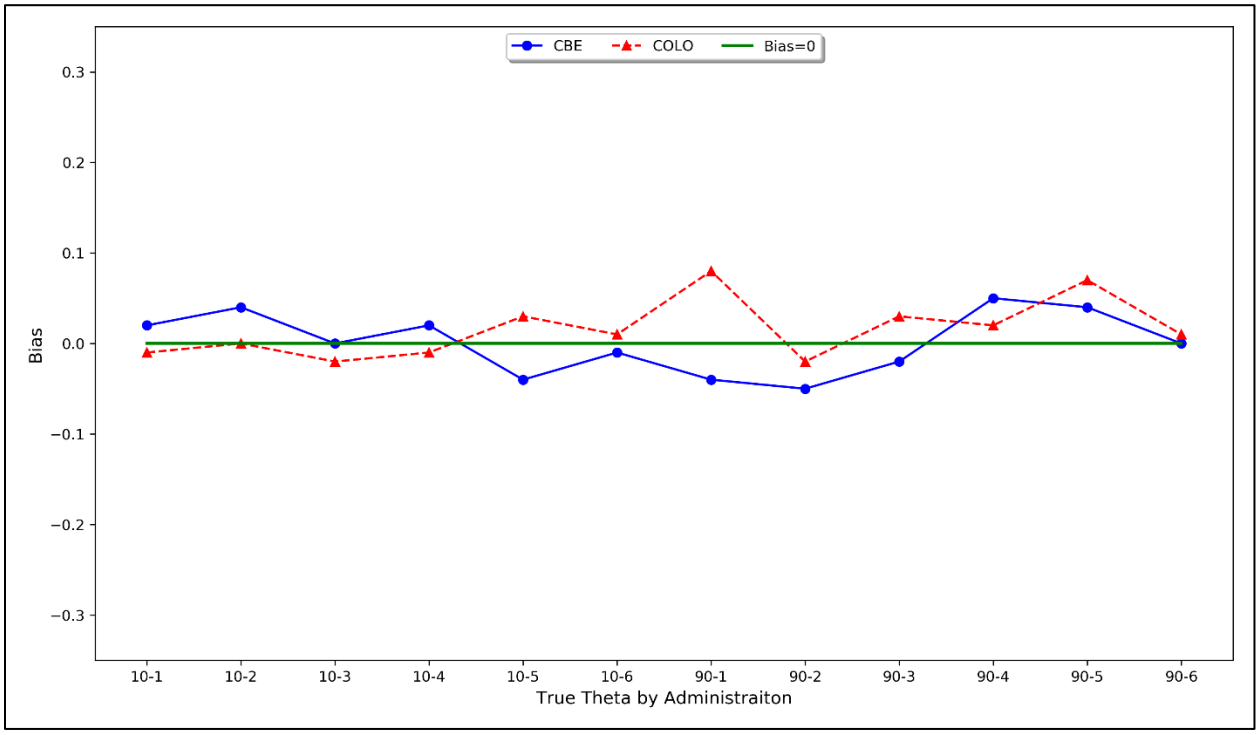

Figure B.8. Plot for RMSE: Mathematics K–2

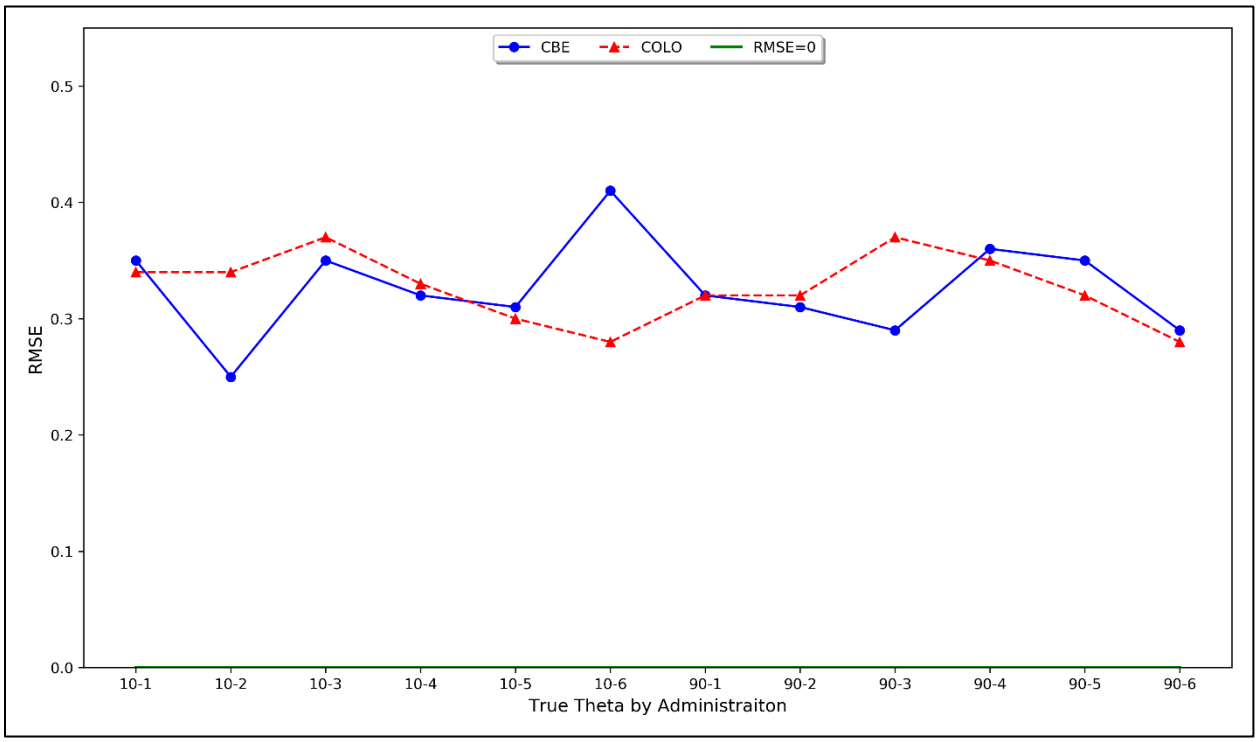

Figure B.9. Plot for Bias: Mathematics 2–5

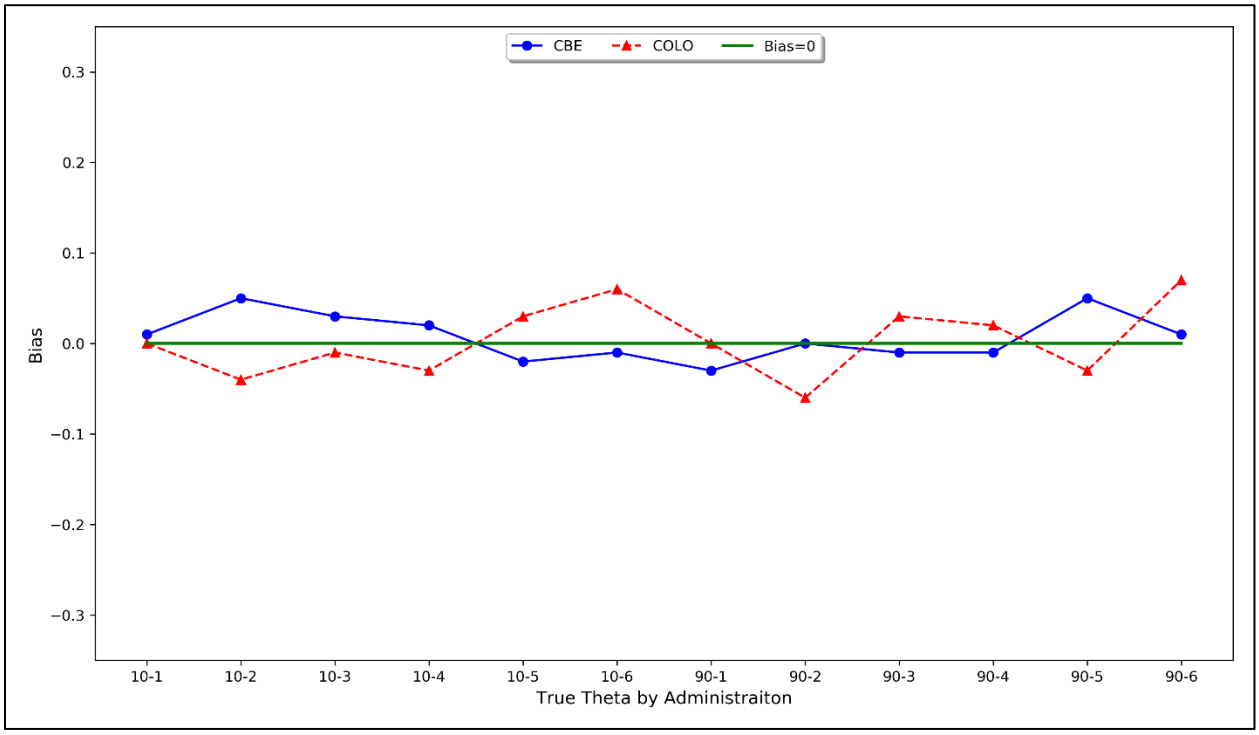

Figure B.10. Plot for RMSE: Mathematics 2–5

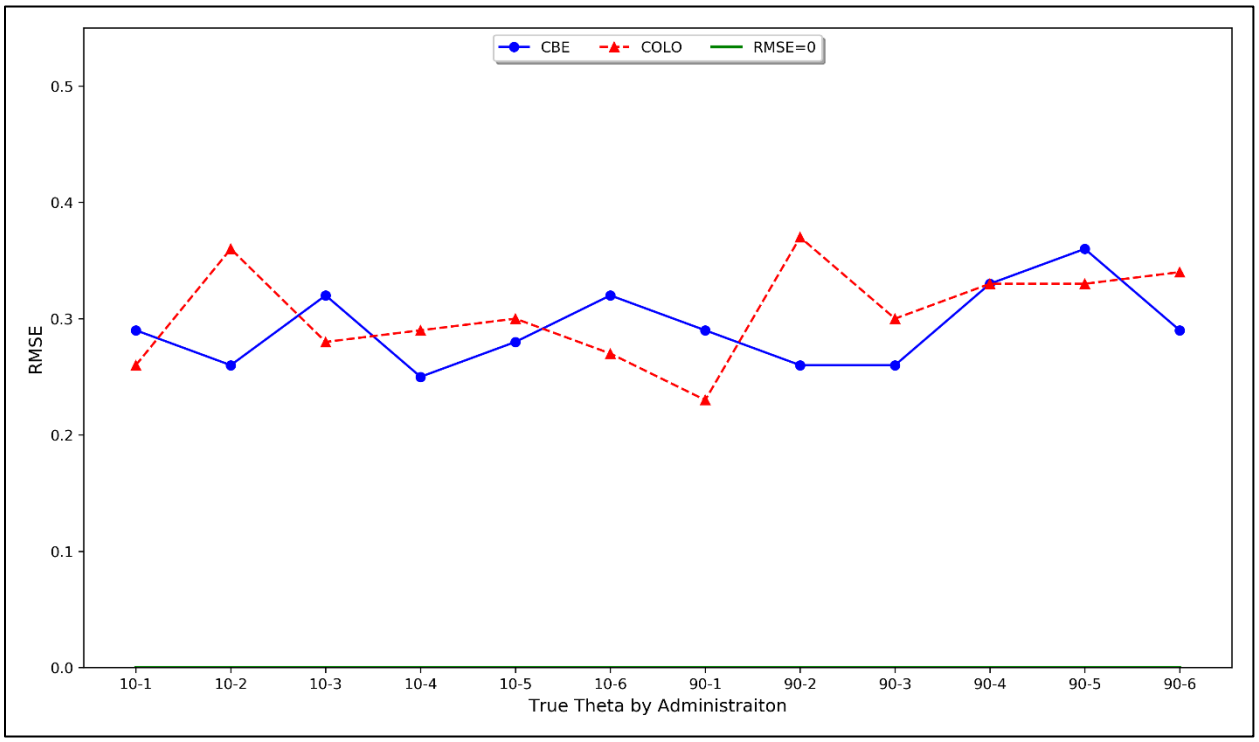

Figure B.11. Plot for Bias: Mathematics 6+

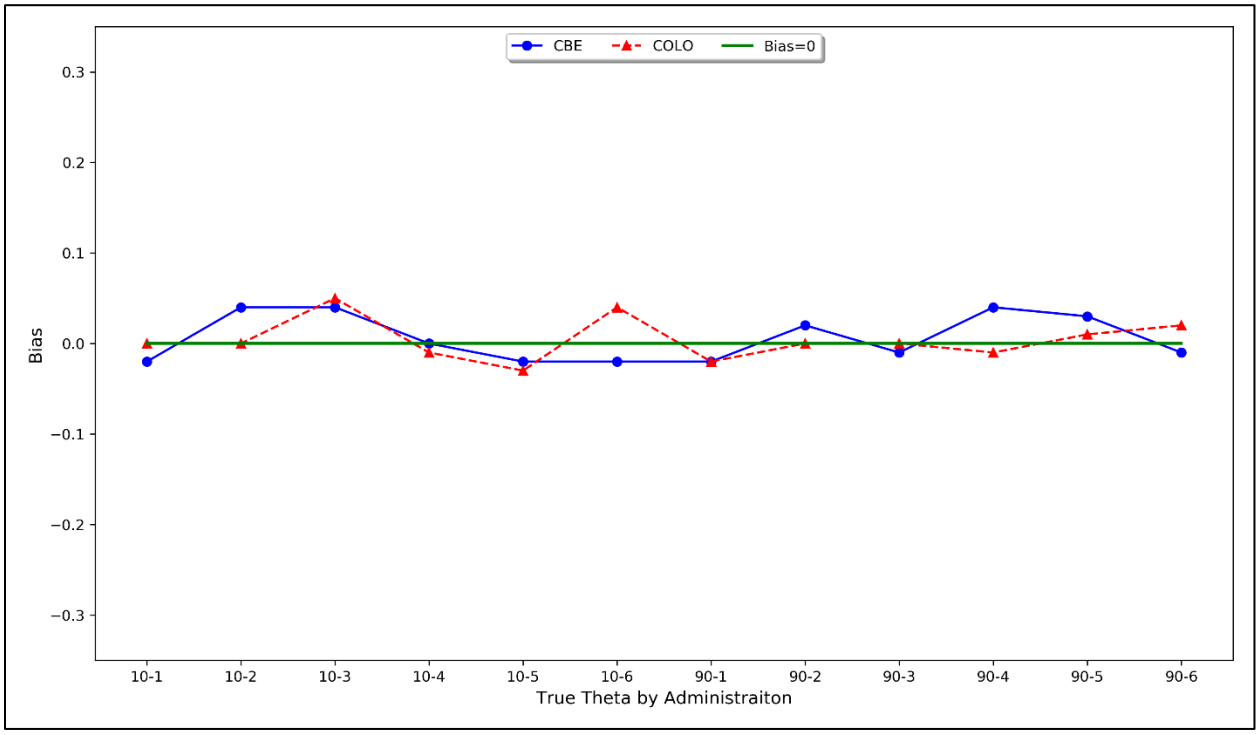

Figure B.12. Plot for RMSE: Mathematics 6+

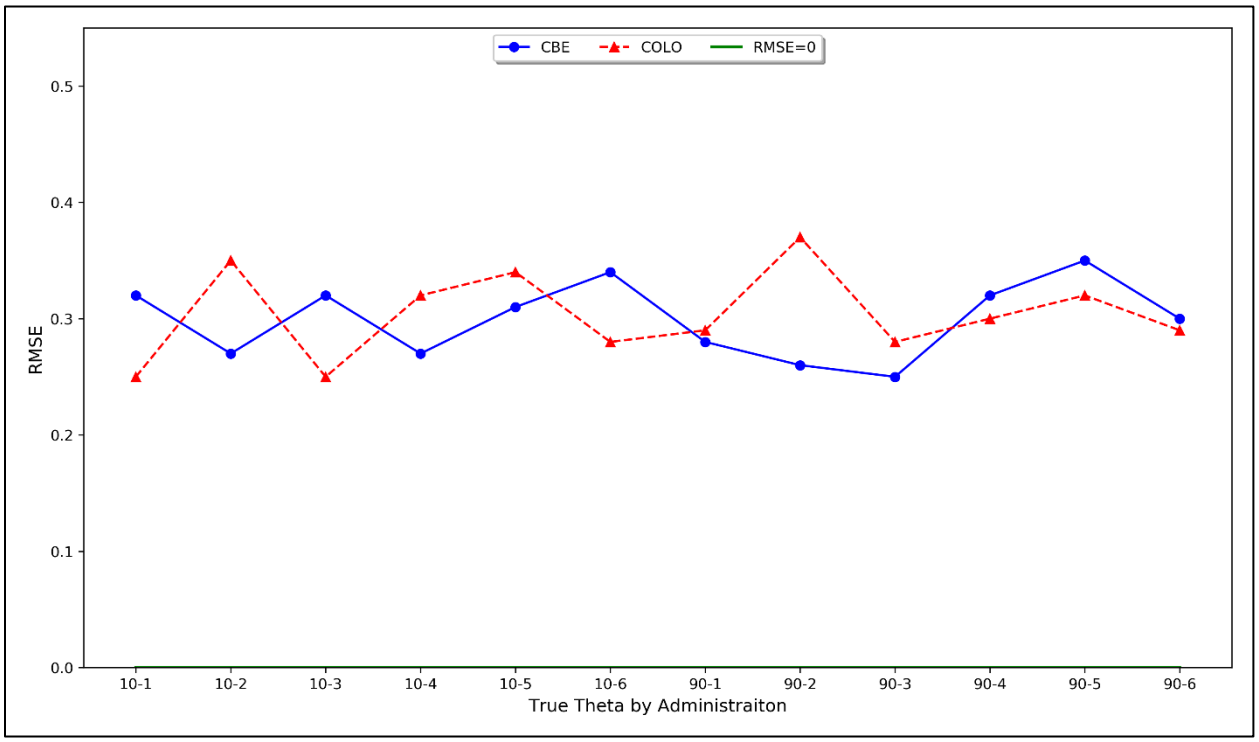

Figure B.13. Plot for Bias: Language Usage 2–12

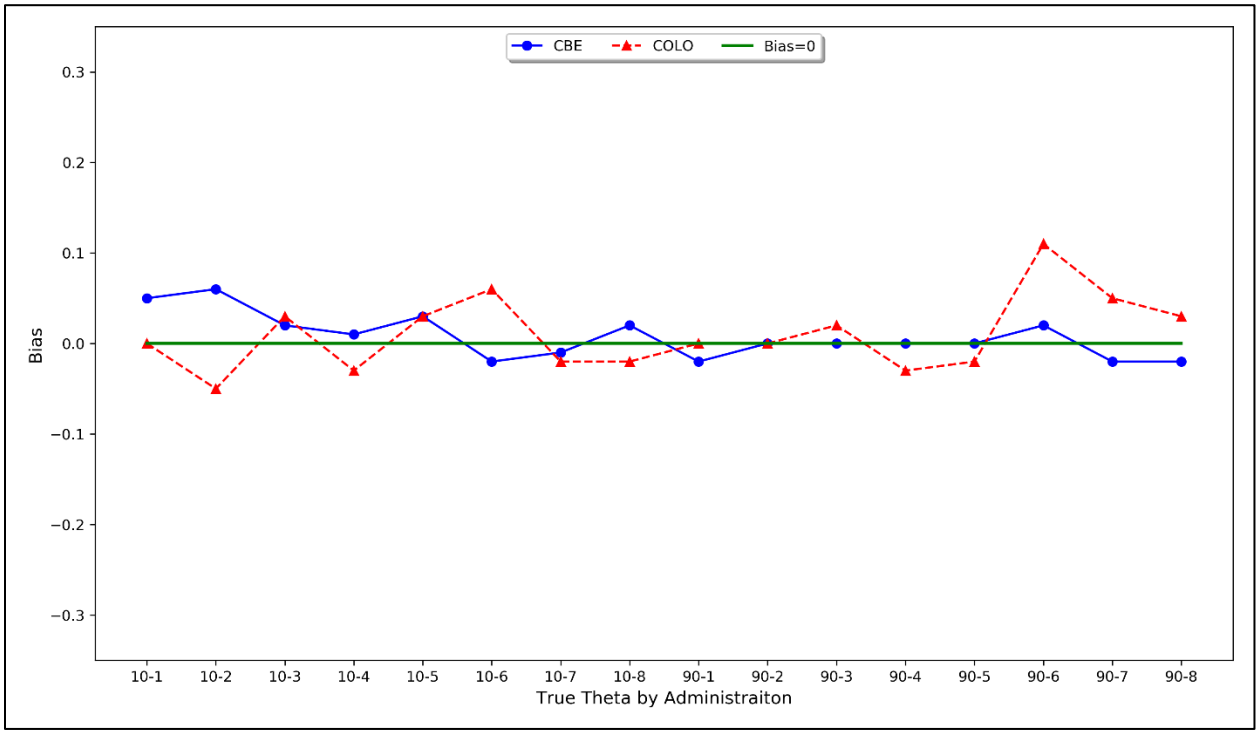

Figure B.14. Plot for RMSE: Language Usage 2–12

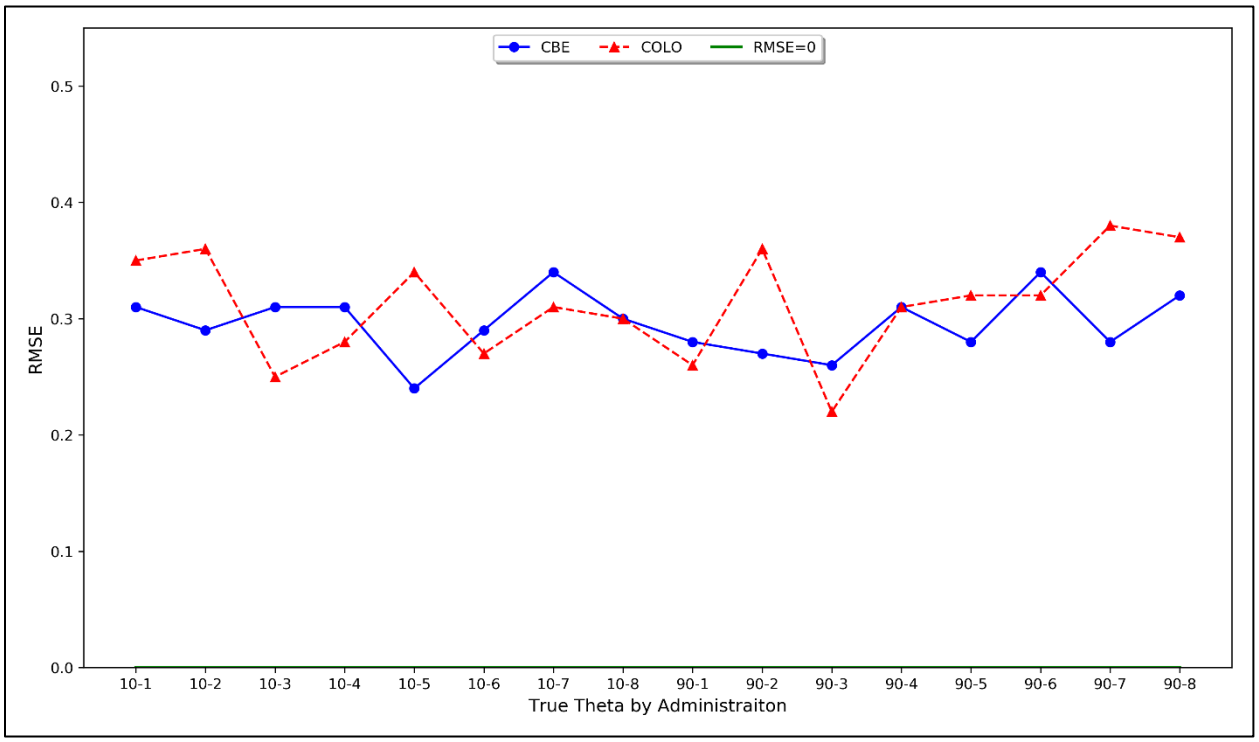

Figure B.15. Plot for Bias: Science 3–5

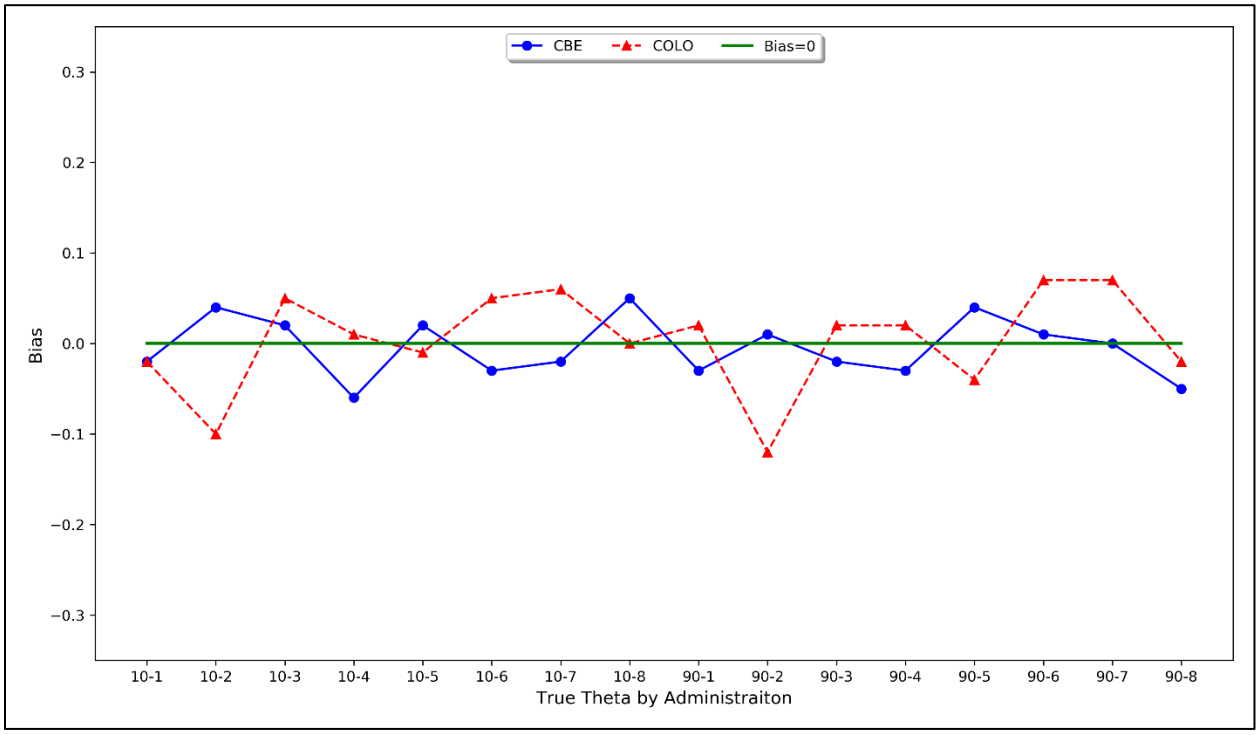

Figure B.16. Plot for RMSE: Science 3–5

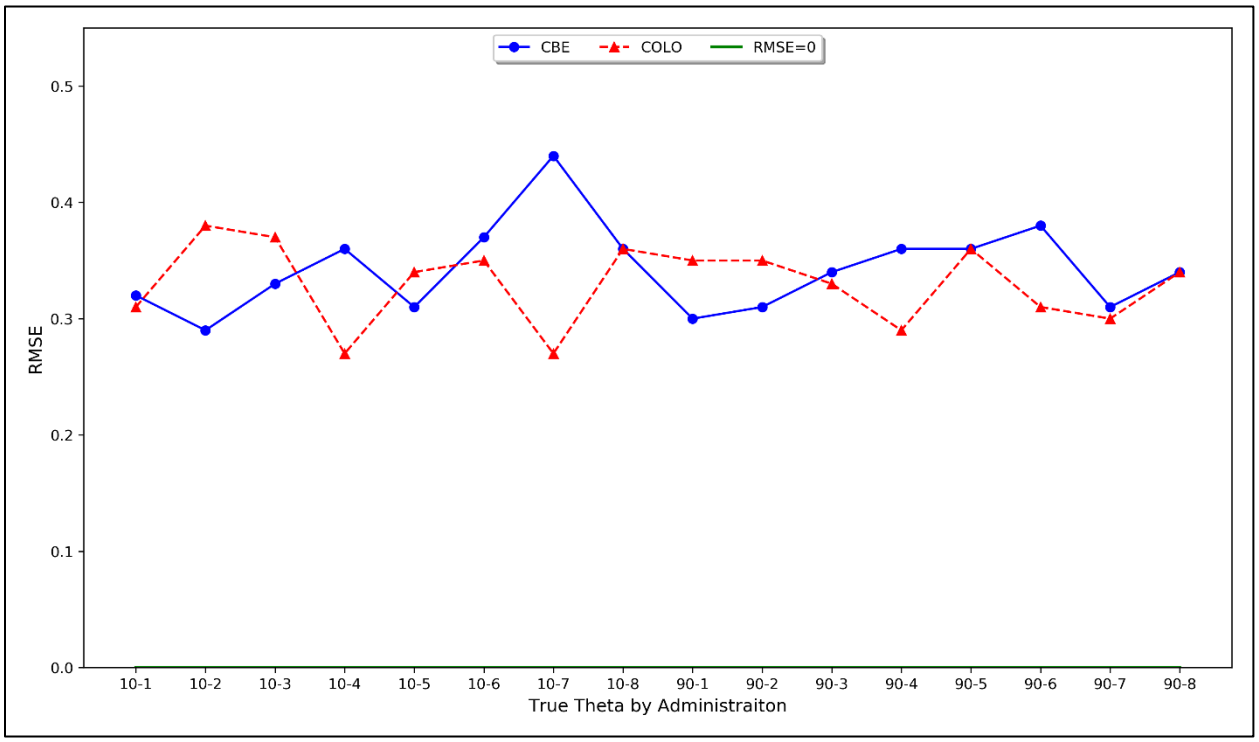

Figure B.17. Plot for Bias: Science 6–8

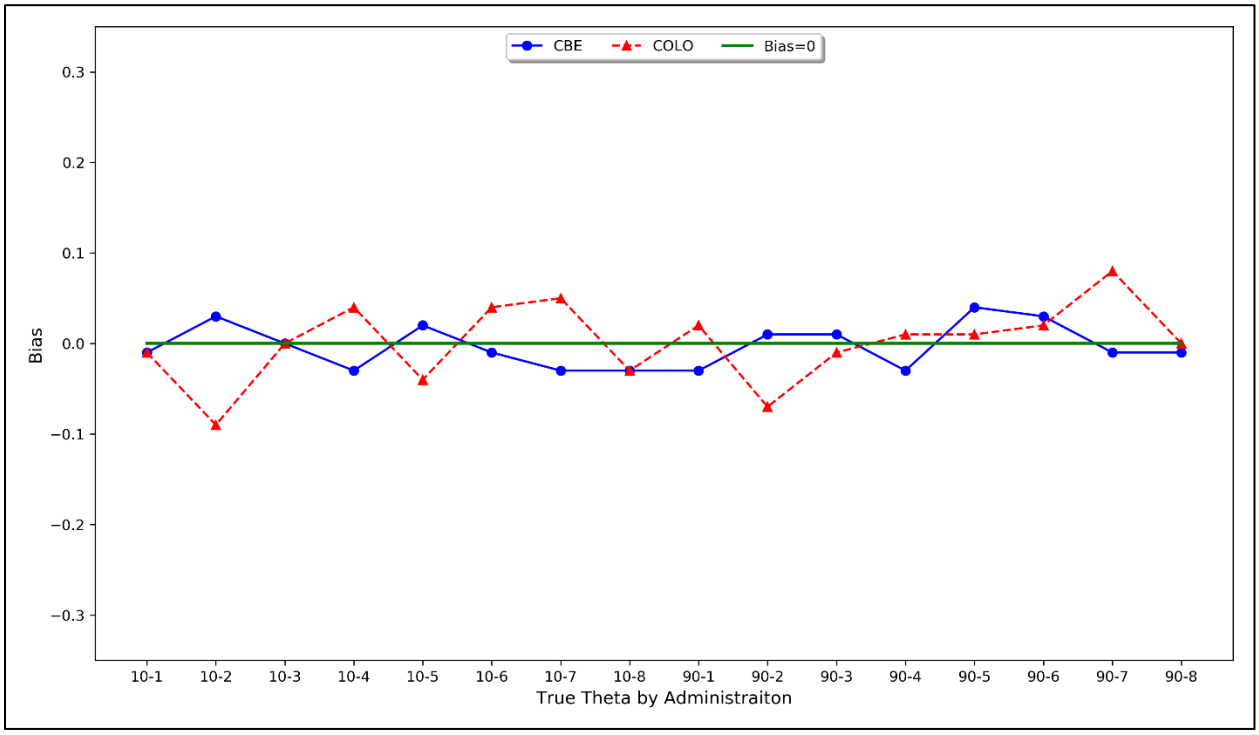

Figure B.18. Plot for RMSE: Science 6–8