CLT

2025 TECHNICAL REPORT

CLT10®

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Letter from the CEO

I never set out to create a test for 10th graders. But when I saw what was happening—how the PSAT® was being used to shape curriculum, gatekeep opportunity, and waste the potential of students across America—I knew we had to do something.

Let's be honest: the PSAT is not a test of intellectual depth or moral imagination. It's a bubble-sheet ritual that has more to do with corporate strategy than real education. And it's everywhere. Even in schools that claim to care about virtue, character, and wisdom, students are drilled to serve a test that reflects none of those values.

That's why we created the CLT10.

The CLT10 is more than an assessment. It's a rebellion. It's a declaration that our brightest students should not be measured by how well they regurgitate sanitized material, but by how deeply they can think, read, and wrestle with the greatest ideas ever written.

Instead of prepping students for corporate gatekeepers, we're preparing them for greatness. Instead of outsourcing academic standards to the College Board, we're inviting schools to reclaim their souls.

We've built the CLT10 to honor the tradition of true education-an education rooted in courage, wonder, and truth. Students encounter authors who shaped civilizations, grapple with questions that matter, and begin to understand their place in the grand conversation of Western thought.

The PSAT will measure how well students conform. The CLT10 will show how well they think.

Let's not raise another generation trained to perform. Let's raise a generation trained to lead.

Jeremy Tate

Jeremy Tate,
Founder and CEO of CLT

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1. INTRODUCTION

1.1 What Is the CLT10®?

CHAPTER ONE

Classic Learning Initiatives (CLI) launched in December 2015 as an alternative to the College Board and ACT Inc. More than one hundred fifty thousand CLT assessments[1] have been administered in homes and schools across the United States in 2025 alone, and over three hundred colleges and universities, including both private and public institutions, accept the CLT as an admissions test.[2]

CLI launched the CLT10 in 2017. Modelled after the CLT, the CLT10 is an online preparatory exam for the CLT, geared toward 9th and 10th grade students. In addition to the CLT10 being used as a preparatory exam for the CLT, high-performing students on the CLT10 are eligible for scholarships to a CLT partner school. The CLT10 is offered as part of a suite, including the CLT3-8 assessments for lower grades and the CLT college admissions exam.

The CLT suite offers a different kind of standardized testing. It aims to dramatically enrich students' test-taking experience and to motivate positive change in assessment and education. The CLT suite is built on the idea that the purpose of education is to make us more human. Students must grapple with ideas that enable them to engage with profound truth, weigh evidence, understand different perspectives, and ultimately build a foundation that will serve them for the rest of their lives.

The CLT10 serves the needs of educators, students, and parents. Students take a short 2-hour exam, either in school or at home with remote proctoring services. Tests taken in school can be taken either online or in paper form (according to the school's preference). Testers and administrators access the exam's analytics through their online CLT accounts, and testers can send their scores to colleges for free. Furthermore, not only does the CLT10 challenge students, it also sets them apart from their peers in college applications.

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1 The CLT suite of assessments is comprised of: the CLT, a college entrance exam; the CLT10, a preparatory exam for the CLT offered to 9th and 10th graders; and the CLT3-8 lower grade assessments.

2 The full list of colleges which have adopted the CLT as an admissions exam is provided at https://www.cltexam.com/colleges.

1.2 Improving Students' Test-Taking Experience

For students, the CLT10 is refreshingly user-friendly and modern. It was designed with the goal of providing the best possible test-taking experience, and includes the following features:

- Online platform accessible via students' own desktops or laptops (tablets also compatible with in-school testing only)
- Remotely proctored exams available for students testing at home
- Paper tests for in-school testers
- Short test-taking time (120 minutes, not including 30 minute optional essay)
- Scores released the Wednesday after the exam for in-school tests and the third Wednesday after the exam for remotely proctored tests
- In-depth Student Analytics

TEST MODES

The CLT10 is primarily administered online, though a paper version is available for in-school testing. The online platform is more natural for contemporary students than a pencil and paper format, and reduces the risk of confusion and unnecessary mistakes. Students can select and change their answers with one click, without having to fill in Scantron bubbles, take time to erase, or risk entering multiple answers. Students testing online use a personal or school-provided device that they are already familiar with, reducing the possibility that the device itself will impair the student's ability to perform.

In the spring of 2020, the CLT launched a new test mode for students testing from home, known as the remotely proctored CLT. Beginning in September 2025, the CLT10 will also be offered as a remotely proctored exam[3]. The remotely proctored exams are auto-timed, and incorporate screen-share and video recording technology to ensure test integrity without requiring an in-person proctor.

PREDICTABLE FORMAT

The CLT10 is designed for simplicity and balance. Each of the three sections has forty (40) questions. Each Verbal Reasoning and Grammar/Writing section has four (4) reading passages, and each passage has ten (10) questions. Knowing what to expect frees students from anxieties that can come from an irregular test design.

Each section loads into a single browser window, so students can scroll to any part of that section without changing pages. A progress bar is provided at the top of the page, giving students a visual sense of their progress on the exam.

The test aesthetic is clean and free from distraction. It uses a white background and a readable serif font, and the reading questions line up side by side with the corresponding passage.

3 Prior to September 2025, the CLT10 could be taken at home with a parent or other in-person proctor. The transition to fully remote proctoring for the CLT10 will ensure a uniform and secure testing experience for all users and consistent alignment with the remote proctoring practices and policies of the CLT.

STRAIGHTFORWARD SCORING

Every CLT10 has 120 scored questions for a total of 120 possible points; there is no penalty for incorrect answers. The 120-point scale allows the test to be divided into three equally valuable sections with 40 questions each. The total score that the student receives on the CLT10 closely approximates the number of test questions that the student answered correctly across all three sections. (In cases where an administered test is slightly less or more difficult than expected, statistical techniques are used to equate tests, ensuring that each test is of equal difficulty and thus that scores are genuinely equivalent.[4])

SHORTER TEST—FASTER RESULTS

The CLT10 is 120 minutes long, or two hours (not including the 30 minute optional essay). The CLT10 was designed to be shorter than comparable tests in order to take as little as possible away from instruction time and to minimize the effects of student cognitive fatigue.

In-school testers that take the exam online can access their scores the following Wednesday. Students who test using a paper-based test receive scores once the tests are scanned and processed, within 30 days of receipt of returned answer sheets. Testers who take the remotely proctored exam receive their scores on the third Wednesday following exam administration.

IN-DEPTH ANALYTICS

As a preparatory exam, CLT10 scores and analytics can be used to assess the students' readiness for the CLT college entrance exam. The CLT10 is not based on a specific curriculum, but rather upon time-tested, traditional sources, as well as basic grammar, mathematics, and logic. Because the CLT10 covers content areas similar to the CLT, student performance on the CLT10 provides a window into their projected performance on the CLT.

CLT10 analytics reports are straightforward and easy to interpret. They indicate performance on the exam across multiple academic domains and subdomains, as well as comparisons to past test performance. The analytics include definitions of each subdomain, sample questions, and lists of the main skills being assessed.

Student-level analytics are available to all students, whether they took the test from home or in school. School- and class-level analytics, as well as individual analytics reports, are available for school

> **"Education means emancipation. It means light and liberty. It means the uplifting of the soul of man into the glorious light of truth, the light by which men can only be made free."**
>
> *Frederick Douglass*

4 See Chapter 8 for more information.

administrators and teachers to view once their school has administered a test. Teachers and administrators can use the analytics and related documents to understand individual student performance and aptitude.

CHANGES TO THE CLT10, 2022-2025

The CLT10 has always mirrored the content structure of the CLT, allowing for a smooth transition from taking the CLT10 as a preparatory exam to taking the CLT for college admissions. However, since the publishing of the 2022 CLT10 Technical Report, increased demand for the CLT10 as a high-stakes test has driven administrative alignment of the CLT10 to current CLT policies and practices, while increasing test security for both assessments. Below is a table to summarize the changes to the CLT10 following the 2022 version of the Technical Report:

	CLT10 IN 2022	CLT10 IN 2025
DIRECT-TO-CONSUMER TESTING OPTION	At home with an adult proctor	Remotely proctored using screen capture and video
TESTING WINDOW	Select one of two available testing dates for each test	Each test offered on one date only
ONLINE TESTING PLATFORM SECURITY	Students access the test using a Test Access Code unique to each test	Students still access the test using a Test Access Code, but heightened security measures include RP recorded video and screenshare, testing in LockDown Browser®, and more.
PSYCHOMETRICS	Classical Test Theory (see Chapter 7)	Item Response Theory (see Chapter 8)

1.3 Motivating Positive Change in Assessment and Education

CLI aims to change the landscape of assessment, and education generally, by providing a rigorous, intellectually rich exam. CLT exams assess both aptitude and achievement, feature rich reading passages, and support strong educational choices.

APTITUDE AND ACHIEVEMENT

Students must draw upon the education they have received in order to demonstrate what they have learned. Achievement within a domain of knowledge is one key purpose of assessment, and a principal focus for the CLT10. Students preparing for the CLT10, and administrators reviewing analytics, want to know that their plan of content formation will put them on the right track to perform well on the exam. The domains and subdomains provide the basic content framework of the exam.

The CLT10 aims to assess not only students' achievement, but also their aptitude. Students at this stage in their education are discovering their innate intellectual potential. CLT10 measures skills students develop through a variety of education types, such as their ability to communicate clearly, to read complex prose, to understand metaphors, to think logically, and to solve puzzles. Some students have natural talent in one or more of these areas, and the CLT10 can help identify those aptitudes.

Because the CLT10 is both an achievement and aptitude test, students are provided a window into their own unique set of intellectual strengths, while also receiving the tools through CLT10 analytics to make incremental improvements in their less developed areas.

RICH READING PASSAGES

In the CLT10 Verbal Reasoning and Grammar/Writing sections, students engage works from the greatest minds in the history of the liberal arts tradition. The test draws on literary, philosophical, and scientific passages from a wide variety of thinkers, such as St. Augustine, Dante, Sir Isaac Newton, Charlotte Brontë, W. E. B. Du Bois, and many more.[5] These sources are both secular and religious, contemporary and historical. They require students to analyze texts, comprehend great ideas, and engage with issues that affect the world at large.

The CLT10's distribution of subject categories in passages is as follows. On every test, out of eight reading passages, two (25%) are in Philosophy/Religion; one (12.5%) is drawn from Literature; two (25%) are in Science; one (12.5%) is an excerpt from Historical/Founding Documents; one (12.5%) is a Historical Profile; and one (12.5%) is drawn from Modern/Influential Thinkers.

DISTRIBUTION OF SUBJECT CATEGORIES ACROSS CLT10 PASSAGES

PASSAGE TYPE	NUMBER OF PASSAGES PER TEST	EXAMPLES
Modern/Influential Thinkers	12.5% (1 passage)	"Blood, Toil, Tears, and Sweat" by Winston Churchill "Letter from a Birmingham Jail" by Martin Luther King, Jr.
Historical Profile	12.5% (1 passage)	*The History of Peter the Great, Emperor of Russia* by Voltaire *Men of Our Times* by Harriet Beecher Stowe
Historical/Founding Documents	12.5% (1 passage)	"Federalist No. 2" by John Jay *Poetics* by Aristotle
Literature	12.5% (1 passage)	*Silas Marner* by George Eliot *Mansfield Park* by Jane Austen
Science	25.0% (2 passages)	"How I Created the Theory of Relativity" by Albert Einstein *Seeds of Hope* by Jane Goodall
Philosophy/Religion	25.0% (2 passages)	"The Fallacy of Success" by G.K. Chesterton "A Farewell Sermon" by Jonathan Edwards

5 See Chapter 2 for a complete list of the CLT Author Bank, from which two-thirds of CLT10 passages are drawn.

1.4 CLT10 in Context

CLI has deep relationships with secondary schools, institutions of higher learning, think tanks, education policy organizations, philanthropists, and lawmakers that are passionate about meaningful education and the liberal arts. By linking arms with these individuals and organizations, CLI seeks both support and counsel in its mission to provide unmatched assessments that reflect and strengthen a holistic education, whether public, private, charter, or classical. Our core values of remaining Anchored, Passionate, and Humane are invigorated and preserved by these vital relationships.

The CLT Board of Academic Advisors is composed of prominent scholars, thought leaders, and visionaries in education who advise and advocate for CLT, as well as provide expert guidance.

In addition to the distinguished list of educators in colleges and universities and in private, parochial, homeschool, and charter schools, the board has executive leaders from a variety of mission-aligned organizations. These include:

- Classical Academic Press
- The Circe Institute
- Classical Conversations
- The Society for Classical Learning
- Hillsdale College K-12 Education
- Memoria Press
- The Association of Classical Christian Schools
- The American Council of Trustees and Alumni
- The Heritage Foundation
- The Institute for Catholic Liberal Education

A complete list of CLT board members can be found on our website.

1.5 About the CLT10 Technical Report

This technical report is a guide explaining the details of how the CLT10 exam works. Chapters 1-5 describe the design and administration of the CLT10, and Chapters 6-11 explain and analyze the test's metrics.

Chapter 2 presents the content of the test itself, including sample questions, the author bank, and information on how test questions are organized by difficulty level. Chapter 3 outlines the steps CLT takes to develop, edit, and prepare each test for administration. Chapters 4 and 5 explain how the CLT10 is administered and describe the measures taken to ensure the test's security and fairness.

Chapter 6 provides information on how CLT10 scores are reported to students, administrators, and colleges. Chapter 7 provides background on Classical Item Analysis. Chapter 8 explains how tests are scaled using Item Response Theory. Chapters 10 and 11 quantify the test's reliability and validity, respectively. Chapter 11 presents norming evidence, including CLT10/PSAT concordance charts.

2.
STANDARDS AND CONTENT COVERAGE

2.1 Overview *(of the CLT Assessments, Skills Measured, and Design)*

The Classic Learning Test (CLT) was created in the context of a national movement to renew the foundations of great education. "Classic" in this context simply means an assessment that reflects tried-and-true ideas rather than contemporary experiments. The CLT10 is accessible to students from a variety of educational backgrounds. Although the CLT10 is open to all test-takers, the intended test-taking population is all 9th and 10th grade students in the U.S. and internationally. The CLT10 is well-suited for any student aspiring to high standards of literacy and numeracy.

The liberal arts education model trains students in language arts and mathematics as a path "to make the acquisition of all later studies more simple and effective."[1] Kevin Clark and Ravi Scott Jain (2013) write, "Recovering the primacy of both the language arts and the mathematical arts is a pivotal piece of this paradigm. Together they train the student not just in what to think but in how to think."[2] To this end, the CLT10 draws on enduring concepts in the humanities and mathematics. These include perennial questions about human nature and the physical world, lessons from history, and universal mathematical concepts.

The constructs to be measured on the CLT10 exam, which underlie the CLT10 score, are *literacy* and *numeracy*. Literacy is understood as having three interconnected parts: (1) the technical skills required for reading and writing; (2) sufficient cultural vocabulary to synthesize meaning in context; (3) the prudence to engage with and respond to the meaning of the text in an appropriate way. Numeracy as measured by the CLT10 includes (1) fluency with numbers, algebraic expressions, and the fundamentals of geometry; (2) well-developed mathematical intuition and logical reasoning; (3) the ability to think abstractly and creatively to solve unfamiliar problems under the given time constraints.

The purpose of the CLT10 exam is to focus on foundational intellectual skills such as clear reasoning and critical thinking, while tapping into the deep intellectual tradition of the classics. This approach to testing is aimed at measuring not just students' academic achievements, but also their aptitude—to allow students to demonstrate their intellectual capabilities, regardless of their prior academic training.

Each CLT10 exam consists of three mandatory sections—Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning—in addition to an optional Essay for in-school online testers.

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1 Clark, Kevin and Ravi Jain. *The Liberal Arts Tradition: A Philosophy of Christian Classical Education*. Classical Academic Press, 2013.

2 Ibid.

OVERVIEW OF CLT10 FORMAT		
Section	Time allotted	Number of Questions
Verbal Reasoning	40 minutes	40
Grammar/Writing	35 minutes	40
Quantitative Reasoning	45 minutes	40
Totals:	2 hours*	120

**2 hours and 30 minutes with the optional essay*

These are similar to the sections in the PSAT™ and are recognizable to students familiar with other standardized tests, but the content of the test is distinct from other standardized tests in two main ways. First, CLT10's Verbal Reasoning and Grammar/Writing sections primarily use selections from time-tested authors who have shaped history, literature, and philosophy in foundational ways through the centuries. The CLT10 thus provides an opportunity for students to interact with important thinkers whose voices have made a profound difference in the world of ideas. Second, the Quantitative Reasoning section assesses students' ability to solve problems and to think in a logical and orderly manner. The test focuses on assessing mathematical reasoning capacity in addition to testing specific mathematical skills or knowledge.

DIFFICULTY LEVELS

Reading passages in the Verbal Reasoning and Grammar/Writing sections are calibrated to fit narrowly within a consistent difficulty level. The test developers use a variety of tools, including a passage calibration software with grade-level ratings, to help analyze the difficulty level of each passage and ensure it falls within an appropriate range.

In the Verbal Reasoning and Grammar/Writing sections, questions are not ordered based on item difficulty level within a passage or within the section overall. In the Quantitative Reasoning section, questions increase in difficulty as they progress. For more information on how tests are calibrated to account for overall difficulty, refer to Chapter 8.

2.2 Author Bank

Education is not just about results. At CLT, we believe standardized testing should provide all students, no matter their educational background, an invaluable opportunity to engage with the texts and authors that have shaped history and culture. Two thirds of the passages on each CLT10 test form are drawn from the list of authors below. The CLT10's focus on the Western and classical traditions presents students with ideas, themes, and arguments they will encounter for the rest of their lives. The men and women who have contributed to this intellectual canon come from all times and places, races and religions, classes and cultures.

ANCIENTS

The *Epic of Gilgamesh*, 18th c. BC?

Homer, 9th c. BC?

Hesiod, 8th c. BC?

Æsop, 621-565 BC

Confucius, 551-479 BC

Æschylus, 525-455 BC

Sophocles, 496-406 BC

Herodotus, 484-425 BC

Euripides, 480-406 BC

Thucydides, 460-400 BC

Hippocrates, 460-370 BC

Plato, 428-347 BC

Aristotle, 382-322 BC

Euclid, 4th-3rd c. BC

Archimedes, 287-212 BC

Terence, 195-159 BC

Cicero, 106-43 BC

Julius Cæsar, 100-44 BC

Lucretius, 99-55 BC

Virgil, 70-19 BC

Livy, 59 BC-AD 17

Ovid, 43 BC-AD 17

Seneca the Younger, 4 BC-AD 55

Josephus, 37-100

Plutarch, 46-120

Epictetus, 55-135

Tacitus, 56-120

Tertullian, 160-220

Origen, 184-253

St. Athanasius, 297-373

St. Gregory of Nyssa, 335-395

St. Jerome, 342-420

St. Augustine of Hippo, 354-430

MEDIEVALS

Boethius, 477-524

St. Benedict, 480-547

Procopius, 500-570

St. Gregory the Great, 540-604

St. Bede the Venerable, 673-735

Beowulf, 9th c.?

The Thousand and One Nights, 9th c.

Avicenna, 980-1037

St. Anselm of Canterbury, 1034-1109

Peter Abælard, 1079-1142

St. Bernard of Clairvaux, 1090-1153

Hugh of St. Victor, 1096-1141

St. Hildegard of Bingen, 1098-1179

Héloïse d'Argenteuil, 1100-1164

Averroës, 1126-1198

Moses Maimonides, 1138-1204

Marie de France, 1160-1215

The *Nibelungenlied*, c. 1200

Magna Carta, 1215

St. Thomas Aquinas, 1225-1274

The Saga of Erik the Red, 13th c.

Dante Alighieri, 1265-1321

Giovanni Boccaccio, 1313-1375

John Wycliffe, 1328-1384

Geoffrey Chaucer, 1343-1400

Julian of Norwich, 1343-1420

St. Catherine of Siena, 1347-1380

Christine de Pizan, 1364-1430

The *Pearl* Poet, 14th c.

St. Thomas à Kempis, 1380-1471

Thomas Malory, 1415-1471

EARLY MODERNS

Desiderius Erasmus, 1466-1536

Niccolò Machiavelli, 1469-1527

Nicolaus Copernicus, 1473-1543

St. Thomas More, 1478-1535

Martin Luther, 1483-1546

Bartolomé de las Casas, 1484-1566

John Calvin, 1509-1564

St. Teresa of Ávila, 1515-1582

Michel de Montaigne, 1533-1592

Francis Bacon, 1561-1626

William Shakespeare, 1564-1616

Galileo Galilei, 1564-1642

John Donne, 1572-1631

Thomas Hobbes, 1588-1679

René Descartes, 1598-1650

John Milton, 1608-1674

Blaise Pascal, 1623-1662

Margaret Cavendish, 1623-1673

Robert Boyle, 1627-1691

John Bunyan, 1628-1688

John Locke, 1632-1704

Isaac Newton, 1642-1727

Gottfried Leibniz, 1646-1716

Charles Montesquieu, 1689-1755

Voltaire, 1694-1778

Jonathan Edwards, 1703-1758

Benjamin Franklin, 1706-1790

David Hume, 1711-1776

Jean-Jacques Rousseau, 1712-1778

Adam Smith, 1723-1790

Immanuel Kant, 1724-1804

Edward Gibbon, 1737-1794

Antoine Lavoisier, 1743-1794

Thomas Jefferson, 1743-1826

Olaudah Equiano, 1745-1797

Johann Wolfgang von Goethe, 1749-1832

James Madison, 1751-1836

Mary Wollstonecraft, 1759-1797

Georg W. F. Hegel, 1770-1831

LATE MODERNS

Jane Austen, 1775-1817

Jakob & Wilhelm Grimm, 1785-1863 & 1786-1859

Mary Shelley, 1797-1851

Sojourner Truth, 1797-1883

St. John Henry Newman, 1801-1890

Alexis de Tocqueville, 1805-1859

Hans Christian Andersen, 1805-1875

John Stuart Mill, 1806-1873

Edgar Allan Poe, 1809-1849

Charles Darwin, 1809-1882

Charles Dickens, 1812-1870

Søren Kierkegaard, 1813-1855

Charlotte Brontë, 1816-1855

Henry David Thoreau, 1817-1862

Karl Marx, 1818-1883

Frederick Douglass, 1818-1895

George Eliot, 1819-1880

Herman Melville, 1819-1891

Susan B. Anthony, 1820-1906

Fyodor Dostoevsky, 1821-1881

Gregor Mendel, 1822-1884

Louis Pasteur, 1822-1895

Leo Tolstoy, 1828-1910

Mark Twain, 1835-1910

Friedrich Nietzsche, 1844-1900

Oscar Wilde, 1854-1900

Sigmund Freud, 1856-1939

Anna Julia Cooper, 1858-1964

Anton Chekov, 1860-1904

Alfred North Whitehead, 1861-1947

Ida B. Wells, 1862-1931

W. E. B. Du Bois, 1868-1963

Mahatma Gandhi, 1869-1948

Willa Cather, 1873-1947

G. K. Chesterton, 1874-1936

Albert Einstein, 1879-1955

Virginia Woolf, 1882-1941

John Maynard Keynes, 1882-1946

Franz Kafka, 1883-1924

Ludwig Wittgenstein, 1889-1951

Zora Neale Hurston, 1891-1960

J. R. R. Tolkien, 1892-1973

Dorothy Sayers, 1893-1957

F. Scott Fitzgerald, 1896-1940

C. S. Lewis, 1898-1963

Ernest Hemingway, 1899-1961

Jorge Luis Borges, 1899-1986

Friedrich Hayek, 1899-1992

Langston Hughes, 1901-1967

John Steinbeck, 1902-1968

George Orwell, 1903-1950

Hannah Arendt, 1906-1975

Albert Camus, 1913-1960

Aleksandr Solzhenitsyn, 1918-2008

James Baldwin, 1924-1987

Flannery O'Connor, 1925-1964

Elie Wiesel, 1928-2016

Martin Luther King, Jr., 1929-1968

Toni Morrison, 1931-2019

2.3 Verbal Reasoning Test

The Verbal Reasoning section tests a student's ability to understand and analyze a text. Students are asked to interact with a variety of texts in different subject areas, described in the subsection "Passage Types", and are tested on their ability to comprehend the text and synthesize ideas within that text. They must be able to understand concepts such as how different phrases and words are used in context, the author's purpose in a particular section or in the passage overall, how a text is structured, and what could be reasonably inferred based on the information in the text. This section contains 40 questions and the standard administration time is 40 minutes.

QUESTION TYPES

Each passage has ten questions. Items are not ordered by level of difficulty, either within a passage or in the section overall. Below is the high-level test blueprint along with a description of each question type within the Verbal Reasoning section.

Comprehension (27 questions)

- Passage as a Whole: These question types measure the student's ability to synthesize information from an entire passage in order to understand its framework and main ideas. (8 questions)
- Passage Details: These question types measure the student's ability to understand key facts and concepts discussed in a passage. (11 questions)
- Passage Relationships: These analogy questions measure the student's ability to recognize important connections between different parts of a passage. (8 questions)

Note: Analogies require students to be able to connect high-level concepts within a passage and to make connections between ideas and terms in a passage. The CLT10's analogies refer to concepts within a passage and use terms students are likely to know already, rather than relying on difficult vocabulary to challenge students.

Analysis (13 questions)

- Textual Analysis: These question types measure the student's ability to make inferences from information in a passage and to understand a character, a narrator, or a writer's point of view. (8 questions)
- Interpretation of Evidence: These question types measure the student's ability to understand how verbal and quantitative evidence are used in a passage. (5 questions)

Note: One of the Interpretation of Evidence questions always refers to a figure accompanying the Science passage, which is always the second passage in the section.

PASSAGE TYPES

Each Verbal Reasoning section consists of four passages: three full passages and one passage composed of two shorter excerpts presented together. Each Verbal Reasoning passage fits narrowly within a word count range of 500-650 words. The total word count for all passages within the Verbal Reasoning section must be between 2,200-2,400, for an average of 2,300 words total.

The passages in the Verbal Reasoning section fall into four categories, which are consistent across each exam. Passages appear in the following order:

- Literature: The passages in the Literature category are drawn from classic and modern literary prose. Authors include those whose stories, style, and ideas have contributed significantly to Western culture.
- Science: The passages in the Science category are from articles, essays, and other works exploring various

disciplines such as genetics, astronomy, physics, biology, and chemistry. When relevant, these passages may touch on the ethical, moral, or societal implications of the work. Each science passage in the Verbal Reasoning section will be accompanied by a graphic, such as a chart or table.

- Philosophy/Religion: The passages in the Philosophy/Religion category are from contemporary or classic sources, and are concerned with issues of truth, reasoning, ethics, and more. They are drawn from a variety of perspectives and periods.
- Historical/Founding Documents: The paired passages in the Historical/Founding Documents category are two brief selections that present perspectives on a topic. The first is a historical document, often drawn from ancient sources. The second is a passage from a writer or time period significant to U.S. history.

For anything to be read or communicated, some common context is assumed. For example, a math question involving a six sided die does not explain what a die is. Tests with the most universally accessible design still do not remove all such questions. Like other fairly designed tests of verbal reasoning constructs similar to it, the CLT10 neither tests knowledge about specific information from outside of its given texts, nor does it avoid asking questions assuming some shared background information.

Further, the CLT10 tends to include passages of relevance, meaning, and weight: passages that have explicit societal and personal implications, that give historical perspectives and references, and that have had an influence on human history. The CLT10 does not test "specific, communally shared information", what E. D. Hirsch calls "acculturation", but neither is it shy from the fact that a wide understanding of literacy lies behind understanding a text with any degree of meaning, relevance, or weight. Hirsch (1987) describes this wide sense of literacy:

"What [Professor Chall] calls world knowledge I call cultural literacy, namely, the network of information that all competent readers possess. It is the background information, stored in their minds, that enables them to take up a newspaper and read it with an adequate level of comprehension, getting the point, grasping the implications, relating what they read to the unstated context which alone gives meaning to what they read."[3]

The CLT10 both seeks a universally accessible test design and recognizes that a student with a wider context of literacy will be more comprehending of and conversant with CLT10 texts.

SAMPLE QUESTIONS

Below is one sample question for each subdomain in the Verbal Reasoning section.

Passage as a Whole

Which of the following best describes the structure of the passage?

A) The author opens with a personal anecdote, discusses important new research, and gives advice on how best to apply that research.

B) The author gives a history of fMRI studies, offers suggestions on directions of new research, and mentions one groundbreaking study.

C) The author places the new research in context, describes the methodology and results of the new studies, and briefly mentions their potential effects.

D) The author discusses two important new studies, looks at the studies' limitations, and offers a solution on how to fix those limitations.

Passage adapted from Emilie Reas's "A neural code for emotion," 2016.

3 Hirsch, E.D. *Cultural Literacy: What Every American Needs to Know.* Houghton Mifflin Company, 1987.

Passage Details

According to the passage, Mrs. Leath has most likely been married for

A) a few weeks.

B) a couple of months.

C) about one year.

D) more than a few years.

Passage adapted from Edith Wharton's The Reef, *1912.*

Passage Relationships (Analogies)

Babylon : Confusion ::

A) arrest : stop

B) scattered : descended

C) nation : earth

D) language : understanding

Passage adapted from Augustine's "On diversity of languages" in The City of God, *fifth century AD.*

Textual Analysis

Based on the passage, how does the author likely feel about Columbus and his voyages?

A) He views the voyages as prompted by greed and disapproves of the false justifications for the project.

B) He views Columbus as an innovative pioneer whose journey is largely misrepresented by history.

C) He views the voyages as daring forays into dangerous territories but condemns the avarice of Columbus's leaders.

D) He views Columbus as a confused and misled explorer who was too frightened to admit his own mistakes.

Passage adapted from Adam Smith's "Of the Motives for Establishing New Colonies," from An Inquiry Into the Nature and Causes of the Wealth of Nations, *1776.*

Interpretation of Evidence

Which lines in the passage best support the answer to the previous question?

A) Paragraph 1, Sentence 1 ("The interest . . . Rome")

B) Paragraph 5, Sentence 1 ("But the . . . of")

C) Paragraph 5, Sentence 2 ("Finding nothing . . . gold")

D) Paragraph 6, Sentence 2 ("The people . . . project")

Passage adapted from Adam Smith's "Of the Motives for Establishing New Colonies," from An Inquiry Into the Nature and Causes of the Wealth of Nations, *1776.*

2.4 Grammar/Writing Test

The Grammar/Writing section tests a student's ability to edit and improve a text. Students are asked to interact with a variety of texts in different subject areas, described in the subsection "Passage Types", and are tested on their ability to correct errors within that text and to improve its readability and flow. The section assesses students on their ability to use punctuation correctly, to convey points precisely and concisely, to make appropriate transitions, to choose the correct part of speech, to match verb tense, and to make other grammatically well-formed choices. This section contains 40 questions and the standard administration time is 35 minutes.

QUESTION TYPES

Each passage has ten questions. Items are not ordered by level of difficulty, either within a passage or in the section overall. Each question requires students to either correct an error or suggest an improvement to the passage. If no change is necessary, students can select the option "NO CHANGE."

Below is a high-level test blueprint along with a description of each question type within the Grammar/Writing section:

Grammar (20 questions)

- Agreement: These question types measure the student's ability to recognize how individual elements of a sentence correspond to or agree with one another. (10 questions)
- Punctuation and Sentence Structure: These question types measure the student's ability to understand how different elements of a sentence are linked by punctuation, and how to properly construct a sentence. (10 questions)

Writing (20 questions)

- Structure: These question types measure the student's ability to recognize how different parts of a passage, paragraph, and sentence relate to one another. (8 questions)
- Style: These question types measure the student's ability to understand a writer's tone and intent. (8 questions)
- Word Choice: These question types measure the student's ability to recognize how different words fit into different contexts. (4 questions)

PASSAGE TYPES

Each Grammar/Writing passage fits narrowly within a word count range of 460-565 words. The section total must be between 2,000-2,200 words, for an average of 2,100 words.

The passages in the Grammar/Writing section fall into four categories, which are consistent across each exam. Passages appear in the following order:

- Philosophy/Religion: The passages in the Philosophy/Religion category are from contemporary or classic sources that reason about issues of truth, ethics, and what it means to be human. They are drawn from a variety of perspectives and periods.

- Historical Profile: The passages in the Historical Profile category consist of short biographical pieces on important historical figures (e.g. Alexander the Great, St. Joan of Arc, William Shakespeare, and Harriet Tubman).
- Science: The passages in the Science category are from articles, essays, and other works exploring various disciplines such as genetics, astronomy, physics, biology, and chemistry. When relevant, these passages may touch on the ethical, moral, or societal implications of the given work. Science passages in Grammar/Writing sections do not include a table or graph as they do in Verbal Reasoning sections.
- Modern/Influential Thinker: The passages in the Modern/Influential Thinker category are similar in scope to the Philosophy/Religion category, but are always drawn from more modern sources, and may offer perspectives on issues currently faced by society.

SAMPLE QUESTIONS

Below is one sample question for each subdomain in the Grammar/Writing section.

Agreement

had been

A) NO CHANGE
B) were
C) are
D) being

Passage adapted from Thomas More's "Of Their Military Discipline" in Utopia, *1516.*

Punctuation and Sentence Structure

rubies emeralds great pearls and diamonds.

A) NO CHANGE
B) rubies, emeralds great pearls and, diamonds.
C) rubies, emeralds, great, pearls, and diamonds.
D) rubies, emeralds, great pearls, and diamonds.

Passage adapted from Patrick Fraser Tyler's "Catharine of Aragon" in Women of History, *1890.*

Structure

For instance

A) NO CHANGE
B) In doing so
C) However
D) Despite this

Passage adapted from Thomas More's "Of Their Military Discipline" in Utopia, *1516.*

Style

Which of the following choices best matches the tone of the passage?

Some labs think it's totally a waste of time to publish negative results given the current culture, which is obsessed with positive findings that could have a high impact.

A) NO CHANGE

B) Some labs may find that it is not worth their time to publish negative results given the current culture, which is driven by the desire to focus on positive findings that could have a high impact.

C) Some labs may find that it is not worth it to publish negative results in our crazy culture, which is driven by the desire to focus on positive findings that could have a super big impact.

D) Some labs may find that it is not worth it to publish negative results given all the stuff going on today, including the desire to focus on positive findings that could have a big impact.

Passage adapted from Alejandra Clark's "Negative Results: A Crucial Piece of the Scientific Puzzle," 2017.

Word Choice

antithetical

A) NO CHANGE

B) anecdotal

C) artificial

D) analytical

Passage adapted from Eric Holder's "Speech at the DOJ African-American History Month Program," 2009.

"It is the background information, stored in their minds, that enables them to take up a newspaper and read it with an adequate level of comprehension, getting the point, grasping the implications, relating what they read to the unstated context which alone gives meaning to what they read."

E.D. Hirsch

2.5 Quantitative Reasoning Test

The Quantitative Reasoning section tests students' ability to think logically, use and manipulate symbols, and understand shapes. Students are asked to complete a variety of questions of various subtypes in order to assess their logical reasoning ability across different domains.

As shown in the question examples on the following pages, the Quantitative Reasoning section of the CLT10 tests algebra and geometry, including coordinate plane geometry. The most notable content difference in Quantitative Reasoning between the CLT10 and the CLT is that the CLT10 does not include trigonometry.

The CLT10 intends to measure more than just content-specific, algorithmic skills—the questions on the CLT10 seek to measure true numeracy by rewarding facility with numbers and expressions, fine-tuned mathematical intuition, and creative approaches to unfamiliar problems. One might be surprised to see a question about odd and even numbers, for example, on a test intended for 9th and 10th grade students—but these questions may be among the most difficult for some students, because they require a working understanding of, and/or reliable intuition about, number theory.

Calculators are not allowed on the exam. Basic formulas are provided on the exam, both at the top of the Quantitative Reasoning section and accessible at any time by selecting the *f(x)* button on the left side of the page. The formulas provided on the CLT10 are shown below:

Area of a circle $= \pi r^2$, where r is the radius of the circle

Circumference of a circle $= 2\pi r$, where r is the radius of the circle

There are 360 degrees in a circle.

There are 2π radians in a circle.

Volume of a sphere $= \frac{4}{3}\pi r^3$, where r is the radius of the sphere

Surface area of a sphere $= 4\pi r^2$, where r is the radius of the sphere

Area of a rectangle $=$ length $\times$ width

Area of a triangle $= \frac{1}{2}$(base $\times$ height)

The sum of the measures of the interior angles of a triangle is 180°.

Pythagorean theorem (for a right triangle): If a, b, and c are the side lengths of the triangle, and c is the hypotenuse, then $a^2 + b^2 = c^2$.

30°- 60°- 90° triangles have side lengths in a ratio of $1 : \sqrt{3} : 2$, corresponding to their opposite angle.

45°- 45°- 90° triangles have side lengths in a ratio of $1 : 1 : \sqrt{2}$, corresponding to their opposite angle.

QUESTION TYPES

In the Quantitative Reasoning section, questions are broken down into three main types:

Algebra (10 questions)

The Algebra domain includes problems on properties of integers, substitution, sequences, systems of equations, quadratic equations, etc.

» Arithmetic and Operations: These question types measure the student's ability to use basic rules of arithmetic to simplify and draw conclusions about expressions, as well as the ability to recognize patterns. (5 questions)

» Algebraic Expressions and Equations: These question types measure the student's ability to simplify algebraic expressions—which, unlike the expressions in "Arithmetic and Operations" questions, usually include variables—solve equations and inequalities, and substitute variables into algebraic expressions. (5 questions)\

Geometry (14 questions)

The Geometry domain tests a student's ability to analyze shapes and determine key pieces of information from what is given in a problem. Students may be tested on polygons, properties of parallel and perpendicular lines, and coordinate geometry. The CLT10 emphasizes intuitive use of geometric principles rather than memorization of formulas.

» Plane Geometry: These question types measure the student's ability to analyze two-dimensional shapes and to understand points, lines, figures, and functions in the (x,y)-coordinate plane. (4 questions)

» Properties of Shapes: These question types measure the student's ability to analyze circles, triangles, and other polygons and determine additional information about those shapes. (10 questions)

Mathematical Reasoning (16 questions)

The Mathematical Reasoning domain will most often be word problems that require students to apply logic and reasoning to given situations. Problems may include properties of integers, geometric shapes, ratios, or algebra. Some questions will ask students to draw conclusions based on a set of given conditions.

» Logic: This subdomain measures the student's ability to deduce a valid conclusion from given information. (8 questions)

» Word Problems: This subdomain measures the student's ability to use reasoning and logic to draw conclusions in real-life scenarios. (8 questions)

SAMPLE QUESTIONS

Below is one sample question for each subdomain in the Quantitative Reasoning section.

Arithmetic and Operations

Which of the following is equivalent to $|-25|$?

○ A) 5^2

○ B) -5^2

○ C) $-30-5$

○ D) $-(-20+5)$

Algebraic Expressions and Equations

Which of the following is equivalent to $x(x+3)$?

- A) $5x$
- B) $2x+3$
- C) x^2+3
- D) x^2+3x

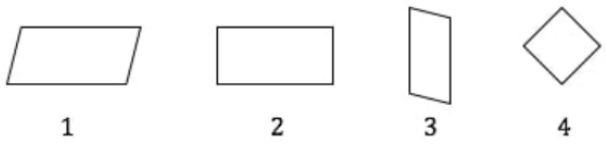
Plane Geometry

Which of the following pairs of lines are perpendicular?

- A) $y=2x-\frac{1}{2}$ and $y=2x+2$
- B) $y=-x$ and $y=-x-1$
- C) $y=-\frac{1}{2}x+2$ and $y=2x$
- D) $y=\frac{1}{2}x-\frac{1}{2}$ and $y=2x-2$

Properties of Shapes

Which of the following two shapes appear to be similar?



- A) 1 and 2
- B) 1 and 3
- C) 2 and 3
- D) 2 and 4

Logic

How many integers between 10 and 80 (inclusive) meet both conditions below?

1. One of the integer's digits is a solution to the equation $x^3+x^2+11x=0$.
2. The sum of the integer's digits is greater than or equal to 4.

- A) 5
- B) 8
- C) 10

If Maya's score was 16 percentage points higher than Lea's score, and Lea received a 17 out of 25, what was Maya's score?

- ○ A) 20 out of 25
- ○ B) 21 out of 25
- ○ C) 22 out of 25
- ○ D) 23 out of 25

2.6 Optional Essay

Testers who take the exam online in a school-proctored setting have the option of completing an unscored essay section. This essay gives students the opportunity to provide colleges with an example of their writing ability under a time limit. Students have 30 minutes to answer one prompt. Their written response is included with their test results when students send their scores to colleges.

Sample essay prompts are as follows:

SAMPLE ESSAY 1: What is more important: talent or hard work? Why? Give 2-3 examples from life and/or literature to support your answer.

SAMPLE ESSAY 2: Shakespeare writes in *Hamlet*, "This above all: to thine own self be true." What does it mean to be true to yourself? Is this a good thing or a bad thing? Use 2-3 examples from literature to support your opinion.

SAMPLE ESSAY 3: In the dedication to one of his books, C. S. Lewis wrote, "Someday you will be old enough to start reading fairytales again." How is children's literature important both for children and adults? Discuss a book that you read as a child that has greatly impacted you.

3. TEST DEVELOPMENT

Overview

The Test Development team at CLT writes and edits each test item according to a specific set of parameters. The Test Development team follows a well-defined process of development and review, ensuring every test adheres to the test blueprint, CLT's quality standards, and our mission.

3.1 Test Blueprint

The Test Development team develops new test forms for every test date in conformity with our test blueprints, described in the previous chapter of this report, and statistical parameters, described in Chapter 8 of this report.

When developing forms that fit the blueprint, the team considers criteria such as content domain, complexity, and accessibility to the population of test-takers. CLT psychometrician(s) weigh in on whether each passage and item within the blueprint meet the desired psychometric properties defined for the CLT10. Test forms are studied post-test to guarantee that blueprint content specifications were met and that mastery of the targeted content was reflected in test scores.

3.2 Selecting and Training Item Developers

The CLT Test Development team chooses item writers based on their qualifications and demonstrated ability in particular subject areas; many have experience in relevant fields such as teaching and tutoring. New item writers are supervised by experienced members of the Test Development team and are trained on the breakdown of question types, difficulty levels, and house style of the CLT suite of exams. Their work then goes through multiple rounds of revision and editing to ensure that each section maintains the high standards of the CLT10, and that all items are consistent, clear, and accurate.

CLT10 editorial reviewers have strong content knowledge in the areas of reading comprehension, grammar and writing, and/or math and logic, in addition to a keen eye for finding mistakes, typographical errors, inconsistencies, or stylistic issues. Occasionally, expert reviewers are also asked to review item scoring post-test to ensure items are appropriate.

3.3 Test Form Creation

TEST FORM ASSEMBLY

When test development begins for the upcoming academic year, test forms are assembled as section modules that follow the content blueprint and certain statistical specifications. A module is a mini test form that consists of a single section. CLT10 uses automated test assembly (ATA) to construct modules that are parallel in content and statistical specifications. ATA is conducted using the eatATA package (Becker et al., 2021) in the R programming language (R Core Team, 2023).

ATA involves computer algorithms that translate a set of constraints defined by psychometricians and content experts into mathematical optimization problems. Constraints related to the content of the tests come from the blueprints created by our Test Development team and include the number of items each form should include from each subject, domain, subdomain, passage type, and question type. Then, statistical constraints are set to ensure that only high-quality items are included in the forms.

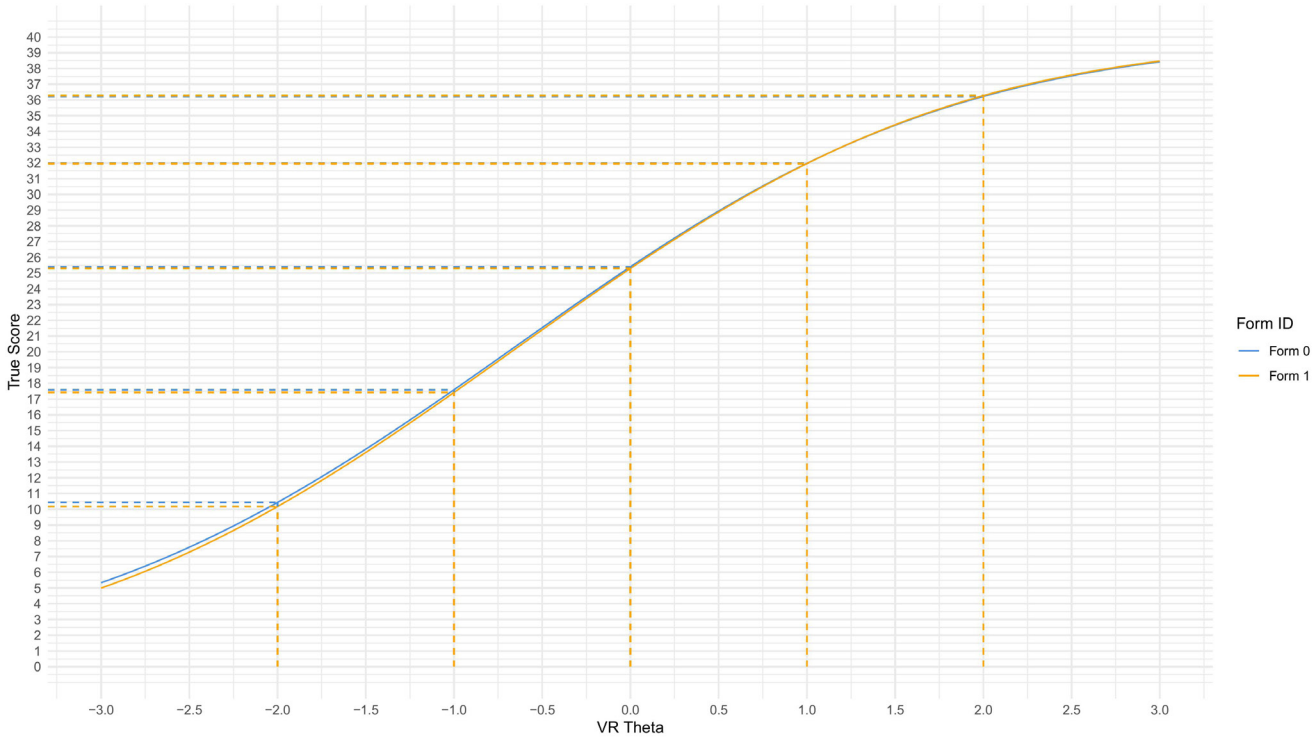
High-quality items are those that can discriminate well between high ability and low ability students and that do not show bias against a particular demographic subgroup such as a gender or an ethnicity. Item discrimination is measured by the pointbiserial correlation between item scores and total scores, as explained in Chapter 7. Bias is investigated using differential item functioning (DIF) statistics that evaluate if each item measures the same construct for each relevant subgroup. Specifically, the Mantel-Haenszel (MH) procedure (Mantel & Haenszel, 1959) along with the Educational Testing Services (ETS) criteria are used to measure DIF (Holland & Thyer, 1985; Dorans & Holland, 1992; Zwick, 2012). ETS places items in the categories of A, B, or C depending on the statistical significance as well as the effect size of DIF (Dorans & Holland, 1992). Category A means that DIF is negligible, category B means that DIF is moderate, and category C means that DIF is large (Magis et al., 2010). However, "the detection of DIF does not always indicate bias in an item; there needs to be a suitable, substantial explanation for the DIF to justify the conclusion that the item is biased" (AERA, APA, & NCME, 2014, p.51). Therefore, items that show DIF are re-evaluated by our content experts (Zieky, 2003) before each test assembly block. Items that fail this process are excluded from test assembly. Furthermore, post-hoc analyses are conducted after the administrations and flagged items are reviewed again by content experts.

In addition to ensuring that only high-quality items are used, ATA allows the Psychometrics team to construct forms that have a consistent level of difficulty. This is accomplished by defining an objective function, which is the statistical outcome that the ATA algorithm strives to achieve. For example, test information can be maximized at a given ability level or a certain difficulty level can be targeted. Then, the software finds the combination of items that minimize the differences between the target difficulty and the difficulty of the forms while satisfying the content constraints. The items are pulled from an item bank that is maintained and updated by our Test Development team and psychometricians.

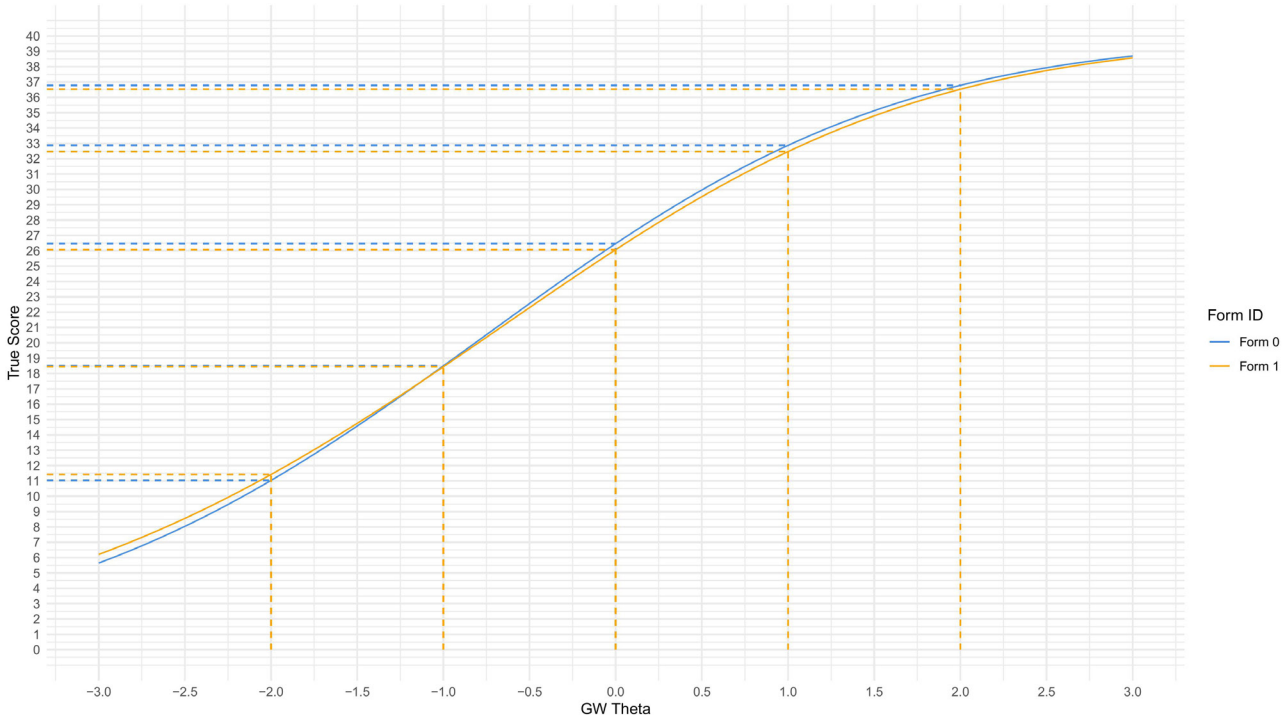
Item difficulties are estimated using IRT, which is discussed in Chapter 8. Passage difficulties are estimated based on 1) the difficulties of the set of items associated with the passage and 2) the difficulty of the text of the passage itself. Figure 3.1. shows the test characteristic curves (TCCs) of the modules assembled for the Spring 2025 administrations. A TCC shows the expected number-correct score on a form given an ability level and the item difficulties. The abilities are on the logit scale as explained in Chapter 8. Each curve in the plots is the TCC of a single module. A high overlap between the curves means that the difficulty differences between the modules are small. Given that there are a finite number of items from which the modules can be created, it is challenging to assemble forms that are identical in difficulty. Chapter 8 explains how our scoring process adjusts for the differences between the forms to ensure that scores obtained from different forms are on the same scale and can be compared.

Figure 3.1

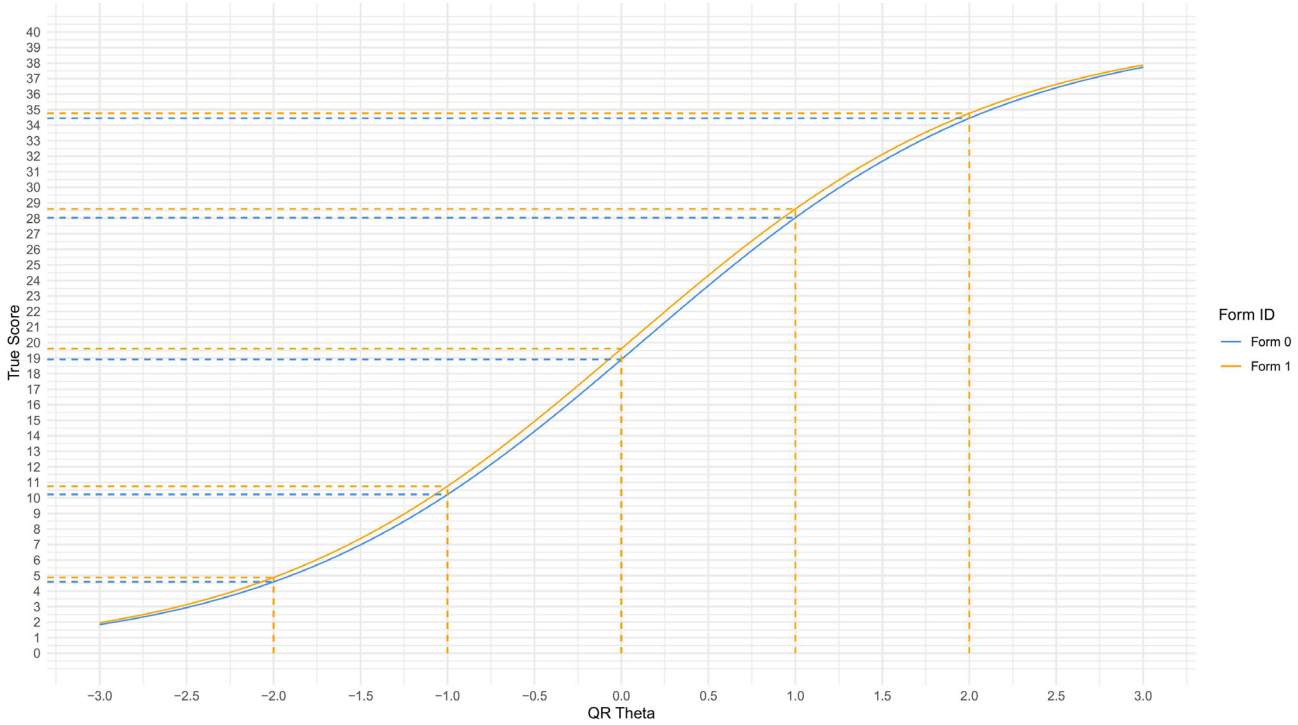
The Test Characteristic Curves of the Modules for the Spring 2025 Administrations



a) The test characteristic curves of the two Verbal Reasoning modules built for the Spring 2025 administrations.



b) The test characteristic curves of the two Grammar/Writing modules built for the Spring 2025 administrations.



c) The test characteristic curves of the two Quantitative Reasoning modules built for the Spring 2025 administrations.

Once the parallel test forms have been constructed and the items have been reviewed by the content experts, the passages and the items are uploaded into the test delivery platform. The constituent components of test data in the website user interface are test questions, passages, and images (e.g., graphs, tables, geometrical images). The data is replicated in each field exactly as it is represented in the test blueprint.

The digital infrastructure for test questions includes variable fields for question numbers (1-120), the text of the question itself, the URL associated with images, the uploaded passage with which the question is associated, the text of answers A, B, C, and D, the correct answer (A, B, C, or D), the difficulty of the question (1-5), and the question type (e.g., "Comprehension — Passage Relationships").

Once all of the passages, images, and test questions are assembled on the website, the online form is reviewed for completeness, correct item ranking, and correct item metadata.

Test forms are reviewed to ensure that they meet CLT style according to the House Style Guide. Items are also checked for consistency, typographical errors, correct metadata, and overall coherence of the form. Once the test content has been finalized, the Test Development team completes additional reviews of the test's accuracy and validity. As part of the test development process, proofreaders and editors simulate taking the full test online and in print during each review, which includes checking the answer key and suggesting any edits needed to uphold CLT's standards of quality for test content. Permissions are also secured for any passages under copyright - see section 3.5 Licensing and Permissions.

PAPER TEST FORM

The CLT10 is primarily an online test, but some schools opt for paper testing. To create a paper test form, the Test Development team creates and formats the paper test document using the final version of the online test. The paper test is then reviewed in its entirety by a new editor, with a particular focus on formatting, formulas, and other potential transcription errors. For every test form that is offered as an in-school paper test, a large print version of that test will be made available upon request for accommodation. The large print test is then reviewed in its entirety by a new editor to ensure that it follows CLT's large print test standards and that no errors have been introduced during reformatting.

3.4 Quality Control Procedures

ITEM BANK

CLT maintains a running item bank in order to track individual item use. The item bank is thoroughly evaluated by an internal reviewer to ensure that no inactive items are used on test forms, items include the correct supplementary information, and no errors are present. The CLT10 item bank is secure and only accessible to employees with privileged access, ensuring that no active items are made available to students outside of test day.

During the scoring of each test, any anomalies in item data such as poor discrimination values or significant displacements in difficulty level are flagged by the Psychometrics team. These items then undergo internal review in which Test Development managers consider item data and actual vs. intended difficulty level. The Test Development managers decide on a course of action for each flagged item: no

change to the item, edits to the item, or complete replacement of the item. Items that are replaced are made inactive within the item bank so that they cannot be reused. This item flagging process ensures that all active items within the item bank follow CLT's item quality standards.

TEST FORM DEVELOPMENT

Test form development proceeds as described in Section 3.3. Quality control procedures for each test form consist of checks at every stage for consistency with the blueprint and style of the CLT10. At form construction, adherence to the blueprint is included as a parameter of the automated test assembly algorithm and is later confirmed via a separate check performed by the Test Development team. Any revisions to the form are reviewed and approved before the form becomes operational.

Many CLT10 items have already undergone multiple rounds of review by expert judges in past years and have already been shown to perform well on previous test administrations. Such test content is available for reuse, assuming applicable passage licensing is up to date and no errors have been identified. While newly-written test content is subject to additional review and increased scrutiny, the full content of every test form, including new and reused content, undergoes multiple rounds of review by expert reviewers and internal Test Development staff. Items are evaluated for consistency with the style of other CLT10 items according to our House Style Guide and adherence to the question types outlined in the CLT10 blueprint. Reviewers must certify that items are semantically clear, logically sound, and informationally accurate.

Finalization procedures include an answer key check, a check of all supplementary question information, a check that all intended edits were made, and final approval from the Test Development team. After finalization, Test Development notifies Operations that each form is ready for printing (if applicable) and administration.

3.5 Licensing and Permissions

The Test Development team works with publishers, agents, and authors to secure rights for any passages or images under copyright at least eight weeks in advance of each exam. Licenses are secured for usage across multiple years and administrations. CLT typically requests worldwide rights to accommodate international test takers. Longer term contracts are sought (three years or more) to maximize reuse from the item bank. Licensing requests include the right to make minor punctuation changes to fit testing context, minor spelling changes to modernize certain words, and the addition of paragraph numbers (Verbal Reasoning) or question numbers (Grammar/Writing) to the text. Licensing rights and permissions are tracked and maintained in a secure database. Licenses are renewed when deadlines or print and online copy limits are reached.

4. TEST ADMINISTRATION

4.1 Overview

The CLT10 is offered multiple times per year. The test is normally administered to students online, either at a user-selected private location (typically at home, but sometimes in a private room inside a public facility, such as a library) or at a CLT partner school (for schools that contract with CLT to administer the exam "in-house" to their students). Schools who administer the CLT10 have the choice of administering the test either online or on paper.

The test is proctored remotely when administered privately; CLT staff record and review the tests to ensure exam integrity. In-school CLT10 administrations are proctored by school staff.

Students receive two hours to complete the CLT10: 40 minutes for the Verbal Reasoning section, 35 minutes for the Grammar & Writing section, and 45 minutes for the Quantitative Reasoning section.

If the exam is taking place at a CLT partner school, the proctor ensures that students proceed from section to section together. In remotely proctored administrations of the test, students may move on early if they choose (up to and including submitting the exam early), but still must move on once the timer for that section expires. Students cannot return to a previous section at any point, in either form of administration, and time "saved" on one section cannot be transferred to another.

Any difficulties that arise during an in-school exam will normally be handled by the proctor. For students who run into problems while testing privately, our live chat support is available to assist them throughout the day; there is no test-time penalty for consulting chat support.

Testing accommodations are available for students with documented disabilities. These may include extended time, extra breaks, use of a calculator, or other policy modifications, as necessitated by the student's disability. Accommodations are described further in Chapter 5 of this report.

4.2 Test Modes

The CLT10 is administered in two different online modes and one paper mode to make testing convenient and secure for all students.

IN-SCHOOL MODES (ONLINE & PAPER)

In-school testers may take the CLT10 as an online exam or on paper with an answer booklet. The school will register for the test and order their tests prior to test day. Students may not register directly for an in-school test or take this version of the exam from their home.

For in-school tests, the school administering the test provides a proctor for the exam for both the online and paper modes of the test. This proctor will provide specific test day directions and guide students through the test using the proctor manual provided by CLT. The proctor is also responsible for contacting CLT in the event of a technical issue on test day.

ONLINE

Students taking the CLT10 from a school as an online exam will use a laptop or desktop computer. Schools may choose to provide suitable devices for all students taking the test, or students may bring a laptop for their own use.

The online test will work on most modern devices. It requires a reliable internet connection with Javascript enabled, and students must have LockDown Browser® downloaded on their devices. Questions in the Quantitative Reasoning portion of the exam may include mathematical notation. Mathematical notation is scripted in HTML (MathML).

Once the test is complete, proctors and administrators complete a post-test survey about their test experience and note any anomalies during the exam administration. Scores for online exams are released the Wednesday following the administration.

PAPER

Students taking the CLT10 on paper will receive a test booklet and answer sheet. They will fill their answers out on the answer sheet, along with their identification information. The optional essay is not available on the paper test.

School administrators order their test kits at least 6 weeks prior to the test administration date. The kits, which include test booklets and answer sheets, are mailed to the school a minimum of one week ahead of the test date, and instructions are provided via email. Test kits are addressed to the attention of the school's primary point of contact. To protect the security and validity of the test, proctors and schools are expected to strictly adhere to the process outlined in the paper test manual.

Once the test is complete, schools return the answer sheets to CLT for processing. Students and administrators receive their scores and analytics within 30 days of the return of the answer sheets.

AT HOME MODE (REMOTELY PROCTORED TEST)

The remotely proctored test is a convenient choice for homeschooled students and students whose schools do not yet offer the CLT10. For students that attend CLT partner schools, it is also a good way to

get ready for an in-school test administration.

To test at home, students must create a profile on the CLT website and sign up for the specified exam date. Once registration and payment are completed, the student receives instructions on how to prepare for the remotely proctored test, including setting up their space, checking their internet speed and computer settings,downloading the secure LockDown Browser®, and simulating a test. On test day, students sign into their profile to access the test.

Students interested in taking the remotely proctored CLT10 at home do so using their own desktops or laptops. If necessary, students can take the test from another location such as a library, church, or a friend or relative's home, provided the space still meets the remotely proctored testing space requirements (see "Testing Room Requirements" in section 4.3 below).

For the remotely proctored test, no onsite proctors are required: test integrity is maintained through CLT's test administration software and review process. The student must test alone in a closed, well-lit room, from the beginning of the exam until it is submitted. The test may be taken any time from 12:00 am to 11:59 pm Pacific Time on the test date. Live chat support is available during the exam from 7am to 7pm Eastern Time for students who encounter any difficulties.

Students are encouraged to become familiar with the test requirements and layout prior to testing to ensure a smooth testing experience. A stable internet connection is required, and students must use a laptop or desktop computer with a functioning camera and microphone. Tablets and mobile devices are not compatible with the remote proctoring software. CLT has developed a number of tools to assist students, including troubleshooting guides, instructional videos, and a fully-featured test simulation that operates the same way as the operational exam to allow students to test their system prior to testing or in the event of technical difficulties.

CLT requires a photo ID to verify student identity on the remotely proctored test. Additionally, there is no optional essay available on the remotely proctored test. During the exam, the testing software records both the student's screen and their camera to ensure that test integrity is maintained. The exam recordings are reviewed by CLT staff following the test. Testers who are found to have violated the CLT honor statement will not receive scores on the test. Scores for the remotely proctored CLT10 are released the third Wednesday following the administration.

PRACTICE TESTS

CLT provides a full-length CLT10 practice test on every student account. Using this test, students can become familiar with the format and content of the online test as well as the testing interface.

4.3 Test Day Processes and Procedures

Students must take the CLT10 under secure, supervised conditions. There are two ways that students can take the CLT10: in-school at a CLT partner school (schools choose whether to administer the exam online or on paper), or at home with the remotely proctored online exam.

IN-SCHOOL TESTS

Admitting Students into the Testing Room - On test day, proctors have the final list of CLT10 students for their specific test site on their CLT administrator accounts. The proctor manual instructs proctors to verify students' identity before they begin the test, using any of the following types of approved photo ID:

- Passport
- Driver's license or permit (if photo included)
- State ID
- Military ID
- High school ID (current year only)
- HSLDA student ID (current year only)
- CLT Student ID Form

Proctors then assign seats for every admitted student.

Test Access Code - In order to take the exam on test day, students must enter the test access code (TAC) specific to the exam in question. Proctors receive the TAC directly from CLT the week before and the day before test day. They provide their students with the TAC to begin the exam once all authorized students have been admitted and seated and the preliminary instructions have been read. In addition to the access code to begin the Verbal Reasoning section of the exam, distinct access codes are also provided to the proctor for the Grammar/Writing and Quantitative Reasoning sections, respectively, in order to prevent students from starting subsequent sections of the exam early. The proctor will provide the applicable access codes when it is time to begin the next section.

Calculators - Calculators are not allowed on the CLT10, including on the Quantitative Reasoning section, unless a student has been specifically approved for a calculator as a testing accommodation. Questions are designed to be solvable without the use of a calculator.

Timing - One of the proctors' primary duties is to ensure that all students adhere to the designated time lengths for each of the exam's sections. To aid the proctor in determining at a glance whether all the students are working on the appropriate section of the exam, each section is color-coded for the online test. A similar aid is available to proctors of paper exams: the names of the first, second, and third sections are printed in bold at the top-left, center, and right of the pages, respectively.

Anomalies - If any anomalies or disruptions occurred during the exam, proctors must submit an Anomaly Report to CLT before exiting the testing room. Potential testing anomalies that are to be noted on the report include:

- Students who arrive late to an exam
- Students who leave during an exam
- Students who use an additional device or open an additional page
- Students who become ill during an exam
- Questions asked during an exam
- Disturbances during an exam
- Emergency evacuations
- Power failure
- Wifi failure
- Device failure
- Site failure
- Copying test materials

PROCTORS

Proctors are responsible for ensuring that the in-school exam is administered and taken under the highest security standards possible. CLT10 proctors must be at least 21 years of age and cannot be related to the students they are proctoring. Each proctor monitors no more than 20 students, allowing for differences in room size and layout. During the exam, the proctor must be able to see all students and ensure that the spacing requirements are respected. Proctors may not provide assistance to students on exam content.

It is the proctor's responsibility to administer the exam fairly, safely, and securely. In order to do so, proctors are responsible for the following duties:

1. **Setting up for the Exam:** Prior to the exam, proctors prepare the room for testing according to the guidelines laid out in the proctor manual. Proctors also assist students with filling out their identifying information on their answer sheets as needed.
2. **Monitoring Students:** Proctors ensure that no students access any of the following prohibited items:

- Cell phone or other device (must be completely off and out of sight)
- Calculator
- Digital watch with internet access, communication capabilities, or calculator
- Books
- Resource/reference material of any kind
- Snacks (may only be eaten during the ten-minute break)

3. **Enforcing Section Times:** The proctor is responsible for keeping time for each section. All sections of the exam must be completed within the allotted times. The proctor cannot lengthen the standard times for any of the test's sections unless the student has received approval for that specific accommodation from CLT.

4. **Remaining in Testing Room:** With the exception of the restroom break and emergencies, students must remain in the testing room for the duration of the test. Proctors are not allowed to leave students unsupervised, even before the exam has begun.

5. **Maintaining Exam Security:** All CLT10 exams are copyrighted and cannot be copied, printed, or otherwise used outside of the test. Proctors may not alter CLT10 materials, transfer them to another file, or make copies. They also may not disclose test materials, questions, or other information to any outside parties. Proctors are tasked with protecting the content of the exam by ensuring that students do not copy or otherwise duplicate exam material, such as by taking pictures of their tests.

6. **Completing Proctor Survey and Anomaly Report (if applicable):** Immediately after the exam, proctors should fill out and submit the Proctor Survey, in addition to an Anomaly Report if any anomalies or disruptions occurred during the exam. CLT staff review these reports as well as testing data and may follow up with school administration as needed.

REMOTELY PROCTORED TESTS

The remotely proctored CLT10 is administered privately and without a proctor; CLT's testing platform records video, screen, audio, and keystrokes during the test, and CLT staff review the recordings afterwards to ensure exam integrity. Recordings are stored in a secure location and deleted within 45 days.

The Test Access Code is emailed to the test-taker and their emergency contact the day before test day. On test day, a student logs into their account when ready, and once their profile is complete, they start the test from the student dashboard: they enter the Test Access Code, read and sign the Honor Code, and complete the pre-test steps to ensure their recording is working and they are testing in a secure environment. The timer does not start until the first section of the test is begun.

Technical and customer support is available from 7am to 7pm Eastern time on test day. Students are strongly encouraged to test during these hours. The test must be taken in one sitting. The test is open from 12:00 am to 11:59 pm Pacific Time on test day. The exam takes about two hours and twenty minutes, including pre-test instructions and procedures. Students will not incur any time penalties for chatting with CLT support during the exam.

TESTING ROOM REQUIREMENTS

1. Students must be alone in a closed, well-lit room from the beginning of the recording until the test is submitted. Public spaces such as cafes, parks, or open seating areas at libraries are not allowed. If it is not possible to meet this requirement, students must contact CLT with details and we will do our best to arrive at an acceptable arrangement.
2. Students must remain in the room alone with no talking throughout the test. Before starting the test, students should remind other members of the household not to interrupt, including anyone who might come home while they are testing.

3. Students should be in a room with a reliable internet connection, preferably as close as possible to the Wi-Fi router.
4. Students' computers and keyboards must be on a desk or table.
5. Students must sit on a standard chair or stool (not a bed, couch, or overstuffed chair).

REQUIRED ITEMS

1. A laptop or desktop computer with a functioning camera and microphone.
   - Tablets and mobile devices cannot be used.
   - Both internal (built-in) and external (e.g. USB) cameras and microphones are acceptable.
   - Students must make sure their computer's speakers are working and turned on so that they can hear the notification tones for the test timer.
   - If using a laptop, students must make sure it is plugged in during the exam.
   - LockDown Browser® must be installed on the student's computer.
2. An approved form of photo ID.
   - Passport, driver's license or permit, or state ID
   - High school ID (current year only), HSLDA Student ID (current year only), or college ID
   - Military/military dependent ID
   - If students do not have any of the above, they may print the CLT Student ID Form and have it notarized by a notary public, or signed and sealed by a school official.

4.4 Test Day Schedules

The CLT10 must be completed in the order and time given. In-school testers taking the CLT10 must remain for the full time of each section and submit their exams simultaneously with the other students present, even if they finish one or more sections early.

Testers taking the remotely proctored CLT10 may move to the next section early (including submitting the exam early) if they finish with extra time. The remotely proctored test contains a test timer and once time has elapsed for a section, students are no longer allowed to enter or change answers.

For in-school tests, proctors are responsible for timing each of the test sections and providing instructions for test takers. The entire test administration will take the proctor about three hours if no students take the essay, or about three hours and thirty minutes if at least one student takes the essay.

SAMPLE SCHEDULE (IN-SCHOOL TEST)

TIME	TASK
9:40 AM	Proctor gathers required items and prepares the testing room.
10:00 AM	Proctor admits students and reads General Announcements.
10:10 AM	Proctor reads Administrative Material.
10:20 AM	Section 1: Verbal Reasoning begins.
10:55/10:59 AM	Proctor gives 5 minutes/1 minute warnings for Section 1.
11:00 AM	End of Verbal Reasoning section, beginning of Grammar/Writing section.
11:30/11:34 AM	Proctor gives 5 minutes/1 minute warnings for Section 2.
11:35 AM	End of Grammar/Writing section, beginning of restroom break.
11:45 AM	End of restroom break, beginning of Quantitative Reasoning section.
12:25/12:29 PM	Proctor gives 5 minutes/1 minute warnings for Section 3.
12:30 PM	End of Quantitative Reasoning section; closing announcements and student surveys.
12:35 PM	Dismissal of students not taking optional essay, beginning of essay for remaining students.
1:00/1:04 PM	Proctor gives 5 minutes/1 minute warnings for the essay.
1:05 PM	End of the optional essay, dismissal of remaining students.
1:10 PM	Proctor submits Administration Report and Proctor Survey.

4.5 Test Day CLT10 Support

Live test-day support for proctors, administrators, and testers is available on test day. CLT has a dedicated team of customer service representatives who are available to answer questions from schools, proctors, and parents.

This team includes representatives from CLT's technology, operations, and customer support teams to ensure that issues can be resolved quickly and directly. On test day, live support is available via chat and phone from 7am to 7pm Eastern time.

4.6 Test Security

CLT's test security is designed to ensure the privacy of its test-takers. The management of their data is described below.

DATA SECURITY

CLT trains all its employees on the high sensitivity levels of CLT data, including the access and use of confidential material such as personally identifiable information (PII). CLT requires each employee to acknowledge and sign internal policies regarding the acceptable use of CLT data. Our security measures are annually reviewed by a third party to ensure we are meeting external standards of data protection.

DATA PRIVACY AND ACCEPTABLE USE

CLT considers all student data confidential, including collected identifiable information (email and student profile data) as well as test results. CLT employees may not share any student's data with a third party without that student's express consent.

Students who take their tests through their school will have access to their scores and analytics. Their scores and analytics will also be available on their school's administrator account, accessible to their school's testing coordinator and any other approved administrators or teachers. All students may opt to share their profile and test results with specific colleges of their interest and/or opt into CLT's partnership program in which CLT shares limited student data with partner institutions. Students who opt in may also opt out of the program at any time by logging into their CLT account and editing their profile.

School administrators can view full student data for test day, including test history, scores, and basic profile information. School administrators do not have access to the full student-entered user profile and cannot view student score shares, practice tests results, or independent registrations or purchases.

ACCESS CONTROL

CLT data may be accessed either through the web application or through the database directly. All users must be authenticated to access CLT data, and authorization is based on security level.

- Web Application Access – The CLT web application security is role-based. By default, all users who register for an account receive the same level of access as students, the most minimal access level. CLT employees grant a role to school administrator accounts that permits them access to the data for their school, as described above.
  - Admin Role – CLT employees are granted an admin role in order to access necessary information to support customers. Users in an admin role can view test registrations and view student data.
  - Test Development Role – a limited number of CLT employees have privileged access that allows them access to write, review, and modify test data in advance of test dates. This includes the ability to add tests, add and edit questions and answers in existing tests, change test dates and deadlines, and deactivate tests.
- Database/Network Access – accessing the database directly falls under privileged access and is limited

to the development and analytics teams. In addition, a subset of Operations and Test Development employees have read-only access to the database. Database access is protected by SSH keys (public-key cryptography). All database traffic is accessed through a single bastion host. Network traffic can also enter through the single bastion host or by restricted IP addresses. Each privileged user is granted two accounts, one read-only and one administrative account. Users use their read-only account unless a critical change is required. Some users, such as those on the Analytics team, may be granted only a read-only account.

- Data Access – all CLT data is stored in a secure cloud environment that is not accessible to CLT employees in general, only to authorized members of the technical and operation teams. The third-party cloud provider ensures the highest level of security and access.

MONITORING AND AUDITING

All activities are logged when changes are made in the software, database, and infrastructure. Logging is monitored on a regular basis to identify breaches, risks, or unexpected behavior. User roles are also monitored on a regular basis to ensure that users have not been inappropriately granted access to data.

INCIDENT MANAGEMENT AND RESPONSE

The CLT Executive Team manages all incidents, including data breaches and/or unacceptable use of data. In the event that user data is compromised, the issue will be immediately remediated and the affected parties will be contacted. CLT also conducts an after action report that is submitted to a third party for evaluation.

5. TEST ACCESSIBILITY

5.1 Fairness During the Testing Process

All CLT testing takes learning differences and disabilities into account, in accord with the Standards for Educational and Psychological Testing (Standards) jointly set forth by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education. CLT also considers fairness in testing a top concern, and persistently works to minimize bias and ensure a universally accessible design.

Using language from the Standards, we begin to define fairness as accessibility: "the notion that all test takers should have an unobstructed opportunity to demonstrate their standing on the construct(s) being measured."[1]

Testing accommodations are adaptations to an exam that can be made for students with diagnosed disabilities; their purpose is to provide candidates with full and equal access in order to accurately demonstrate their skills and abilities as measured on the test. (Accommodations on the CLT10 do not guarantee test completion, improved performance, or any other specific outcome.) All testing accommodations are made on a case-by-case basis. Regardless of diagnosis, we ask that individuals seeking disability-related accommodations provide us with documentation of the nature of their disability and its relevance to the test. Accommodations for the CLT10 must be submitted for approval at least four weeks prior to the test administration date.

1 American Educational Research Association, American Psychological Association, & National Council on Measurement in Education (Eds.). (2014). Standards for educational and psychological testing. American Educational Research Association.

5.2 Fairness in Test Accessibility

CLT provides testing accommodations to students with documented disabilities to make testing equally accessible to all. Test accommodations are individualized and considered on a case-by-case basis.

Regardless of diagnosis, all individuals seeking disability-related accommodations must provide evidence that their condition rises to the level of a disability, which adversely affects a child's educational performance, and provide information about those functional limitations. Demonstrating that an individual meets diagnostic criteria for a particular disorder does not automatically mean that the person qualifies for test accommodations. Accommodations must be appropriate to the particular task and setting involved, and proper documentation of the effective use of accommodations in classroom or individual learning activities should support use in testing.

5.3 Accommodations and Requests

CLT is committed to providing every student a fair test-taking experience by ensuring the security, integrity, and validity of its examinations. CLT is committed to providing access to its programs and services to students with documented disabilities, a disability being a physical or mental impairment that substantially limits a major life activity.

CLT therefore offers a range of accommodations for students with documented learning or physical disabilities, in accordance with the Individuals with Disabilities Education Act (IDEA) and the Americans with Disabilities Act (ADA). In compliance with these laws and in support of our core values, CLT seeks to minimize bias and provide equality of access to the test. In addition to accommodations for documented disabilities, we also offer English Language Learner (ELL) accommodations.

Test-takers seeking accommodations are required to submit an accommodations request. Information is available on the CLT website. Accommodations approvals are granted for a period of up to five years.

All accommodations requests must be submitted on behalf of individual students at least four weeks in advance of the testing date.

When accommodations requests are submitted by school administrators on behalf of individual students, parents must also sign and return a Consent Form for Releasing Accommodations Documentation which authorizes the student's school to release accommodations-related documentation to CLT.

Approved accommodations on the exam may include:

EXTENDED TIME

- 25% Extended Time
- 50% Extended Time
- 100% Extended Time

MEDICAL NEEDS ACCOMMODATIONS

- Food/drinks/medication in the test space
- Medical devices in the test space
- Further monitoring, if requested

ELL STUDENT ACCOMMODATIONS

- 50% Extended Time
- Approved bilingual word-to-word dictionary

CALCULATOR

- 4-Function Calculator. No scientific or graphing calculators are permitted.

MISCELLANEOUS

- Text-to-speech
- Reader
- Scribe
- Read aloud to self
- Breaks between sections
- Additional scrap paper
- Large font exam
- Small group testing
- Other accommodations can be approved and provided as needed for access to the exam.

REVIEW TIMELINE

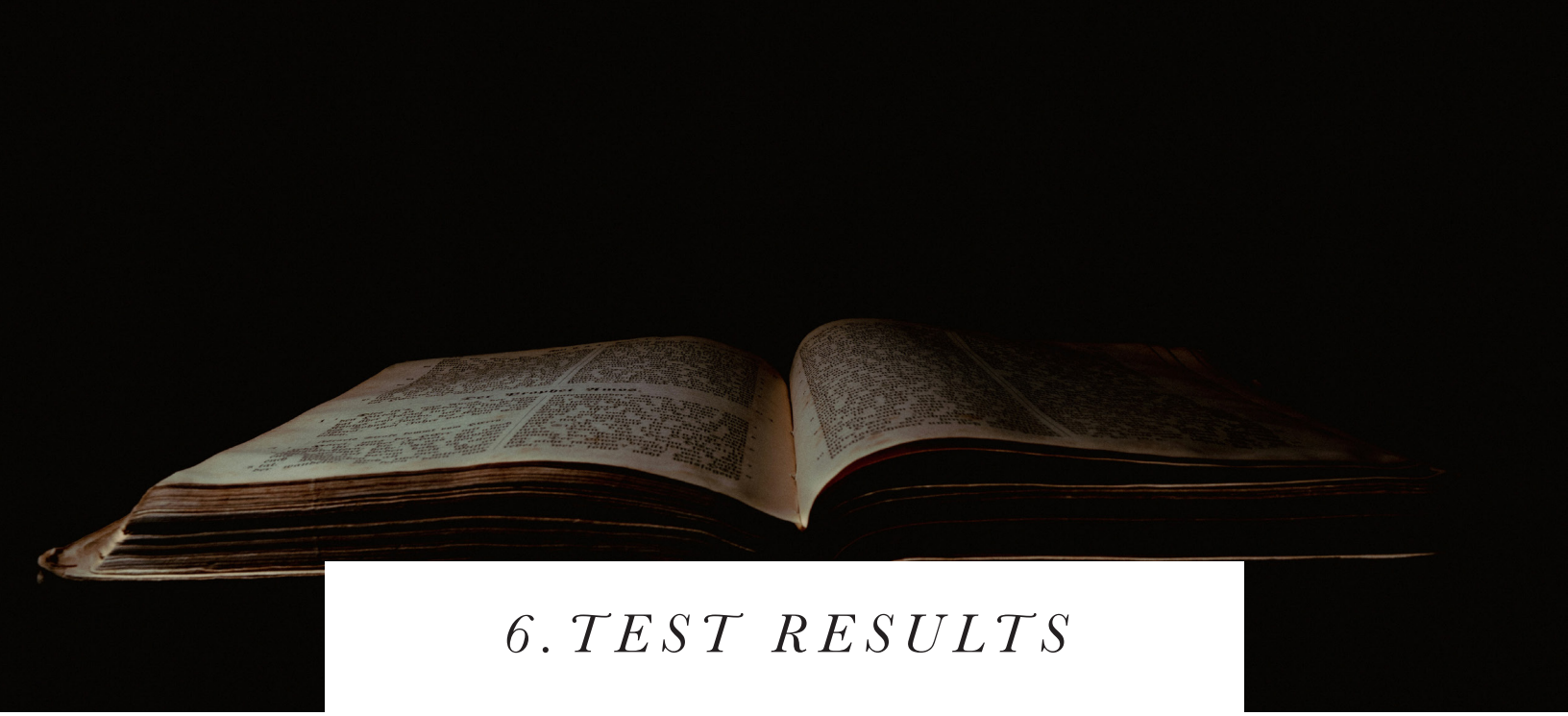
To ensure the timely fulfillment of accommodations requests, such requests must be submitted (with supporting documentation) at least four weeks before the test date.

CLT reviews accommodations requests and submitted documentation and will contact the submitter about any matters requiring clarification. Please note that if a request is incomplete when uploaded, it may take longer to process while we request the required documentation. CLT keeps the submitter updated as to the status of their request.

CLT staff will make every effort to review and approve requests; however, CLT cannot guarantee a full review for requests received after the accommodations deadline. In order to be fair to all candidates, accommodations requests are reviewed in the order they are received; requests cannot be expedited.

Testers may appeal an accommodation decision if their request is not approved. Successful appeals should include a specific reason for appeal, as well as additional documentation beyond what was included in the original request.

CHAPTER FIVE



6. TEST RESULTS

CHAPTER SIX

6.1 Student Score Reports

Students receive test results as part of a score report which is available to them through their online accounts on the CLT website. The data provided helps students and teachers identify strengths and areas for improvement. CLT10 score reports may also be shared with partner colleges to indicate interest and qualify for scholarships.

An individual student score report has five main sections, as pictured and described below.

1. SCORE SUMMARY

This part of the Student Score Report shows the CLT10 scaled score on the overall test and on each section. The overall scale ranges from 0-120 and the sections contain scaled scores from 0 to 40. Testers also see a concorded score on the PSAT as well as a national percentile, which allows a tester to compare their score to the scores of a nationally representative group on the same test.

Score Summary

Scores are shown by subject area and total.

	Adjusted Score	Nat'l Percentile ⓘ
Overall Score	99	96th
Verbal Reasoning	32	
Grammar / Writing	34	
Quantitative Reasoning	33	

Concordance	Projected Score
PSAT	1260

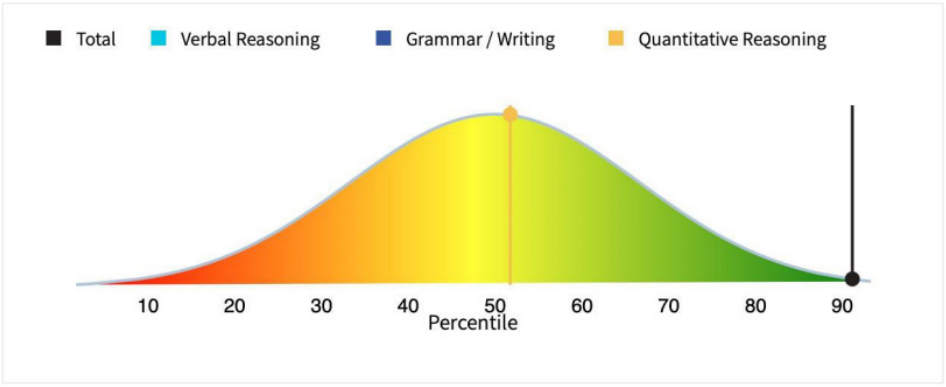
2. CLT10 USER PERCENTILES

User Percentiles show the percentage of CLT10 scores that are equal to or below the tester's score.

CLT User Percentiles ⓘ	
Overall Performance	91st
Verbal Reasoning	99th
Grammar / Writing	99th+
Quantitative Reasoning	51st

3. CLT10 SCORE BELL CURVE

The bell-shaped figure visualizes the distribution of all CLT10 scores. The black line locates the user percentile of the tester's total score on the exam. Scores in the yellow zone are average, while scores in the green zone are above average.



4. DOMAINS AND SUBDOMAINS

The Domains and Subdomains Report shows tester strengths and areas for improvement. "Top Question Types" shows the types of questions which were answered with the highest accuracy.

Top Question Types

Question Type by Academic Domain-Subdomain Pairing	% Correct
Grammar - Agreement	100%
Writing - Word Choice	100%
Grammar - Punctuation and Sentence Structure	100%
Writing - Style	100%

In contrast, "Improvement Areas" shows the types of questions with the lowest percentage of correct answers.

Improvement Areas

Question Type by Academic Domain-Subdomain Pairing	% Correct
Algebra - Algebraic Expressions and Equations	0%
Geometry - Plane Geometry	25%
Mathematical Reasoning - Logic	38%
Geometry - Properties of Shapes	50%

5. DETAILED PERFORMANCE

Below the Top Question Types and Areas for Improvement, testers may access a detailed view of their performance on each subject, domain, and subdomain. The "% Correct" column shows the percentage of questions answered correctly in each category. From this section, testers may also access more information about each subdomain and view example problems in that category.

Detailed Performance by Subject Section, Academic Domain, and Academic Subdomain

Question Type by Academic Domain-Subdomain Pairing	% Correct	Example Practice Questions
− **Verbal Reasoning**		
Analysis	**100%**	
Interpretation of Evidence ⓘ	100%	12
Textual Analysis ⓘ	100%	4
Comprehension	**93%**	
Passage as a Whole ⓘ	100%	8
Passage Details ⓘ	82%	6
Passage Relationships ⓘ	100%	10
+ **Grammar / Writing**		
+ **Quantitative Reasoning**		

6.2 College Score Reports

The student has the option to share their CLT10 score report with as many colleges as they choose at no additional cost. If the student completes the optional essay section, he or she may also choose whether or not to share the text of the essay with colleges.

When students opt to send their score reports and optional essays to colleges of their choice, these colleges receive those students' CLT10 score information as shown in the following sample report.

CLT Official Score Report

Student Information

Name	Example Name
DOB	2006-01-01
Address	Example Address Annapolis, MD 21401
Email	example
Phone	example
Gender	example

CLT Scores

Test Date	October 15, 2022
Verbal Reasoning	38 / 40
Grammar/Writing	39 / 40
Quantitative Reasoning	20 / 40
Total Score	97 / 120

School Information

GPA	3.9
High/Home School	
High/Home School Type	Homeschool
Graduation Class	2024

Additional Information

Projected SAT	1420*
Projected ACT	32*
Intended Major	Arts and Humanities
Financial Aid Interest	Not Provided

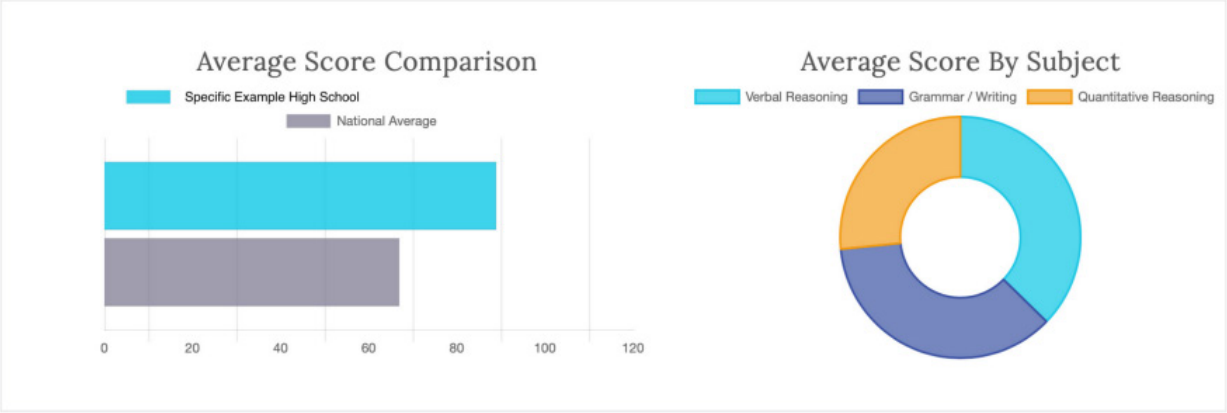
* Projected based on concordance with CLT score

6.3 Secondary School Score Reports

CLT provides detailed class and individual analytics for schools who have offered the CLT10 exam.

Once scores for an exam have been released, administrators of secondary schools and home school organizations may view student scores by logging in to their CLT school administrator accounts to view scores and analytics.

Students can view their own scores by logging in to their CLT accounts and viewing their individual student score reports, as described above.



Analytics include historical average scores for the school, as well as scores and CLT10 percentiles for each student, per test. CLT10 percentiles are user-referenced and indicate how a student performed on the test as compared to other CLT10 testers.

Students (Test Date)				Overall		Verbal Reasoning		Grammar/Writing		Quantitative Reasoning		
Last Name	First Name	Grad Year	DOB	Score	CLT User Percentile	Score	CLT User Percentile	Score	CLT User Percentile	Score	CLT User Percentile	Actions
Student 1	clt	2024	2006-01-09	85	70th	30	64th	24	29th	31	94th	
Student 10	clt	2021	2006-05-04	95	88th	30	64th	32	76th	33	97th	
Student 2	clt	2024	2005-10-23	93	85th	32	76th	32	76th	29	90th	
Student 3	clt	2023	2004-11-30	78	55th	27	46th	26	39th	25	77th	
Student 4	clt	2024	2005-12-22	67	31st	24	31st	21	18th	22	62nd	
Student 5	clt	2024	2005-09-29	79	57th	28	52nd	25	34th	26	81st	
Student 6	clt	2024	2006-03-21	74	45th	23	27th	24	29th	27	84th	
Student 7	clt	2024	2005-10-10	60	19th	20	16th	18	9th	22	62nd	
Student 8	clt	2022	2004-04-01	92	84th	32	76th	33	82nd	27	84th	
Student 9	clt	2021	2003-06-28	68	33rd	21	19th	27	45th	21	57th	

Test administrators also have access to detailed student and school-level analytics. Student performance is reported individually by academic domain and academic subdomain.

Table 6.3.1 CLT10 Sections, Domains, and Subdomains

SUBJECT SECTION	VERBAL REASONING		GRAMMAR/WRITING		QUANTITATIVE REASONING		
Domain	Analysis	Comprehension	Grammar	Writing	Algebra	Geometry	Mathematical Reasoning
Subdomain	Interpretation of Evidence	Passage as a Whole	Agreement	Structure	Algebraic Expressions and Equations	Coordinate Geometry	Logic
	Textual Analysis	Passage Details	Punctuation and Sentence Structure	Style	Arithmetic and Operations	Properties of Shapes	Word Problems
		Passage Relationships		Word Choice			

School administrators can view a percent correct metric for each domain and subdomain, both based on overall school performance and individual student performance. At the school level, this percent correct metric displays the average percentage of questions the students at that school answered correctly within the specified category for the specified test.

School administrators can see the top and bottom four domain-subdomain pairings (in terms of performance), as well as a breakdown of how the school performed on each section, domain, and subdomain, as pictured below.

Top Question Types

Question Type	Correct
Writing - Word Choice	100%
Grammar - Punctuation and Sentence Structure	95%
Analysis - Textual Analysis	94%
Comprehension - Passage as a Whole	94%

Improvement Areas

Question Type	Correct
Algebra - Algebraic Expressions and Equations	20%
Geometry - Plane Geometry	38%
Geometry - Properties of Shapes	45%
Mathematical Reasoning - Logic	63%

Performance by Subject & Question Type

The average adjusted score is the average score of your students after adjusting for test difficulty. The CLT user percentile shows the percentage of CLT test takers who scored equal to or lower than the corresponding adjusted score.

Section	Average Adjusted Score	CLT User Percentile ⓘ
Verbal Reasoning	37	98th
Grammar / Writing	34	85th
Quantitative Reasoning	24	67th

Verbal Reasoning

Analysis	92%
Interpretation of Evidence	90%
Textual Analysis	94%
Comprehension	91%
Passage as a Whole	94%
Passage Details	91%
Passage Relationships	88%

Grammar / Writing

Grammar	93%
Agreement	90%
Punctuation and Sentence Structure	95%
Writing	78%
Structure	81%
Style	63%
Word Choice	100%

Quantitative Reasoning

Algebra	55%
Algebraic Expressions and Equations	20%
Arithmetic and Operations	90%
Geometry	43%
Plane Geometry	38%
Properties of Shapes	45%
Mathematical Reasoning	75%
Logic	63%
Word Problems	88%

7. CLASSICAL ITEM ANALYSIS

CHAPTER SEVEN

7.1 Introduction to Item Statistics in Classical Test Theory

This chapter introduces psychometric measures used to analyze items in the Classical Test Theory (CTT) framework: item difficulty and item discrimination. We show the results of CTT item analysis for a base CLT10 form that is also used as a reference form in other psychometric analyses presented in this technical report.

In CTT, the difficulty of an item is defined as the proportion of test takers who answered it incorrectly. Rather than measuring difficulty directly, CTT uses an item "easiness" parameter called the p value, which is the proportion of students who answered the item correctly (Crocker & Algina, 2008). The p value of item i is given by Equation 7.1:

$$p_i = \frac{\sum_{n=1}^{N} X_{ni}}{N} \tag{7.1}$$

where X_{ni} is the response of student n to item i, coded as 1 for a correct answer and 0 for an incorrect answer. N is the total number of students. The p value is sample dependent, meaning it will change depending on the abilities of a sample of test takers; the same item may appear as difficult in a low-ability sample but easy in a high-ability sample (Chapter 8 presents difficulty metrics that are

comparable across samples).

Item discrimination is the ability of an item to distinguish students of high ability from those of low ability (Crocker & Algina, 2008). In CTT, one measure of item discrimination is the point-biserial correlation between scores on an item and total scores on the test (the calculation of the total scores excludes the item being analyzed). The point-biserial correlation (r_{pb}) is the correlation between a binary variable (item responses) and a continuous variable (total scores), ranging between -1 and 1. If an item has high discrimination, it is more likely to be answered correctly by students with high ability than low ability. Thus, the correlation between the responses to the item and the total scores obtained on the test will have a large, positive correlation. Conversely, if there is no relationship between student responses to an item and total scores, the point-biserial correlation will be close to 0. Sometimes, a negative point-biserial is observed, indicating that high ability students are less likely to answer the item correctly than low ability students. This may indicate an issue with the answer key and needs to be evaluated by test developers and content experts. Like the p value, the point-biserial correlation is sample dependent, meaning that the point-biserial correlation of an item may vary across groups. The p values and point-biserial correlations are calculated using the CTT package (Willse, 2022) in the R programming language (R Core Team, 2024).

7.2 The Results of Classical Item Analysis

Table 7.1. shows the distribution of p values in the CLT10 base form, and Table 7.2. shows the distribution of the point-biserial correlations.

Table 7.1

The Distribution of p Values in the CLT10 Base Form

Section	N Items	Mean	SD	Min	Max
Verbal Reasoning	40	0.64	0.15	0.28	0.89
Grammar/Writing	40	0.67	0.18	0.35	0.97
Quantitative Reasoning	40	0.55	0.20	0.18	0.89

Table 7.2

The Distribution of Point-Biserial Correlation r_{pb} in the CLT10 Base Form

Section	N Items	Mean	SD	Min	Max
Verbal Reasoning	40	0.35	0.1	0.15	0.52
Grammar/Writing	40	0.34	0.08	0.09	0.48
Quantitative Reasoning	40	0.42	0.09	0.17	0.56

CHAPTER SEVEN

8. IRT CALIBRATION, SCALING, AND SCORING

8.1 Introduction

Each academic year, CLT assembles multiple CLT10 forms using different items to ensure test security. This prevents the items from being shared or remembered from previous test attempts. Given that students take different versions of the test, it is crucial that every test-taker is scored fairly and consistently. For example, two students who took different forms but have the same ability should receive the same score regardless of the specific test form they were administered. However, if the items on the two forms vary in content and difficulty, and the forms are scored simply based on the number of correct responses, then the scores of these two students will not be comparable. Chapter 3 describes the automated test assembly (ATA) procedures we use to pre-equate test forms, ensuring that students are administered test forms that are parallel in content and statistical specifications such as difficulty and measurement precision. In practice, it is difficult to build forms that are identical in difficulty, so post-equating is performed to further improve the equivalence of test forms. Equivalence implies that any form is fully interchangeable with any other form.

To achieve these objectives, CLT conducts a series of psychometric analyses based on the modern measurement theory, Item Response Theory (IRT). IRT consists of a family of latent variable models that model the probability of a correct response to an item based on the interaction between item parameters and latent ability parameters. Item and ability parameters obtained from different test forms are placed on the same scale through a process of calibration that is described below (Kolen

& Brennan, 2014). Using IRT enables two key outcomes: 1) measurement of an individual student's ability that is independent of the items on a particular test form, and 2) evaluation of test items that is independent of any particular group of test-takers. However, the scale of latent ability estimates obtained from IRT models is hard to interpret, so the ability estimates are transformed to scale scores that can be interpreted and understood more easily by stakeholders.

This chapter begins with an overview of the Rasch model, which is the IRT model used for all the CLT suite of assessments. Then, we explain the calibration process that is carried out to ensure that the ability estimates obtained from the Rasch model can be compared across test forms and groups of students. Next, we describe the data cleaning process conducted before the IRT calibrations. Finally, we explain the process used to transform the ability estimates to the scale scores that are reported to students.

8.2 The Rasch Model

The Rasch model quantifies the probability that a given test-taker will answer a given item correctly as a function of two variables: the test-taker's ability and the item's difficulty. The more capable the student and the easier the item, the higher the odds that the student will get the item right. Mathematically, odds are defined as the ratio of probabilities. In this case, the odds refer to the ratio of the probability of answering an item correctly to the probability of answering it incorrectly. Taking the logarithm of the odds allows us to express them as a linear function of student ability and item difficulty (Equation 8.1):

$$\log\left(\frac{P_{ni}}{1-P_{ni}}\right) = \theta_n - b_i \tag{8.1}$$

where P_{ni} is the probability that test-taker n will answer item i correctly, θ_n is the ability of test-taker n, and b_i is the difficulty of item i.

Both the ability estimates and the difficulty estimates are on the log-odds scale, also called the logit scale. Consequently, item difficulty and test-taker ability can be directly compared to each other. In the Rasch model, item difficulty is defined as the ability level at which the probability of answering the item correctly is 50%. That is, students whose ability is higher than the item's difficulty will have greater than a 50% chance of answering the item correctly, whereas students whose ability is lower than the item's difficulty will have smaller than a 50% chance of answering the item correctly. Most observed logit values fall in the -3 to 3 range. The probability of answering an item correctly (P_{ni}) can be expressed directly as well (Equation 8.2):

$$P_{ni} = \frac{\exp^{\theta_n - b_i}}{1 + \exp^{\theta_n - b_i}} \tag{8.2}$$

The Rasch model makes three assumptions: monotonicity, unidimensionality, and local independence. Monotonicity means that the probability of answering an item correctly increases monotonically with student ability. The Rasch model also fixes the slope of this ability-probability curve to a common value for every item, implying that every item has equal discrimination. Unidimensionality means that the items on the test measure only a single construct/ability. Chapter 10 uses factor analysis to evaluate the dimensionality of the CLT10, showing that it measures three constructs: Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning. Therefore, we fit the Rasch model to the three sections separately. Local independence means that the responses of a student to any two items are independent after controlling for ability. This assumption may be violated, for example, if the answer to an item is implied in a previous item, making the two items dependent after controlling for ability. CLT carefully screens items to prevent such cluing.

The fit of the items to the Rasch model can be examined using the outfit and infit mean squares (MSQ) (Wright & Masters, 1982). These fit statistics are sensitive to violations of model assumptions, particularly to unequal item discrimination (Wu et al., 2016). The outfit MSQ of an item is the average of its squared standardized residuals, which are the differences between the observed responses in the data and the response probabilities predicted by the model, divided by the modeled variance of the response (Equation 8.3).

$$OutfitMSQ_i = \frac{\sum\limits_n z_{ni}^2}{n} \tag{8.3}$$

where $z_{ni} = \frac{X_{ni} - E(X_{ni})}{\sqrt{Var(X_{ni})}}$, X_{ni} is the observed response of student n to item i, $E(X_{ni})$ is the expected response of student n to item i, and $Var(X_{ni}) = E(X_{ni})(1 - E(X_{ni}))$ is the variance of a student's response to an item. Outfit statistics are sensitive to outliers such as lucky guesses on hard questions by low-ability students or careless mistakes on easy questions by high-ability students. The infit MSQ, however, accounts for outliers by weighting the squared residuals by the proximity between an item's difficulty and a student's ability (Equation 8.4). For instance, for hard items, prediction errors for high-ability students are weighted more heavily than the prediction errors for low-ability students.

$$InfitMSQ_i = \frac{\sum\limits_n z_{ni}^2 \times Var(X_{ni})}{\sum\limits_n Var(X_{ni})} \tag{8.4}$$

where z_{ni} and $Var(X_{ni})$ are defined as above. The $Var(X_{ni})$ term serves as the item-specific weight because the variance of the response, and thus information gained from a student's response, is maximized when a student's ability matches the item's difficulty (i.e., the probability of answering the item correctly is 0.5). Outfit and infit values have an expectation of 1, and values above 1.5 indicate model misfit. Items with an infit value greater than 1.5 are not used in CLT10 forms. Given the sensitivity of outfit to outliers, we do not use it to exclude items from test assembly.

ESTIMATING ITEM DIFFICULTIES AND PERSON ABILITIES

IRT models have scale indeterminacy, which means that for any given value of item difficulty, we can find an ability level that retains the same probability of a correct response to that item. That is, without constraining the scale of either the item difficulties or the student abilities, we would have infinitely many ways to describe the relative difference between item difficulty and latent ability, and produce the same response probability. Therefore, the model must be constrained in some way to allow parameter estimation. To solve the issue of scale indeterminacy, one of two approaches is used: 1) identify the scale of test-taker abilities by constraining the latent ability distribution; or 2) identify the scale of item difficulties by constraining the distribution of item parameters. CLT follows the common practice in scale identification by setting the mean of student abilities to 0, which sets a reference point for the estimation of both item difficulties and student abilities.

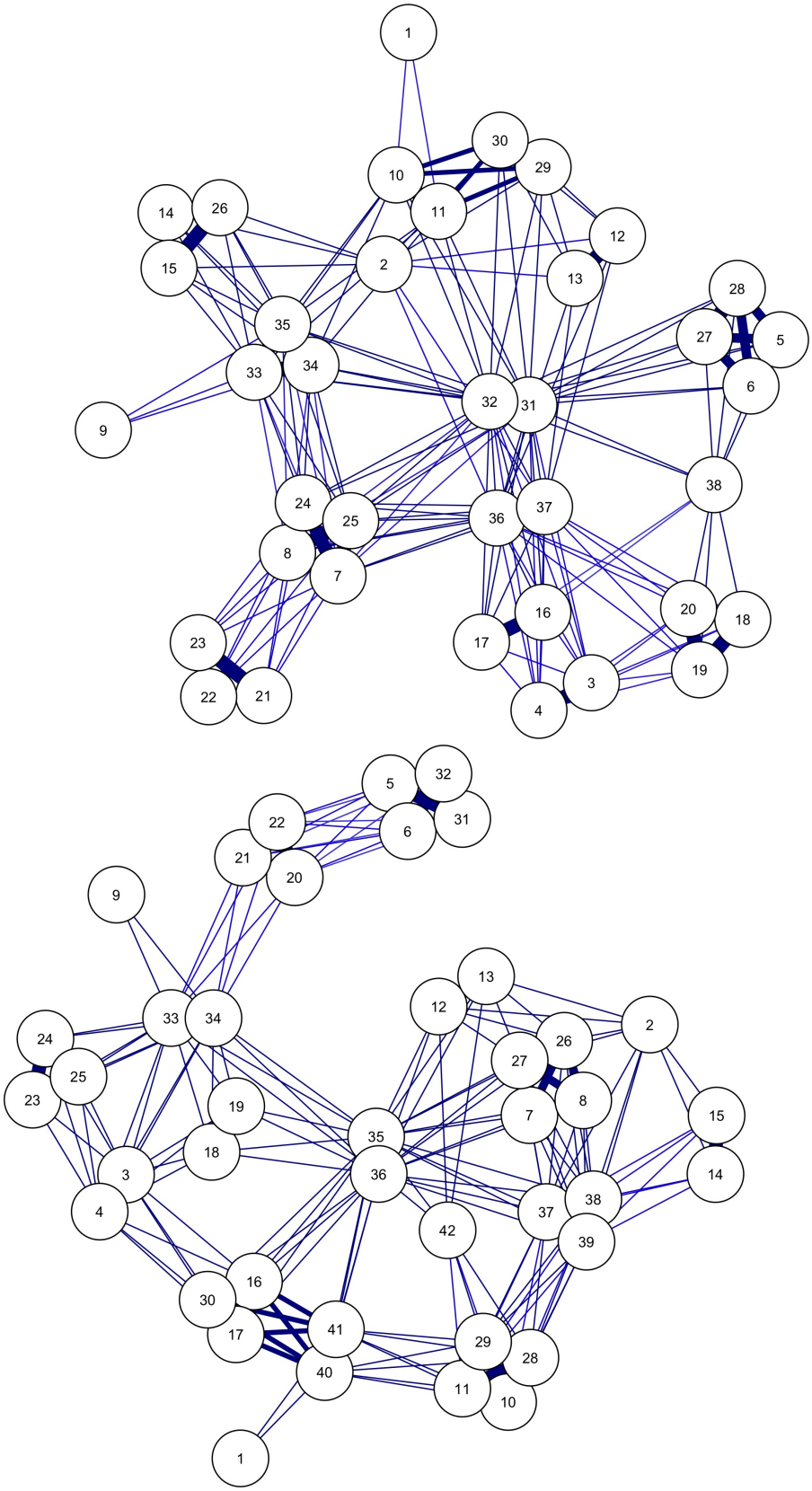
Constraining the mean of student abilities determines the scale for the purposes of parameter estimation, but further steps need to be taken before we can compare estimates obtained from different test forms administered to different groups of students. To illustrate why, suppose that group A takes form X and group B takes form Y, and suppose that the average ability of group A is higher than the average ability of group B. If the scale is identified by constraining the mean of test-taker abilities, the mean of the ability distribution will be set to 0 for both groups even though the actual ability of group A is higher than the ability of group B. This means that even if two items in different forms have the same difficulty estimate, they cannot be considered equally difficult because the ability level "0" that serves as the reference point in both analyses have a different meaning for different groups. Therefore, when Rasch analysis involves items from multiple test forms administered to groups that differ in ability, a calibration and equating process is necessary to ensure that the logit values derived from the different forms are on a consistent scale and thus comparable. This process is described next. CLT uses the R package TAM (Robitzsch, 2024) and the WINSTEPS® software (Linacre, 2024) for Rasch calibrations. TAM allows easy integration with the CLT data systems whereas WINSTEPS® serves as a quality control tool.

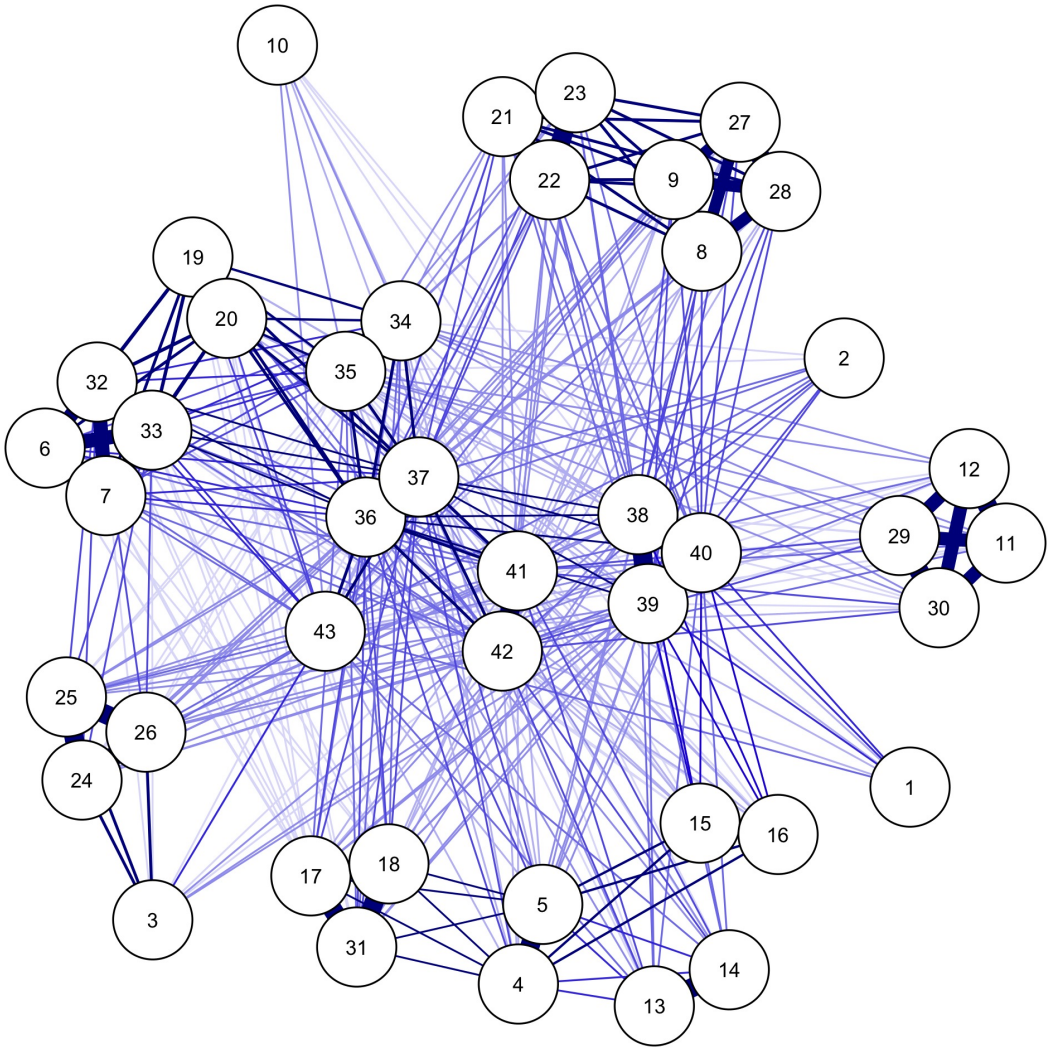
8.3 Fixed Parameter Calibration Using the Common-Item Nonequivalent Groups Design

Items administered to different groups of students can be placed on the same scale when the test forms share a sufficient number of items that represent the characteristics of the test as a whole (Kolen & Brennan, 2014). This study design is known as the common-item nonequivalent group design, and the common items are referred to as anchor items when used to link the scales of two forms. In the Verbal Reasoning and Grammar/Writing sections, the respective anchor items come from common passages. In the Quantitative Reasoning section, the anchor item sets are created from individual items. Anchor items were used to place the item difficulties and the abilities of different groups on the same scale via the fixed-parameter calibration method. First, a base form was selected, which set up an IRT scale for each section. The base form was selected according to the psychometric properties of the overall test form, including reliability and the distribution of p values and point-biserial correlations. To calibrate a new form on the scale of the base form, the difficulty estimates of the anchor items obtained from the base form were constrained to be the same in the new form. This placed the item difficulties as well as the person abilities estimated from the new form onto the scale of the base form. When a new form did not share any items with the base form but had common items with other forms that had already been calibrated and placed on the scale of the base form, those common items were used as anchor items to calibrate the new form. The links between different test forms can be conceptualized as a network with the forms as the nodes and the common items as the edges connecting the nodes. Figure 8.1 presents the network graphs that show the common item structure of the CLT10 forms for each section. In the graphs, each node is a CLT10 form and the edges are the common items linking the forms. Thicker edges indicate a larger number of common items. Each number in the circles is a form ID. The networks were plotted with the qgraph package (Epskamp et al., 2012) in R (R Core Team, 2024).

Figure 8.1

The Common Item Structure of CLT10 Forms





(c) The item network of Quantitative Reasoning

The network of the Quantitative Reasoning section is denser because in addition to being connected by sets of items with a balanced content representation, Quantitative Reasoning forms can share small numbers of stand-alone items. On the other hand, Verbal Reasoning and Grammar/Writing items belong to passages and are used as intact sets of items. To prevent whole sets of items from being administered too often, Verbal Reasoning and Grammar/Writing passages are reused more sparingly. In the Quantitative Reasoning section, single items that are high quality can be reused more often.

CHARACTERISTICS OF ANCHOR ITEMS

The psychometric literature suggests that to achieve a stable calibration, 20% of the items in a form should be anchor items (Kolen & Brennan, 2004). Since there are 40 items in each CLT10 section, this corresponds to 8 items, a standard which was either met or exceeded. In addition, the common items between the forms must remain stable to serve as anchor items. We check anchor item stability to ensure that anchor items function the same in the forms that are linked. Items may function differently across forms due to item drift or mode effects. Item drift refers to the fact that the difficulty of an item may change over time, and mode effects mean that an item may have a different difficulty depending on the mode in which it was administered (i.e., in-school online, in-school paper, or direct-to-consumer[1]). To evaluate anchor item stability, we use the displacement statistic (Linacre, 2024). Displacement is the difference between the anchored difficulty of an item and the difficulty estimate that would be obtained if the item was calibrated freely in the new form (i.e., if it was "unanchored"). Items that show a displacement of 0.5 or more logits in absolute value are not used as anchor items (O'Neill et al., 2013). Instead, their difficulty parameters are estimated freely and updated to reflect the most recent estimate for a given mode of administration. Students are scored using the difficulty estimates obtained from the mode in which they were administered the test. Further, we screen anchor items to ensure that they are high quality and unbiased using the point-biserial correlation, the infit and outfit statistics, and differential item functioning (DIF) statistics. Specifically, items with a point-biserial correlation of less than 0.10 or infit or outfit value above 1.5 are excluded from being anchors (see Chapter 3 for more information on DIF statistics).

DATA CLEANING AND MISSING VALUES

Before the analyses, we apply certain exclusion rules to ensure that the calibration samples are representative of the population, the assumptions of the Rasch model are met, and the parameter estimates are unbiased. First, repeat attempts are excluded from the item calibrations. That is, only the first attempt of each student is used to calibrate the items. Second, we exclude students who did not attempt a given section from the calibrations of that section. Third, missing/blank responses are treated differently in item calibration and scoring; during calibrations, we make a distinction between omitted and not-reached items.

Omitted items are items to which a student did not respond but after which the student continued the test. Given that the student had responses to the subsequent items, we assume that the student saw the omitted items and decided not to respond because they thought that the item was too difficult. In contrast, not-reached items are the missing responses at the end of the test – the missing responses

[1] Direct-to-consumer administrations will be replaced by remotely-proctored administrations starting in the 2025-2026 academic year. Please see the section on Test Security in Chapter 4 for more information.

ITEM 1	ITEM 2	ITEM 3	ITEM 4	ITEM 5	ITEM 6	ITEM 7	ITEM 8	ITEM 9	ITEM 10	ITEM 11
1	1	0	x	1	0	1	1	x	x	x

that are not followed by any response. We assume that the student did not actually encounter these items either because they ran out of time or decided to stop the test. As an example, consider the following response string in a hypothetical test with 11 items where 1 indicates a correct answer, 0 indicates an incorrect answer, and "x" indicates a missing response:

item_1	item_2	item_3	item_4	item_5	item_6	item_7	item_8	item_9	item_10	item_11
1	1	0	x	1	0	1	1	x	x	x

In this example, we assume that the student saw item 4, since they continued the test afterwards. That is an omitted item. On the other hand, items 9, 10, and 11 all have missing values, so it is more likely that the student never reached them (e.g., they ran out of time). Since the student never reached these questions, we do not know if they could have answered them correctly or not. Therefore, these questions are left as missing values during the calibrations. The distinction between omitted and not-reached items are only made during item calibration. When scoring students, all missing responses are treated as 0. For a detailed treatment of this approach with examples and an explanation of its advantages, we refer the reader to Ludlow and O'Leary (1999).

CALIBRATION RESULTS

After these exclusions, we follow the anchoring procedure described in the previous section and fit the Rasch model to each form. The result of this process is a calibrated item bank that has all the difficulty estimates on the same logit scale. Table 8.1 and Table 8.2 show the distribution of the difficulty (b) and the discrimination (r_{pb}) parameters in each section, and Figures 8.2 and 8.3 show the respective frequency distributions. The range of r_{pb} is restricted to ≥ 0.05 because items with a lower point-biserial correlation are excluded from further use and are not displayed in the tables. Items with a point biserial correlation larger than 0.05 but smaller than 0.10 are flagged and reviewed by content experts. As mentioned above, items with an infit or outfit mean square larger than 1.5 are also excluded from analyses and thus not displayed in the tables.

Table 8.1

Distribution of the Item Difficulties (b)

Section	N	Mean	SD	Min	Max	$b < -2.5$	$-2.5 \leq b \leq 2.5$	$b > 2.5$
VR	437	-0.61	1.03	-4.22	2.77	3.66%	96.11%	0.23%
GW	444	-0.80	1.23	-4.50	2.96	7.66%	91.44%	0.90%
QR	569	0.06	1.26	-5.23	5.94	4.04%	95.08%	0.88%

Note. The table shows the number of calibrated items and the mean, standard deviation, minimum, and the maximum of the item difficulties. The last three columns show the percentage of items within different difficulty ranges. The table only shows items with a point biserial correlation ≥ 0.05 and infit and outfit mean squares smaller than 1.5.

Table 8.2

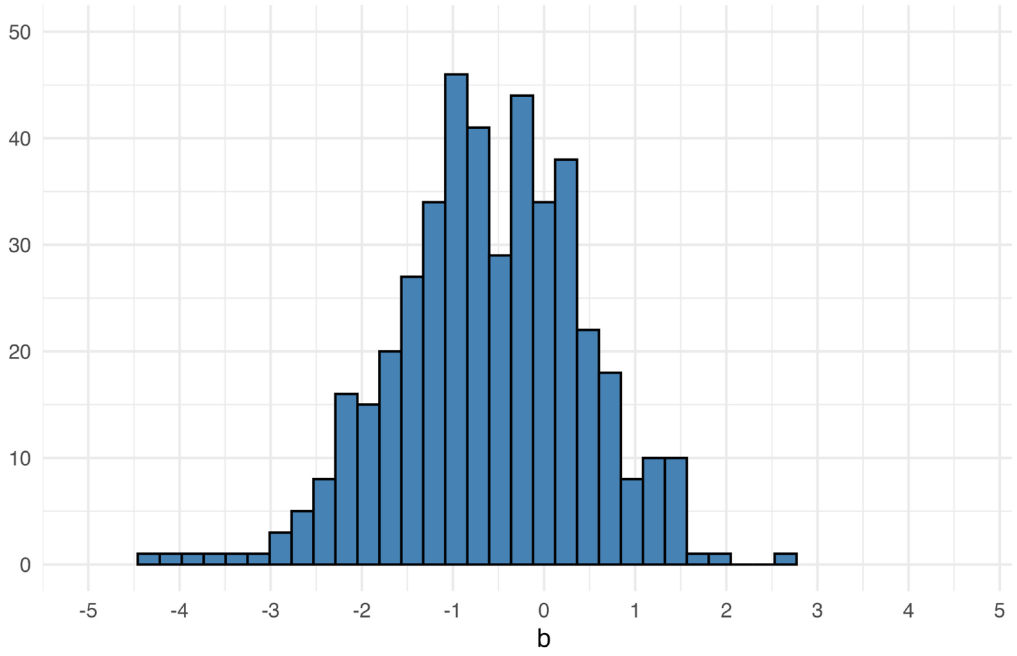
Distribution of the Point-Biserial Correlations (r_{pb})

Section	N	Mean	SD	Min	Max	$0.05 \leq r_{pb} < 0.10$	$0.10 \leq r_{pb} < 0.25$	$r_{pb} \geq 0.25$
VR	437	0.29	0.09	0.06	0.50	2.75%	27.92%	69.34%
GW	444	0.31	0.09	0.05	0.58	0.68%	23.87%	75.45%
QR	569	0.29	0.11	0.06	0.52	3.69%	32.69%	63.62%

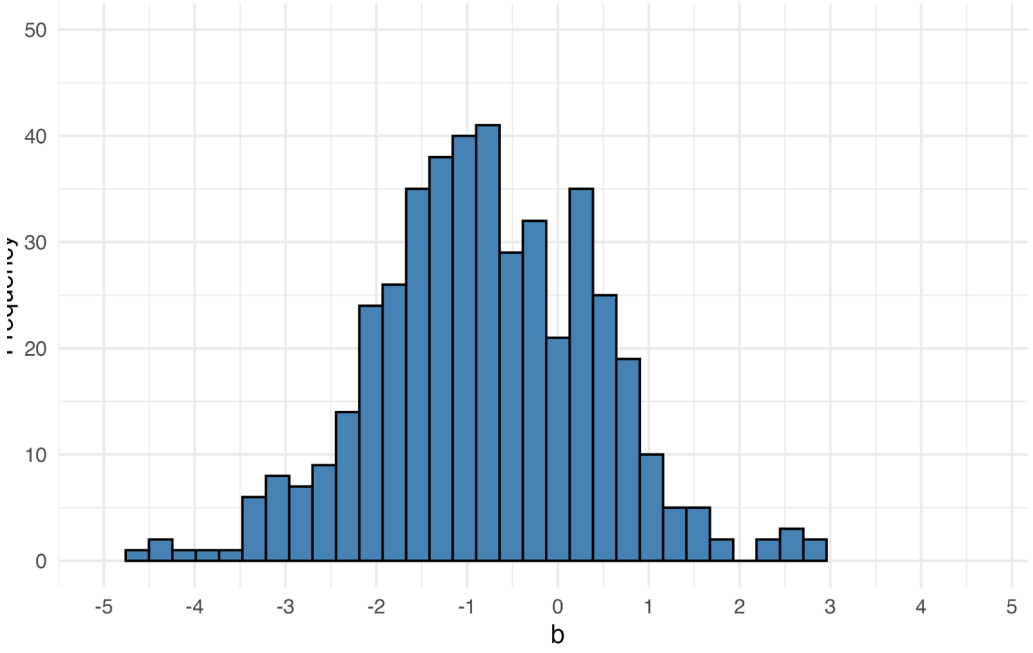
Note. The table shows the number of calibrated items and the mean, standard deviation, minimum, and the maximum of the point-biserial correlations. Also, the last three columns show the percentage of items with a point-biserial correlation in the given range. Items with $r_{pb} < 0.05$ are excluded from operational use and from the tables. The table only shows items with a point biserial correlation $\geq$ 0.05 and infit and outfit mean squares smaller than 1.5.

Figure 8.2

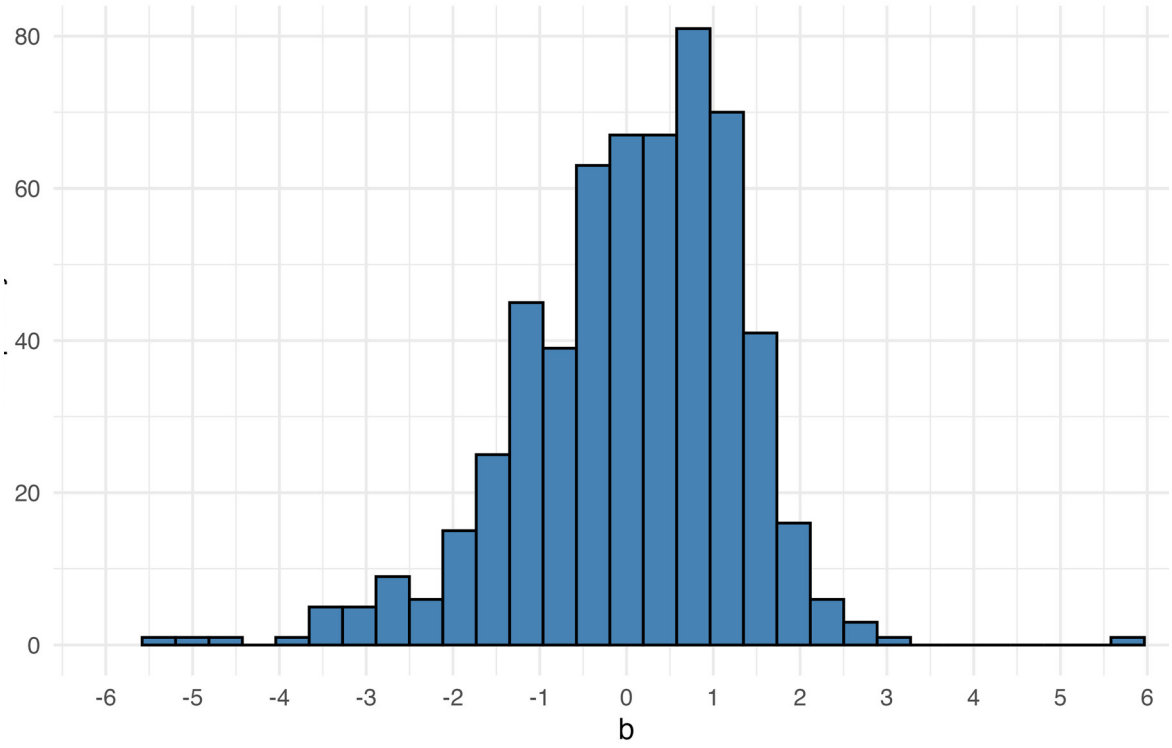
Frequency Distribution of Item Difficulties (*b*) in Each Section



(a) Verbal Reasoning



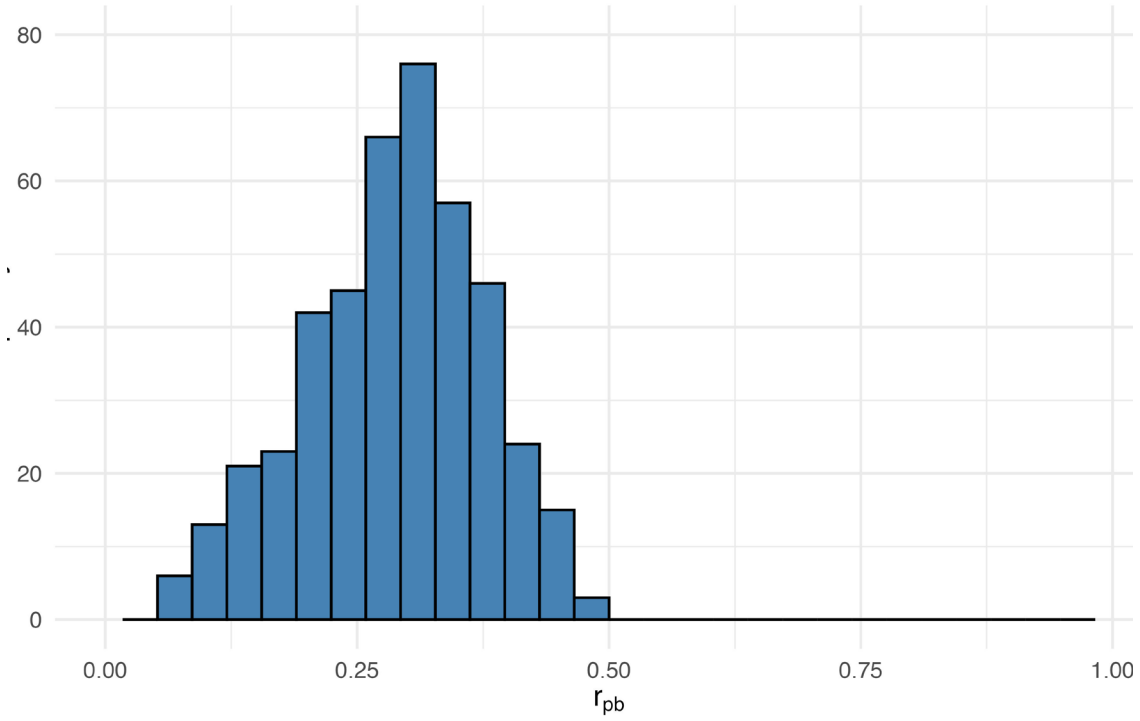
(b) Grammar/Writing



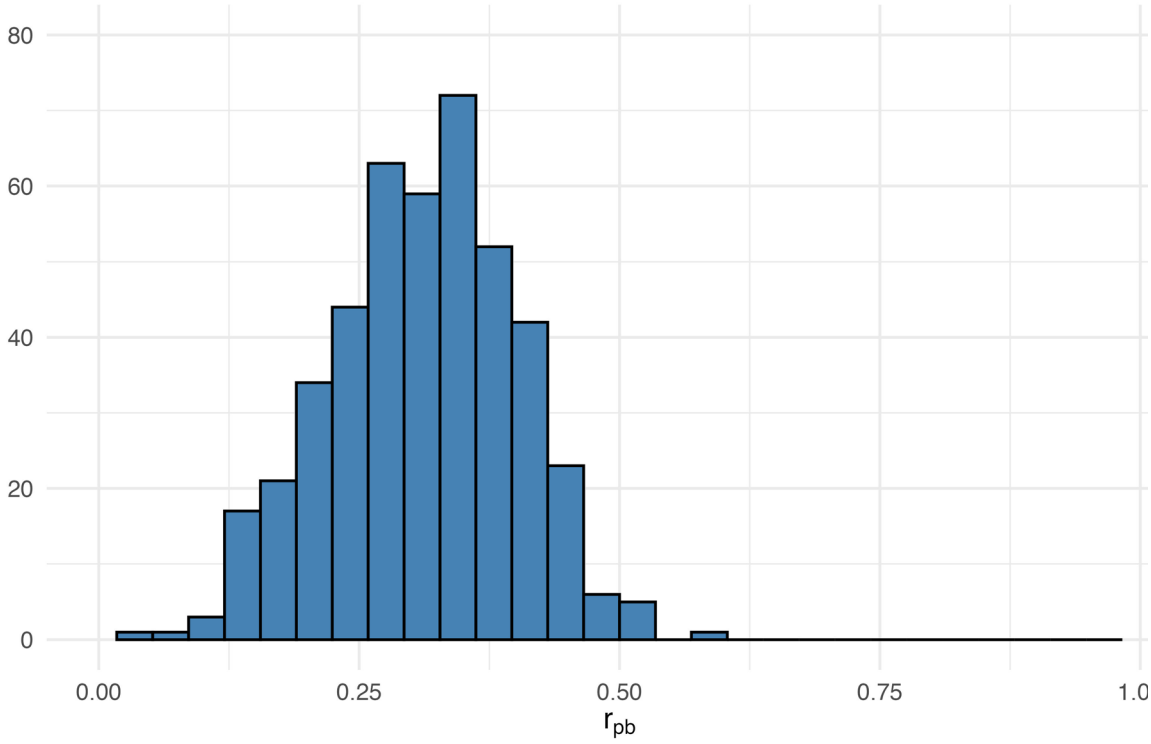
(c) Quantitative Reasoning

Figure 8.3

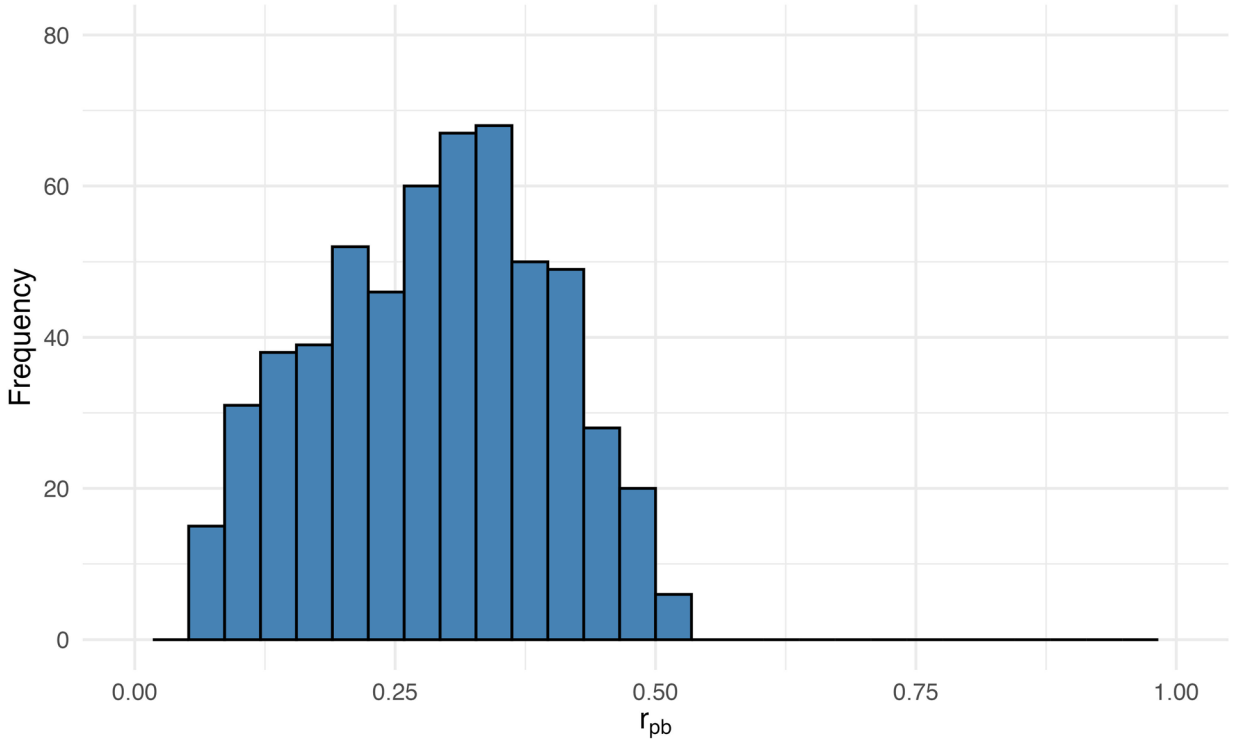
Frequency Distribution of Point-Biserial Correlations (r_{pb}) in Each Section



(a) Verbal Reasoning



(b) Grammar/Writing



(c) Quantitative Reasoning

8.4 Scaling and the Reported Scores

Once the items have been calibrated, parallel test forms have been constructed, and the tests have been administered, we take the following steps to calculate the scale score of each student: first, we create a raw-to-theta conversion table for the test form using the item difficulties. This conversion table maps each raw score on the test to an ability estimate. Next, the ability estimates are used to compute the true score of each student on the base form using its item difficulties. These true scores are the expected scores of each student on each section of the base form, based on their abilities and the difficulties of the items in the base form. The expected score of person n on item i is simply P_{ni} – their probability of answering the item correctly – because it represents the expectation of a binary outcome (correct or incorrect). The total expected score (or the true score) of person n across all the items in a section is the sum of these response probabilities (Equation 8.5).

$$T_n = \sum_i P_{ni} \tag{8.5}$$

Computing true scores using the items of the base form for all the students ensures that all the

true scores are on the same scale. Then, we apply a linear transformation to the true scores to place them on the reported reference CLT scale. The linear transformation has the following form:

$$SS_n = A \times T_n + B \tag{8.6}$$

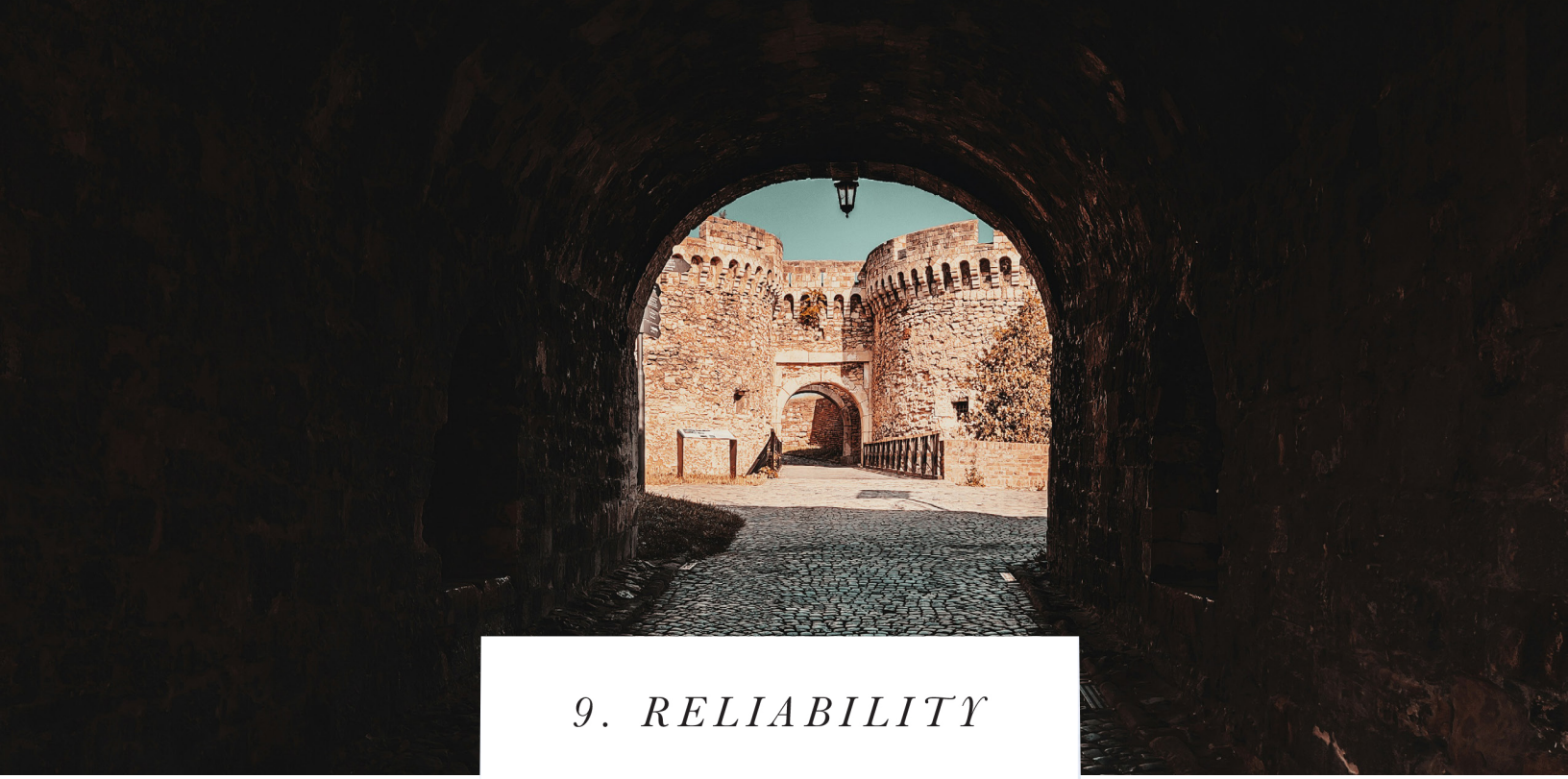
where SS_n is the scale score of student n, T_n is the true score of student n on the base form, $A = \frac{\sigma(CLT_{SS})}{\sigma(T_{Base})}$, and $B = \mu(CLT_{SS}) - \frac{\sigma(CLT_{SS})}{\sigma(T_{Base})}\mu(T_{Base})$. $\mu(T_{Base})$ and $\sigma(T_{Base})$ are the mean and the standard deviation of the true scores of a representative group of CLT test takers on the base form, and $\mu(CLT_{SS})$ and $\sigma(CLT_{SS})$ are the targeted mean and standard deviation of the scale scores. The values of the slope (A) and the intercept (B) are given in Table 8.3 for each section.

Table 8.3

The Scaling Constants of Each Section

Section	A	B
Verbal Reasoning	1.008	0.045
Grammar/Writing	0.981	0.290
Quantitative Reasoning	1.034	-1.909

True scores that are transformed to a scale score lower than the lowest obtainable scale score (LOSS) of 0 or higher than the highest obtainable scale score (HOSS) of 40 are truncated to 0 and 40, respectively. Moreover, perfect raw scores are converted to the HOSS and zero raw scores are converted to the LOSS. After the scale scores are calculated for each section, they are summed to obtain a total CLT10 scale score. These total and section scale scores are then reported to students.



9. RELIABILITY

9.1 Introduction

The reliability of test scores pertains to the precision and consistency of the scores a test produces. Validity, on the other hand, addresses the degree to which a test measures the construct it was designed to measure. Test scores must be reliable to be valid, but they do not have to be valid to be reliable (i.e., a test could reliably measure a construct that is different from the one it was designed to measure). Reliability is the focus of this chapter; validity is discussed in Chapter 10.

Test scores can be influenced by errors stemming from various random factors. For instance, a student might perform sub-optimally due to poor sleep the previous night or score higher than their true ability would suggest due to sheer luck (e.g., guessing correctly on items). CTT formalizes this concept by separating test scores into two components: a true score and an error component (Equation 9.1):

$$X = T + E \tag{9.1}$$

where X represents the observed score (number of correct answers), T signifies the true score, and E denotes the error. A larger error implies larger variability of observed scores around the true score. The standard error of measurement (SEM) corresponds to the standard deviation of the observed scores around the true score. In other words, SEM quantifies the spread of the error term. The

Standards for Educational and Psychological Testing (AERA, APA, & NCME, 2014) recommends that in addition to SEM, conditional standard errors of measurement (CSEM) are reported for each score point. This is because measurement precision is not constant across the score scale, and modern measurement theories such as IRT highlight that a test will measure certain ranges of abilities more precisely than others. Therefore, we use CTT to report reliability at the test level and IRT to report measurement precision at different ability levels. Specifically, Sections 9.2-9.4 use Cronbach's alpha (Cronbach, 1951) to estimate reliability and SEM at the test level whereas Section 9.5 calculates CSEM using IRT for each ability level on the logit scale.

9.2 Quantifying Reliability

Reliability can be quantified as the proportion of observed score variance that is due to true score variance (Harvill, 1991):

$$r_{XX'} = \frac{s_T^2}{s_X^2} \tag{9.2}$$

where $r_{XX'}$ denotes the reliability of the test scores, s_T^2 is the variance of true scores, and s_X^2 is the variance of observed scores. This expression can be re-written as

$$r_{XX'} = 1 - \frac{s_E^2}{s_X^2} \tag{9.3}$$

where s_E^2 is the error variance. Thus, the error variance becomes $s_E^2 = s_X^2(1 - r_{XX'})$ and the SEM is:

$$SEM = s_E = \sqrt{s_X^2(1 - r_{XX'})} = s_X\sqrt{(1 - r_{XX'})} \tag{9.4}$$

The most commonly used reliability coefficient is Cronbach's alpha, which measures the internal consistency of a test by examining the covariance between the items (Tavakol & Dennick, 2011). Internal consistency is the degree to which the items in a test measure the same latent construct and are related to each other. The formula for Cronbach's alpha is given in Equation 9.6 (Bland & Altman, 1997):

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum s_i^2}{s_X^2}\right) \tag{9.5}$$

where k is the number of items in the test, s_i^2 is the variance of item i, and s_X^2 is the variance of the total number-correct scores. Cronbach's alpha is affected not just by the variances and covariances of items and total scores but by test length as well; adding similar items to a test form will increase alpha. Also, Cronbach's alpha is a lower bound to reliability, meaning it may under-estimate reliability. Cronbach's alpha takes values between 0 and 1, and the psychometric literature has suggested acceptable values that range from 0.70 to 0.95 with no consensus on what value of alpha is "good" or "high" (Taber, 2018; Tavakol & Dennick, 2011).

Cronbach's alpha is a sample-dependent statistic, meaning that it does not estimate a test's reliability in general but the reliability of the scores obtained by a specific sample of examinees (Graham, 2006). Also, Cronbach's alpha assumes unidimensionality, which means that the items must measure a single latent construct (Cho & Kim, 2014). Given that the CLT10 measures the three constructs of Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning (Chapter 10), we report Cronbach's alpha for each CLT10 section separately. Cronbach's alpha was calculated using the CTT package (Willse, 2022) in the R programming language (R Core Team, 2024).

9.3 The Reliability and SEM of the Base Form

Table 9.1 presents the Cronbach's alpha and SEM of each section of the base form. Table 9.2 shows the reliabilities for each gender, and Table 9.3 for four ethnicities. The tables show that each section of the CLT10 base form has high reliability for each analyzed group according to criteria often cited in the psychometric literature (Taber, 2018) as well as criteria used by state scholarships and education departments. For example, Florida's Tax Credit Scholarships require that students take a standardized test with internal consistency/reliability of at least 0.80 (Florida Department of Education, 2023), and Texas Education Agency considers a reliability coefficient between 0.80-0.89 as good (Texas Education Agency, 2022).

Table 9.1

The Reliability of Each Section of the Base Form

Section	α	SEM
Verbal Reasoning	0.86	2.70
Grammar/Writing	0.86	2.58
Quantitative Reasoning	0.91	2.53

Table 9.2

The Reliability of Each Section of the Base Form by Gender

Section	Male		Female	
	α	SEM	α	SEM
Verbal Reasoning	0.86	2.71	0.86	2.65
Grammar/Writing	0.87	2.56	0.86	2.50
Quantitative Reasoning	0.93	2.45	0.88	2.63

Table 9.3

The Reliability of Each Section of the Base Form by Ethnicity

Section	White		African American		Hispanic		Asian	
	α	SEM	α	SEM	α	SEM	α	SEM
Verbal Reasoning	0.85	2.72	0.91	2.76	0.86	2.83	0.85	2.54
Grammar/Writing	0.85	2.57	0.86	2.79	0.84	2.63	0.88	2.57
Quantitative Reasoning	0.90	2.55	0.85	2.80	0.85	2.71	0.93	2.24

9.4 Test Information and Conditional Standard Errors of Measurement (CSEM)

The test information function (TIF) computes the amount of information a set of item responses provide about the latent ability parameter. The information provided by an item about the ability parameter depends on the item's difficulty, and is maximized when the item's difficulty matches the student's ability. In the Rasch model, test information is simply the sum of the information provided by individual items (Equation 9.6):

$$I(\theta) = \sum_{i=1}^{k} P_i(1 - P_i) \tag{9.6}$$

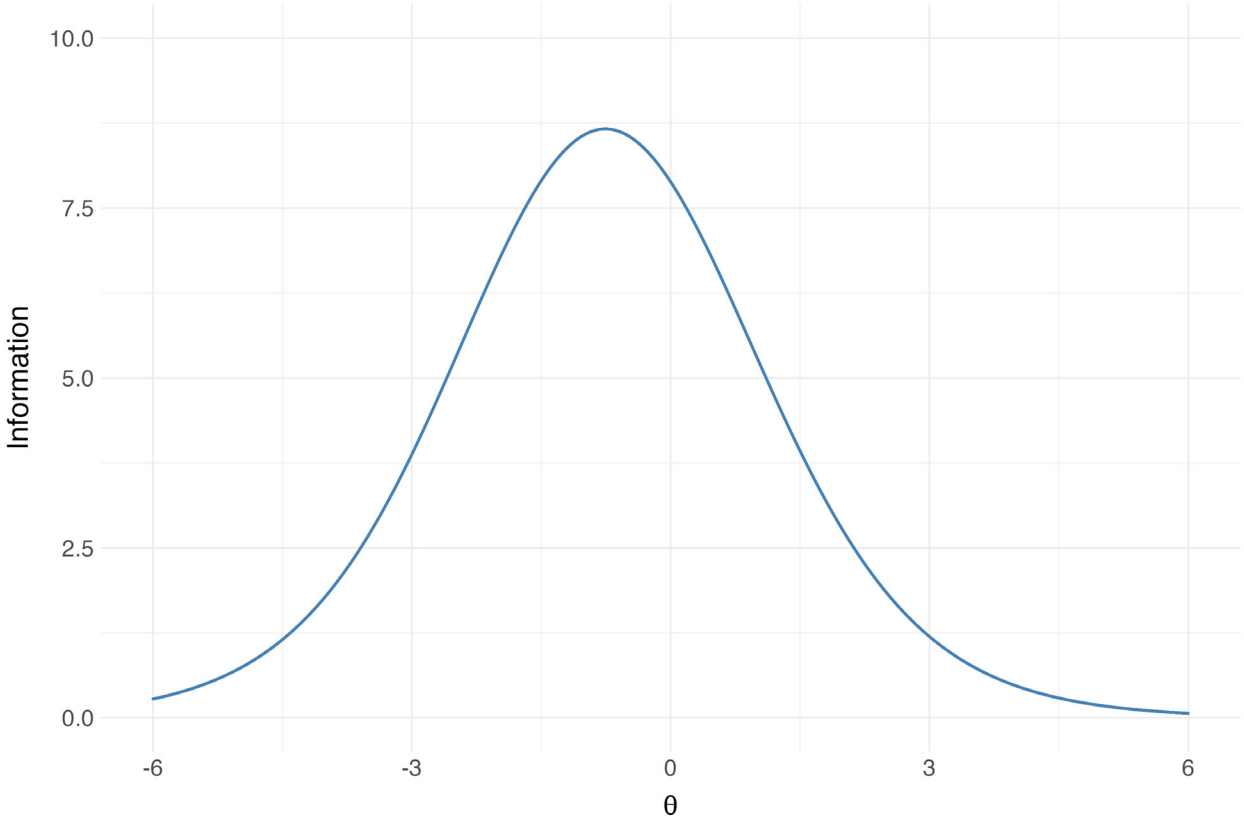
where P_i is the probability of a correct response to item i for a person with ability θ, and k is the total number of items. Test information determines the precision with which a student's ability is estimated by a given set of items. Specifically, test information is inversely related to SEM. Given that test information is a function of the proximity between the test's difficulty and a student's ability, a test will measure different abilities with different levels of precision. While Cronbach's alpha and SEM produce a single estimate of measurement precision for a test form, the IRT framework can estimate CSEM to evaluate measurement imprecision at specific ability levels. Equation 9.7 gives the SEM for a given ability level:

$$SEM(\theta) = \frac{1}{\sqrt{I(\theta)}} \tag{9.7}$$

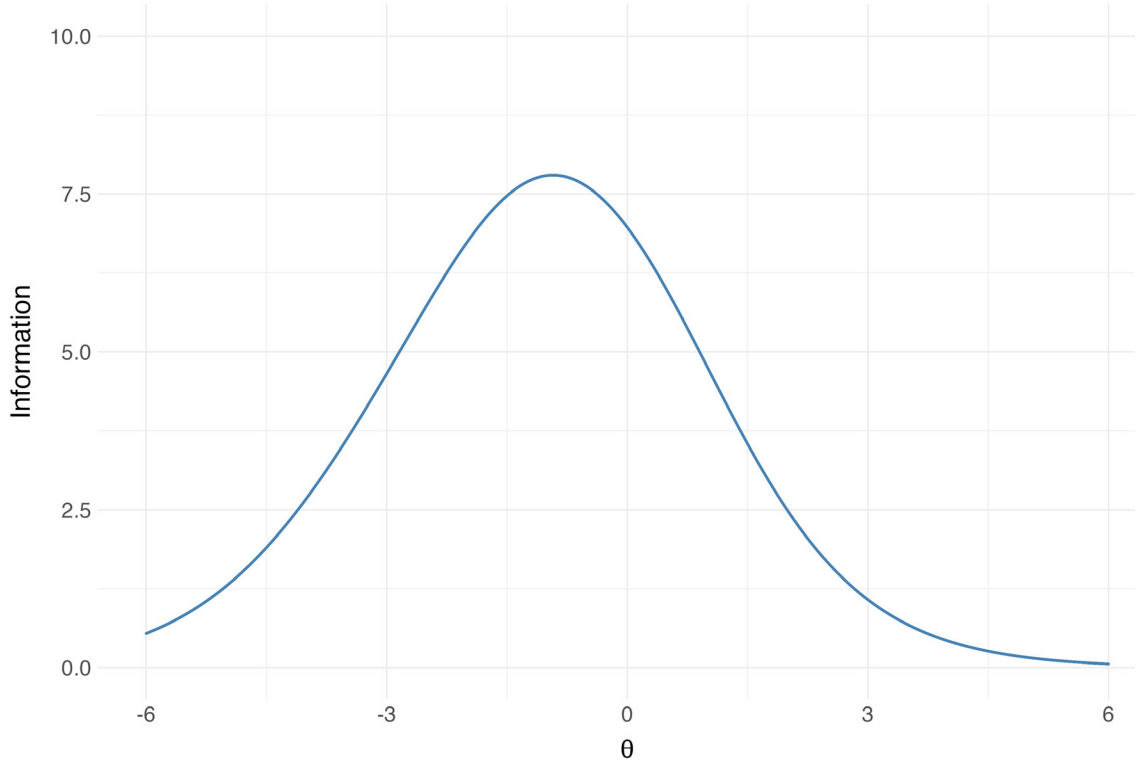
where $I(\theta)$ is the test information function as defined above. Figure 9.1 displays the TIF of the base form for the logit range [-6, 6]. Figure 9.2 shows the CSEM for the same ability range. IRT ability estimates have larger errors at the tails of the distribution than in the middle, which is reflected in Figure 9.2.

Figure 9.1

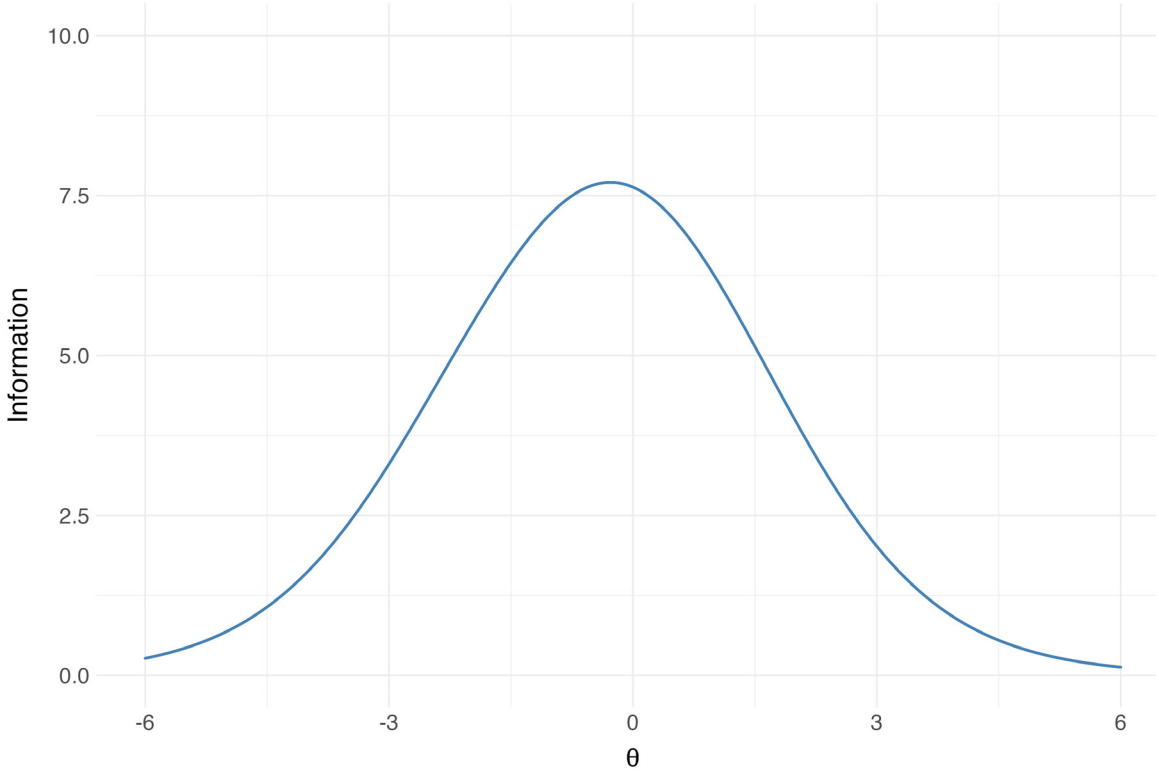
The Test Information Function (TIF) of the Base Form for Each Section



(a) The test information function of the Verbal Reasoning section



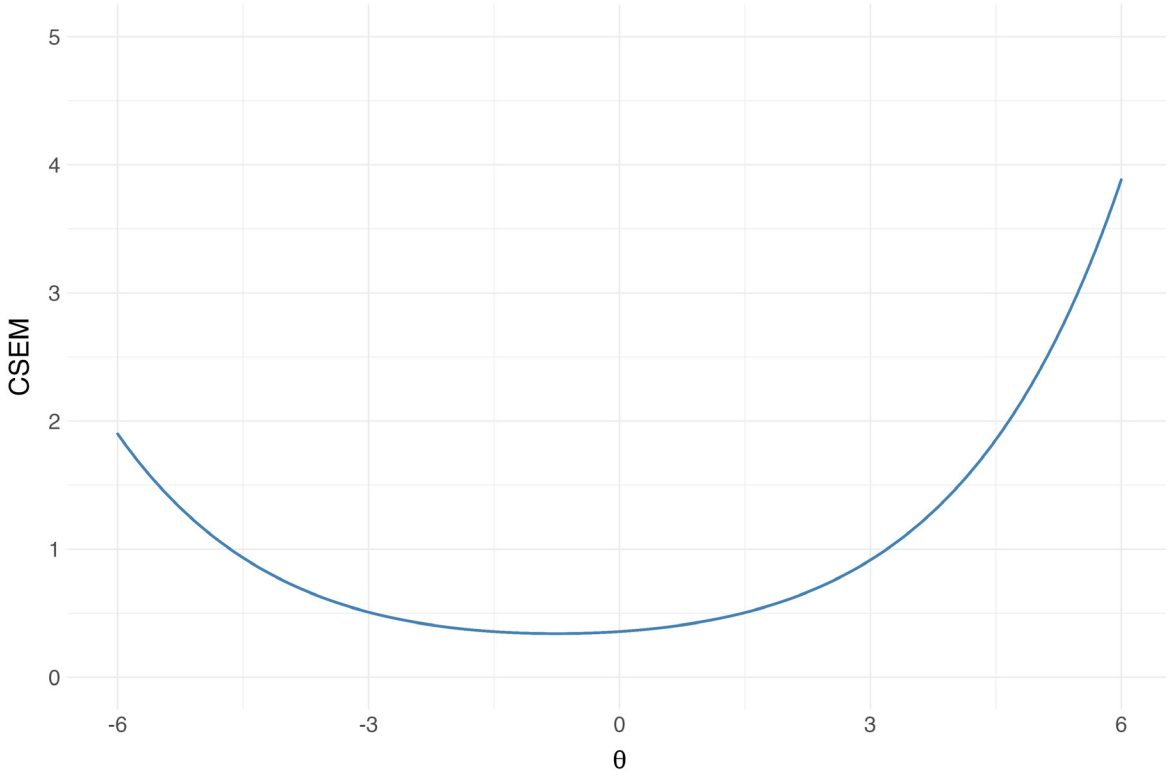
(b) The test information function of the Grammar/Writing section



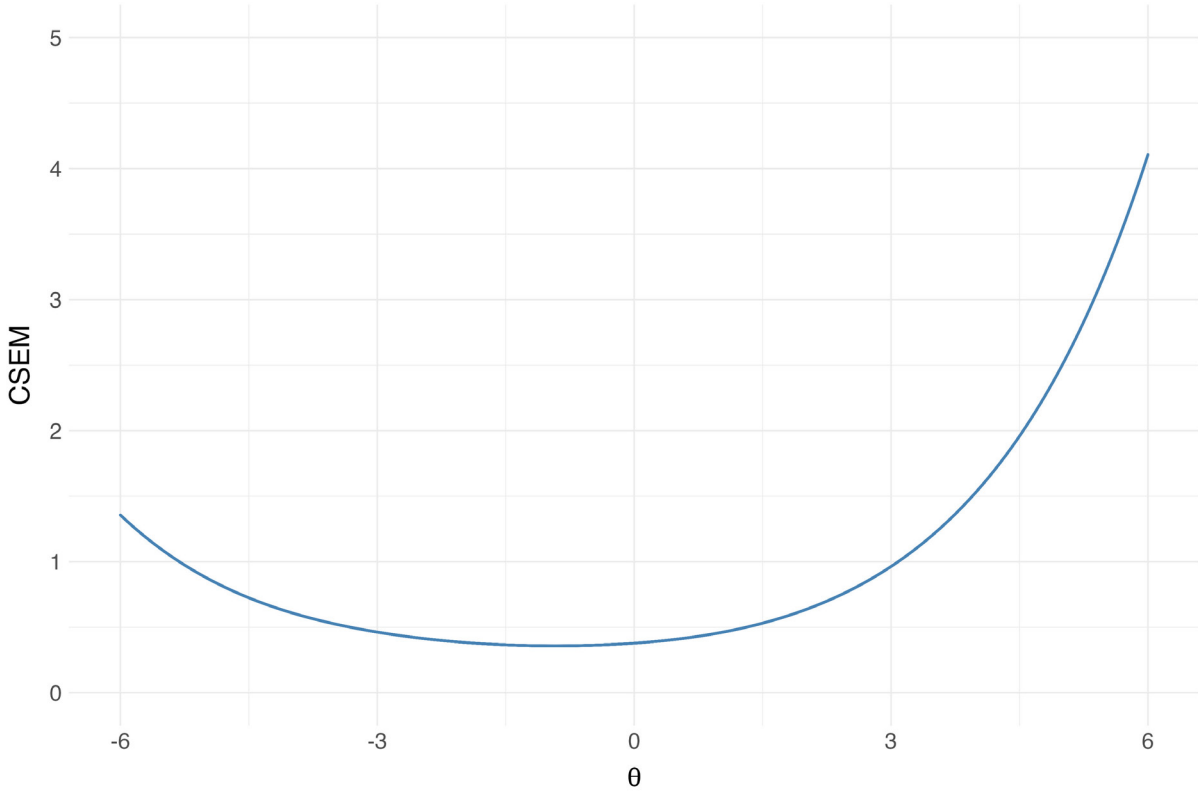
(c) The test information function of the Quantitative Reasoning section

Figure 9.2

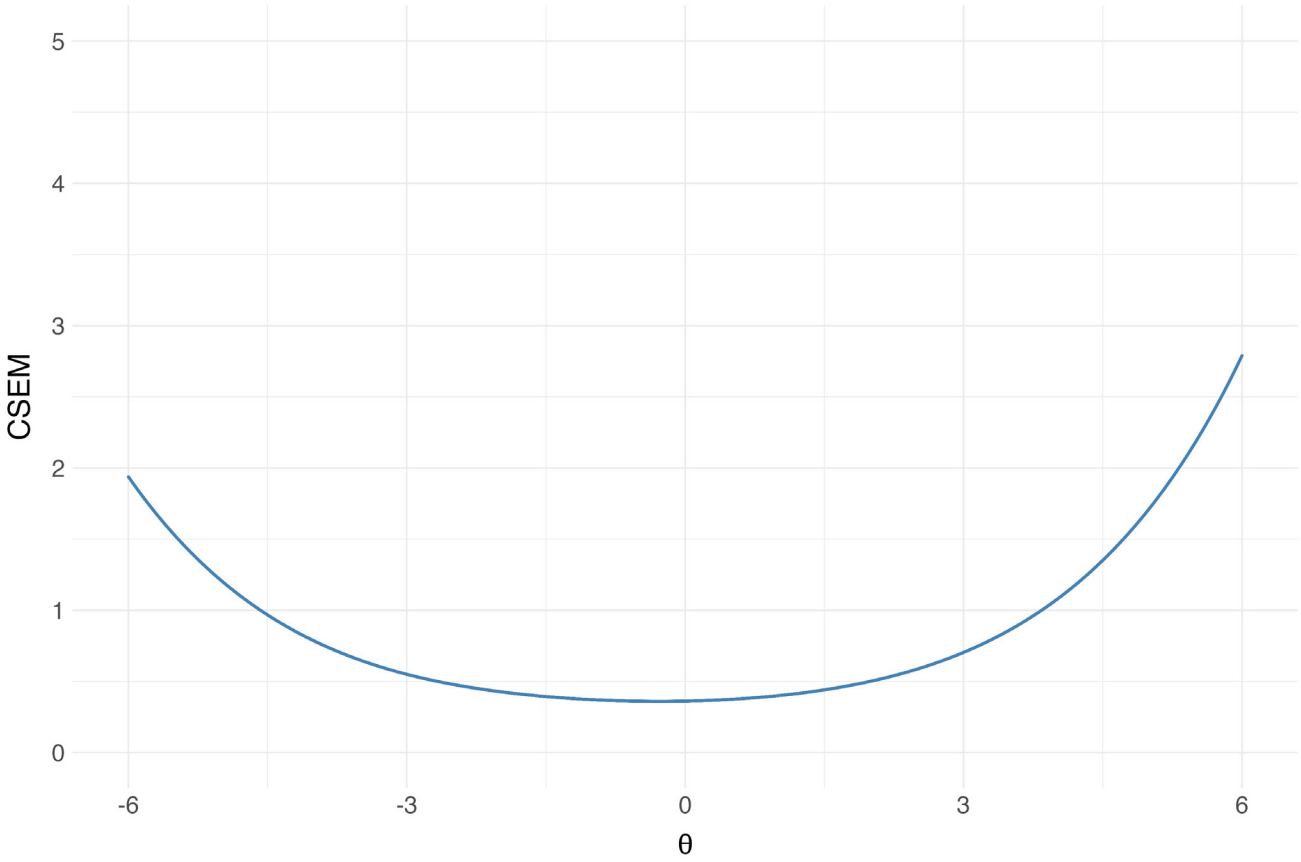
The CSEM of the Base Form for Each Section



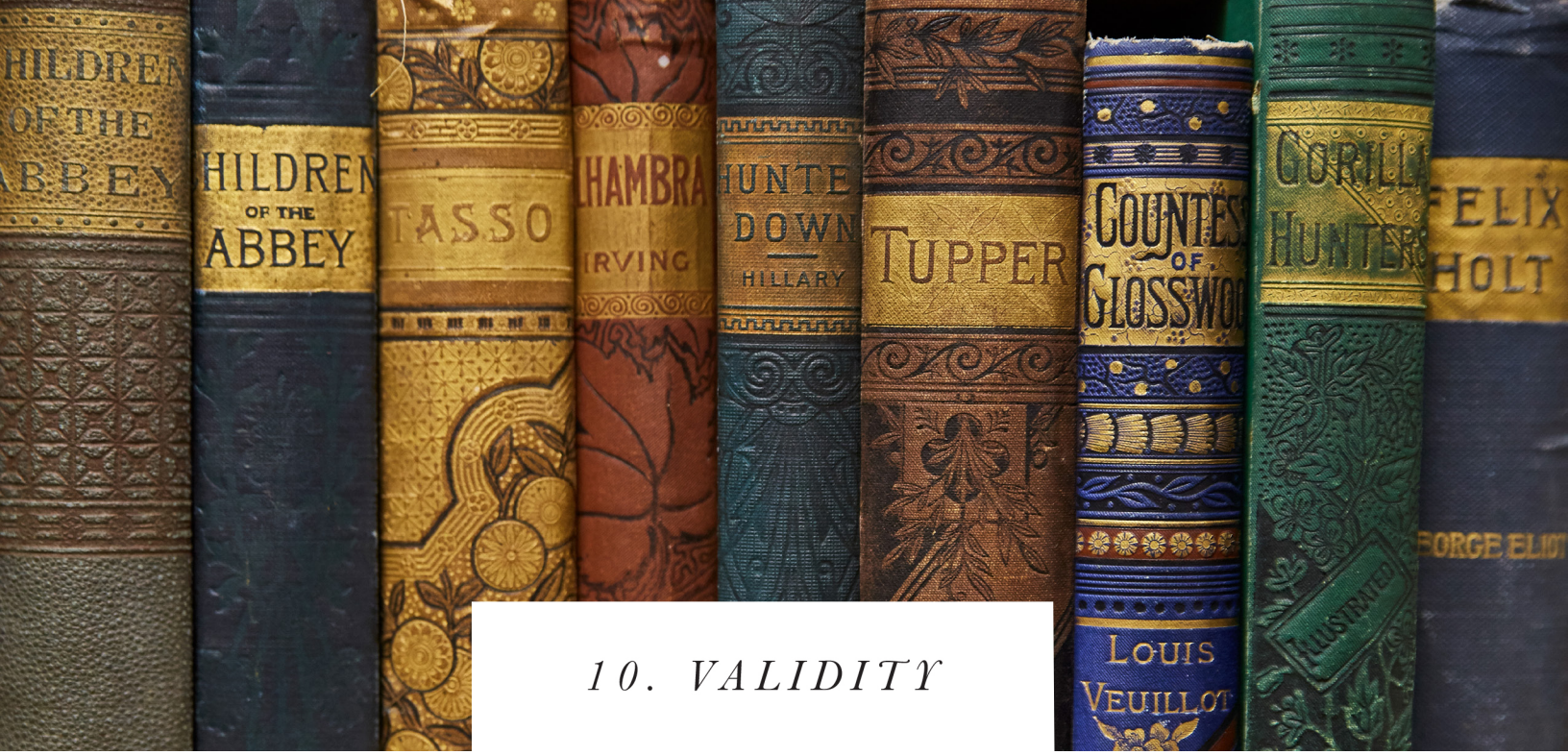
(a) The CSEM of the Verbal Reasoning section



(b) The CSEM of the Grammar/Writing section



(c) The CSEM of the Quantitative Reasoning section



10. VALIDITY

CHAPTER TEN

10.1 What is Validity?

The Standards for Educational and Psychological Testing defines validity as "the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests" (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 2014, p.11). In other words, validity relates to the interpretation of test scores, not the test itself. Testing organizations must provide evidence to validate the intended interpretations of the test scores. A valid test score interpretation is built upon high reliability. Thus, reliability is a prerequisite for validity. However, a reliable test may lead to invalid interpretations if the construct that it measures is different from the one it is intended to measure.

10.2 Sources of Validity Evidence

The Standards for Educational and Psychological Testing describes five sources of validity evidence: test content, response processes, internal structure, relations to other variables, and consequences of testing (AERA, APA, & NCME, 2014). Evidence based on test content includes a description of the content domains that the test is intended to measure and an analysis of how the content of the test substantiates different aspects of the latent construct. Validity evidence based on content was provided in the preceding chapters. This chapter provides validity evidence based on internal

structure and relations to other variables.

Evidence based on internal structure analyzes the relationships between the items on a test to examine if the data support the hypothesized factorial structure of the latent construct that the test was designed to measure. For instance, items designed to measure mathematical reasoning should be strongly correlated with each other while showing a weaker relationship to other constructs such as reading comprehension. We use confirmatory factor analysis to evaluate the degree to which the CLT10 measures the three constructs represented by its sections: Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning.

Evidence based on relations to other variables include convergent and discriminant evidence, test-criterion relationships, and validity generalization. Convergent evidence means that the scores obtained from the test that is being validated correlate strongly with scores obtained from other tests that measure a similar construct. Discriminant evidence means that the scores obtained from the test that is being validated correlate weakly with scores obtained from tests that measure a different construct. Test-criterion evidence refers to the degree to which the test scores predict an outcome of interest, and validity generalization refers to the degree to which the test-criterion relationships generalize to new situations. This chapter provides convergent evidence based on the correlations between the CLT10 and the PSAT®.

10.3 Validity Evidence Based on Internal Structure: Confirmatory Factor Analysis (CFA)

Psychological and cognitive constructs such as student ability, happiness, and creativity are not directly observable. Therefore, they are called latent constructs. To measure a latent construct, observable behaviors that manifest the construct need to be identified. In standardized testing, the latent construct is the ability or the skill the test measures, and the observable behaviors are the students' responses to the test items. Thus, test items are also called indicators of the latent construct. The latent construct is assumed to underlie the indicators. For example, the responses of a student to questions of reading comprehension are modeled as a function of the student's ability to comprehend a text. In psychometrics, latent variables can be studied using a variety of models, including IRT and factor analytic models. Factor analysis includes exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA models do not have a priori assumptions about the factor structure that underlies the data. Instead, the number of factors and their structural relationships are uncovered from the data. When the researcher has a priori expectations about the factor structure, they can use CFA to test if the response data conform to their expectations. Moreover, different factor models

can be empirically compared to test if one factor structure fits the data better than others.

Theoretically, three different factor structures could be argued to underlie the CLT10. First, it is possible that Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning scores are all manifestations of the same general factor. Alternatively, it may be that Verbal Reasoning and Grammar/Writing represent a common "literacy" factor whereas Quantitative Reasoning represents a "numeracy" factor. However, given that the CLT10 has three sections designed to measure Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning, it is hypothesized that a three-factor model provides the best description of the test data. Each of these three factors is expected to load on the latent construct underlying each section. To test this hypothesis, CFA was performed on CLT10 domain scores using the R package lavaan (Rosseel, 2012). The semPlot (Epskamp, 2022) package was used to visualize the factor models.

MODEL FIT

We tested and compared the three different factor structures described in the previous section: a one-factor model where each domain score is an indicator of a single ability, a two-factor model in which the Verbal Reasoning and Grammar/Writing domain scores form one factor while the Quantitative Reasoning domains form a second factor, and a three-factor model in which the Verbal Reasoning domains form one factor, the Grammar/Writing domains form a second factor, and the Quantitative Reasoning domains form a third factor. The fit of each model to the data was examined using exact fit, close fit (MacCallum et al., 1996), and incremental fit indices (Bentler, 1990; Tucker & Lewis, 1973). Exact fit was assessed with the chi-square test, which tests the null hypothesis that the model covariance matrix describes the observed covariance matrix perfectly. A p-value < 0.05 means that the model does not fit the data perfectly. Since the model never fits the data perfectly, we use indices of close fit and incremental fit in addition to exact fit. The close fit indices include the Root Mean Square Error (RMSEA), the RMSEA test of close fit, and the RMSEA test of not-close fit (MacCallum et al., 1996). RMSEA estimates the degree to which the model deviates from a saturated model (i.e., a model that fits the data perfectly). Values below 0.05 indicate good fit, values between 0.05 and 0.08 indicate acceptable fit, and values above 0.08 indicate poor fit. RMSEA test of close fit tests the null hypothesis that RMSEA is smaller than 0.05, with a p-value < 0.05 indicating that the model does not fit the model very well (but the fit may still be acceptable). RMSEA test of not-close fit tests the null hypothesis that RMSEA is greater than 0.08, with a p-value < 0.05 indicating that the model does not fit the data poorly. The ideal scenario is that the chi-square test of exact fit is non-significant, the RMSEA fit of close fit is also non-significant, but the RMSEA test of not-close fit is significant.

In addition, we used several incremental fit indices. While RMSEA compares the model to a

model that fits the data perfectly, incremental fit indices compare it to the baseline model, which only estimates variances and does not model the covariances. In other words, incremental fit indices tell us the degree to which our model is better than the worst possible model. So, the higher they are, the better. We use the Comparative Fit Index (CFI) (Bentler, 1990) and the Tucker-Lewis Index (TLI) (Tucker & Lewis, 1973). Values above 0.90 indicate acceptable fit and values above 0.95 indicate good fit. Further, we report the Goodness of Fit (GFI) and the Adjusted GFI (AGFI), which estimate the proportion of variance in the sample covariance matrix that is explained by the model covariance matrix. Values above 0.90 indicate acceptable fit.

Finally, we used the Akaike Information Criterion (AIC) (Akaike, 1973) and the Bayesian Information Criterion (BIC) (Schwarz, 1978) to compare the models with different numbers of factors. The AIC balances the likelihood of the model against its complexity, with a penalty for the number of parameters estimated by the model. A lower AIC value indicates a model that has a good balance of fit and parsimony. The BIC also considers both the likelihood and the number of parameters, but it penalizes models with more parameters more heavily than the AIC does. Thus, for both AIC and BIC, the model with the lowest value is preferred, with BIC generally favoring simpler models compared to AIC when choosing between models with similar likelihoods. AIC and BIC are given in Equations 10.1 and 10.2:

$$AIC = 2k - 2(L) \tag{10.1}$$

where k is the number of parameters in the model and L is the likelihood of the model given the data, and

$$BIC = k(n) - 2(L) \tag{10.2}$$

where k is the number of parameters, n is the number of observations (the sample size), and L is the likelihood of the model.

THE CORRELATION MATRIX OF THE BASE FORM DOMAIN SCORES

Table 10.1 presents the sample correlation matrix of the domain scores of the base form to provide an overview of its structure. The strongest correlations are between the two domains of the Verbal Reasoning section, Comprehension and Analysis. This is followed by the correlation between Mathematical Reasoning and Algebra. As expected, the correlations within Quantitative Reasoning are larger than the correlations between Quantitative Reasoning and Verbal Reasoning-Grammar/Writing domains.

Table 10.1

The Correlation Matrix of the Base Form Domain Scores

	Comprehension	Analysis	Grammar	Writing	Algebra	Geometrical Reasoning	Mathematical Reasoning
Comprehension	1						
Analysis	0.773***	1					
Grammar	0.717***	0.659***	1				
Writing	0.756***	0.686***	0.726***	1			
Algebra	0.573***	0.522***	0.560***	0.541***	1		
Geometrical Reasoning	0.538***	0.489***	0.476***	0.501***	0.707***	1	
Mathematical Reasoning	0.678***	0.622***	0.620***	0.626***	0.767***	0.703***	1

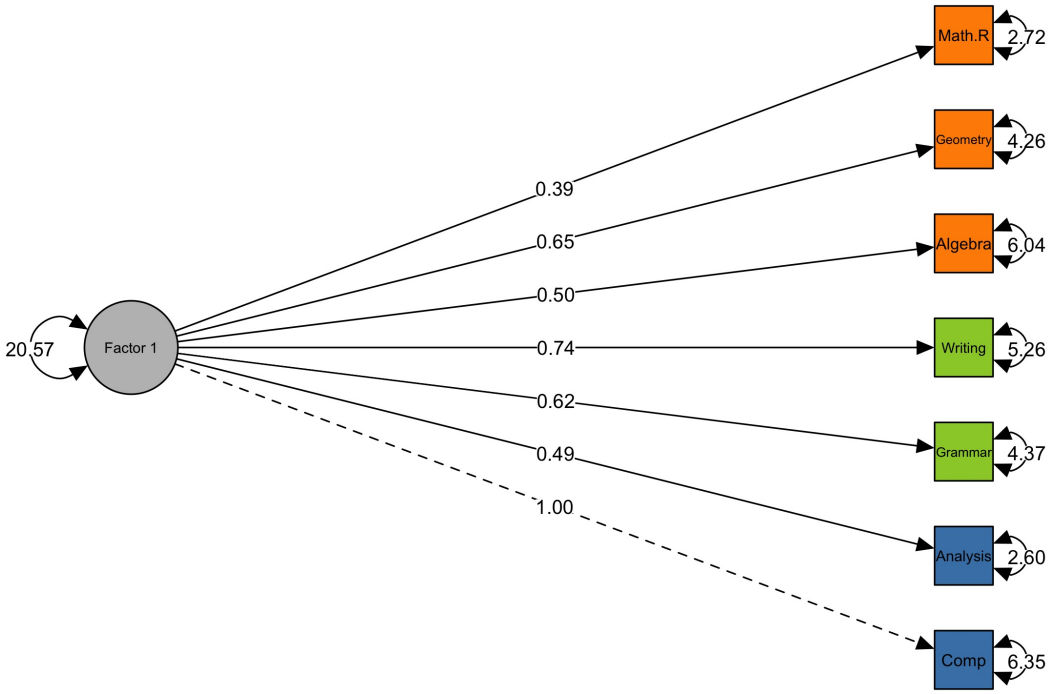
**Correlation is significant at the 0.001 level (2-tailed).

CFA RESULTS

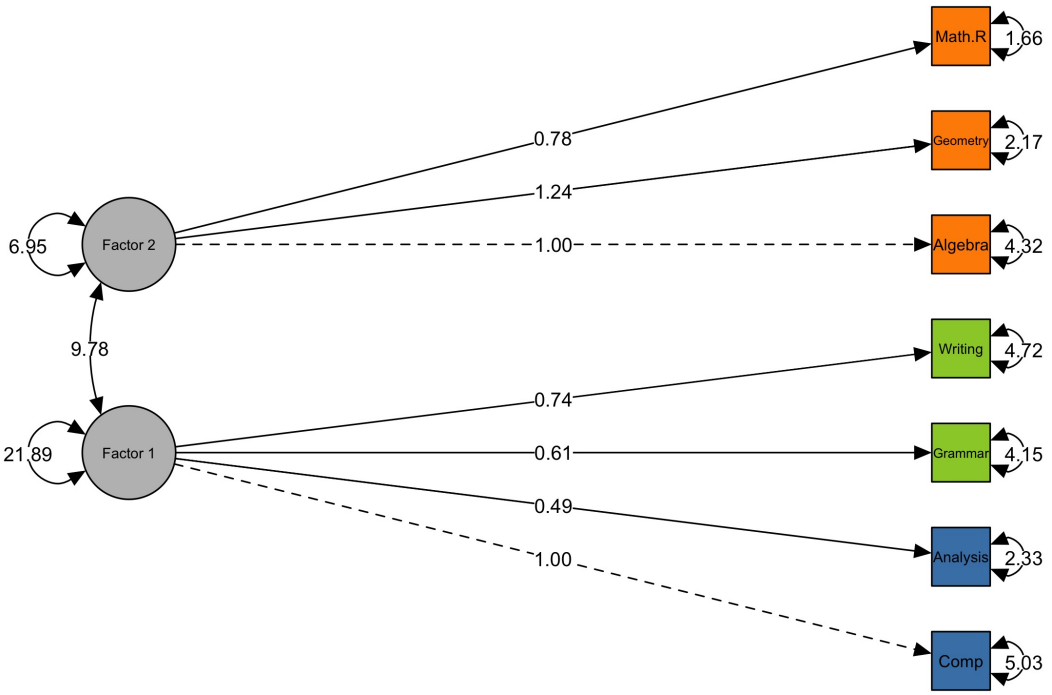
Figure 10.1 visualizes each of the three factor models. The gray circles are the factors and the orange square boxes are the domain scores. Verbal Reasoning domains are colored in blue, Grammar/Writing domains are colored in green, and Quantitative Reasoning domains are colored in orange. The arrows that go from the factors to the domains show the relationship assumed by the model. The fit of these models to the data are evaluated below. The values on these arrows show the factor loadings of each domain. The circular arrows that originate from and end in the same factor show the factor variances, the arrows between the factors show the covariances between the factors, and the arrows that originate from and end in the domains show the variances of the residuals. Model fit is summarized in Table 10.2.

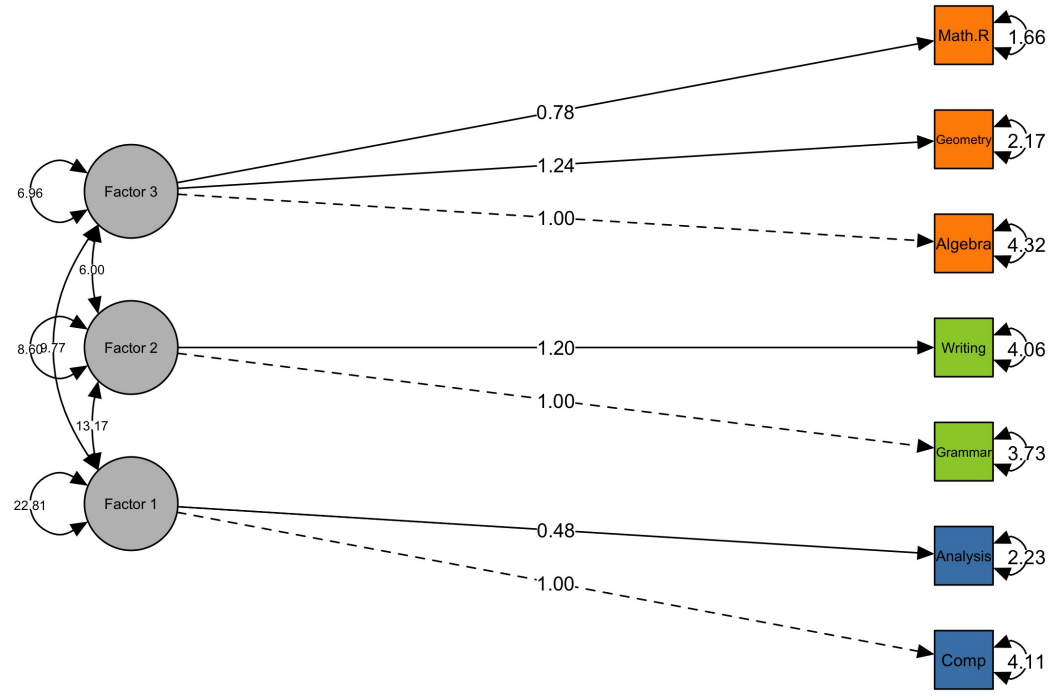
Figure 10.1

The Structure of the One-Factor, Two-Factor, and Three-Factor CFA Models



(a) The path diagram of the one-factor model


Math.R
1.66
Geometry
2.17
Algebra
4.32
Writing
4.72
Grammar
4.15
Analysis
2.33
Comp
5.03
Factor 2
Factor 1
6.95
21.89
9.78
0.78
1.24
1.00
0.74
0.61
0.49
1.00


Math.R
1.66
Geometry
2.17
Algebra
4.32
Writing
4.06
Grammar
3.73
Analysis
2.23
Comp
4.11
Factor 3
Factor 2
Factor 1
6.96
8.60
9.77
22.81
6.00
13.17
0.78
1.24
1.00
1.20
1.00
0.48
1.00

(c) The path diagram of the three-factor model

Table 10.2

The Fit of the CFA Models

Model	χ^2	df	p	RMSEA	p_{Close}	$p_{Not-Close}$	CFI	TLI	GFI	AGFI	AIC	BIC
1-factor	376.338	14	$< .0001$	0.215	$< .0001$	1.000	0.875	0.813	0.802	0.605	18309.554	18370.120
2-factor	48.140	13	$< .0001$	0.069	0.066	0.219	0.988	0.981	0.975	0.946	17983.356	18048.249
3-factor	29.596	11	0.002	0.054	0.352	0.045	0.994	0.988	0.985	0.961	17968.812	18042.356

The results of the one-factor model showed that the model did not fit the data well. The chi-square test was significant ($\chi^2(14) = 376.338, p < 0.0001$), with $RMSEA = 0.215$. The RMSEA test of close fit was also significant ($p < 0.0001$), and the RMSEA test of not-close fit was not significant ($p = 1.000$). Furthermore, $CFI = 0.875$, $TLI = 0.813$, $GFI = 0.802$, and $AGFI = 0.605$ did not reach the acceptable thresholds. For the two-factor model, the chi-square test of exact fit was significant ($\chi^2(13) = 48.140, p < 0.0001$), but both the RMSEA test of close fit and the RMSEA test of not-close-fit were non-significant, giving inconclusive results. On the other hand, the incremental fit indices indicated good fit. For the three-factor model the chi-square test of exact fit was significant ($\chi^2(11) = 29.596$), $p = 0.002$), but all the other fit indices showed good fit. The RMSEA was 0.054, test of close fit was not significant ($p = 0.352$), and the test of not-close fit was significant ($p < 0.045$). $CFI = 0.994$, $TLI = 0.988$, $GFI = 0.985$, and $AGFI = 0.961$ were all high. As would be expected from these results, model comparisons favored the three-factor model, with $AIC = 17968.812$ and $BIC = 18042.356$. Thus, these findings indicate that the CLT10 measures three related but distinct constructs represented by the Verbal Reasoning, Grammar/Writing, and Quantitative Reasoning sections.

10.4 Validity Based on Convergent Evidence: The Relationship Between the CLT10 and the PSAT®

As discussed above, two tests that measure similar constructs are expected to have strong relationships. Also, if one of the tests has already been accepted as a valid measure of the given construct, then the validity of a new test can be evaluated by analyzing the degree to which the scores it produces are correlated with the scores produced by the established test (this yields *concurrent* evidence for validity). To that end, we analyzed the correlation between the CLT10 and the PSAT® using the self reported PSAT® scores of students who took the CLT10 between August 2019 and June 2025. Correlation analysis was conducted only for total scores because students are not asked to report their section scores on the PSAT®.

Since the CLT10 is intended for grades 9 and 10, we excluded test attempts in other grades. We also excluded invalid PSAT® scores, defined as a value outside the 320-1520 range or that is not a multiple of 10. For the CLT10, we excluded test attempts with a raw score below 30, which corresponds to the guessing threshold with 120 items and 4 answer choices. For students who took the test multiple times or who reported multiple PSAT® scores, we selected the highest scaled score. As an important final step, we excluded multivariate outliers using the robust Mahalanobis distance (Rousseeuw, 1985) with the R package **rrcov** (Todorov, 2024). Specifically, score pairs outside the 99.9% confidence ellipse were treated as outliers and excluded from the correlation analysis. We kept the cutoff conservative to make sure that we would not "force" the data to give high correlations as well as retain both very low and very high scores from each test.

This procedure resulted in a final sample of 2557 score pairs. The score distribution of this sample is provided in Table 10.3. The table indicates that the final sample was significantly higher performing than the user populations of each test. Specifically, the 50th percentile of the CLT10 user population is approximately 75, and the 50th percentile of the PSAT® population is approximately 890 for 10th graders (College Board, 2025). The correlation between the total CLT10 scores and total PSAT® scores was 0.79 (Figure 10.2), which is a high correlation and provides evidence of convergent validity for the CLT.

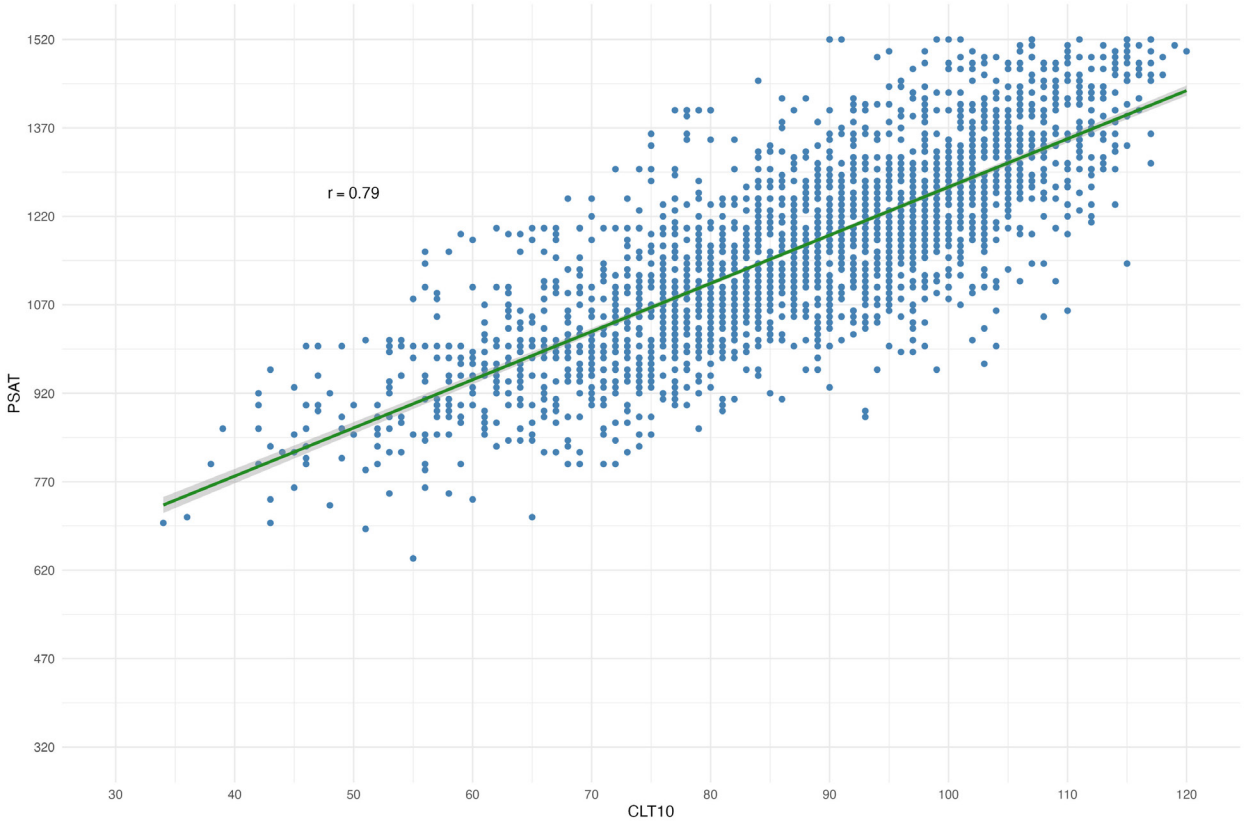
Table 10.2

The Score Distribution of the Correlation Sample

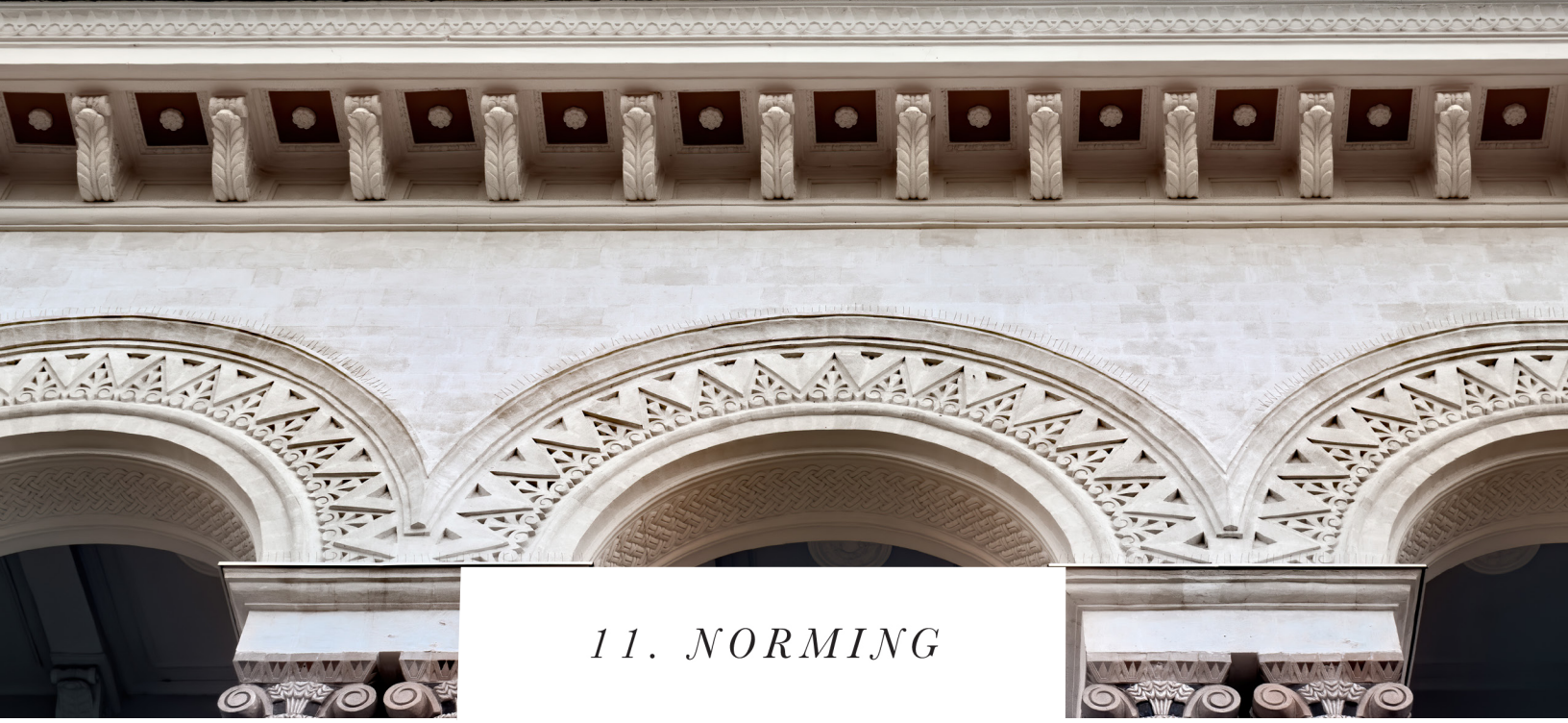
Test	N	Mean	SD	Min	Max
CLT10	2553	87.62	15.34	34	120
PSAT®	2553	1168.31	157.69	640	1520

Figure 10.2

The Relationship Between the CLT10 and PSAT® Total Scores



Note. The green line is the line of best fit through the points. The correlation is displayed in the top left part of the graph.



11. NORMING

CHAPTER ELEVEN

This chapter provides national norms for CLT10 scores through an updated concordance link with the PSAT®. That is, we first link CLT10 scores to PSAT® scores, then present the corresponding PSAT® national percentiles of 10th grade students (College Board, 2025). An initial concordance between the two tests was established in CLT's 2019 CLT10 Norm Reference Report (Tyler et al., 2019). We largely follow the methodology of the 2019 study, using equipercentile linking with a single group design as the method of linking. In this method, the linked scores have the same percentile rank within the same group of students. For two scales X and Y where X is linked to Y, this relationship is expressed in Equation 11.1 (Kolen & Brennan, 2014):

$$e_Y(x) = G^{-1}[F(x)] \tag{11.1}$$

where $e_Y(x)$ is the Y scale equivalent of score x, $F(x)$ is the cumulative distribution function of X, and G^{-1} is the inverse of the cumulative distribution function of Y.

The sample used in this study was identical to the one used for the correlation analysis in the previous chapter which also describes the data cleaning procedure. Specifically, the link between the CLT10 and the PSAT® is established using the self-reported PSAT® scores of students who took the CLT10 between 2019 and 2025. The sample size was 2,557, which is well above the minimum of 1,500 needed to obtain precise estimates from equipercentile linking (Kolen & Brennan, 1995). As noted in the previous chapter, this sample is higher performing than the CLT10 and PSAT® user populations, and the concordance relationship should be interpreted with this limitation in

mind. The bivariate distribution of the scores was pre-smoothed using loglinear smoothing. Akaike Information Criterion (AIC) (Akaike, 1973) was used to select a 5th degree polynomial. The R package equate (Albano, 2022) was used for the analyses. Records with a raw score below the guessing threshold of 30 were excluded from analysis. The minimum CLT10 scale score in the final sample was 34 and the minimum PSAT® score was 640. The maximum CLT10 and PSAT® scores were 120 and 1520, respectively. Therefore, the concordance table is presented for CLT10 scale scores of 30 or above. Table 11.1 shows each CLT10 total scale score, the corresponding PSAT® total score, and the national PSAT® percentile of 10th grade students.

Table 11.1

The Concordance Between CLT10 and PSAT Total Scores and the Corresponding PSAT National Percentiles

CLT10	PSAT	PSAT NATIONAL PERCENTILE (GRADE 10)
120	1520	99+
119	1520	99+
118	1520	99+
117	1510	99+
116	1500	99+
115	1500	99+
114	1490	99+
113	1480	99+
112	1460	99+
111	1450	99+
110	1430	99+
109	1420	99
108	1400	99
107	1390	99
106	1370	99
105	1360	99
104	1350	98
103	1330	98
102	1320	98
101	1300	97
100	1290	97
99	1280	97
98	1270	96
97	1250	95
96	1240	95
95	1230	94
94	1220	94
93	1210	93
92	1200	92
91	1190	91
90	1180	91
89	1170	90
88	1160	89
87	1150	88
86	1140	87
85	1130	86
84	1120	84
83	1110	83
82	1100	82
81	1090	81
80	1080	79
79	1070	78
78	1060	76
77	1050	75
76	1050	75
75	1040	73
74	1030	71
73	1020	69
72	1010	67
71	1000	65
70	990	63
69	990	63
68	980	62
67	970	60
66	960	58
65	950	56
64	940	54
63	930	52
62	920	50
61	920	50
60	910	48
59	900	46
58	890	44
57	880	42
56	870	40
55	860	38
54	850	36
53	840	33
52	840	33
51	830	31
50	820	28
49	810	26
48	800	24
47	790	22
46	780	19
45	780	19

44	770	17
43	760	15
42	750	13
41	740	11
40	730	9
39	720	8
38	720	8
37	710	6
36	700	5
35	690	4
34	680	3
33	670	2
32	650	1
31	640	1
30	610	1-

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