Colorado Alternate (CoAlt) Science Assessment Technical Report

2023–2024

Foreword

This technical report documents the evidence of reliability and validity to support test users in evaluating the intended purposes, uses, and interpretations of the test scores for the Spring 2024 administration of the Colorado Alternate (CoAlt) Science assessment. The evidence includes descriptions of the test design, development, and administration procedures; the student test results; and psychometric analyses including calibration, equating, and scaling to ensure that the test results can be compared across different test forms and administrations. The report adheres to industry best practices and follows the guidelines of the *Standards for Educational and Psychological Testing* (AERA et al., 2014).

The Colorado Department of Education's vision is to create an equitable educational environment where all students and staff in Colorado thrive. Their role is to improve student outcomes and ensure that students and families across Colorado have access to high-quality schools by providing actionable support to local educational agencies, implementing policy and legislation in an effective way, and sharing the experiences of local educational agencies and students.

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Chapter 1: Introduction

The purpose of this technical report is to inform users and other interested parties about the development, administration, and technical characteristics of the Spring 2024 Colorado Alternate (CoAlt) assessment administered in science to students with the most significant cognitive disabilities to measure their mastery of the Extended Evidence Outcomes (EEOs) of the Colorado Academic Standards (CAS) and comply with state and federal accountability requirements.

1.1. Assessment Overview

The Colorado Measures of Academic Success (CMAS) assessments are Colorado's end-of-year standards-based assessments designed to measure student achievement of the grade-level CAS. To ensure the participation of students with the most significant cognitive disabilities, Colorado also administers the CoAlt Science assessments as their end-of-year alternate assessment administered each spring in grades 5, 8, and 11 to measure student achievement of Colorado's alternate academic achievement standards (the EEOs of the CAS).

The CoAlt Science assessment is designed for students with the most significant cognitive disabilities who have significant limitations in cognitive functioning and deficits in adaptive behavior. These students may also exhibit limitations in communication, response methods, attention span, and short-term memory. The CoAlt English Language Arts (ELA) and Mathematics assessments are administered by the Dynamic Learning Maps (DLM) consortium and documented in a separate technical report located online at https://dynamiclearningmaps.org/publications. The social studies assessments have not been administered since 2014 for high school and 2019 for grades 4 and 7 due to legislative decisions.

The CoAlt Science assessment includes paper-based test books used by the test administrator to administer test items to the students. Each assessment is administered one-on-one and can be split over as many sessions/days as appropriate for the student. The test books are designed to sit on the table, allowing the test administrator to read the item to the student while the student views the answer options. The test books include scripted text for the test administrator to follow as they read the item stems and answer options to the student. There is flexibility for presentation and response based on the student's mode of communication, but the script and order in which the answer choices are presented to the student must remain the same.

Each test form is administered as a fixed-form assessment, meaning all students receive the same set of operational items in a predetermined order but different embedded field test items depending on which test form they receive. The purpose of field testing is to administer newly developed items to generate item statistics and assess their eligibility to become operational. The field test items do not count toward a student's score.

The assessment includes 1-point selected response (SR) and 3-point supported performance task (SPT) item types. The test administrator marks a student's responses to the 1-point SR items (A, B, C, D, or NR when there is no response from the student) and indicates their assigned scores for the 3-point SPT items (0, 1, or NR) in the scannable answer document that is then returned to Pearson. The 1-point SR items are machine-scored, whereas each of the three prompts in an SPT item had already been scored by the test administrator using the built-in rubric to evaluate student performance.

Student results are reported as an overall scale score and performance level, with the percentage of points earned provided for Physical Science, Life Science, Earth and Space Science, and the Science and Engineering Practices (SEPs). The assessments have four performance levels: *Emerging, Approaching Target, At Target,* and *Advanced*. Students in the top two performance levels are considered ready for continuing study in the content area.

1.2. Background

The CoAlt assessments follow the direction of the Office of Standards and Instruction (SIS) and Exceptional Student Services Unit (ESSU) at the Colorado Department of Education (CDE). A key element in the Every Student Succeeds Act of 2015 (ESSA) is that alternate assessments must be aligned with the content standards for the grade level in which the student is enrolled. The CAS for science were originally adopted in December 2009. On August 3, 2011, the State Board of Education adopted the EEOs of the CAS for students who qualify for an alternate assessment. In partnership with Colorado educators and Pearson, CDE developed the CoAlt Science assessments to evaluate student mastery of the EEOs in science for students with the most significant cognitive disabilities. For eligible students, these end-of-year assessments provide an indicator of student progress toward the EEOs of the CAS, known as the alternate academic achievement standards.

The first operational administration of the CoAlt Science assessments occurred in Spring 2014 for grades 5 and 8 and in Fall 2014 for grade 11. The Spring 2020 CoAlt administration was cancelled due to the COVID-19 pandemic. In 2021, Colorado received a partial waiver of the federal assessment requirements from the U.S. Department of Education (USED) due to COVID-19 conditions in Colorado. With the exception of students with a parent/guardian excusal, only students in grades 8 and 11 took the CoAlt Science assessment.

In 2022, newly revised CAS were implemented for mathematics, ELA, and science. In 2008, Colorado passed Senate Bill 212 (also known as CAP4K) that required the State Board of Education to adopt content standards that prepare students for the 21st century workforce and for active citizenship upon receiving a high school diploma. It also required a revision to the CAS by July 1, 2018, and every six years thereafter. As such, the 2009/2010 CAS were reviewed and revised, resulting in the 2020 CAS. While minimal changes were made to the mathematics and ELA CAS, the science CAS underwent a substantial update to keep up with the shift to the Next Generation Science Standards (NGSS; NGSS Lead States, 2013). After the CAS were adopted, a committee of both special and content educators convened to adapt the Evidence Outcomes (EOs) from the 2020 CAS to the EEOs to which the CoAlt is aligned.

Schools were asked to complete full instructional implementation of the new three-dimensional science standards by 2021–2022, with item development for the new CoAlt Science assessment beginning in Spring 2021. Colorado students saw items aligned to the 2020 CAS for the first time in Spring 2022. The new assessment was administered to all tested students, which made it possible to test enough new content to allow for a robust item bank and to obtain a sufficient sample of students to conduct field test analyses. Standard setting was conducted in Fall 2022 so full results with scale scores and performance levels could be reported for the Spring 2023 administration. While the Spring 2022 CoAlt Science assessment reported percentile ranks only, all subsequent administrations have reported scale scores and performance levels.

Item reductions were made to the Spring 2023 grade 5 blueprint to address timing concerns from CoAlt educators. In Spring 2024, the grades 8 and 11 test blueprints were also reduced to lower administrative and testing burden for this population based on feedback from educators. The blueprints were a proportional reduction of the Spring 2023 blueprints. In addition to the reduced blueprints for grades 8 and 11, all CoAlt Science assessments had fewer embedded field test items to address teachers' concerns about administrative and testing burden across all CoAlt Science assessments.

1.3. Purpose of CoAlt

The goals of the Colorado Assessment System, including CoAlt, are to measure and support student progress toward the content standards; provide students, parents/guardians, and other stakeholders with information regarding student achievement; and gauge the quality and efficiency of educational programs in public schools. The primary purpose of the CoAlt assessment is to determine the level at which Colorado students with significant cognitive disabilities meet the EEOs of the CAS. CoAlt also promotes improved instruction toward grade-level expectations, growth over time toward independent performance, and high expectations toward achievement in the content areas. CoAlt results may be used in many ways, including to

- inform instruction in the classroom;
- inform district and school leaders about potential programming and instruction priorities;
- provide the community with information on how well the state's education system is meeting the goals of helping every student attain academic proficiency in accordance with Colorado's alternate standards;
- provide aggregated data for the state's accountability system; and
- allow students to demonstrate their mastery of skills and concepts in the EEOs.

1.4. Testing Requirements

All public schools in Colorado are required by state law to administer the standards-based summative assessment each year in specified content areas and grade levels to comply with the federal accountability requirements as stated in ESSA. ESSA also specifies that states must provide an alternate assessment when implementing statewide accountability systems to help ensure the inclusion of all students in a state's accountability system, and the Individuals with Disabilities in Education Act of 2004 (IDEA) mandates that all students have access to the general curriculum and be included in each state's accountability system.

A very small number of students with the most significant cognitive disabilities who cannot participate in the CMAS assessment, even with accommodations, may take the CoAlt assessment. These students must be identified as having a most significant cognitive disability, although Intellectual Disability does not have to be the student's primary disability label for IDEA eligibility. CoAlt participation is determined by a student's Individualized Education Program (IEP) team that decides whether the student meets the criteria in the alternate academic achievement standards and the Alternate Assessment Participation Guidelines Worksheet provided in Appendix A.[1]

[1] The participation guideline worksheet is also available online at http://www.cde.state.co.us/cdesped/accommodationsmanual_participationguidelinesworksheet.

The IEP team can decide that the CoAlt assessment is most appropriate if the student meets all the following participation criteria:

- The student has been evaluated and determined to be eligible to receive special education services and has an IEP.
- The student has documented evidence of a most significant cognitive disability.
- The student has a significant cognitive disability.
- The student receives daily instruction based on the alternate academic achievement standards.

In 2015, Colorado passed legislation (C.R.S. §22-7-1013 (8) (a-c)) that allows for parents/guardians to excuse their child(ren) from testing. However, every student, regardless of ability or language background, must be provided with the opportunity to demonstrate their content knowledge through the state assessments.

1.5. Assessment Development Partners

CoAlt assessment activities were conducted collaboratively by CDE, the Colorado educator community, and Pearson, with input and advice from the Colorado Technical Advisory Committee (TAC), as shown in Table 1.1. Each contributor plays a vital role in ensuring that the assessments yield valid and reliable test results. Educator participation in the test development process is critical to ensuring that the assessments are aligned to the EEOs, are appropriate for Colorado students with the most significant cognitive disabilities at the assessed grade level, and are free from bias and sensitivity issues. Recommendations from the TAC have been reviewed, addressed, and incorporated into the assessments.

Table 1.1. Assessment Development Partners

Organization/Group	Roles and Responsibilities
Colorado Department of Education (CDE)	• The administrative arm of the State Board of Education responsible for implementing state and federal education laws • Works closely with Colorado school districts, educators, community stakeholders, and test development partners to develop and administer the state assessments, focusing on creating assessments that serve students, schools, districts, and the community while complying with state and federal legal requirements • Works closely with Pearson on each facet of the assessment, with CDE serving as the ultimate approver of the services and products provided
Colorado Educator Community	• Review items to ensure content alignment and identify potential bias and sensitivity concerns before items are field tested • Participate in data review to review field tested items with statistical parameters outside of normal ranges to determine if the items are acceptable for inclusion in the operational item bank
Pearson	• Primary contractor responsible for the end-to-end assessment cycle services and products • Works closely with CDE throughout the CMAS and CoAlt Science assessment development and administration processes, including item and test development, forms creation, enrollment, packaging and distribution, test delivery, scoring, customer service, standard setting, scoring, score reporting, and psychometric services

Organization/Group	Roles and Responsibilities
Technical Advisory Committee (TAC)	• A group of psychometric, assessment, and special populations experts who provide high-level consulting and expert advice regarding validity and reliability issues on topics such as blueprint design, scaling and equating, mode comparability, scoring, reporting, alignment study feedback, peer review, and standard setting • Included the following members during the 2024 assessment cycle: – Dr. Elliot Asp, Senior Partner, The Colorado Education Initiative – Dr. Jonathan Dings, Executive Director of Student Assessment and Program Evaluation, Boulder Valley School District – Dr. Michael Kolen, Psychometric Consultant – Dr. Suzanne Lane, Professor, University of Pittsburgh – Dr. Martha Thurlow, Director, National Center on Educational Outcomes – Dr. Jon Twing, Chief Scientist, HumRRO

Chapter 2: Test Design

2.1. Alternate Academic Achievement Standards

The EEOs are alternate academic achievement standards aligned to the grade-level 2020 CAS in science but reduced in depth, breadth, and complexity. They can be found online at http://www.cde.state.co.us/CoExtendedEO/StateStandards. The standards are considered three-dimensional in that they incorporate Disciplinary Core Ideas (DCIs), Science and Engineering Practices (SEPs), and Crosscutting Concepts (CCCs). The DCIs encompass the content that occurs at each grade and provides the background knowledge for students to develop sense-making around phenomena in the three standards of Physical Science, Life Science, and Earth and Space Science:

- Physical Science: Students know and understand common properties, forms, and changes in matter and energy.
    - PS1: Matter and its interactions
    - PS2: Motion and stability: Forces and interactions
    - PS3: Energy
    - PS4: Waves and their applications in technologies for information transfer

- Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment.
    - LS1: From molecules to organisms: Structures and processes
    - LS2: Ecosystems: Interactions, energy, and dynamics
    - LS3: Heredity: Inheritance and variation of traits
    - LS4: Biological evolution: Unity and diversity

- Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.
    - ESS1: Earth's place in the universe
    - ESS2: Earth's systems
    - ESS3: Earth and human activity

The SEPs describe how scientists investigate and build models and theories of the natural world or how engineers design and build systems. They reflect science and engineering as they are practiced and experienced. There are eight practices:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

CCCs cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world. They build bridges between science and other disciplines and connect the DCIs and SEPs throughout the fields of science and engineering. There are seven CCCs:

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

The most substantial revision from the 2009 EEOs is the addition of a one-to one correspondence to each EO, thereby increasing the rigor for students with the most significant cognitive disabilities. Prior iterations of the EEOs had only 1–4 outcomes for each standard. SEPs and CCCs are incorporated into the EEOs, though not all EEOs are three-dimensional. SEPs and CCCs are also assessed within the test items.

The CoAlt Science assessment is administered in grades 5, 8, and 11. Consistent with the standards, the grade 5 assessment assesses the grade-level standards. Because the science standards are articulated by grade band at the middle school and high school levels rather than grade levels, the grade 8 assessment assesses all middle school science standards, and the grade 11 assessment assesses all high school science standards.

2.2. Item Types

The CoAlt Science assessment includes 1-point selected response (SR) and 3-point supported performance task (SPT) item types.[2] The test administrator records student responses to the SR items and their scores on the SPT items on a scannable answer document included with the task manipulatives set provided for each test, which is then returned to Pearson for scoring.[3] SR items are scaffolded items presented in a three-item cluster set (Part A, Part B, and Part C items) that correspond to the same phenomenon-based stimulus but are unrelated to each other. The stimulus provides the phenomenon that students reference to answer each item, and the art is repeated on the student-facing page with each item. The items are organized as follows:

- The first item in the set (Part A) has three picture answer options and is one-dimensional, testing only the DCI from the EEO. These items do not require sensemaking (i.e., the items are DOK Level 1, meaning they are just recall and do not require the student to figure something out).
- The Part B item has three picture answer options and is two-dimensional, requiring sensemaking and testing the DCI and either the SEP or CCC.
- The Part C item has four answer options that are primarily picture-based (and rarely text-based). It is three-dimensional and requires sensemaking.

[2] Sample CoAlt Science items are available online at https://coassessments.com/practice-resources/.
[3] An example of the answer document is provided in the *CoAlt Test Administrator Manual* available online at https://coassessments.com/manuals/.

SPT items consist of three related prompts (i.e., address the same EEO) that students respond to by placing a set of option cards in designated boxes within a chart or graphic. Students may manipulate the option cards independently or indicate the desired placement through their preferred mode of expressive communication, such as verbal directions, pointing, or eye gaze. Test administrators score the student's performance on each prompt using a 1-point scoring rubric that is built into the item (1 if the student responds correctly, 0 if the student responds incorrectly, NR if the student does not respond). The points for the three prompts are added together to provide one score for the SPT item. This item type reveals a different level of understanding of specific concepts and skills than those demonstrated through SR items alone. These items are all three-dimensional, are phenomenon based, and require sensemaking.

SPT items are classified as either "give a card" or "find a card." For "give a card" items, the test administrator gives the student a card to place in a table or other graphic organizer. The tasks have three answer cards, all of which are used. For "find a card" items, the test administrator asks the student to search for a card of four provided cards in response to an item and place that card in a table or other graphic organizer. In these tasks, four answer cards are provided, but one is not used.

2.3. Test Frameworks and Blueprints

The CoAlt frameworks were developed to better identify the content standards that may be assessed on the CoAlt Science assessments. The frameworks define the elements of the EEOs suitable for state testing and are available at http://www.cde.state.co.us/assessment/newassess-coaltsss. The test blueprints take the frameworks a step further by specifying the number of test items by content standard, grade-level expectation (GLE), EEO, and item type. The specificity of the test blueprints ensures that the assessments cover the breadth of the content indicated by the CAS within the associated grade or grade band. CDE and Pearson collaboratively developed the CoAlt Science test blueprints based on the CMAS blueprints.

The Spring 2022 CoAlt Science timing results showed that most students were completing the test in a reasonable amount of time. However, to address timing concerns from educators before the first operational administration, item reductions were made to the Spring 2023 grade 5 blueprint. After the Spring 2023 administration, CDE received more feedback from CoAlt educators expressing concern about the administrative load of the high school assessment. As a result, CDE implemented a reduced blueprint in grades 8 and 11 in Spring 2024 to reduce administrative and testing burden for this population. The grade 8 blueprint was reduced given that it mirrors the high school blueprint.

This blueprint reduction is also in line with those made for CMAS Science in grade 11. Like CMAS Science, the Spring 2024 CoAlt Science grades 8 and 11 blueprints were a proportional reduction of the Spring 2023 blueprints. Teachers were still able to divide the test administration over as many sessions/days as appropriate for the student. In addition to the reduced blueprints for grades 8 and 11, all CoAlt Science assessments had fewer embedded field test items to allow teachers' concerns about administrative and testing burden to be addressed across all CoAlt Science assessments.

While the complete blueprints are used internally, Table 2.1 presents the high-level CoAlt Science blueprints that summarize the number of items and percentage of score points on each test.

Table 2.1. 2024 CoAlt Science Test Blueprints

Grade	Subclaim	#Item Sets	Total #Items	#1-Point SR Items	#3-Point SPT Items	Total #Points	% of Total Points
5	Physical Science	4	13 (14)	12 (13)	1	15–16	36–38%
	Physical Science/Life Science	2	7	6	1	9	21%
	Earth and Space Science	5	16 (15)	15 (14)	1	17–18	40–43%
	Total	11	36	33	3	42	100%
8	Physical Science	4	13	12	1	15	38%
	Life Science	3	10	9	1	12	31%
	Earth and Space Science	3	10	9	1	12	31%
	Total	10	33	30	3	39	100%
11	Physical Science	4	13 (14)	12 (13)	1	15–16	38–41%
	Life Science	3	10	9	1	12	31%
	Earth and Space Science	3	10 (9)	9 (8)	1	11–12	28–31%
	Total	10	33	30	3	39	100%

Note. SR = selected-response, SPT = supported performance task

2.4. Cognitive Complexity

All CoAlt Science items are assigned a Depth of Knowledge (DOK) level that indicates the cognitive complexity of the item. DOK refers to the level of rigor or sophistication of the task in an item designed to reflect the complexity of the CAS. To ensure that the assessments include a deep pool of items that span a full range of cognitive levels and skills, each item was evaluated and tagged with one of the following DOK levels: Level 1: Recall, Level 2: Skill & Concepts, and Level 3: Strategic Thinking. Level 4: Extended Thinking items are not included because the tests do not contain any extended-response items.

2.5. Test Composition

The Spring 2024 test forms included a set of operational items held constant across all forms and a set of embedded field test items differing from form to form. Only the operational items were included in students' final scores. Table 2.2 presents the number of items on each test form, including the number of operational vs. embedded field test items and the total number of possible score points.

Table 2.2. 2024 CoAlt Science Test Designs

Grade	#Test Forms	Total #OP + FT Items	#1-Point OP SR Items	#3-Point OP SPT Items	#1-Point FT SR Items	#3-Point FT SPT Items	Total #OP Points
5	2	50	33	3	12	2	42
8	2	51	39	3	18	0	39
11	2	51	39	3	18	0	39

Note. OP = operational, FT = field test, SR = selected-response, SPT = supported performance task

Chapter 3: Item Development

The CoAlt Science item development follows the same process as the CMAS Science assessment to the extent possible, with modifications to reflect the unique characteristics of the alternate assessment program such as the item types and needs of the student population. CDE relies on input from both general and special education Colorado educators and alternate assessment specialists to ensure that the CoAlt Science assessment is equitable for students and accurately measures the content standards.

The item development process is a tiered, inter-related process that begins with the development of the test blueprints for each grade level, followed by developing the item development plan used to forecast the targeted number of items needed to create a robust item bank that is refreshed over time. Once written, newly developed items go through multiple rounds of review, including contractor, CDE, and Colorado educator content, bias, and data reviews. The Spring 2024 CoAlt Science stimulus and item writing was completed by Colorado educators. Table 3.1 presents the item development activities for the items field tested on the Spring 2024 assessments.

Table 3.1. Item Development Activities

Event	Date(s)
Item Writer Training	January 24–25, 2023
Content and Bias Review	July 18–21, 2023
Data Review	August 1–2, 2024

3.1. Content Management Tool

Pearson's proprietary software, ABBI (Assessment Banking and Building solutions for Interoperable assessments), is used to support the test development processes from initial content authoring through the review cycles. ABBI is the authoritative source for all content, data, and functionality for all CoAlt system components. It serves as the repository where the item bank is housed, item revisions are catalogued, and items and item metadata are uploaded and revised by assessment specialists. Items can be moved into various statuses, each representing a step in the item development process. The items and associated stimuli are tracked, and revisions are recorded from creation through retirement in a secure environment.

Custom development reports can be generated out of ABBI, which allows users to generate Excel reports that capture metadata (e.g., unique item number, task type, cognitive complexity, associated stimulus, item status, item statistics, and comments) useful for analyzing the item bank. ABBI is the source of reference for how and when changes to the item and the metadata have been implemented.

3.2. Item Development Plan

An item development plan is created at the beginning of each item development cycle to determine the number of items needed to construct the assessment based on the test blueprint requirements, informing item development targets that address item shortages. The grade-level item development plans delineate the target number of items per content standard/reporting category, GLE, and EEO and help to forecast the number of items needed to create a robust operational item bank that will be refreshed over time. To accomplish this, the item bank is analyzed and gaps are identified.

3.3. Item Writing

After the test blueprints and item development plans were developed, the teacher item writing process began. SR and SPT items for each assessment were written to measure concepts and skills found in the EEOs. Item writers used various guides and resources developed during specifications development, including the content standards, item specifications, and item writing guidelines.

3.4. Item Review

3.4.1. Internal Review

Once the items were written and entered into ABBI, they underwent a content review at Pearson to evaluate the standard and knowledge-and-skill match, quality of the items, adherence to the universal design principles, cognitive demand, item relevance to the purpose of the test, readability, and appropriateness of graphics. Additional fact-checking was also conducted to ensure the accuracy of item content.

Pearson's editorial team checked items for clarity, correctness of language, appropriateness of language for the grade level, adherence to style guidelines, and conformity with acceptable item writing practices. Editors with content expertise in science also reviewed the items, adding a valuable layer of content validation and fact-checking. Alternate assessment specialists with expertise in the areas of special education and students with disabilities reviewed all items to ensure that they were appropriate for students with significant cognitive disabilities.

Pearson also performed a universal design review to assess item accessibility irrespective of diversity of background, cultural tradition, and viewpoints; evaluate changing roles and attitudes toward various groups; review the role of language in setting and changing attitudes toward various groups; appraise contributions of diverse groups (including ethnic and minority groups, individuals with disabilities, and women) to the history and culture of the United States and the achievements of individuals within these groups; and edit for inappropriate language usage or stereotyping regarding sex, race, culture, ethnicity, class, or geographic region.

These reviews were conducted to ensure that all students would have an equal opportunity to demonstrate achievement regardless of their gender, ethnic background, religion, socio-economic status, or geographic region. Items that were accepted based on the Pearson reviews were re-classified in ABBI as ready for CDE review. CDE then reviewed the items, checking to make sure the content was accurate, the EEO alignment was appropriate, the language was appropriate for the grade level and student population, and the graphics were clear and relevant to the item. Items accepted based on the CDE review were re-classified in ABBI as accepted.

3.4.2. External Content and Bias Review

Items that passed the internal review were included in external content and bias review. Educators reviewed the items for content and bias concerns, evaluating whether they were properly aligned to the content standards and identifying any potential bias in the items while considering the unique needs of students with significant cognitive disabilities. These reviews included content-specific general educators, special educators, and teachers of students who are culturally and linguistically diverse. Items that were accepted based on the educator committee recommendation were re-classified in ABBI as ready for field testing.

3.5. Data Review

After item development was complete, selected items were placed on the operational assessments in embedded field test positions. The goal of field testing is to allow for the evaluation of the quality of the newly developed items through a review of item performance data to determine their inclusion in the operational item pool. To accomplish this, psychometricians performed statistical analyses on the field tested items to evaluate their quality.

Table 3.2 presents the statistical flags applied to the field tested items. Classical statistics included item means (*p*-values), item-total correlations/point biserials, and distribution of responses across answer options or score points, depending on the item type. Differential item functioning (DIF) analyses were conducted on various subgroups (gender, ethnicity, free and reduced lunch, and multilingual learner [ML]) using Mantel–Haenszel Delta DIF statistics (Dorans & Holland, 1992). Classification rules derived from National Assessment of Educational Progress (NAEP) guidelines (Allen et al., 1999) were used to classify items as having either negligible, moderate, or significant DIF. Items were then flagged based on the criteria in Table 3.2, and the flagged items were taken to a data review meeting where a committee of educators reviews the flagged items and their statistics along with student performance data.

Table 3.2. Item Statistical Flagging Criteria

Statistic	Criterion	Possible Indication
P-value	< 0.1 or > 0.9	Very difficult or easy item
Item-total correlation	< 0.15	Poorly discriminating item
Distractor item-total correlation (SR only)	> 0.0	Possible miskey*
Score point percentage (multi-point items only)**	<1% or >50%	Very few students or many students got a certain score
Differential item functioning (DIF)***	B, C	Item could be biased toward a certain student demographic group

*Possible miskey because the key should have a positive item-total correlation
**If a multi-point item has less than 1% for a score point or more than 50% zeros, the item is flagged.
***B DIF indicates moderate DIF, whereas C DIF indicates significant DIF.

During the data review meeting, educators were trained to interpret the statistical information and judge the appropriateness of the flagged items. The committee members used the data as a tool to direct them toward potential flaws in an item and discuss whether there were construct-irrelevant reasons for a data flag. A data flag alone was not the sole reason an item was rejected. Committee members were instructed that their final judgments about the appropriateness or fairness of an item for any individual and subgroup encompassed by the data flag should be based on their expertise with their content area and experience as Colorado educators.

Committee members reviewed each item and recommended whether to accept or reject it. An accepted item indicated that the educators, through their varying expertise, determined that there is not a construct-irrelevant reason for the data flag within the item, whereas a rejected item indicated that the educators determined there was a construct-irrelevant reason for the data flag. Construct-irrelevant reasons for data flags could include issues such as language that is above grade-level or content that is biased against a particular group. In contrast, construct-relevant explanations could be difficult content that is part of the standards or distractors that reflect a very common misunderstanding of the concept covered by the item, which would not be a reason to reject the item.

Following the data review meeting, CDE reviewed the committee's recommendations and made final decisions. Accepted items were moved into "Ready for Operational" status, whereas rejected items were reclassified as "Do Not Use" or "Revise and Re-field Test" to eliminate them from use on an operational test. These items may be modified and field tested again on future test forms. Table 3.3 presents the results of the data review based on Spring 2024 data (i.e., the number of field tested items that were either accepted, accepted for revision and re-field test, or rejected as a result of the data review).

Table 3.3. Data Review Results

Grade	#Accepted	#Accepted for Revision and Re-field Test	#Rejected
5	6	0	1
8	5	1	2
11	7	0	4

Chapter 4: Test Construction

The Spring 2024 CoAlt Science operational test forms in grades 5, 8, and 11 were newly developed by Pearson. The grade 5 blueprint was reduced in 2023, and the grades 8 and 11 blueprints were reduced in 2024 as a proportional reduction of the Spring 2023 blueprints. Appendix K presents the results of an analysis conducted to compare students' 2023 test results based on the 2023 full blueprint to their adjusted scale scores and performance levels based on the reduced 2024 blueprint. Once the test forms were constructed, CDE reviewed the forms, provided feedback, and gave final approval. The following guidelines were used during the Spring 2024 form construction:

- Adherence to the test blueprints
- Efficient and deliberate use of varied content representative of the knowledge and skills in the content standards
- Balance of gender, ethnicity, geographic regions, and relevant demographic factors
- Thorough review of each item to verify that the content is up-to-date and relevant
- Review of the full form, including embedded field test items, for instances of clueing and/or content overlap

After the initial operational items are selected, the assessment specialist verifies that the test form meets the blueprint and specifications (i.e., the required number of items, EEO coverage, and item types). The psychometrician then verifies that the form falls within the psychometric and blueprint parameters and identifies the anchor item set within each operational form. (See Chapter 10 for information about anchor items.)

Once the test form is vetted internally, it is presented to CDE for review. If needed, CDE and Pearson assessment specialists and psychometricians collaborate to finalize the test form. After the operational test form is approved, field test items are selected from the items in ABBI that are coded as ready for field testing. The assessment specialists assemble field test item sets so they comprise the appropriate distribution of standards, item types, topic coverage, and key distributions. They also review item replacement for future years to ensure appropriate item rotation. Items chosen are embedded on the operational test form in a designated location. The specific responsibilities for Pearson and CDE during test construction are outlined below:

- Pearson responsibilities:
  - generate a test construction schedule
  - select and sequence a proposed set of operational items
  - select and sequence a proposed set of anchor items
  - select and sequence a proposed set of field test items
  - conduct content and psychometric reviews of each proposed set of items
  - construct a test map that provides content and psychometric information for each item
  - manage the CDE review process
  - provide the CDE with copies of proposed items and the associated test map
  - revise the proposed item set based on CDE comments
  - document edits/comments provided by CDE

- CDE responsibilities:
  - review and approve item selection based on content and psychometric properties
  - review and approve the test form for layout, item sequencing, and avoidance of cueing

Chapter 5: Test Administration

The CoAlt Science assessments are paper-based assessments administered one-on-one by a test administrator who records student responses on a scannable answer document. The assessments are untimed, and testing may extend over multiple days for a student. The assessment may be stopped or restarted at any time, but once an item is presented to the student, the item should be completed before stopping the assessment. The amount of time it takes the student to complete the assessment is recorded by the test administrator on the answer document after testing is complete. Table 5.1 presents the test administration window, including the release of the CoAlt score reports. (See Chapter 8 for information on reporting.)

Table 5.1. Test Administration Activities

Event	Date(s)
DAC Administration Training	October 2023
Spring 2024 Administration Window	April 8–26, 2024
Reports Released	July 9, 2024

The District Assessment Coordinator (DAC) is responsible for establishing the administration schedule and ensuring that every student taking a CoAlt Science assessment is assessed within the state assessment window. Districts may use the entire state testing window for administration of this assessment, but it is expected that students taking the CoAlt Science assessment will test during the same testing window as their peers taking the CMAS assessments. It is important that scheduling of the assessment is based on the individual needs of the student.

5.1. Manuals

The following manuals were available online at https://coassessments.com/manuals/ to support the CoAlt Science administration:

- The *CoAlt Science Test Administrator Manual* provides instructions for administering and scoring the CoAlt Science assessments and the before, during, and after testing tasks for the test administrator. Test administration policies and procedures, including scoring information, are to be followed as written so that all testing conditions are uniform statewide, ensuring that every student in Colorado receives the same standard directions and scoring during the test administration.
- The *CMAS and CoAlt Procedures Manual* provides instructions for the coordination of the CoAlt Science assessments. Instructions include the protocols that all school staff are to follow related to test security, test administration, and providing accommodations. The manual also includes the tasks to be completed by DACs, School Assessment Coordinators (SACs), and District Technology Coordinators (DTCs) before, during, and after the test administration.
- The *PearsonAccess^{next} Online User Guide* provides guidance for DACs, SACs, DTCs, and student enrollment personnel who use PearsonAccess^{next}, the website used for student registration, test setup, administration preparation, and assessment and data management.

5.2. Test Materials

Table 5.2 presents the paper-based test materials used by the test administrator during the administration of the CoAlt Science assessment, distributed by the SAC, as provided in the *CMAS and CoAlt Procedures Manual*. For the SR items, the student marks/points/indicates their response in the test book, and the test administrator marks the student answer on the answer document. SPT items have cutout cards that the student places/indicates placement of in the correct box in the test book. The test administrator scores the student response and marks the student's score in the answer document.

Table 5.2. Test Materials

Test Material	Description
CoAlt *Test Administrator Manual*	Provides information necessary for the administration and scoring of the CoAlt Science assessment for use by the test administrator. The manual contains the SPT Score Flow Chart for scoring the SPT items.
Test Books	The test administrator uses the CoAlt test book to read the administration script from the test administrator page while the student response pages face the student.
Task Manipulatives	Students use task manipulatives to respond to the SPT items. Prior to testing, test administrators must prepare the task manipulatives by cutting them apart.
Answer Document	The test administrators use the answer document to record student responses during testing. After testing, answer documents are returned to Pearson for scoring.
Secure Return Envelope	Transport test materials between the testing environment and the central storage area in an unsealed secure return envelope. Task manipulatives should be stored and returned in the envelope. (Note: Test books will not fit in the envelopes.)

5.3. Administration Training

Prior to the administration, training of Colorado districts, schools, and teachers was a high priority because the assessments involve specifically developed materials, administration requirements, and score entry steps. Administration training is intended to make sure all individuals involved in the CoAlt Science assessment activities at the school and district levels are prepared to follow administration processes and procedures with fidelity, as well as support adherence to security procedures. CoAlt Science assessment administration and training procedures are standardized to ensure that students receive comparable test results while allowing flexibility to accommodate the unique needs of students in this population. Fidelity to standardized test administration processes and procedures helps to ensure the comparability of resulting scores and accurate interpretation of results.

Test administration procedures were communicated to the appropriate individuals via manuals and virtual and recorded trainings. Thorough trainings were conducted by CDE for DACs and district-based special education staff across Colorado. The virtual trainings contained information regarding proper procedures for administration. Training sessions covered CoAlt Science assessment eligibility requirements, the test design, accommodations, distribution of materials, test security, and PearsonAccess^{next} tasks necessary to set up and administer the assessment and access test results. The trainings were posted on the CDE website at http://www.cde.state.co.us/assessment/trainings-archive. Administration training materials such as web-based modules, slide decks, and manuals were also available on the CDE website for training SACs. After CDE trained DACs and special education staff, these individuals trained SACs and any other individuals within the district who planned to participate in the CoAlt Science assessment administration.

Pearson customer service center staff were also trained to answer questions thoroughly and knowledgeably about the administration, and to escalate inquiries as necessary. A knowledge base of commonly asked questions was created to ensure accurate and consistent responses to school and district personnel. The knowledge base was created by the CDE and Pearson based on information covered in the training materials and manuals. Revisions and additions were made to the knowledge base as needed. CDE met with Pearson daily during the administration window to review questions from districts and ensure that appropriate answers were provided. Policy questions received by the Pearson customer service center were referred to CDE.

5.4. Practice Resources

Colorado Practice Resources (CPRs) were available online at https://coassessments.com/practice-resources/ to help students become familiar with the SR and SPT item types on the CoAlt Science assessments. Each grade has multiple SR clusters and SPT samples. As the assessment system progresses, the CPRs will be updated to reflect the current assessment.

5.5. Accessibility Features and Accommodations

The CoAlt Science assessments were developed to be accessible for students with the most significant cognitive disabilities. Accessibility was considered from the beginning of the test development process and is inherent within the CoAlt Science assessments and administration procedures. For example, CoAlt Science assessments are read aloud to students, and all students are assessed individually. The assessments can also be administered over several days for students who need more time due to limitations in behavioral control, stamina, or communication. Even though the assessments are designed to be accessible, students with disabilities taking the assessments may still require changes to the assessment procedures, or accommodations, to accurately demonstrate their knowledge and skills of the content. This also includes students classified as ML who need language supports to demonstrate their knowledge of the content.

In addition to incorporating accessibility into the assessment, accommodations are also available to students who need additional changes to the test administration to access the assessment. Accommodations provide a student with an opportunity to engage with the assessment while not affecting the reliability or validity of the assessment. Accommodations can be adjustments to the test presentation, materials, environment, or response mode of the student and are based on student need. Accommodations should not provide an unfair advantage to any student. Providing an accommodation for the sole purpose of increasing test scores is not ethical and CDE provides extensive training on how to implement accommodations. Accommodations must be documented in the student's IEP and used regularly during classroom instruction and assessments prior to the assessment window to ensure the student can successfully use the accommodation.

Although accommodations are used for classroom instruction and assessments, some may not be appropriate for use on statewide assessments. As a result, it is important that educators become familiar with the state assessment policies about the appropriate use of accommodations and that districts have a plan in place to ensure and monitor the appropriate use of accommodations. Accommodations for the CoAlt Science assessments could include the following:

- Assistive technology
- Eye gaze
- Modified picture symbols (enlarged pictures and/or pictures of real objects)
- Objects (three-dimensional or representational objects)
- Sign language
- Translation into student's native language
- Other
- None

5.6. Test Security

Test security procedures are put in place to enhance the likelihood that security is maintained before, during, and after assessment administration. For example, materials used during the administration of the assessment are to be kept in locked storage locations when not under the direct supervision of Pearson or approved assessment coordinators and administrators. All district and school personnel involved in the CoAlt Science test administration are required to participate in annual local training. DACs and district special education staff are responsible for overseeing training for the district, including verifying that the SACs are trained. SACs are responsible for ensuring that all individuals involved in handling test materials at the school level are trained and subsequently act in accordance with all security requirements.

A chain of custody plan for materials is required to be written and implemented to ensure that materials are securely distributed from DACs to SACs to test administrators and securely returned from test administrators to SACs and then to DACs. SACs are required to distribute materials to and collect materials from the test administrators each day of testing and to securely store and deliver materials to DACs after testing is completed in accordance with the instructions in the *CMAS and CoAlt Procedures Manual*.

All individuals involved in the test administration are required to sign a security agreement prior to handling test materials, which requires them to follow all procedures set forth in the aforementioned manuals and prevents them from divulging the contents of the assessment, copying any part of the assessment, reviewing test items with the students, allowing students to remove test materials from the testing room, or interfering with the independent work of any student taking the assessment.

PearsonAccess^{next} used during the administration includes permissions-based user role access to all information within the system, including accessing student information and reports. Access to this information is tightly controlled before, during and after test administration, requiring a login ID and password to enter the system.

After all testing is completed at a school, used and unused materials are required to be securely stored and returned to the DAC by the district deadline for shipment to Pearson. DACs are required to report any missing test materials or test irregularities and to complete the appropriate documentation.

5.7. Test Monitoring

During the Spring 2024 administration, five assessment specialists were selected by Pearson and approved by CDE to serve as test monitors who were sent out to a small sample of schools to observe the administration of the CoAlt Science assessments. The assessment specialists were familiar with administering alternate assessments, including CoAlt Science, and with the population of students who take alternate assessments. The test monitor's task was to record several metrics during their observations, including adherence to administration procedures, security measures, and score entry. The observations were scheduled to mitigate any impact on the classroom and will be used to evaluate the training procedures and manuals for the following year.

5.7.1. Training

Prior to monitoring the test administrations, the test monitors participated in training developed by CDE and Pearson via teleconference to ensure that they would be consistent in their methods. The training facilitator reviewed the test monitors' region assignments, the purpose of test monitoring, the test monitor materials, and the expectations of the test monitors. The test monitor materials included materials such as a security agreement form, the *Procedures Manual*, the *Test Administrator Manual*, a test monitor checklist, and an answer document.

5.7.2. Process

Test monitors used a test monitor checklist containing questions related to the test administration and test security to indicate how well test administrators were adhering to the test administration procedures and security measures. The test monitors also transcribed student responses from their observations onto a CoAlt answer document that would later be used to evaluate score entry. Once all observations were completed, the test monitor checklists and transcriptions were returned to Pearson for analysis. Response frequencies were generated for the test monitor checklist questions to evaluate how well test administrators were following the test administration procedures and security measures. To evaluate score entry, the test monitor's student responses were compared to the test administrator's student responses to determine the amount of agreement between the set of responses.

5.7.3. Participation

Pearson and CDE worked together to recruit schools to participate in test monitoring during the Spring 2024 administration. Schools were selected so that the sample of observed students would be representative of the geographic regions of the state and diverse in terms of gender and ethnicity. As shown in Table 5.3, the participating school districts represented five of the eight geographic regions of the state. As shown in Table 5.4 that presents the number of observations conducted (counted once for each student) compared to the total CoAlt Science student population, four students were observed for grade 5, five students were observed for grade 8, and one student was observed for grade 11.

Table 5.3. Number of Participating Schools in Test Monitoring

Geographic Region	Grade 5	Grade 8	Grade 11
Metro	1	1	–
North Central	1	–	1
Northeast	–	–	–
Northwest	1	–	–
Pikes Peak	–	1	–
Southeast	–	–	–
Southwest	–	1	–
West Central	–	–	–

Table 5.4. Number of Participating Students (Observations) in Test Monitoring

Grade	Population N	Male	Female	Sample N	Male	Female
5	458	61%	39%	4	75%	25%
8	473	67%	33%	5	60%	40%
11	421	59%	41%	1	100%	0%

5.7.4. Results

In general, test monitors indicated that the testing environment was appropriate. Test administrators seemed comfortable with the students, were well prepared for administering the test, provided the accommodations needed for the students, and administered the assessment at an appropriate pace. The test monitors also noted that the testing rooms had adequate space, the rooms were free of visible materials that could aid with the test items, and there were no interruptions/distractions in the testing rooms. However, the test monitors noted some challenges. For example, there was an instance of a test administrator not always following the standardized script, and there were instances of some confusion around the process of referring back to the item stimulus. CDE noted the issues and will use the test monitor feedback as part of test administrator training sessions in the next year.

Test monitors also transcribed student responses as part of their observations. To evaluate the transcription, the student responses transcribed by the test monitor and the test administrator were compared to determine perfect agreement (i.e., when the test monitor and test administrator assign the same response to the same item). Test monitors could not always observe the student taking all the test items, such as when students were tested across multiple days, which led to instances where test monitor scores were missing. When this occurred, only the items with responses from both the test monitor and the test administrator were included in the analysis. As shown in Table 5.5 that presents the resulting agreement results for Spring 2024, the perfect agreement rates indicate high levels of agreement between the sets of transcribed student responses.

Table 5.5. Test Monitoring Percent Agreement Rates between Transcribers

Grade	Perfect Agreement	Non-Perfect Agreement
5	99%	1%
8	98%	3%
11	94%	6%

Chapter 6: Scoring

The test administrator marks a student's responses to the 1-point SR items (A, B, C, D, or NR when there is no response from the student) and indicates their assigned scores for the 3-point SPT items (0, 1, or NR) in the scannable answer document that is then returned to Pearson. The 1-point SR items are then machine-scored, whereas each of the three prompts in an SPT item had already been scored by the test administrator using the built-in rubric to evaluate student performance.

6.1. SR Scoring

The SR items are key-based multiple-choice items. Initial scoring expectations are developed during item development and are included in the item review process. The scoring rules and correct responses are included in the items' XML coding. Prior to scoring, key checks are completed for all SR items to verify that the machine is correctly identifying correct and incorrect responses. If there is a discrepancy in the scoring, content experts review the item and adjustments are made as needed. During testing, actual distribution of scores is compared to expected distribution. Further evaluation is completed if a discrepancy is identified.

6.2. SPT Scoring

SPT items consist of three related items called prompts. Students are required to manipulate option cards by placing them in designated areas on a diagram or chart to respond to each prompt. Student performance on each prompt is scored using a 1-point rubric by the test administrator during the administration, as shown in Table 6.1. To administer the item, the test administrator has the student response page and option cards ready for the student to engage with the item. The test administrator then presents the scripted text for the first prompt. Scores are assigned by the test administrator based on the following scenarios:

- If the student responds correctly, they receive 1 point.
- If the student responds incorrectly, they receive 0 points.
- If the student does not provide a response to the prompt, they receive an NR, or no response, that represents 0 points.

Table 6.1. SPT Scoring Rubric

Score Point	Requirement
1	Student responds correctly
0	Student responds incorrectly
NR	Student does not respond

Note. NR = no response, which represents 0 points. This rubric is used for each of the three prompts within each SPT item.

If an incorrect response is given or the student does not respond, the test administrator places the correct option card in the response box and tells the student the correct answer. After the first prompt is completed, the test administrator completes the same steps for the remaining two prompts. For scoring and reporting purposes, the points for the three prompts are added together to provide one score for the SPT item that can range from 0–3 points.

Chapter 7: Standard Setting

To support the interpretation of student results, student performance on the CoAlt Science assessment is described in terms of performance levels as presented in Table 8.1. Standard setting is the process of translating those policy-driven performance standards into scores on the assessment. The purpose of a standard setting study is to determine the boundaries—or cut scores—along the score scale that differentiate student performance among performance levels (e.g., Cizek et al., 2004; Kane, 1994).

Standard setting for the new CoAlt Science assessment aligned to the EEOs of the 2020 CAS took place from October 25–26, 2022, with Colorado educators using a modified version of the Item Descriptor (ID) Matching method (Ferrara et al., 2012), as detailed in the *CoAlt Science 2022 Standard Setting Report* (Pearson, 2024). Three grade-level panels were convened, with a total of 35 educators participating across all panels. The recommendations from the standard setting panels were then presented to CDE and ultimately the Colorado State Board of Education for consideration and final approval on December 14, 2022.

Table 7.1 presents the resulting scale score cut scores for each grade that are used to report student results on the CoAlt Science assessments.

Table 7.1. Performance Level Cut Scores

Grade	*Emerging*	*Approaching Target*	*At Target*	*Advanced*
5	150–224	225–249	250–272	273–350
8	150–224	225–249	250–276	277–350
11	150–224	225–249	250–276	277–350

Chapter 8: Reporting

8.1. Description of Scores

The CoAlt Science reports provide information on student performance in terms of scale scores, performance levels, and percent earned scores.

8.1.1. Scale Scores

A scale score is a conversion of a student's total test score (i.e., the total number of points earned on a test) to a scale that is common to all test forms for that assessment. Scale scores are particularly useful for comparing test scores over time and creating comparable scores when a test has multiple forms. Students taking the CoAlt Science assessment receive an overall test scale score that ranges from 150 to 350, as shown in Table 7.1. In addition to the overall test scale score, an indicator of the range of scale scores a student would likely receive if the assessment was taken multiple times is also provided.

8.1.2. Performance Levels

Performance levels are reported at the overall assessment level. Students are classified into performance levels based on their scale score and the cut scores obtained from standard setting. CoAlt Science has four performance levels: *Emerging*, *Approaching Target*, *At Target*, and *Advanced*.

The performance levels are accompanied by performance level descriptors (PLDs) that articulate what a student should know and be able to do in a particular performance level (e.g., the set of statements describing what it means for a Grade 8 student to reach *At Target* in science. The CoAlt Science assessment uses two types of PLDs: (1) policy PLDs (also known as policy claims) that provide a general idea of what is expected of a student at each level regardless of their grade level, as shown in Table 8.1, and (2) grade-level PLDs that provide detailed descriptions of performance levels by grade level, available online at https://www.cde.state.co.us/assessment/newassess-coaltsss and included on the Individual Student Performance Report and in the *CMAS and CoAlt Interpretive Guide to Assessment Reports*.

Table 8.1. Performance Levels and Policy Claims

Performance Level	*Emerging*	*Approaching Target*	*At Target*	*Advanced*
Policy Claim	Students performing at this level demonstrate an initial understanding of concepts and skills represented by the EEOs of the CAS. They will need extensive academic supports to engage successfully in further studies in the content area.	Students performing at this level demonstrate a limited understanding of concepts and skills represented by the EEOs of the CAS. They will likely need moderate academic supports to engage successfully in further studies in the content area.	Students performing at this level demonstrate a foundational understanding of concepts and skills represented by the EEOs of the CAS. They are academically prepared to engage in further studies in the content area with appropriate supports.	Students performing at this level demonstrate a solid understanding of the concepts and skills represented by the EEOs of the CAS. They are academically well prepared to engage in further studies in the content area with appropriate supports.
Scale Score	150–224	225–249	250–varies*	varies*–350

*varies by grade

8.1.3. Percent Earned

To prevent incorrect interpretations and provide a more generally understood metric, student performance is also reported as the percentage of points earned (i.e., the number of points a student earned out of the total number of points possible) for the content standards (Physical Science, Life Science, and Earth and Space Science) and the SEPs. Unlike scale scores, the percent of points earned scores cannot be compared across years because individual items change from year to year and are not constructed to be comparable in difficulty.

8.2. Score Reports

Two types of score reports are provided to communicate student performance on the CoAlt Science assessments: (a) the student-level Student Performance Report and (b) the aggregate reports. The Student Performance Report provides information about the performance of a particular student. The student's scale score, associated performance level, and percent of points earned are displayed on a one-page report, along with comparative information related to state performance. PLDs are also provided. Student Performance Reports are printed and shipped to districts for distribution to students and parents. Electronic reports are available in PearsonAccess^{next}.

Two types of aggregate reports are produced for schools and districts: Performance Level Summaries and Content Standards Rosters. These reports are produced at the school, district, and state levels and provide summary information for a given school or district. State, district, and school reports are provided electronically through PearsonAccess^{next}. Access to the reports is limited to authorized users.

Appendix B presents a sample Student Performance Report, and examples of each type of aggregate report and a detailed explanation are provided in the *CMAS and CoAlt Interpretive Guide to Assessment Reports*. For a detailed explanation of the information provided in all reports, refer to the *CMAS and CoAlt Interpretive Guide to Assessment Reports* located online at https://coassessments.com/reporting/.

Chapter 9: Test Results and Analysis

9.1. Student Participation

Table 9.1 presents a breakdown of the number of students who took the Spring 2024 CoAlt Science assessment by various demographic characteristics. All forms were administered in paper format. A total of 1,352 students across grades took the assessment in Spring 2024.

Table 9.1. Student Participation N-Count Demographic Distribution

Subgroup	Grade 5	Grade 8	Grade 11
Total	458	473	421
No IEP	*	*	*
IEP	458	473	421
No Accommodation	*	*	*
Accommodation	458	473	421
Am. Indian/Alaska Native	*	*	*
Asian	*	22	*
Black	35	37	31
Hispanic	200	200	190
White	178	183	167
Hawaiian/Pacific Islander	*	*	*
Two or More Races	27	27	18
Missing	*	*	*
No Economic Disadvantage	170	194	184
Economic Disadvantage	288	279	237
Female	178	158	171
Male	280	315	250
Language Proficiency NA	357	367	351
Language Proficiency NEP	66	46	33
Language Proficiency LEP	*	*	*
Language Proficiency FEP	26	45	33
Not Migrant	457	473	417
Migrant	*	*	*

*n-count less than 16

9.2. Performance Results

Table 9.2 presents the scale score performance summary and performance level distributions (i.e., the percentage of students classified into each performance level), and Table 9.3 presents the summary statistics for points earned by subclaim. Appendix C presents the cumulative scale score distributions by grade, Appendix D displays the same information in graphical form, and Appendix E presents the summary statistics for the overall scale scores by demographic subgroup.

Table 9.2. Scale Score Performance Summary and Performance Level Distributions

Grade	N	Mean	SD	Median	%*Emerging*	%*Approaching Target*	%*At Target*	%*Advanced*
5	458	241	35.8	238	30.8	30.8	19.4	19.0
8	473	235	32.0	235	37.4	29.4	24.7	8.5
11	421	235	39.3	235	35.2	30.2	22.8	11.9

Table 9.3. Summary Statistics for Points Earned by Subclaim

Subclaim	Grade	Mean	SD	Min.	Max.	Average % Correct
Physical Science	5	6.8	3.0	0	15	45.59
	8	7.1	2.9	0	15	47.39
	11	6.9	3.7	0	15	46.12
Life Science	5	4.6	2.3	0	9	50.83
	8	7.1	2.9	0	12	58.81
	11	5.7	2.8	0	12	47.76
Earth and Space Science	5	8.3	3.7	0	18	46.09
	8	5.8	2.8	0	12	47.98
	11	4.6	2.3	0	12	38.50

Note. Life Science is Physical Science/Life Science in Grade 5.

9.3. Classical Item Analysis

Table 9.4 presents the overall item difficulty and item discrimination results across all items for each assessment, and Appendix F presents the item-level classical statistics for the Spring 2024 CoAlt Science assessments, including the omit rate, *p*-value, item-total correlation, and the percentage of students earning each score point (SPT items only).

Item difficulty is measured by the *p*-value bounded by 0.0 and 1.0 that indicates how easy or hard an item is. The *p*-value for 1-point items is the proportion of students who answered an item correctly and is calculated by dividing the number of students who got the item correct by the total number of students who answered it. For multiple-point items, the *p*-value is the average item score (i.e., the sum of student scores on an item divided by the total number of students who responded to the item) that is then put on a 0 to 1 scale by dividing the average item score by the maximum number of points for the item. A high *p*-value indicates that an item is easy (high proportion of students answered it correctly), whereas a low *p*-value indicates that an item is difficult. Easy and hard items are both necessary to include on an assessment to balance the test difficulty.

Item discrimination is represented by the item-total correlation (also known as the point-biserial correlation), is bounded by -1.0 and 1.0, and indicates how well an item discriminates, or distinguishes, between low-performing and high-performing students. The item-total correlation is based on the relationship between student performance on a specific item and performance on the entire test based on their test score. Students who do well on a test are expected to do well on a given item, and students who do not do well on a test are expected to not do well on a given item. This means that for a highly discriminating item, students who get the item correct will have a higher average test score than students who get the item incorrect. An item with a high positive item-total correlation discriminates between low-performing and high-performing students better than an item with an item-total correlation near zero. A negative item-total correlation indicates that low-performing students did better on that item than high-performing students.

Table 9.4. Summary of *P*-Values and Item-Total Correlations

Statistic	Grade	#OP Items	Mean	SD	Min.	Max.	Median
P-value	5	36	0.44	0.12	0.17	0.68	0.44
	8	33	0.50	0.15	0.18	0.80	0.49
	11	33	0.45	0.13	0.14	0.77	0.43
Item-Total Correlation	5	36	0.41	0.13	0.11	0.65	0.39
	8	33	0.42	0.12	0.21	0.65	0.42
	11	33	0.42	0.13	0.19	0.68	0.45

Note. SD = standard deviation, Min. = minimum, Max. = maximum

9.4. Subclaim Correlations

The CoAlt Science assessments have three subclaim scores: Physical Science, Life Science, and Earth and Space Science. One way to assess the internal structure of a test is through the evaluation of correlations among subclaim subscores, as presented in Table 9.5. There is evidence of unidimensionality if the components within a content area are strongly related to each other. The intercorrelations between the subclaims were between 0.649 and 0.760, which indicates a moderate to strong relationship between the subclaims. The correlations between Physical Science and Life Science tended to be higher than the correlations of those subclaims with Earth and Space Science. Correlations between the subclaims and the total test ranged from 0.778 to 0.927.

Table 9.5. Correlations Between Subclaims

Grade	Subclaim	Life Science	Earth and Space Science	Total Test
5	Physical Science	0.649	0.677	0.881
	Life Science	–	0.663	0.843
	Earth and Space Science	–	–	0.911
8	Physical Science	0.670	0.673	0.889
	Life Science	–	0.650	0.879
	Earth and Space Science	–	–	0.875
11	Physical Science	0.760	0.579	0.927
	Life Science	–	0.553	0.891
	Earth and Space Science	–	–	0.778

Note. Life Science is Physical Science/Life Science in Grade 5.

Chapter 10: Calibration, Equating, and Scaling

The item response theory (IRT) Rasch partial credit model (RPCM) was used to develop, calibrate, equate, and scale the CoAlt Science assessments and to maintain and build the item bank. All test analyses including calibrations, scaling, and item model fit were accomplished within the IRT framework. Equating was conducted to place the Spring 2024 test forms on the Spring 2023 base scale for the CoAlt Science assessments. All steps in the calibration, equating, and scaling processes were repeated for each CoAlt Science assessment and were independently replicated by at least two members of the Pearson psychometric team to ensure accuracy.

Calibration is the process of estimating the parameters (such as item difficulty) for each item on an assessment so that all items are placed on a common scale. To maintain the same performance standards across different administrations of a particular test, it is necessary for each administration of the test to be of comparable difficulty. It is not fair to compare students to a common standard if the overall difficulty of the forms changes from year to year. Maintaining test form difficulty across administrations is achieved through equating. Equating adjusts for differences in overall test difficulty of test forms so that the scores resulting from two different administrations can be considered interchangeable.

Equating and scaling typically occur in sequence. First, equating is used to adjust for differences in test difficulty so resulting estimates of student proficiency (i.e., equated raw scores, theta estimates) are on a common metric. The equated estimates of proficiency are then converted to scale scores for reporting purposes.

10.1. IRT Model

For each grade-level assessment, the RPCM was used to place the CoAlt Science items and student proficiency on the same scale. The model is an extension of the Rasch one-parameter IRT model attributed to Georg Rasch (1966), as extended by Wright and Stone (1979), Masters (1982), and Wright and Masters (1982). The RPCM was selected because of its flexibility in accommodating various item types, including the 1-point SR and multi-point SPT items. The RPCM maintains a one-to-one relationship between scale scores and raw scores, meaning each raw score is associated with a unique scale score. It is the underlying Rasch scale that allows for comparisons of student performance across years and facilitates the maintenance of equivalent performance standards across years.

The RPCM is a mathematical measurement model with a single item parameter relating a student's performance on a given item involving m+1 score categories. The probability of student n scoring x on m steps of item i is a function of the student's performance level, θ_n (also referred to as "ability"), and the step difficulties, δ_{ij} of the m steps in question i as follows:

$$P_{xni} = \frac{exp \sum_{j=0}^{x} (\theta_n - \delta_{ij})}{\sum_{k=0}^{m_i} exp \sum_{j=0}^{k} (\theta_n - \delta_{ij})}, x = 0, 1, \ldots m_i$$

10.2. Data Preparation

Prior to any analyses, several steps were completed in preparation: (a) the data file containing student responses was verified and exclusion rules were applied, (b) traditional item analyses of all items were conducted prior to calibration, and (c) complete data matrices (CDMs) and incomplete data matrices (IDMs) were created for calibrations. A traditional item analysis of all operational and embedded field test items was conducted prior to calibration. The purpose of this analysis was to obtain classical statistics used to evaluate item performance. The following statistics were calculated: item sample size, response distribution, item mean score, and item-total correlation.

10.3. Calibration

Calibration refers to the estimation of item parameters that places items and students on a common scale. To obtain the Rasch item parameter estimates for the Spring 2024 assessments, the RPCM was applied to the operational and embedded field test items. Winsteps (Linacre, 2021) was used for all grade-level calibrations. All operational items within a grade are calibrated concurrently.

10.4. Equating

10.4.1. Operational Equating

Equating is used to place new forms onto the operational base scale. Equating of the operational test forms involves adjusting for differences in the difficulty of forms, both within and across administrations, to ensure that students taking one form of a test are neither advantaged nor disadvantaged when compared to students taking a different form. Each time a new form is constructed, equating is used to allow scores on the new form to be comparable to scores on the previous form. If the IRT models fit the data and the model assumptions are met, item calibration places both items and students on a scale that is independent of any sample of students up to a linear transformation. Equating is used to determine and apply a scale transformation that allows for meaningful comparisons of student performance across different forms or test administrations.

A fixed common items approach was used to equate the Spring 2024 assessments. The operational items used to post-equate the assessments to the base scales are called anchor items. The anchor items are a set of common items that are already equated to the base scale and are placed on forms from adjacent administrations. This set of items represents the test blueprint in terms of content and item types and represents approximately 30% of a full test form. To obtain equated Rasch parameter estimates, anchor item parameter estimates were fixed to their previously equated item parameter estimates before calibrating the remaining non-anchor operational items. This method placed the non-anchor operational items on the same scale as the anchor items.

The stability check for the anchor items was conducted using classical item analysis, scatter plots of item difficulties, and displacement estimates from Winsteps to compare the anchor item performance across years. Displacement estimates greater than or equal to ±0.30 were used as the flagging criteria. Items flagged from the stability check are examined and consideration is given to the impact of flagged item(s) on the content representativeness of the resulting anchor set. A flag alone is not the sole criteria for removing an item from the anchor item set. It is important to also make sure that the remaining anchor set continues to be representative of the overall content and structure of the test. The final anchor sets for grades 5, 8, and 11 represented 33% of the total test points.

10.4.2. Field Test Equating

The field test equating process is similar to operational equating, except the anchor items are the operational items. With this calibration method, the embedded field test items are calibrated with the operational item parameters fixed at their previously estimated values. This process places the field test item parameter estimates onto the operational base scale. All field test items are calibrated concurrently.

10.5. Item-Level IRT Statistics

Appendix G presents the item parameter estimates for each grade. The item numbers are merely identifiers and do not reflect the sequence of items as they were presented to students. The "Model" refers to the IRT model under which the item was estimated (Rasch for all CoAlt assessments). The "B" column shows the item parameter estimate for difficulty, and "D1" through "D4" for the RPCM category threshold estimates. The last two columns reflect the infit and outfit statistics generated from Winsteps. Fit values were reviewed, and no items were removed due to misfit.

10.6. Scaling

After the item parameter estimates were obtained for the operational items for each grade-level assessment, student proficiencies were estimated by conducting an anchored calibration of the operational items' item parameter estimates. Estimates were obtained via the joint maximum likelihood method (JMLE) applied within the Winsteps software program. Student proficiency estimates are generated only for students who meet the attemptedness criteria. To be classified as attempted, a student must respond to at least nine items in section one of the test. The nine items can be operational or field test items.

Student proficiencies were then transformed to scale scores ranging from 150 to 350 using the cut scores determined from standard setting. The CoAlt Science scale scores represent linear transformations of the student proficiencies (θ). The transformation is made by first multiplying any given θ by a slope (a) and then adding an intercept (b). The following linear transformation was used to convert student proficiency estimates into scaled scores (SS):

$$SS = (a*\theta) + b$$

The a and b values are referred to as scaling constants. These scaling constants will be applied each year to the Rasch proficiency estimates for that year's set of operational items. After the scale scores were obtained, the lowest observable scale score (LOSS) and the highest observable scale score (HOSS) for the performance levels were applied. The LOSS and HOSS for the performance levels were set to 150 and 350, respectively. After equating and scaling, a test characteristic curve (TCC) for each grade-level test was created using the new operational item parameter estimates. Appendix H presents plots of the TCCs and each cut score for a given grade is indicated with a red vertical line.

Chapter 11: Reliability

The *Standards for Educational and Psychological Testing* (AERA et al., 2014) refer to reliability as the "consistency of scores across replications of a testing procedure" (p. 33). A reliable test produces stable scores; very similar score distributions would result if the test were administered repeatedly under similar conditions to the same students without memory or fatigue affecting the scores. The level of reliability/precision of scores has implications for validity. In other words, scores must be consistent and precise enough to be useful for intended purposes. If scores are to be meaningful, tests should produce stable scores if the same group of students were to take the same test repeatedly without any fatigue or memory of the test. The range of certainty around the score should also be small enough to support educational decisions. Reliability for the CoAlt Science assessment is evaluated with the following analyses:

- Internal consistency (coefficient alpha)
- Standard error of measurement (SEM)
- Conditional standard error of measurement (CSEM)
- Decision consistent and accuracy

11.1. Internal Consistency (Coefficient Alpha)

Within the framework of classical test theory, an observed test score is defined as the sum of a student's true score and error ($X = T + E$, where X = the observed score, T = the true score, and E = error). A true score is considered the student's true standing on the measure, while the error score reflects a random error component. Thus, error is the discrepancy between a student's observed and true score. Internal consistency is typically measured via correlations among the items on an assessment and provides an indication of how much the items measure the same general construct. High reliability of test scores implies that the test items within a subclaim are measuring a single construct, which is a necessary condition for validity when the intention is to measure a single construct.

The reliability coefficient of a measure is the proportion of variance in observed scores accounted for by the variance in true scores. The coefficient can be interpreted as the degree to which scores remain consistent over parallel forms of an assessment (Ferguson & Takane, 1989; Crocker & Algina, 1986). In the internal consistency method used to estimate reliability for the CoAlt Science assessments, a single form is administered to the same group of students to determine whether students respond consistently across the items within a test. A basic estimate of internal consistency reliability is Cronbach's coefficient alpha statistic (Cronbach, 1951). Coefficient alpha is equivalent to the average split-half correlation based on all possible divisions of a test into two halves. Coefficient alpha can be used on any combination of dichotomous and polytomous test items and is computed as follows:

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum_{j=1}^{n} S_j^2}{S_X^2}\right)$$

where n is the number of items, S_j^2 is the variance of students' scores on item j, and S_X^2 is the variance of the total-test scores.

Coefficient alpha ranges from 0.0 to 1.0, where higher values indicate a greater proportion of observed score variance. Two factors affect estimates of internal consistency: test length and homogeneity of items. The longer the test, the more observed score variance is likely to be true score variance. The more similar the items, the more likely students will respond consistently across items within the test.

Coefficient alpha estimates for CoAlt Science are provided for the overall test and by subclaim, as shown in Table 11.1. The coefficient alpha for the total group was 0.85 across the science assessments. Given the differences in length, it is expected that the coefficient alpha for the overall test will be higher than that of the subscales. Appendix E presents the coefficient alphas by demographic subgroup.

Table 11.1. Coefficient Alpha

Grade	Physical Science	Life Science	Earth and Space Science	Total Test
5	0.64	0.60	0.72	0.85
8	0.60	0.70	0.64	0.85
11	0.75	0.65	0.55	0.85

Note. For Grade 5, the subclaim is Physical Science/Life Science.

11.2. Standard Error of Measurement (SEM)

The SEM is another measure of reliability. This statistic uses the standard deviation of test scores along with a reliability coefficient (e.g., coefficient alpha) to estimate the number of score points that a student's test score would be expected to vary if the student was tested multiple times with equivalent forms of the assessment. It is calculated as follows:

$$SEM = s_x\sqrt{1 - p_{XX}}$$

where S_x is the standard deviation of test scores, and p_{xx} is the reliability coefficient.

There is an inverse relationship between the reliability coefficient and SEM: the higher the reliability, the lower the SEM. Table 11.2 presents the SEM results by subclaim for the CoAlt Science assessment. The SEM values for the total group ranged from 2.94 to 3.08.

Table 11.2. SEM

Grade	Physical Science	Life Science	Earth and Space Science	Total Test
5	1.82	1.45	1.94	3.08
8	1.85	1.59	1.68	2.94
11	1.85	1.65	1.56	2.99

Note. For Grade 5, the subclaim is Physical Science/Life Science.

11.3. Conditional Standard Error of Measurement (CSEM)

While the SEM provides an estimate of precision for an assessment, the CSEM considers how measurement error likely varies across the scale score. In other words, the CSEM provides a measurement error estimate at each score point on an assessment, so the CSEM estimate could be used to indicate what the most likely range of scores would be for students receiving that score if they tested multiple times. The CSEM is defined as the standard deviation of observed scores given a particular true score and is estimated within the IRT framework as the inverse of the test information function. Appendix I presents plots of test information curves (TICs) and CSEM curves across the score scale range.

Because there is typically more information about students with scores in the middle of the score distribution where scores are most frequent, the CSEM is usually smallest, and thus the scores are most reliable, in the middle of the score distribution. An IRT method for estimating score-level CSEM is used because test- and item-level difficulties for CoAlt Science were calibrated using the Rasch measurement model. By using CSEMs that are specific to each scale score, a more precise error band can be placed around each student's observed score. During test construction, CSEMs are reviewed to ensure that they are minimized around the performance level cut scores.

11.4. Decision Consistency and Accuracy

The CoAlt Science scales are divided into four performance levels: *Emerging*, *Approaching Target*, *At Target*, and *Advanced*. Based on a student's scale score, the student is classified into one of the four performance levels. The consistency and accuracy of these performance level classifications is another important aspect of reliability to examine.

The consistency of a decision refers to the extent to which the same classification would result if a student were to take two parallel forms of the same assessment. However, since test-retest data are not available, psychometric models can be used to estimate the decision consistency based on test scores from a single administration. The accuracy of a decision refers to the agreement between a student's observed score classification and a student's true score classification, if a student's true score could be known.

Procedures developed by Livingston and Lewis (1995) were used to estimate the consistency and accuracy of performance level classifications. For the overall test, consistency and accuracy estimates, along with PChance (i.e., the probability of a consistent classification due to chance) and Cohen's Kappa (κ) coefficient (Cohen, 1960), are calculated as follows:

$$K = \frac{P - P_c}{1 - P_c}$$

where P is the probability of consistent classification, and P_c is the probability of consistent classification by chance (Lee et al., 2000).

Table 11.3 presents the kappa interpretations. Table 11.4 presents the decision accuracy and consistency results, and Table 11.5 presents the accuracy and consistency estimates at each cut score.

Table 11.3. Kappa Values

Value of Kappa	Strength of Agreement
< 0.20	Poor
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81 – 1.00	Very Good

Table 11.4. Decision Accuracy and Consistency Estimates

Grade	Accuracy	Consistency	PChance	Kappa
5	0.68	0.59	0.26	0.44
8	0.71	0.62	0.29	0.46
11	0.68	0.58	0.28	0.42

Table 11.5. Decision Accuracy and Consistency of Cut Scores

Statistic	Grade	*Approaching Target* Cut	*At Target* Cut	*Advanced* Cut
Accuracy	5	0.89	0.87	0.91
	8	0.88	0.88	0.94
	11	0.88	0.86	0.92
Consistency	5	0.84	0.82	0.87
	8	0.84	0.83	0.92
	11	0.83	0.81	0.88

Chapter 12: Validity

"Validity refers to the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests" (AERA et al., 2014). As such, it is not the CoAlt Science assessments that are validated but rather the interpretations of the scores. The purpose of the CoAlt Science assessment is to provide information about a student's level of mastery of the EEOs of the CAS. In support of this, this technical report has described processes that were implemented throughout the CoAlt Science assessment cycle with validity and fairness considerations in mind. This chapter describes the various sources of validity evidence as outlined in the *Standards for Educational and Psychological Testing* (AERA et al., 2014), often referencing other chapters and sections of this report. As the CoAlt Science assessments mature, validity evidence supporting the assessments' interpretations will continue to be collected and documented.

12.1. Evidence Based on Test Content

It is important to examine the extent to which the items on an assessment measure the intended construct. The CoAlt Science assessments intend to measure the EEOs of the CAS, and steps are put in place throughout the development process with a focus on this goal, as outlined in Chapter 2 and Chapter 3 of this report. For example, an item goes through numerous reviews to confirm that it adequately aligns to the EEO that it is intended to measure. Statistical bias analyses (i.e., DIF analyses) were also conducted on the items to identify any items that may be measuring a dimension unrelated to the intended construct. The test blueprints were carefully developed with specificity at multiple levels to most optimally measure the EEOs.

An independent alignment study was conducted by the Human Resources Research Organization (HumRRO) in 2023 to provide further evidence to support the claim that the content of the CoAlt Science test items matches the intended content as specified in the EEOs (Revivo et al., 2023). For the study, three panels (one per grade) of Colorado educators were convened to review the alignment between the CoAlt Science items and the EEOs. Every effort was made to recruit panels consisting of teachers reflecting the various demographic subgroups and regions across Colorado. HumRRO applied alignment criteria drawn from the principles of Achieve (2018), Webb (1997, 1999, 2002) and Links for Academic Learning (Flowers et al., 2007). This procedure required the panelists to (a) provide Depth of Knowledge (DOK) ratings for each item, (b) indicate the EEO best aligned to each item, (c) indicate if each item aligned to an SEP or CCC, and (d) indicate if each item was amenable to supports and accommodations.

Overall, the results of the study provide validity evidence to support the claim that the content of the CoAlt Science test items matches the intended content as specified in the EEOs and test blueprint. The panelists' ratings strongly support that the assessment is composed of multidimensional items that reflect a range of the 2020 CAS, although the study also found that the item DOK levels may not reflect the intended distributions found in the blueprint. Finally, items tended to be rated as accessible to a wide range of student groups and amenable to accommodations. The results of the alignment study have been considered during the item development process for subsequent administrations.

12.2. Evidence Based on Response Processes

Evidence based on response processes pertains to the cognitive aspect behind how students respond to items and the processes by which judges or observers evaluate student performance. As part of the test administration, test administrators were asked a set of questions about students' instruction, their communication modes, and their item responses. These results, presented in Appendix J, help support the validity of the students' responses on the assessment.

One of the test validity questions asked teachers if they believe that student responses accurately reflect their understanding of the material. This question provides evidence as to whether teachers believe that students are using their knowledge of the content when responding to the items. The results from this question indicate that most teachers believe that students are using their content knowledge to answer test items, although these results need to be considered in conjunction with the other data related to the number of hours of instruction in the content area, teacher's familiarity with the content and the student, and the characteristics of the student population.

The test validity question regarding students' receptive and expressive communication methods provides evidence to support the test design and the types of accommodations provided on the assessment. The results from this question indicate that most students use oral administration or picture communication to receive information, and they use these same methods when responding to others.

12.3. Evidence Based on Internal Structure

The internal structure of an assessment pertains to the degree to which the items on an assessment measure one underlying construct. When assessments are designed to measure one underlying construct, the internal components of the assessments should exhibit a high degree of homogeneity that can be measured in terms of the internal consistency estimates of reliability. As a result, the internal consistency for the CoAlt Science assessments is evaluated using reliability coefficients as provided in Section 11.1.

12.4. Evidence Based on Relations to Other Variables

Evidence was collected showing the correlation between student scores and variables related to the student. Student test scores were correlated with test administrators' responses in Appendix J for several test validity questions to determine the strength of relationship between the variables. Table 12.1 presents the correlation coefficients between the student scores and these variables, providing validity evidence based on relations to other variables. The test validity questions are variables related to the student (e.g., how familiar are you with this student? How many hours per week does this student spend in instruction on this content area? Approximately how much instructional time for this content area is in the general education classroom?).

As shown in Table 12.1, the correlations between student scores and the familiarity of the test administrator with the student are small and indicate no meaningful relationship between the variables. The correlations between student scores and the instructional hours and instructional time variables are low positive correlations which indicate a relationship between student scores and the instructional hours and instructional time variables. The strength of these relationships will be reviewed for future administrations as test administrators and students have more opportunity to engage with the CAS in the classroom setting.

Table 12.1. Correlation Between Test Validity Questions and Student Scores

Question	Grade	N	Correlation
Familiarity with the Student	5	442	0.02
	8	449	0.06
	11	400	0.04
Hours Per Week in Instruction on the Content Area	5	440	0.19
	8	445	0.27
	11	394	0.09
How Much Instructional Time in the Content Area Is in the General Education Classroom	5	440	0.31
	8	446	0.25
	11	396	0.31

Students who are eligible to take the alternate assessments take the Dynamic Learning Maps (DLM) consortium assessments for ELA and mathematics. Table 12.2 presents the correlations between the CoAlt science scale scores and DLM performance.

Table 12.2. Correlation Between CMAS Science and DLM ELA and Mathematics

Grade	Correlation with DLM ELA	Correlation with DLM Mathematics
5	0.75	0.70
8	0.74	0.67
11	0.72	0.65

12.5. Evidence for Validity and Consequences of Testing

Because state tests are administered "in the expectation that some benefit will be realized from the intended use of the scores" (AERA et al., 2014, p. 19), validity evidence supporting the use and interpretation of CoAlt results may be investigated as a consequence of testing. One intended consequence of testing is that more students will demonstrate mastery over the CAS over time, as evidenced by more students achieving in the top performance levels, if the data are used appropriately to make improvements in programming at the school and district levels. Table 12.3 presents the percentage of students who have reached proficiency on the CoAlt Science assessments over the years. As shown in the table, student performance has improved since the first administration where students' scale scores and performance levels were first reported.

Table 12.3. Student Performance Over Time

Grade	First Administration %*Met or Exceeded*	2024 %*Met or Exceeded*	%Change, First Admin. to 2024
5	35.2	38.4	3.2
8	32.5	33.2	0.7
11	33.0	34.7	1.7

Note. The first administration for science was Spring 2022. The first administration for which scale scores and performance levels were generated for science was Spring 2023.

12.6. Fairness

Fairness is an important aspect of validity, as it is critical that an assessment provide accurate measurements for all students. To that end, the following fairness considerations were woven into the development and administration of the CoAlt Science assessments:

- Sample items that provide the opportunity for teachers and students to become familiar with the test design and scoring of the assessments before experiencing the items on an operational test (Section 5.4)
- Universal design principles that are adhered to during the test development process with the goal of avoiding construct-irrelevant aspects of the assessment that could impact student performance (Chapter 3)
- DIF analyses to identify any items that appear to be unfairly favoring one subgroup over another. All items which show DIF are reviewed by educators for potential bias in the item. (Chapter 3)
- Accessibility tools and accommodations to allow students to fully demonstrate their content knowledge without being hindered by non-construct related elements in addition to being developed to be accessible for students with significant cognitive disabilities (Chapter 2, Chapter 3, Section 5.5)

References

Achieve, Inc. (2018). *Criteria for procuring and evaluating high-quality and aligned summative science assessments*. https://www.nextgenscience.org/sites/default/files/Criteria03202018.pdf

Allen, N. L., Carlson, J. E., & Zelenak, C. A. (1999). *The NAEP 1996 technical report (NCES 1999–452).* National Center for Education Statistics, US Department of Education.

American Educational Research Association (AERA), American Psychological Association (APA), & National Council on Measurement in Education (NCME). (2014). *Standards for educational and psychological testing*. AERA.

Cizek, G. J., Bunch, M. B., & Koons, H. (2004). Setting performance standards: Contemporary methods. *Educational Measurement: Issues and Practice, 23*(4), 31–50.

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory.* Harcourt Brace Jovanovich College Publishers.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334.

Dorans, N. J., & Holland, P. W. (1992). DIF detection and description: Mantel-Haenszel and standardization. In P. W. Holland & H. Wainer (Eds.), *Differential item functioning: Theory and practice* (pp. 35–66). Erlbaum.

Ferguson, G. A., & Takane, Y. (1989). *Statistical analysis in psychology and education* (6th ed.). McGraw-Hill.

Ferrara, S., Perie, M., & Johnson, E. (2008). Matching the judgmental task with standard setting panelist expertise: The item-descriptor (ID) matching method. *Journal of Applied Testing Technology, 9*(1), 1–22.

Flowers, C., Wakeman, S., Browder, D. M., & Karvonen, M. (2007). Links for Academic Learning (LAL): A conceptual model for investigating alignment of alternate assessments based on alternate achievement standards. *Educational Measurement: Issues and Practice, 28*, 25–37.

Kane, M. (1994). Validating the performance standards associated with passing scores. *Review of Educational Research*, *64*(3), 425–461.

Linacre, J. M. (2021). Winsteps® (version 4.8.1.0) [computer program]. Winsteps.com.

Masters, G. N. (1982). A Rasch model for partial credit scoring. *Psychometrika*, *47*(2), 149–174.

National Research Council (NRC). (2012). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press. https://doi.org/10.17226/13165

NGSS Lead States. (2013). *Next generation science standards: For states, by states*. The National Academic Press. https://www.nextgenscience.org/search-standards

Pearson. (2024). *Colorado Alternate (CoAlt) Science 2022 standard setting report*. Report developed under contract for the Colorado Department of Education (CDE).

Rasch, G. (1966). An individualistic approach to item analysis. In P. Lazarfeld & N. W. Henry (Eds.), *Readings in Mathematical Social Science* (pp. 89–107). Science Research Associates.

Revivo, R. Z., Dickinson, E. R., & Borawski, E. A. (2023, October). *Colorado Alternate (CoAlt) Science alignment study report*. Human Resources Research Organization (HumRRO).

Stout, W. F. (1990). A new item response theory modelling approach and applications to unidimensionality assessment and ability estimation. *Psychometrika, 55*, 293–325.

Webb, N. L. (1997). *Research Monograph No. 6: Criteria for alignment of expectations and assessments in science and science education*. Council of Chief State Schools Officers.

Webb, N. L. (1999). *Research Monograph No. 18: Alignment of science and science standards and assessments in four states*. National Institute for Science Education and Council of Chief State School Officers. (ERIC Document Reproduction Service No. ED440852).

Webb, N. L. (2005). *Webb alignment tool: Training manual*. Wisconsin Center for Education Research.

Wright, B. D., & Masters, G. N. (1982). *Rating scale analysis*. MESA Press.

Wright, B. D., & Stone, M. H. (1979). *Best test design*. MESA Press.

Appendix A: CoAlt Eligibility Guidelines

Alternate Academic Achievement Standards and Alternate Assessment Participation Guidelines Worksheet

* For further clarification of terms used in this worksheet, please refer to the companion document *Participation Guidelines: Alternate Academic Achievement Standards for Instruction and Alternate Assessment*

Criterion #1: The student has been evaluated and determined to be eligible to receive special education services and has an IEP.	Response:
☐ Has the student been determined to be a student with a disability eligible to receive special education services under the Individuals with Disabilities Education Act (IDEA)? ☐ Is a current Individualized Education Program (IEP) in place or being developed for the student?	☐ **No. Stop here.** The student must meet Special Education *Determination of Eligibility* criteria in one or more disability categories defined in ECEA Rules http://www.cde.state.co.us/cdesped/IEP_Forms.asp ☐ **Yes.** If both elements can be affirmed, **continue to Criterion #2.**
Criterion #2: The student has documented evidence of a cognitive disability.	**Response:**
☐ During the process of determining eligibility for a student to receive special education services, did the IEP Team review a body of evidence that supports the existence of a cognitive disability?	☐ **No. Stop here.** The student must have documented evidence of the existence of a cognitive disability, regardless of the special education disability category. ☐ **Yes.** Empirical evidence of a cognitive disability is documented in the IEP. **Continue to Criterion #3.**
Criterion #3: The student has a significant cognitive disability.	**Response Options:**
☐ The student's demonstrated cognitive functioning and adaptive behavior in the home, school, and community environments are **significantly below age expectations, even with program modifications, adaptations and accommodations** and ☐ the School Psychologist (or other personnel trained in administering psychometric evaluation) presents evidence that the student's cognitive and adaptive functioning is consistent with that of a student with a **significant cognitive disability***. ***Empirical evidence includes, but is not limited to, formal testing results, multi-disciplinary team evaluations, and other evaluative data.***	☐ **Yes.** Both elements affirm that the student's evaluated performance falls within range of the most **significant cognitive disability**. The student (a) requires extensive, repeated individualized instruction and support that is not of a temporary or transient nature and (b) uses substantially adapted and modified materials and individualized methods of accessing information in alternative ways to acquire, maintain, generalize, demonstrate and transfer academic and functional skills necessary for application in school, work, home and community environments. Daily modified instruction is linked to the enrolled grade level **Colorado Academic Standards Extended Evidence Outcomes (EEOs)**. For students receiving instruction on alternate standards and taking alternate assessment, the IEP must contain measurable annual goals **and** objectives for content areas. **Continue to 4B to select alternate standards-based instruction and appropriate alternate assessment.** ☐ The documented evidence supports the existence of a significant cognitive disability. However the IEP Team determines that with appropriate adaptations (supports and accommodations), the student will receive daily instruction based on the Colorado Academic Standards enrolled **grade-level expectations**. (The student then does not qualify for instruction on alternate academic achievement standards or to take alternate assessment based on alternate academic achievement standards.) **Continue to 4A to select Grade-level standards-based instruction and appropriate grade-level assessment.** ☐ **Yes.** Although the documented evidence supporting the existence of a significant cognitive disability does not fall into the lower ranges, the IEP Team has considered the impact and severity of the disability along with other related factors in order to determine that the student qualifies to receive modified daily instruction based on the Colorado Academic Standards **Extended Evidence Outcomes** (alternate academic achievement standards) and participate in alternate assessment based on alternate academic achievement standards. **Continue to 4B to select Alternate standards-based instruction and appropriate alternate assessment.**

For questions related to this optional worksheet and companion guidance, please contact:
Gina Herrera Herrera_g@cde.state.co.us Exceptional Student Services Unit Colorado Dept. of Education
Rev. 9/15

Alternate Academic Achievement Standards and Alternate Assessment Participation Guidelines Worksheet

Tested Content Areas	4A Instruction and Assessment based on **Grade-Level Academic Achievement Standards** (Grade-level Expectations / Evidence Outcomes)	4B Instruction based on **Extended Evidence Outcomes (EEOs)** and ***Alternate Assessment** based on Alternate Academic Achievement Standards (AA-AAS)
CMAS: Reading/ Writing (ELA) Math Social Studies Science	☐ Grade-level classroom/ district assessments ☐ with accommodation ☐ without accommodation ☐ **State** Summative Assessment ☐ with accommodations allowed for use on state assessment ☐ without accommodation ☐ Unique Request- pending approval by CDE Assessment Unit	☐ Alternate classroom/ district assessments based on alternate standards ☐ Alternate **State** Summative Assessments (Gr. 3-9 and 11) Note: With the passage of IDEA in 1997 and its reauthorization in 2004, it is required that both state and districts provide an alternate assessment for students who cannot participate in general state and district assessments.
Other	☐ ACCESS for ELLs (K-12) ☐ with allowable accommodations ☐ Grade 10 Preparatory Exam ☐ Grade 11 College Entrance Exam	☐ Alternate ACCESS for ELLs (Gr. 1-12) ☐ 10th Grade DLM Alternate Assessment ☐ 11th Grade DLM Alternate Assessment
Dual Assessment	*Dual assessment is NOT an option beginning with the 2014-15 school year. If a student meets the guidelines to receive instruction on alternate standards and take alternate assessment based upon those alternate standards, then ALL tested content areas or other state-mandated assessments required for the student's enrolled grade level, will be ALTERNATE assessments.	

Exclusionary Factors:

The **IEP Team affirms**

- ☐ that annual assessment data was reviewed for each content area and
- ☐ the decision for participation in the Alternate Assessment is NOT based on:
  1. A disability category or label
  2. Poor attendance or extended absences
  3. Native language/social/cultural or economic difference
  4. Expected poor performance on the grade-level assessment
  5. Services student receives
  6. Educational environment or instructional setting
  7. Percent of time receiving special education
  8. English Language Learner (ELL) status
  9. low reading level/academic level
  10. Anticipated student's disruptive behavior
  11. Impact of student scores on accountability system
  12. Administrator decision
  13. Anticipated student's emotional duress

IEP Team Consensus: (Record decision on IEP Form)

☐ **Student meets participation guidelines as a student with a significant cognitive disability and will receive instruction based upon alternate academic achievement standards and participate in alternate assessment as indicated above.**

* For further clarification of terms used in this worksheet, please refer to the companion document ***Participation Guidelines: Alternate Academic Achievement Standards for Instruction and Alternate Assessment***

For questions related to this optional worksheet and companion guidance, please contact:
Gina Herrera Herrera_g@cde.state.co.us Exceptional Student Services Unit Colorado Dept. of Education
Rev. 9/15

Appendix B: Sample Student Performance Report

Confidential Student Performance Report
Spring 2024

Colorado Alternate Assessment
Student: **FIRSTNAME LASTNAME**
SASID: **9999999999** Birthdate: **MM/DD/YYYY**
School: **SAMPLE SCHOOL NAME (9999)**
District: **SAMPLE DISTRICT NAME (9999)**

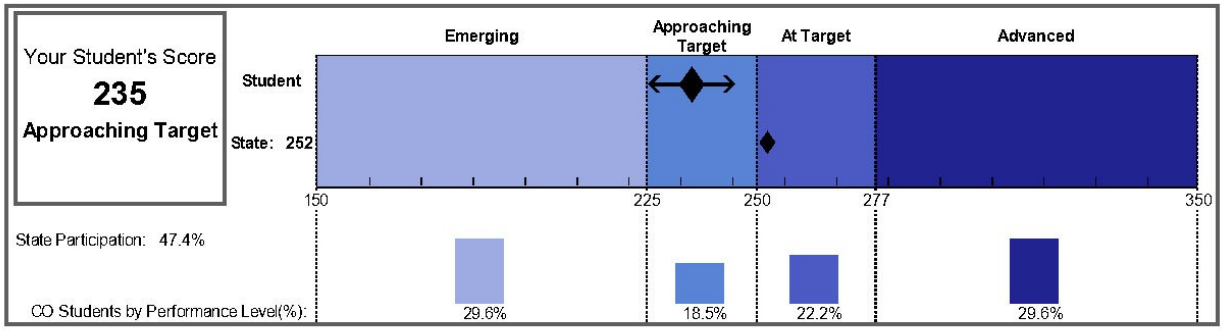
Watch a video about this report!

Science — Grade 8

This Colorado Alternate Assessment (CoAlt) report provides information about your student's understanding of the Extended Evidence Outcomes (EEOs) of Colorado's middle school science standards. Scan the QR code to see a video that will talk you through your student's report.

Your student's performance is shown as:
- A number on a scale between 150 and 350
- A performance level that is described below

As you review this report:
- Review arrows around the large diamond to see where your student may have scored if the assessment was taken multiple times.
- Make state comparisons with caution if participation is low.
- Talk with your student's teacher about your student's progress in science.



Performance Level Description - Approaching Target

FIRSTNAME008 showed a limited understanding of the EEOs of Colorado's middle school science standards and will likely need moderate academic support to successfully engage in the next grade level. Students in the Approaching Target level typically:

- Identify that the amount of or the mass of atoms does not change in a chemical reaction.
- Identify simple molecules, such as water or oxygen gas.
- Identify a device that releases or absorbs heat energy by chemical processes and a device that either minimizes or maximizesheat energy transfer.
- Identify the relative amounts of kinetic and potential energy in a system.
- Identify that different materials can affect the reflection, absorption, or transmission of a light or sound wave.
- Identify how characteristic animal behaviors and specialized plant structures help the plants and animals survive, and identify examples of competitive, predatory, and mutually beneficial relationships between organisms.
- Identify an example of the cycling of matter and energy among living and nonliving parts of an ecosystem.
- Identify that variations of traits in populations increase some individuals' probability of surviving and reproducing and that natural selection works over many generations.
- Identify two locations of similar or different climates.
- Identify that regional climate is based on the region's landforms and latitude.
- Identify that Earth's resources are limited and unevenly distributed.
- Identify gravity as what keeps Earth and the Moon in their orbits and as what draws and holds together the matter making up Earth and the Moon.

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To view a video report and the full version of the performance level descriptor, visit **https://coassessments.com/parentsandguardians/** or access the QR code.

Watch a video about this report!

Information about the Colorado Academic Standards measured by this assessment:
http://www.cde.state.co.us/coextendedeo.

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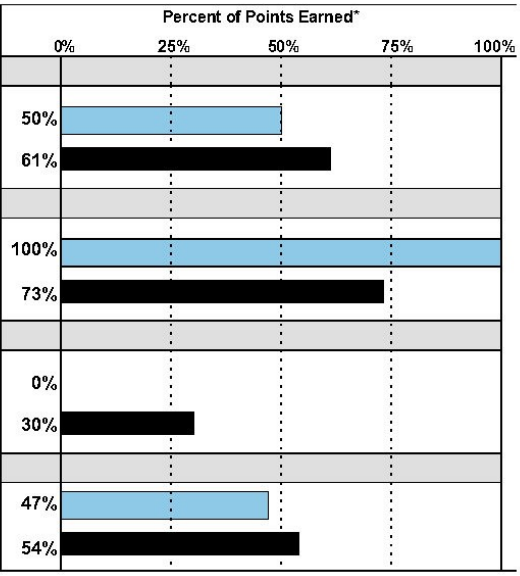
03192024-Z9999999-9999-9999 - 0000000

FIRSTNAME LASTNAME

Content Standard Performance

Content Standard Performance

Reporting Category Description	Points Earned	Points Possible	Percent of Points Earned*
Physical Science			
Common properties, forms, and changes in matter and energy	9	18	50% 61%
Life Science			
Characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment	15	15	100% 73%
Earth and Space Science			
Processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space	0	15	0% 30%
Science and Engineering Practices			
Making sense of the natural world through investigation and problem solving	14	30	47% 54%



*Percent of points earned cannot be compared across years because individual test questions change from year to year. They also cannot be compared across specific areas of science because the number and difficulty of questions may not be the same.

For information on the CoAlt assessment program, visit
http://www.cde.state.co.us/assessment.

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Appendix C: Scale Score Distributions

Table C.1. Scale Score Distribution—Science Grade 5

Scale Score	Freq.	%	Cum. Freq.	Cum. %
150	13	2.84	13	2.84
158	5	1.09	18	3.93
167	1	0.22	19	4.15
175	2	0.44	21	4.59
182	5	1.09	26	5.68
188	4	0.87	30	6.55
194	8	1.75	38	8.30
199	5	1.09	43	9.39
204	11	2.40	54	11.79
209	14	3.06	68	14.85
213	20	4.37	88	19.21
217	20	4.37	108	23.58
222	33	7.21	141	30.79
225	29	6.33	170	37.12
230	31	6.77	201	43.89
234	22	4.80	223	48.69
238	26	5.68	249	54.37
242	16	3.49	265	57.86
246	17	3.71	282	61.57
250	16	3.49	298	65.07
254	15	3.28	313	68.34
258	15	3.28	328	71.62
262	19	4.15	347	75.76
266	8	1.75	355	77.51
270	16	3.49	371	81.00
273	15	3.28	386	84.28
279	9	1.97	395	86.24
284	14	3.06	409	89.30
289	14	3.06	423	92.36
294	9	1.97	432	94.32
300	5	1.09	437	95.41
306	4	0.87	441	96.29
313	8	1.75	449	98.03
320	2	0.44	451	98.47
329	5	1.09	456	99.56
339	2	0.44	458	100.00

Note: Freq. = frequency, Cum. Freq. = cumulative frequency, Cum. % = cumulative percentage

Table C.2. Scale Score Distribution—Science Grade 8

Scale Score	Freq.	%	Cum. Freq.	Cum. %
150	9	1.90	9	1.90
152	2	0.42	11	2.33
162	4	0.85	15	3.17
170	2	0.42	17	3.59
177	5	1.06	22	4.65
183	3	0.63	25	5.29
188	4	0.85	29	6.13
193	8	1.69	37	7.82
197	9	1.90	46	9.73
202	15	3.17	61	12.90
206	19	4.02	80	16.91
209	10	2.11	90	19.03
213	23	4.86	113	23.89
217	19	4.02	132	27.91
221	19	4.02	151	31.92
224	26	5.50	177	37.42
225	26	5.50	203	42.92
231	26	5.50	229	48.41
235	25	5.29	254	53.70
239	21	4.44	275	58.14
242	17	3.59	292	61.73
246	24	5.07	316	66.81
250	16	3.38	332	70.19
254	20	4.23	352	74.42
258	23	4.86	375	79.28
262	21	4.44	396	83.72
267	11	2.33	407	86.05
271	16	3.38	423	89.43
276	10	2.11	433	91.54
277	13	2.75	446	94.29
288	8	1.69	454	95.98
294	8	1.69	462	97.67
302	1	0.21	463	97.89
310	3	0.63	466	98.52
321	3	0.63	469	99.15
336	4	0.85	473	100.00

Note: Freq. = frequency, Cum. Freq. = cumulative frequency, Cum. % = cumulative percentage

Table C.3. Scale Score Distribution—Science Grade 11

Scale Score	Freq.	%	Cum. Freq.	Cum. %
150	21	4.99	21	4.99
152	1	0.24	22	5.23
163	9	2.14	31	7.36
173	5	1.19	36	8.55
181	6	1.43	42	9.98
188	8	1.90	50	11.88
194	15	3.56	65	15.44
200	15	3.56	80	19.00
206	15	3.56	95	22.57
211	18	4.28	113	26.84
216	13	3.09	126	29.93
221	22	5.23	148	35.15
225	15	3.56	163	38.72
230	38	9.03	201	47.74
235	15	3.56	216	51.31
239	18	4.28	234	55.58
244	22	5.23	256	60.81
248	19	4.51	275	65.32
250	21	4.99	296	70.31
257	20	4.75	316	75.06
261	17	4.04	333	79.10
266	13	3.09	346	82.19
271	17	4.04	363	86.22
276	8	1.90	371	88.12
277	11	2.61	382	90.74
286	8	1.90	390	92.64
292	8	1.90	398	94.54
298	6	1.43	404	95.96
305	4	0.95	408	96.91
312	2	0.48	410	97.39
320	4	0.95	414	98.34
330	1	0.24	415	98.57
341	3	0.71	418	99.29
350	3	0.71	421	100.00

Note: Freq. = frequency, Cum. Freq. = cumulative frequency, Cum. % = cumulative percentage

Appendix D: Scale Score Distribution Histograms

Figure D.1. Scale Score Distribution Histogram—Grade 5

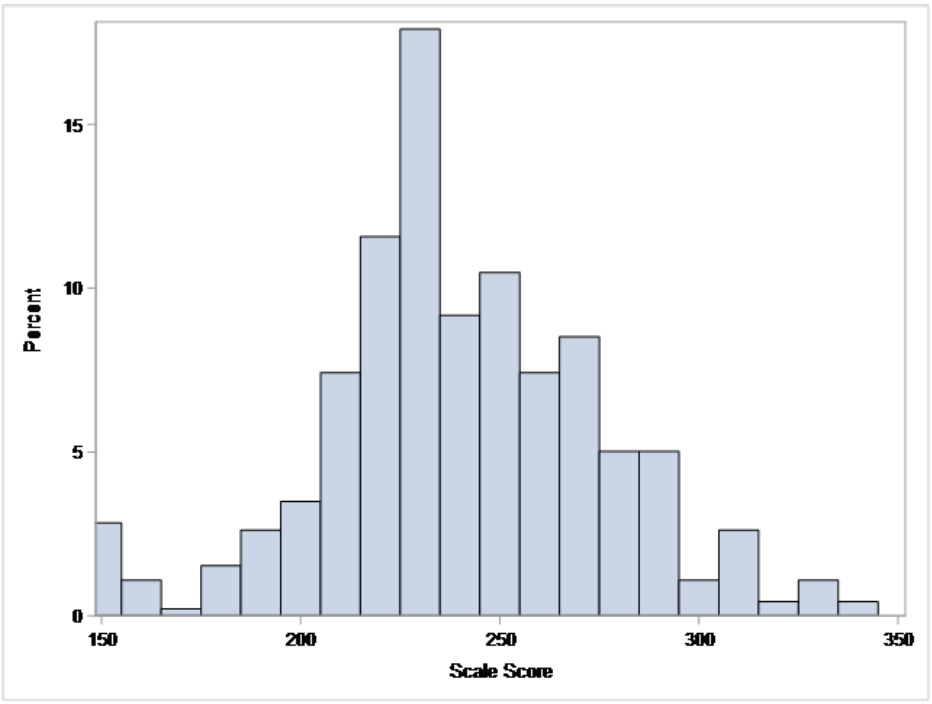


Figure D.2. Scale Score Distribution Histogram—Grade 8

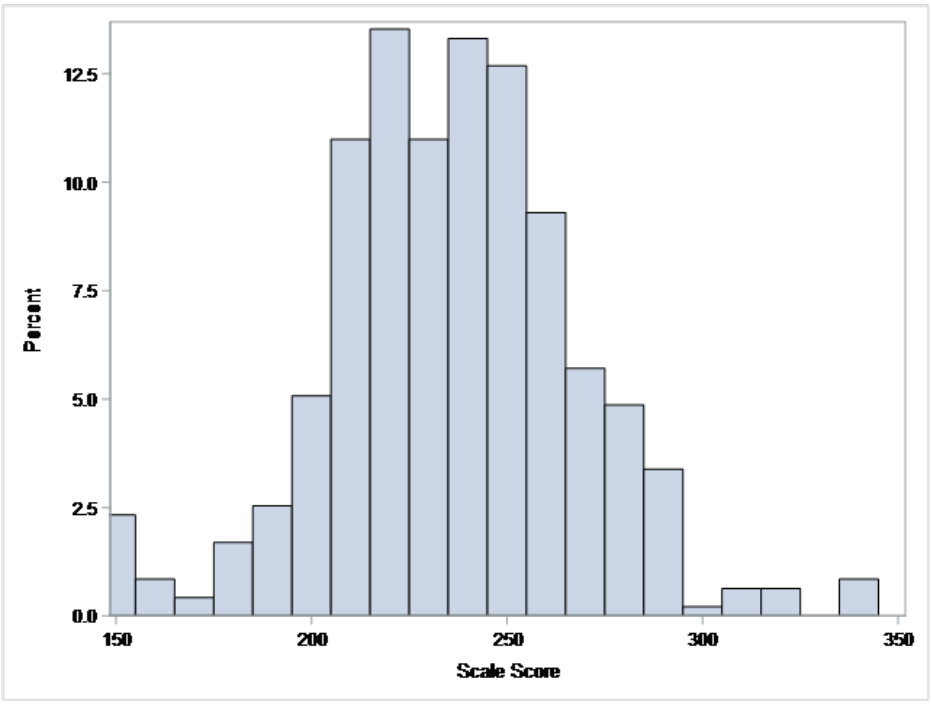
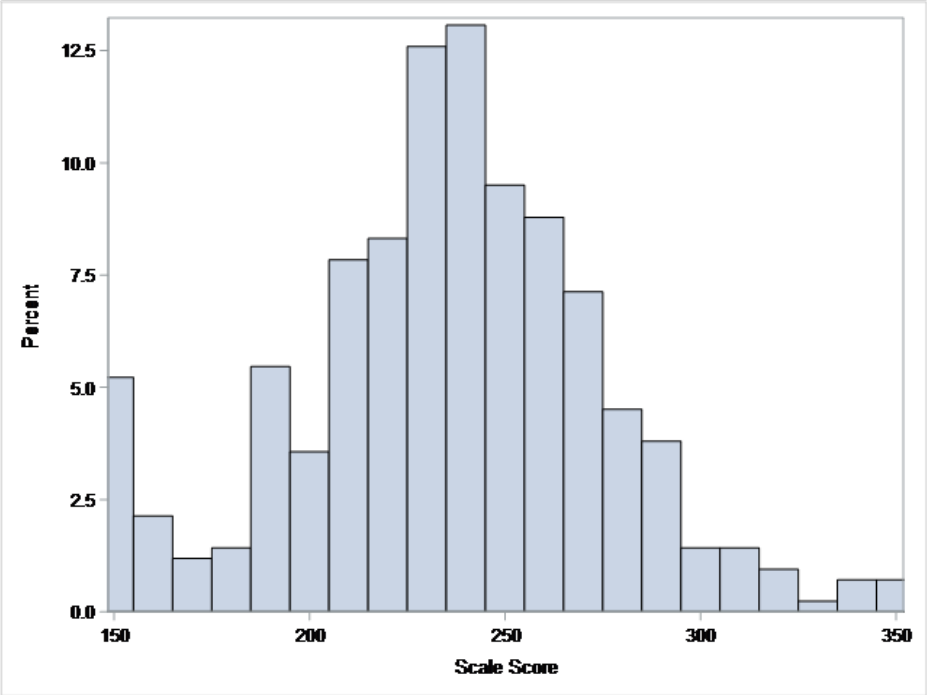


Figure D.3. Scale Score Distribution Histogram—Grade 11



Appendix E: Performance Results by Demographic Subgroup

Table E.1. Scale Score Summary Statistics by Demographic Subgroup—Grade 5

Subgroup	N	Mean	SD	Min.	Max.	Alpha
No IEP	*	*	*	*	*	*
IEP	458	240.56	35.80	150	339	0.85
No Accommodation	*	*	*	*	*	*
Accommodation	458	240.56	35.80	150	339	0.85
Am. Indian/Alaska Native	*	*	*	*	*	*
Asian	*	*	*	*	*	*
Black	35	239.00	37.72	150	329	0.87
Hispanic	200	241.54	34.35	150	339	0.84
White	178	240.65	37.67	150	339	0.87
Hawaiian/Pacific Islander	*	*	*	*	*	*
Two or More Races	27	235.63	38.33	150	313	0.87
Missing	*	*	*	*	*	*
No Economic Disadvantage	170	233.65	31.76	150	320	0.82
Economic Disadvantage	288	244.65	37.44	150	339	0.87
Female	178	238.88	30.96	150	320	0.81
Male	280	241.64	38.58	150	339	0.87
Language Proficiency NA	357	242.57	36.77	150	339	0.86
Language Proficiency NEP	66	229.85	29.47	150	320	0.78
Language Proficiency LEP	*	*	*	*	*	*
Language Proficiency FEP	26	244.15	30.13	175	300	0.79
Not Migrant	457	240.48	35.79	150	339	0.85
Migrant	*	*	*	*	*	*

*n-count less than 16

Table E.2. Scale Score Summary Statistics by Demographic Subgroup—Grade 8

Subgroup	N	Mean	SD	Min.	Max.	Alpha
No IEP	*	*	*	*	*	*
IEP	473	235.38	32.04	150	336	0.85
No Accommodation	*	*	*	*	*	*
Accommodation	473	235.38	32.04	150	336	0.85
Am. Indian/Alaska Native	*	*	*	*	*	*
Asian	22	236.05	32.19	150	321	0.84
Black	37	234.51	35.10	162	321	0.88
Hispanic	200	233.27	30.89	150	336	0.84
White	183	237.28	33.09	150	336	0.85
Hawaiian/Pacific Islander	*	*	*	*	*	*
Two or More Races	27	238.30	31.30	162	294	0.85
Missing						
No Economic Disadvantage	194	234.26	30.98	150	336	0.83
Economic Disadvantage	279	236.16	32.78	150	336	0.86
Female	158	234.56	29.19	150	321	0.82
Male	315	235.80	33.41	150	336	0.86

Subgroup	N	Mean	SD	Min.	Max.	Alpha
Language Proficiency NA	367	236.94	32.37	150	336	0.85
Language Proficiency NEP	46	219.48	31.63	150	277	0.85
Language Proficiency LEP	*	*	*	*	*	*
Language Proficiency FEP	45	241.07	25.66	202	336	0.72
Not Migrant	473	235.38	32.04	150	336	0.85
Migrant	*	*	*	*	*	*

*n-count less than 16

Table E.3. Scale Score Summary Statistics by Demographic Subgroup—Grade 11

Subgroup	N	Mean	SD	Min.	Max.	Alpha
No IEP	*	*	*	*	*	*
IEP	421	234.68	39.33	150	350	0.85
No Accommodation	*	*	*	*	*	*
Accommodation	421	234.68	39.33	150	350	0.85
Am. Indian/Alaska Native	*	*	*	*	*	*
Asian	*	*	*	*	*	*
Black	31	220.29	36.87	150	312	0.84
Hispanic	190	231.51	39.36	150	350	0.85
White	167	241.32	40.28	150	350	0.86
Hawaiian/Pacific Islander	*	*	*	*	*	*
Two or More Races	18	230.06	30.22	163	276	0.76
Missing	*	*	*	*	*	*
No Economic Disadvantage	184	232.85	37.67	150	350	0.84
Economic Disadvantage	237	236.10	40.59	150	350	0.86
Female	171	236.22	37.74	150	350	0.84
Male	250	233.63	40.42	150	341	0.86
Language Proficiency NA	351	237.01	39.08	150	350	0.85
Language Proficiency NEP	33	215.48	42.13	150	292	0.89
Language Proficiency LEP	*	*	*	*	*	*
Language Proficiency FEP	33	231.76	35.89	150	341	0.82
Not Migrant	417	234.61	39.43	150	350	0.86
Migrant	*	*	*	*	*	*

*n-count less than 16

Appendix F: Classical Item-Level Statistics

Table F.1. SR Item Classical Statistics—Science Grade 5

Item	Omit %	*P*-value	Item–Total Correlation
1	0.65	0.43	0.35
2	0.87	0.33	0.35
3	0.87	0.23	0.23
4	0.65	0.46	0.56
5	0.44	0.61	0.39
6	0.44	0.17	0.21
7	0.44	0.39	0.37
8	0.44	0.49	0.38
9	0.44	0.43	0.46
10	0.44	0.49	0.50
11	0.44	0.41	0.55
12	0.44	0.28	0.38
13	0.44	0.63	0.42
14	0.44	0.45	0.22
15	0.87	0.42	0.27
16	0.22	0.56	0.26
17	0.44	0.43	0.52
18	0.87	0.41	0.58
19	0.00	0.56	0.39
20	0.00	0.34	0.37
21	0.00	0.31	0.47
22	0.44	0.50	0.41
23	0.44	0.51	0.31
24	0.65	0.35	0.30
25	0.44	0.43	0.51
26	0.44	0.45	0.46
27	1.96	0.31	0.46
28	0.22	0.44	0.54
29	0.44	0.34	0.52
30	0.22	0.47	0.30
31	0.00	0.48	0.11
32	0.00	0.61	0.26
33	0.22	0.33	0.39

Table F.2. SPT Item Classical Statistics—Science Grade 5

Item	Max. Points	Omit %	0%	1%	2%	3%	*P*-value	Item-Total Correlation
1	3	0.87	9.80	15.47	32.46	41.39	0.68	0.65
2	3	0.00	13.73	17.65	27.89	40.74	0.65	0.64
3	3	0.44	14.16	28.10	41.61	15.69	0.53	0.49

Table F.3. SR Item Classical Statistics—Science Grade 8

Item	Omit %	*P*-value	Item–Total Correlation
1	0.63	0.47	0.52
2	0.63	0.46	0.42
3	0.63	0.39	0.44
4	0.63	0.49	0.40
5	0.63	0.57	0.42
6	0.63	0.42	0.25
7	0.63	0.68	0.57
8	0.63	0.44	0.41
9	0.63	0.44	0.35
10	0.42	0.61	0.55
11	0.21	0.59	0.58
12	0.21	0.49	0.57
13	0.21	0.58	0.30
14	0.21	0.36	0.29
15	0.42	0.34	0.41
16	0.21	0.64	0.46
17	0.21	0.76	0.49
18	1.26	0.29	0.28
19	0.42	0.52	0.38
20	0.42	0.67	0.39
21	0.42	0.20	0.24
22	0.42	0.69	0.46
23	0.42	0.52	0.44
24	0.42	0.18	0.27
25	0.42	0.56	0.64
26	0.21	0.73	0.44
27	0.21	0.42	0.21
28	0.42	0.47	0.32
29	0.42	0.40	0.36
30	0.84	0.23	0.25

Table F.4. SPT Item Classical Statistics—Science Grade 8

Item	Max. Points	Omit %	0%	1%	2%	3%	*P*-value	Item-Total Correlation
1	3	1.05	24.63	30.11	24.63	19.58	0.46	0.56
2	3	0.21	9.26	10.53	11.37	68.63	0.80	0.65
3	3	0.42	22.53	28.21	24.42	24.42	0.50	0.50

Table F.5. SR Item Classical Statistics—Science Grade 11

Item	Omit %	*P*-value	Item–Total Correlation
1	0.47	0.40	0.37
2	0.71	0.39	0.29
3	0.71	0.42	0.27
4	0.71	0.71	0.57
5	0.71	0.27	0.21
6	0.71	0.26	0.27
7	0.71	0.58	0.54
8	0.71	0.29	0.21
9	0.71	0.41	0.45
10	0.24	0.58	0.58
11	0.24	0.48	0.43
12	0.47	0.36	0.20
13	0.24	0.55	0.45
14	0.24	0.33	0.35
15	0.24	0.53	0.53
16	0.24	0.77	0.48
17	0.24	0.14	0.19
18	0.24	0.42	0.41
19	0.24	0.35	0.27
20	0.24	0.46	0.50
21	0.24	0.40	0.52
22	0.24	0.48	0.47
23	0.24	0.49	0.48
24	0.47	0.43	0.50
25	0.47	0.64	0.44
26	0.47	0.33	0.33
27	0.71	0.39	0.42
28	0.00	0.50	0.55
29	0.24	0.43	0.56
30	0.00	0.66	0.49

Table F.6. SPT Item Classical Statistics—Science Grade 11

Item	Max. Points	Omit %	0%	1%	2%	3%	*P*-value	Item-Total Correlation
1	3	0.95	36.26	39.81	18.25	4.74	0.30	0.36
2	3	0.24	23.46	22.99	25.59	27.73	0.52	0.68
3	3	0.47	31.04	25.12	18.25	25.12	0.46	0.61

Appendix G: IRT Item-Level Statistics

Table G.1. Operational Item Parameter Estimates—Science Grade 5

Item	Item Type	Model	B	D1	D2	D3	D4	Infit	Outfit
1	SPT	Rasch	-1.049	0	-0.533	-0.227	0.760	0.86	0.93
2	SPT	Rasch	-0.892	0	-0.444	-0.057	0.501	0.91	0.87
3	SPT	Rasch	-0.515	0	-1.313	-0.284	1.597	1.20	1.19
4	SR	Rasch	0.035	–	–	–	–	1.04	1.07
5	SR	Rasch	0.613	–	–	–	–	1.05	1.09
6	SR	Rasch	1.162	–	–	–	–	1.12	1.20
7	SR	Rasch	-0.232	–	–	–	–	0.85	0.8
8	SR	Rasch	-0.817	–	–	–	–	1.00	1.05
9	SR	Rasch	1.537	–	–	–	–	1.09	1.19
10	SR	Rasch	0.482	–	–	–	–	1.07	1.15
11	SR	Rasch	-0.156	–	–	–	–	1.02	1.01
12	SR	Rasch	0.234	–	–	–	–	0.98	0.94
13	SR	Rasch	-0.226	–	–	–	–	0.90	0.87
14	SR	Rasch	0.130	–	–	–	–	0.86	0.82
15	SR	Rasch	0.840	–	–	–	–	0.99	0.97
16	SR	Rasch	-0.939	–	–	–	–	0.98	0.93
17	SR	Rasch	-0.060	–	–	–	–	1.18	1.23
18	SR	Rasch	-0.006	–	–	–	–	1.11	1.20
19	SR	Rasch	-0.346	–	–	–	–	1.13	1.18
20	SR	Rasch	-0.169	–	–	–	–	0.88	0.86
21	SR	Rasch	0.173	–	–	–	–	0.82	0.77
22	SR	Rasch	-0.571	–	–	–	–	1.01	1.02
23	SR	Rasch	0.492	–	–	–	–	1.01	1.02
24	SR	Rasch	0.473	–	–	–	–	0.87	0.84
25	SR	Rasch	-0.289	–	–	–	–	0.99	0.99
26	SR	Rasch	-0.351	–	–	–	–	1.09	1.07
27	SR	Rasch	0.447	–	–	–	–	1.09	1.11
28	SR	Rasch	0.066	–	–	–	–	0.88	0.89
29	SR	Rasch	-0.049	–	–	–	–	0.94	0.94
30	SR	Rasch	0.656	–	–	–	–	0.91	0.88
31	SR	Rasch	0.014	–	–	–	–	0.86	0.85
32	SR	Rasch	0.481	–	–	–	–	0.86	0.84
33	SR	Rasch	-0.164	–	–	–	–	1.10	1.14
34	SR	Rasch	-0.185	–	–	–	–	1.28	1.33
35	SR	Rasch	-0.865	–	–	–	–	1.12	1.22
36	SR	Rasch	0.384	–	–	–	–	0.95	0.95

Table G.2. Operational Item Parameter Estimates—Science Grade 8

Item	Item Type	Model	B	D1	D2	D3	D4	Infit	Outfit
1	SPT	Rasch	0.109	0	-0.807	0.115	0.692	1.13	1.24
2	SPT	Rasch	-1.226	0	-0.053	0.634	-0.581	0.88	0.65
3	SPT	Rasch	-0.122	0	-0.725	-0.017	0.743	1.33	1.30
4	SR	Rasch	0.097	–	–	–	–	0.89	0.85
5	SR	Rasch	0.148	–	–	–	–	0.99	1.00
6	SR	Rasch	0.478	–	–	–	–	0.95	0.94
7	SR	Rasch	-0.007	–	–	–	–	1.01	1.00
8	SR	Rasch	-0.526	–	–	–	–	1.01	1.01
9	SR	Rasch	0.322	–	–	–	–	1.15	1.17
10	SR	Rasch	-0.932	–	–	–	–	0.84	0.74
11	SR	Rasch	0.187	–	–	–	–	0.99	0.99
12	SR	Rasch	0.252	–	–	–	–	1.05	1.06
13	SR	Rasch	-0.569	–	–	–	–	0.87	0.80
14	SR	Rasch	-0.495	–	–	–	–	0.83	0.77
15	SR	Rasch	-0.039	–	–	–	–	0.84	0.80
16	SR	Rasch	-0.453	–	–	–	–	1.10	1.18
17	SR	Rasch	0.638	–	–	–	–	1.08	1.33
18	SR	Rasch	0.749	–	–	–	–	0.98	0.95
19	SR	Rasch	-0.847	–	–	–	–	0.98	0.94
20	SR	Rasch	-1.183	–	–	–	–	0.82	0.77
21	SR	Rasch	1.189	–	–	–	–	1.16	1.34
22	SR	Rasch	-0.146	–	–	–	–	1.03	1.02
23	SR	Rasch	-0.875	–	–	–	–	1.00	1.04
24	SR	Rasch	1.622	–	–	–	–	1.08	1.22
25	SR	Rasch	-0.847	–	–	–	–	0.91	0.84
26	SR	Rasch	-0.146	–	–	–	–	0.97	0.97
27	SR	Rasch	1.733	–	–	–	–	1.04	1.23
28	SR	Rasch	-0.340	–	–	–	–	0.77	0.71
29	SR	Rasch	-1.273	–	–	–	–	0.95	0.93
30	SR	Rasch	0.322	–	–	–	–	1.20	1.23
31	SR	Rasch	0.107	–	–	–	–	1.09	1.13
32	SR	Rasch	0.307	–	–	–	–	1.02	1.02
33	SR	Rasch	1.388	–	–	–	–	1.06	1.57

Table G.3. Operational Item Parameter Estimates—Science Grade 11

Item	Item Type	Model	B	D1	D2	D3	D4	Infit	Outfit
1	SPT	Rasch	0.742	0	-1.386	0.099	1.287	1.38	1.41
2	SPT	Rasch	-0.407	0	-0.498	0.001	0.497	0.92	0.89
3	SPT	Rasch	-0.164	0	-0.383	0.284	0.099	1.09	1.11
4	SR	Rasch	0.231	–	–	–	–	1.05	1.10
5	SR	Rasch	0.192	–	–	–	–	1.10	1.18
6	SR	Rasch	0.069	–	–	–	–	1.14	1.20
7	SR	Rasch	-1.508	–	–	–	–	0.88	0.79
8	SR	Rasch	0.889	–	–	–	–	1.13	1.28
9	SR	Rasch	0.899	–	–	–	–	1.08	1.10
10	SR	Rasch	-0.708	–	–	–	–	0.89	0.85
11	SR	Rasch	0.764	–	–	–	–	1.17	1.16
12	SR	Rasch	0.127	–	–	–	–	0.96	0.93
13	SR	Rasch	-0.890	–	–	–	–	0.88	0.81
14	SR	Rasch	-0.016	–	–	–	–	1.00	0.98
15	SR	Rasch	0.391	–	–	–	–	1.18	1.27
16	SR	Rasch	-0.566	–	–	–	–	0.96	0.96
17	SR	Rasch	0.528	–	–	–	–	1.04	1.11
18	SR	Rasch	-0.490	–	–	–	–	0.89	0.88
19	SR	Rasch	-1.863	–	–	–	–	0.97	0.88
20	SR	Rasch	1.762	–	–	–	–	1.12	1.16
21	SR	Rasch	0.297	–	–	–	–	1.03	1.01
22	SR	Rasch	0.440	–	–	–	–	1.11	1.21
23	SR	Rasch	-0.055	–	–	–	–	0.92	0.88
24	SR	Rasch	0.186	–	–	–	–	0.88	0.83
25	SR	Rasch	-0.336	–	–	–	–	0.95	0.91
26	SR	Rasch	-0.289	–	–	–	–	0.93	0.89
27	SR	Rasch	0.048	–	–	–	–	0.91	0.88
28	SR	Rasch	-1.027	–	–	–	–	0.99	0.98
29	SR	Rasch	0.600	–	–	–	–	1.07	1.16
30	SR	Rasch	0.234	–	–	–	–	0.98	0.93
31	SR	Rasch	-0.335	–	–	–	–	0.87	0.83
32	SR	Rasch	-0.119	–	–	–	–	0.85	0.80
33	SR	Rasch	-1.157	–	–	–	–	0.95	0.88

Appendix H: Test Characteristic Curves (TCCs)

Figure H.1. TCC—Grade 5

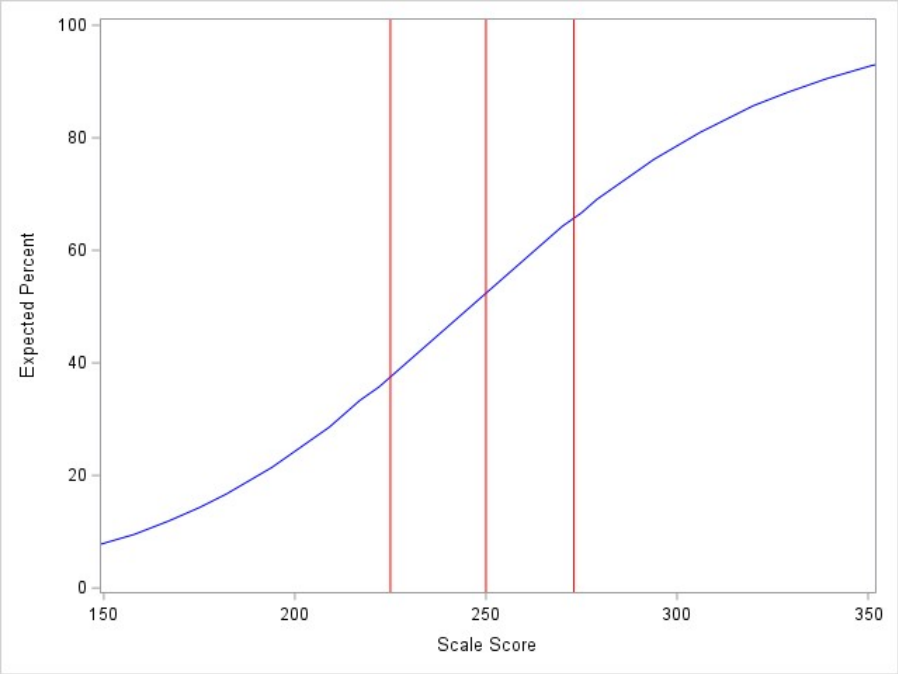


Figure H.2. TCC—Grade 8

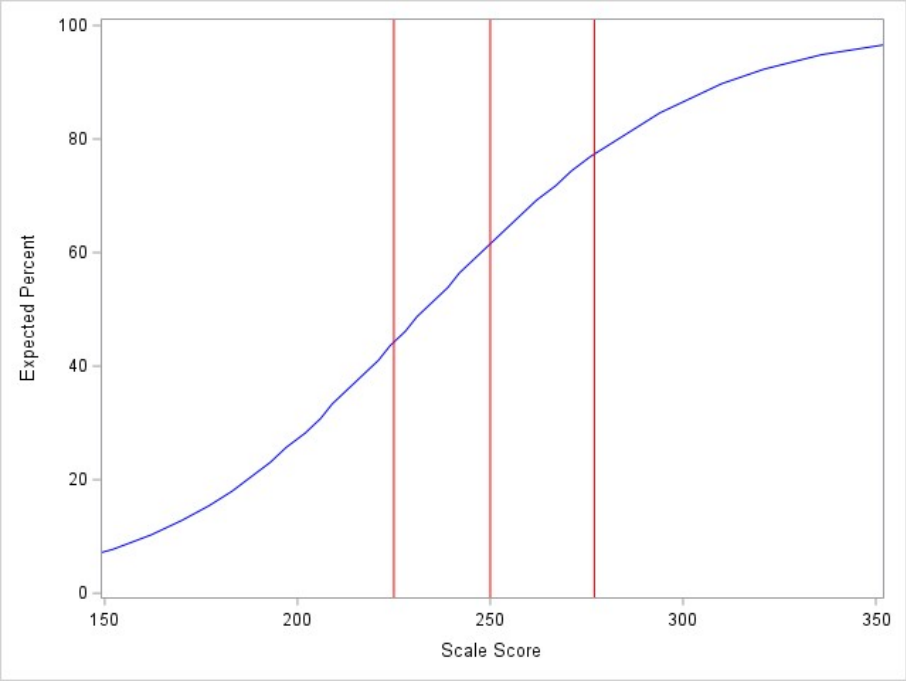
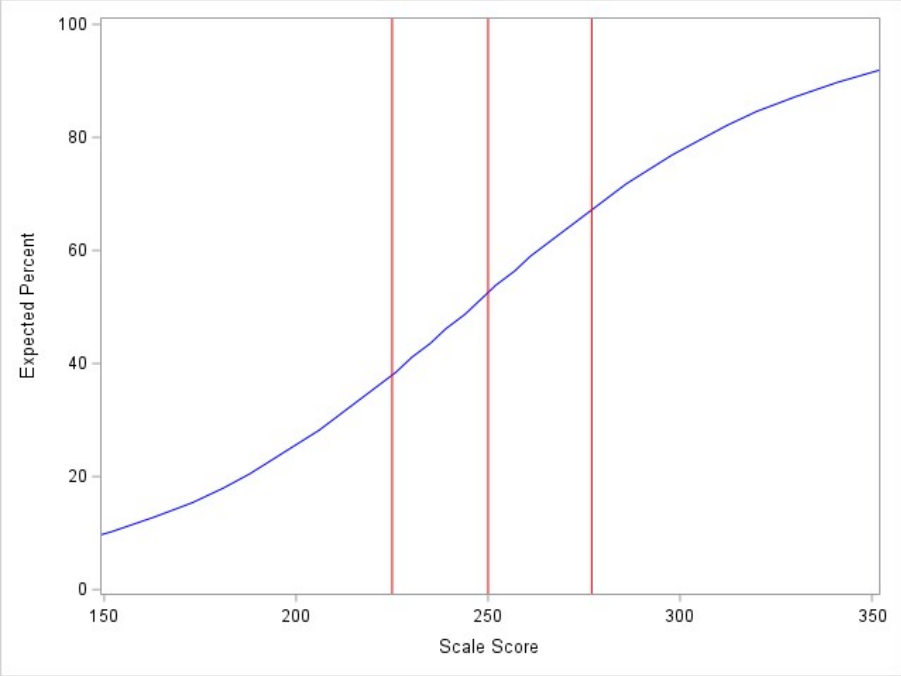


Figure H.3. TCC—Grade 11



Appendix I: Test Information Curves (TICs) and CSEM Curves

Figure I.1. TIC—Grade 5

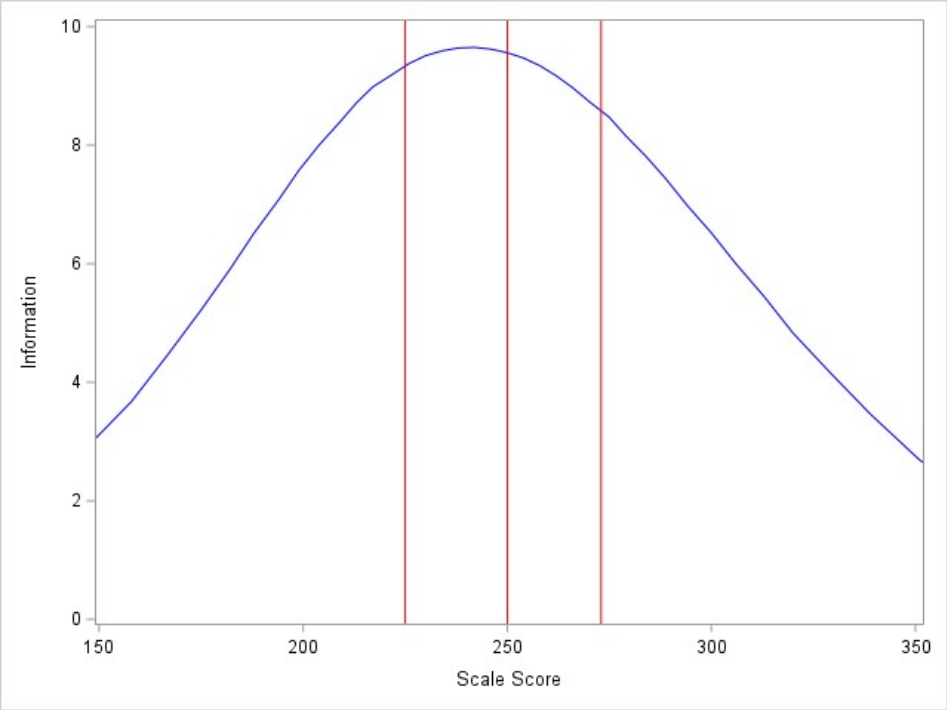


Figure I.2. TIC—Grade 8

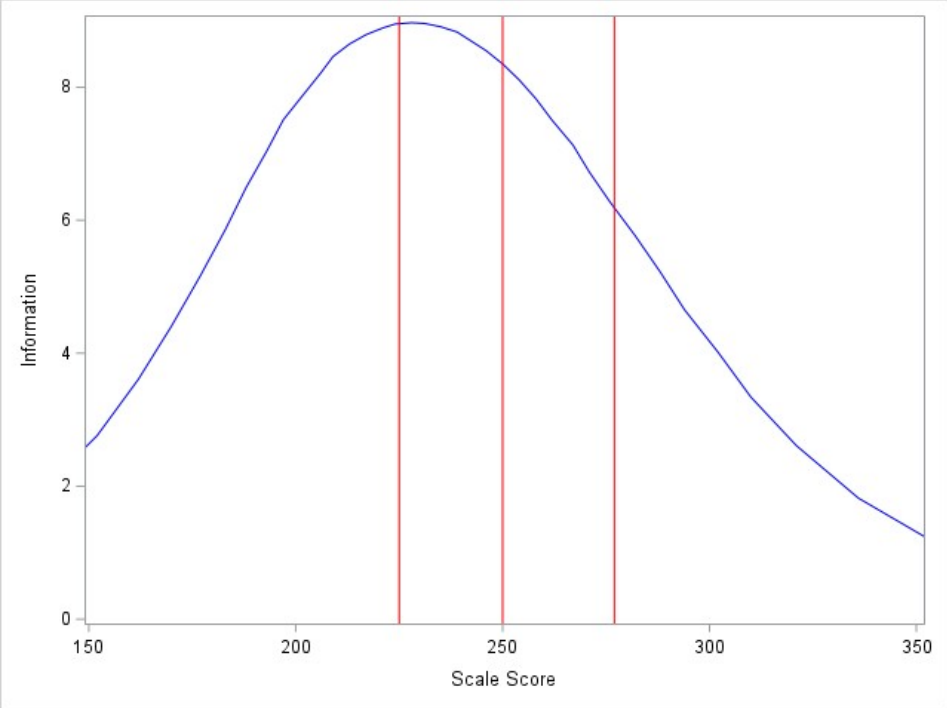


Figure I.3. TIC—Grade 11

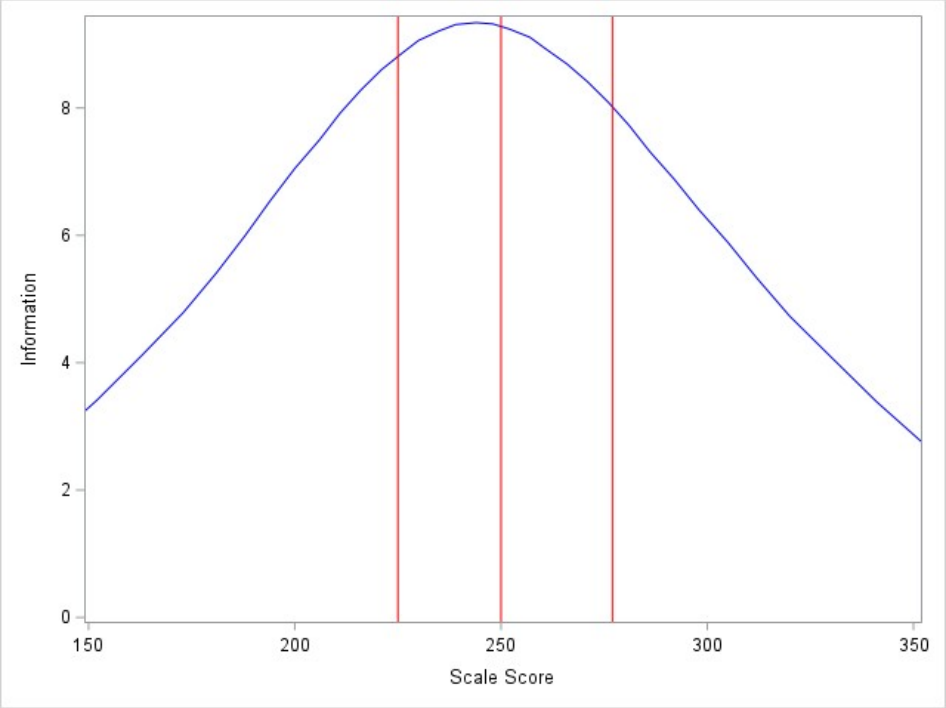


Figure I.4. CSEM Curve—Grade 5

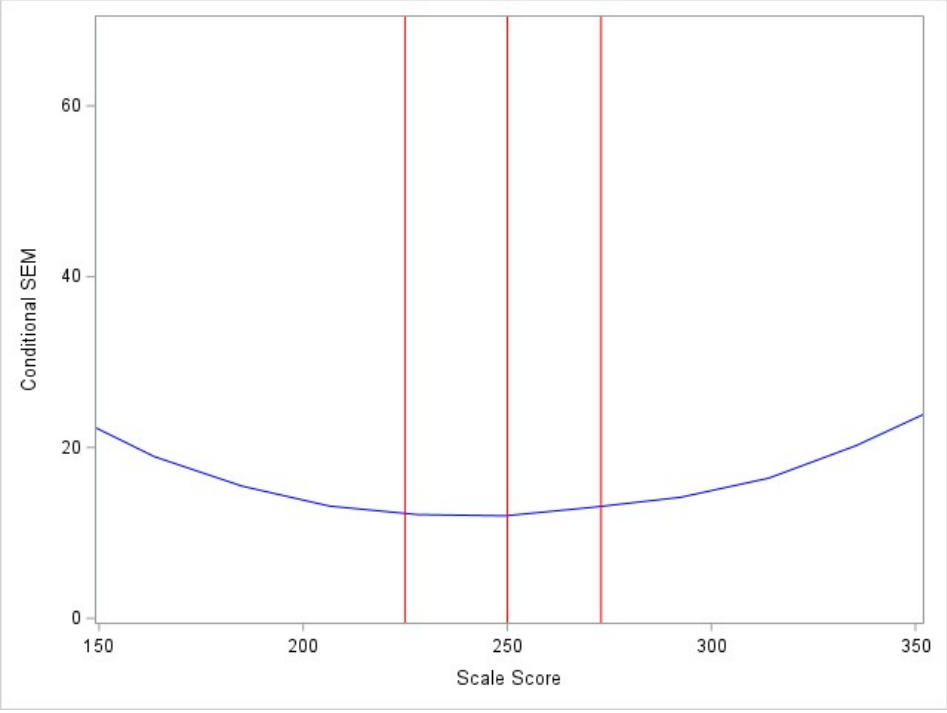


Figure I.5. CSEM Curve—Grade 8

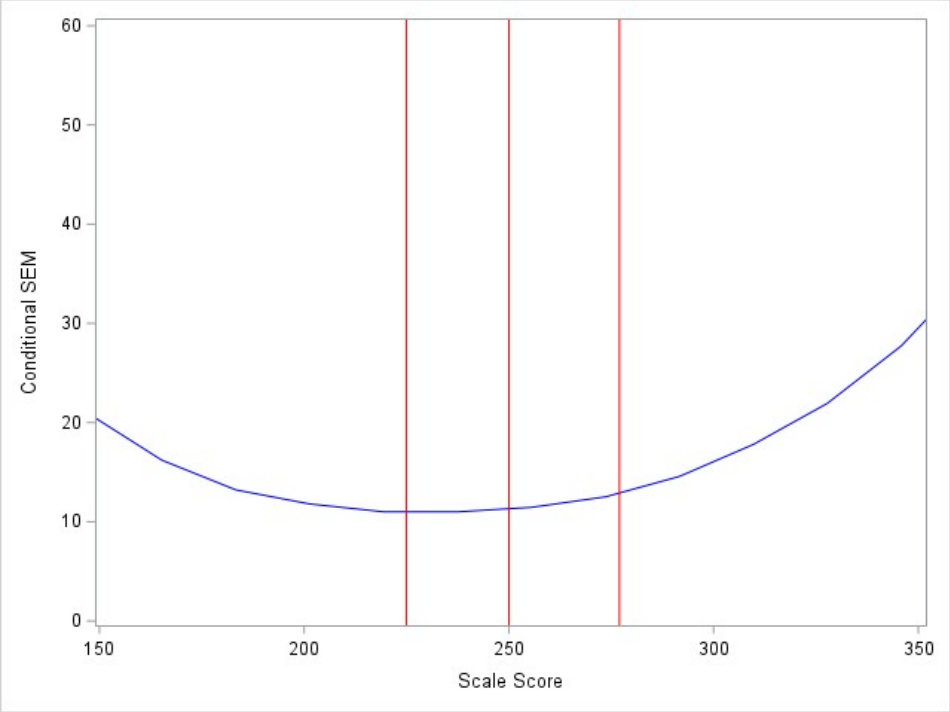
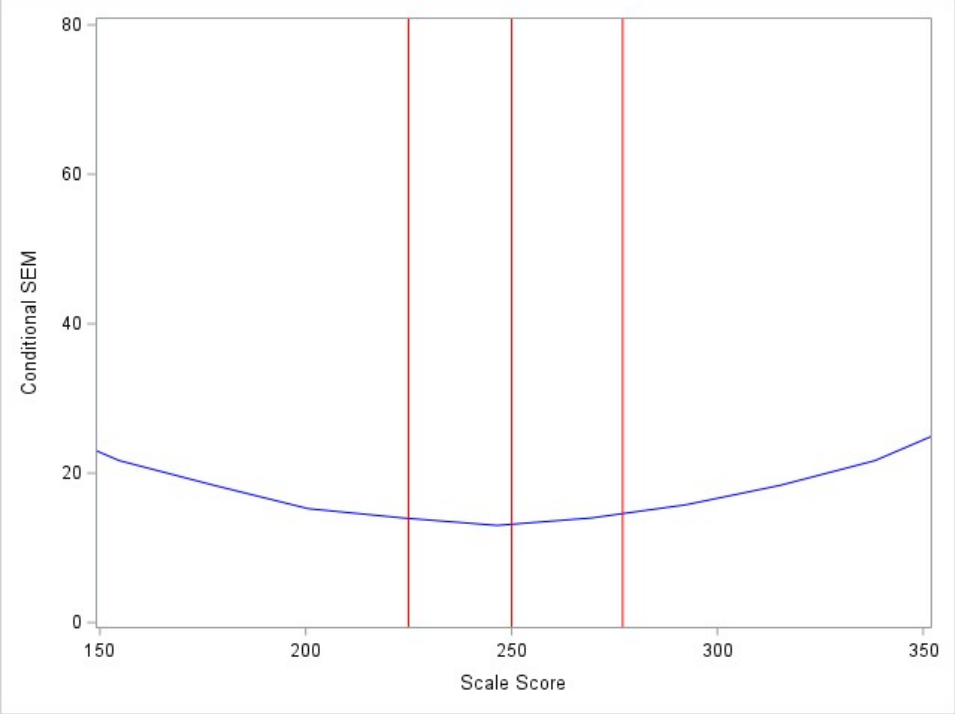


Figure I.6. CSEM Curve—Grade 11



Appendix J: Test Administrator Survey Responses

How familiar are you with this student?

Grade	Very Familiar	Somewhat Familiar	Familiar	Somewhat Unfamiliar	Unfamiliar	Missing
5	84.28%	5.46%	3.49%	2.40%	0.87%	3.49%
8	86.68%	4.44%	2.33%	0.85%	0.63%	5.07
11	80.29%	7.36%	4.51%	2.61%	0.24%	4.99%

How many hours per week does this student spend in instruction on this content area?

Grade	<1 Hour	1 to <2 Hours	2 to <3 Hours	3 to <4 Hours	4 to<5 Hours	≥5 Hours	Do Not Know	Missing
5	22.27%	37.34%	18.78%	9.61%	5.90%	2.18%	0.00%	3.93%
8	12.05%	10.15%	13.32%	16.07%	34.88%	7.61%	0.00%	5.92%
11	15.44%	15.91%	18.76%	24.94%	14.96%	3.56%	0.00%	6.41%

Approximately how much instructional time for this content area is in the general education classroom?

Grade	25%	50%	75%	100%	None	Missing
5	23.36%	6.99%	13.32%	28.17%	24.24%	3.93%
8	4.02%	9.73%	10.78%	39.32%	30.44%	5.71%
11	12.83%	5.94%	5.94%	17.10%	52.26%	5.94%

This student's primary receptive communication is:

Grade	Oral Language	Sign Language	Reading	Picture Communication	Tactile	Other	Do Not Know	Missing
5	89.30%	0.22%	0.66%	3.71%	0.00%	1.75%	0.00%	4.37%
8	87.32%	0.00%	1.06%	3.17%	0.42%	0.42%	0.00%	7.61%
11	89.79%	0.71%	0.95%	2.38%	0.00%	0.24%	0.24%	5.70%

This student's primary expressive communication is:

Grade	Oral Language	Sign Language	Writing	Picture Communication	Augmentative Communication Device	Tactile	Other	Do Not Know	Missing
5	72.93%	0.44%	0.22%	3.93%	12.66%	0.00%	2.62%	0.22%	6.99%
8	76.11%	0.42%	0.00%	4.23%	9.94%	0.21%	1.48%	0.00%	7.61%
11	81.71%	0.95%	0.24%	2.38%	5.94%	0.00%	1.90%	0.24%	6.65%

I feel that the student's responses accurately reflect their understanding of the material.

Grade	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Do Not Know	Missing
5	30.79%	36.46%	14.85%	7.64%	4.15%	1.75%	4.37%
8	44.19%	33.19%	11.21%	3.17%	1.27%	0.85%	6.13%
11	40.38%	31.83%	14.01%	3.80%	1.90%	1.66%	6.41%

How much time did this student take on the assessment?

Grade	0–30 Minutes	31–60 Minutes	61–90 Minutes	91–120 Minutes	121–150 Minutes	151–180 Minutes	≥181 Minutes	Missing
5	5.02%	43.67%	29.26%	10.48%	2.84%	1.75%	1.53%	5.46%
8	4.44%	54.76%	23.89%	6.77%	3.38%	0.21%	1.06%	5.50%
11	4.75%	53.92%	25.89%	6.41%	1.90%	1.43%	0.95%	4.75%

Appendix K: CoAlt Science Grades 8 and 11 Blueprint Reduction Study

CoAlt Science Blueprint Adjustment Results

The Colorado Department of Education is exploring shortening the Colorado Alternate Assessment (CoAlt) Science in grade 8 and High School. This document contains the grade 8 and High School reduced blueprint analysis results. The analyses compared students' spring 2023 scale scores and performance levels based on the 2023 full blueprint to the adjusted scale scores and performance levels based on the proposed 2024 reduced blueprint.

Table 1.1. *CoAlt Science Grade 8 Blueprint and Adjusted Points*

Standard	Blueprint Points	Adjusted Points	Blueprint Percentage	Adjusted Percentage
Physical Science	18	15	38%	38%
Life Science	15	12	31%	31%
Earth and Space Science	15	12	31%	31%
Total	48	39	100%	100%

Table 1.2. *CoAlt Science High School Blueprint and Adjusted Points*

Standard	Blueprint Points	Adjusted Points	Blueprint Percentage	Adjusted Percentage
Physical Science	18-19	15-16	38-40%	38-41%
Life Science	15	12	31%	31%
Earth and Space Science	14-15	11-12	29-31%	28-31%
Total	48	39	100%	100%

There is a range of Total Points for Physical SC and Earth SC because one Physical SC EEO could also be assessed with Earth SC EEOs because of related concepts.

Table 1.3. *Summary Statistics for Full and Adjusted Scores for CoAlt Science Grade 8*

		Count	Mean	Standard Deviation	Minimum	Maximum
Overall	**Full Scale Score**	**465**	**234.16**	**31.11**	**150**	**343**
	Adjusted Scale Score	**465**	**234.22**	**32.43**	**150**	**335**
	Full Scale Score CSEM	**465**	**10.80**	**1.97**	**10**	**24**
	Adjusted Scale Score CSEM	**465**	**12.11**	**2.70**	**11**	**24**

Table 1.4. *Summary Statistics for Full and Adjusted Scores for CoAlt Science High School*

		Count	Mean	Standard Deviation	Minimum	Maximum
Overall	**Full Scale Score**	**400**	**235.17**	**37.96**	**150**	**350**
	Adjusted Scale Score	**400**	**235.06**	**37.86**	**150**	**350**
	Full Scale Score CSEM	**400**	**13.63**	**2.38**	**12**	**22**
	Adjusted Scale Score CSEM	**400**	**15.36**	**2.66**	**14**	**25**

Table 1.5. *CoAlt Science Grade 8 and High School Performance Level Agreement*

Overall	Exact Agreement	Higher Level for Adjusted	Lower Level for Adjusted
Grade 8	**90.5%**	**5.4%**	**4.1%**
High School	**87.5%**	**7.5%**	**5.0%**

Table 1.6. *CoAlt Science Grade 8 Overall Performance Level Percent Agreement*

	Adjusted Performance Levels				
Overall	PL 1	PL 2	PL 3	PL 4	**Total**
2023 PL 1	**167 (35.9%)**	14 (3.0%)			181 (38.9%)
2023 PL 2	9 (1.9%)	**115 (24.7%)**	9 (1.9%)		133 (28.6%)
2023 PL 3		8 (1.7%)	**100 (21.5%)**	2 (0.4%)	110 (23.7%)
2023 PL 4			2 (0.4%)	**39 (8.4%)**	41 (8.8%)
Total	176 (37.8%)	137 (29.5%)	111 (23.9%)	41 (8.8%)	**465 (100%)**

Table 1.7. *CoAlt Science High School Overall Performance Level Percent Agreement*

	Adjusted Performance Levels				
Overall	PL 1	PL 2	PL 3	PL 4	**Total**
2023 PL 1	**127 (31.8%)**	13 (3.2%)			140 (35.0%)
2023 PL 2	8 (2.0%)	**106 (26.5%)**	14 (3.5%)		128 (32.0%)
2023 PL 3		7 (1.8%)	**77 (19.3%)**	3 (0.8%)	87 (21.8%)
2023 PL 4			5 (1.3%)	**40 (10.0%)**	45 (11.3%)
Total	135 (33.8%)	126 (31.5%)	96 (24.0%)	43 (10.8%)	**400 (100%)**

Table 1.8. *Pearson Correlations between Full and Adjusted Scale Scores*

Overall	Full and Adjusted Scale Scores Correlation
Grade 8	0.987
High School	0.985

Figure 1.9. *CoAlt Science Grade 8 Overall Full vs. Adjusted Scale Scores*

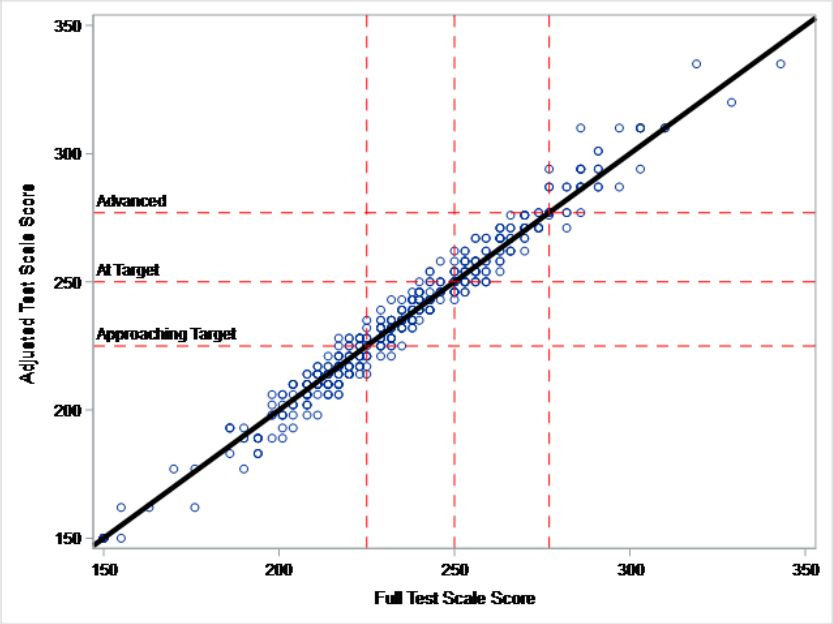


Figure 1.10. *CoAlt Science High School Overall Full vs. Adjusted Scale Scores*

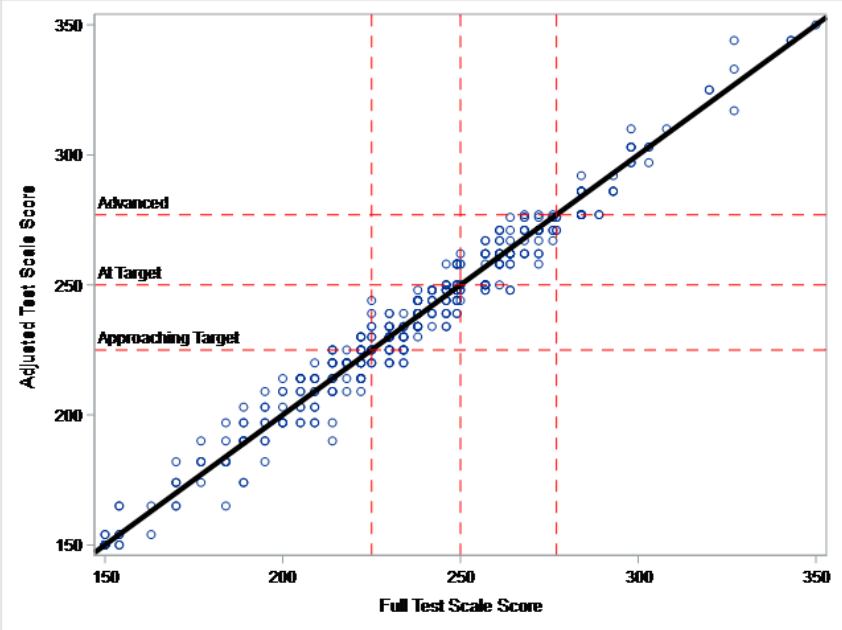


Figure 1.11. *CoAlt Science Grade 8 Overall Scale Score Differences Between Adjusted and Full Scale Scores*

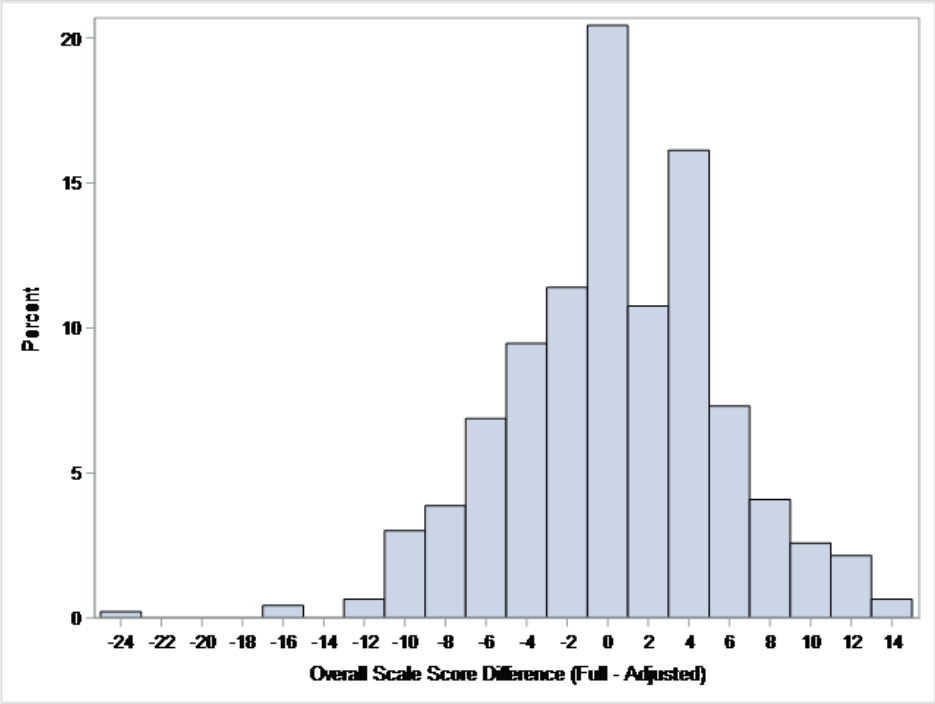


Figure 1.12. *CoAlt Science High School Overall Scale Score Differences Between Adjusted and Full Scale Scores*

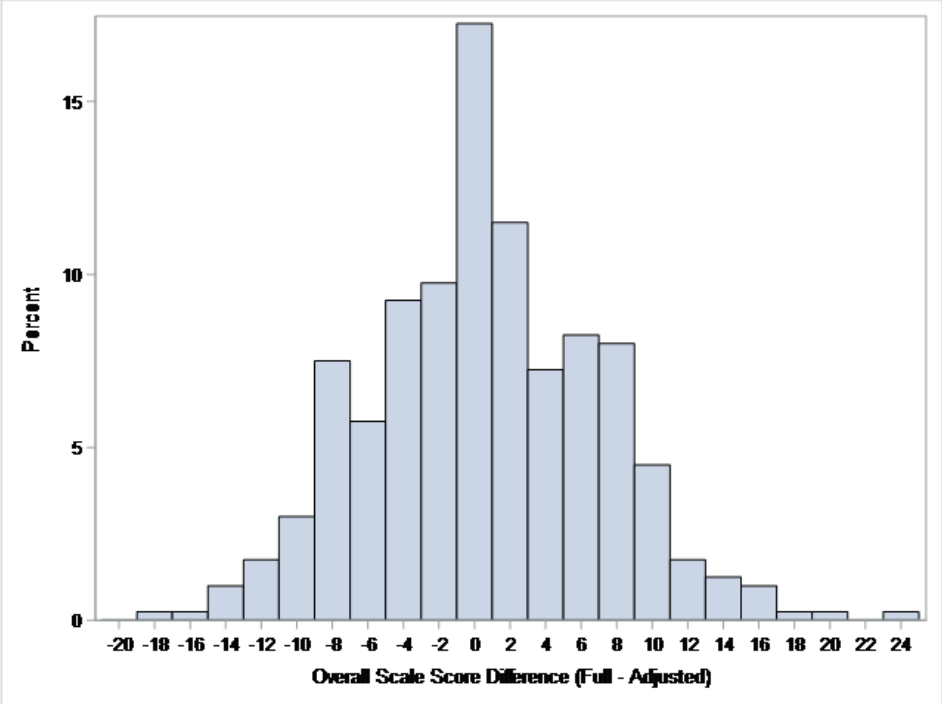


Figure 1.13. *CoAlt Science Grade 8 Overall Percentage Test Characteristic Curves for Full and Adjusted Raw Scores*

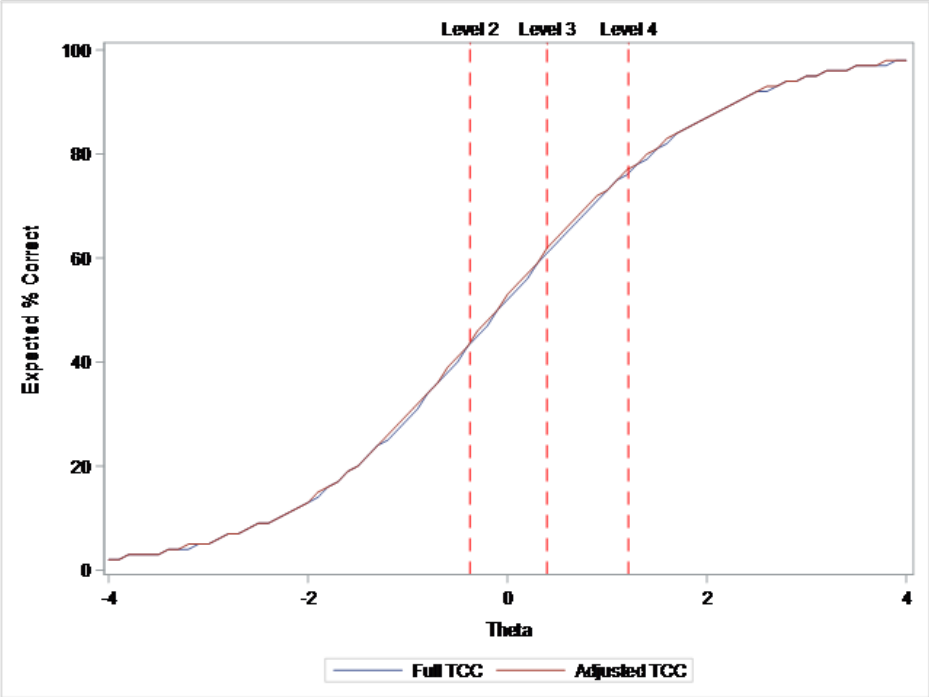


Figure 1.14. *CoAlt Science High School Overall Percentage Test Characteristic Curves for Full and Adjusted Raw Scores*