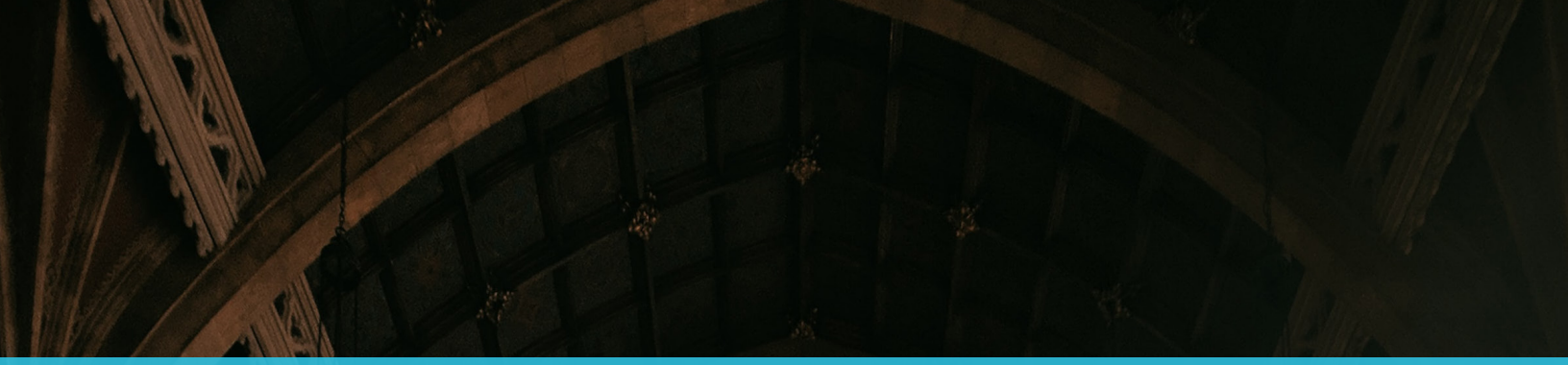

THE CONCORDANCE RELATIONSHIP

Between the Classic Learning Test (CLT) and the Scholastic Aptitude Test (SAT)

April 2023

CLT

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Dear Reader,

I am pleased to present to you our latest concordance report titled, "The Concordance Relationship Between the Classic Learning Test (CLT) and the Scholastic Aptitude Test (SAT®)." As the Chief Psychometrician, I am proud to share the findings of our concordance analysis, which represents a significant step towards supporting an alternative assessment for college admissions, as part of the larger educational freedom movement of our time.

The Classic Learning Test (CLT) is a college entrance exam that was launched by our founder, Jeremy Tate, in 2015 as a response to the national movement to renew the foundations of education. Our assessment is anchored in ideas and texts that have withstood the test of time, proving their value, influence, and appeal to generation after generation. The CLT focuses on perennial questions about human nature, knowledge, and experience, which have the power to awaken a passion for learning. Since its foundation, CLT has expanded its suite of assessments, including the development of the CLT10 and CLT8, which are already available, and the CLT3-CLT7, which will be available operationally in the 2023-2024 academic year.

In this report, we conducted a concordance study between the CLT and SAT. A concordance study is a statistical analysis that compares the scores of two different tests, providing a way to interpret how well these tests relate to each other. This analysis is particularly important for students who were exposed to a liberal arts education in high school, as the CLT offers an alternative assessment for college admissions grounded in the ideas and principles of the greatest minds of history. By establishing a concordance relationship between the two college entrance exams, we can offer an alternative test to students by providing them with more options to showcase their academic abilities.

We are humbled by the growth that CLT has seen since our original concordance was developed in 2017. I would like to take this opportunity to express my gratitude to Mr. Asena for his technical leadership of this project in running all of the statistical analysis, Dr. Jiao and Dr. Zhang for their thought leadership in the design and full replication of the study, Dr. Wilson for her assessment leadership, and Mr. Tyler for his leadership in education policy in executing this study. I would also like to thank Mr. Tate for his vision in founding CLT and his foresight into the profound impact that this assessment has had on tens of thousands of CLT test takers over the past seven years.

As the Chief Psychometrician, I have a passion for psychometrics, measurement, assessment, and educational choice and freedom, and it has been an honor to serve as a leader on this project. We hope that this report will be a valuable resource for students, educators, researchers, and admissions professionals alike.

Sincerely,

Tracy Gardner, Ph.D. Chief Psychometrician, Classic Learning Test (CLT)

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I. Introduction

The purpose of this study is to build a concordance relationship between the Classic Learning Test (CLT) and the Scholastic Aptitude Test (SAT®) total and section scores. The CLT is a college admissions test that launched in December 2015 as an alternative to the SAT (CLT, 2018) and the ACT®. Based on a classical liberal arts education model, the CLT has become popular among homeschooled students and students who attend private and classical schools (CLT, 2018). On the other hand, the SAT is taken mostly by public school students (NCES, 2009). Despite this difference in the student populations they serve, the CLT and the SAT measure similar skills and both of them were designed to be used for college admissions. Therefore, building a concordance relationship between the two tests will assist educators and decision makers in utilizing CLT scores in admissions and scholarship programs. We also present the concordance relationship between the CLT and the ACT, but it is directly based on the official concordance relationship between the SAT and the ACT as established by the College Board and the ACT (College Board, 2018), and is not established in this study.

Concordance is a form of *linking*, and in particular, *scale alignment* (Dorans, 2020). The goal of scale alignment is "to transform the scores from two different tests onto a common scale" (Dorans, 2020, p.3). However, linking differs from *equating*, which adjusts for differences in difficulty between separate forms of the same test (Kolen & Brennan, 2014). The forms that are equated must be built to the same test specifications and measure the same latent construct for the equated scores to be used interchangeably. In contrast, linking aligns the scales of tests that are built to different test specifications but measure similar constructs. The constructs measured by the tests should still be similar enough to justify linking them and use the linking relationship to evaluate a student's performance across different tests. The degree of similarity between the tests is assessed by evaluating the alignment between the content measured in each test and by measuring their empirical relationship (Dorans, 2004) through the correlation between the tests. Although linking differs from equating in the interpretations it allows, the same statistical methods can be used for both. This study uses equipercentile linking with a single-group design. This method places the scores from two tests on a common scale such that linked scores have the same relative standing or percentile rank in a group of students.

This report begins with an overview of CLT and SAT, and evaluates the alignment of the content coverage between the two tests. Then, we discuss the data and the methodologies used to establish the concordance relationships both for the overall test and their sections. Next, we present the results, which include the correlations between test scores as empirical evidence for their alignment, the concordance tables, and estimates of the linking error. Finally, we summarize the findings and discuss the generalizability of the concordance relationships.

Total Scores

CLT	SAT	ACT
120	1600	36
119	1600	36
118	1590	36
117	1580	36
116	1580	36
115	1570	36
114	1560	35
113	1550	35
112	1540	35
111	1530	35
110	1520	34
109	1500	34
108	1490	34
107	1480	33
106	1470	33
105	1460	33
104	1440	32
103	1430	32
102	1420	32
101	1410	31
100	1390	31

CLT	SAT	ACT
99	1380	30
98	1370	30
97	1360	30
96	1340	29
95	1330	29
94	1320	28
93	1310	28
92	1300	28
91	1290	27
90	1270	27
89	1260	27
88	1250	26
87	1240	26
86	1230	26
85	1220	25
84	1210	25
83	1200	25
82	1190	24
81	1180	24
80	1170	24
79	1160	24

CLT	SAT	ACT
78	1150	23
77	1140	23
76	1140	23
75	1130	23
74	1120	22
73	1110	22
72	1100	22
71	1090	21
70	1080	21
69	1080	21
68	1070	21
67	1060	21
66	1050	20
65	1040	20
64	1040	20
63	1030	20
62	1020	19
61	1010	19
60	1000	19
59	1000	19
58	990	19

The concordance between the CLT and the ACT is derived from the official concordance between the SAT and the ACT, which can be found in this link:* ***https://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html*

CLT	SAT	ACT
57	980	18
56	970	18
55	960	18
54	950	17
53	940	17
52	940	17
51	930	17
50	920	17
49	910	16
48	900	16
47	890	16
46	880	16
45	870	15
44	860	15
43	850	15
42	840	15
41	840	15
40	830	15
39	820	14
38	810	14
37	800	14

CLT	SAT	ACT
36	790	14
35	780	14
34	770	13
33	760	13
32	750	13
31	740	13
30	740	13
29	730	13
28	720	12
27	710	12
26	700	12
25	690	12
24	690	12
23	680	11
22	670	11
21	660	11
20	660	11
19	650	11
18	640	10
17	630	10
16	630	10

CLT	SAT	ACT
15	620	10
14	610	9
13	610	9
12	600	9
11	590	9
10	590	9
9	580	#N/A
8	570	#N/A
7	570	#N/A
6	560	#N/A
5	550	#N/A
4	550	#N/A
3	540	#N/A
2	530	#N/A
1	520	#N/A
0	510	#N/A

Verbal Reasoning + Grammar/Writing Scores

CLT	SAT	ACT
80	800	72
79	790	72
78	780	71
77	770	71
76	760	70
75	750	70
74	740	69
73	730	68
72	730	68
71	720	67
70	710	66
69	700	64
68	690	63
67	690	63
66	680	61
65	670	60
64	670	60

CLT	SAT	ACT
63	660	58
62	650	57
61	640	55
60	640	55
59	630	54
58	620	52
57	620	52
56	610	51
55	600	49
54	600	49
53	590	48
52	580	46
51	580	46
50	570	45
49	560	44
48	560	44
47	550	43

CLT	SAT	ACT
46	540	42
45	540	42
44	530	40
43	520	39
42	520	39
41	510	38
40	510	38
39	500	37
38	490	35
37	490	35
36	480	34
35	470	33
34	470	33
33	460	32
32	450	31
31	450	31
30	440	30

The concordance between the CLT and the ACT is derived from the official concordance between the SAT and the ACT, which can be found in this link:* ***https://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html*

CLT	SAT	ACT
29	440	30
28	430	29
27	420	28
26	420	28
25	410	27
24	400	26
23	400	26
22	390	25
21	380	24
20	380	24
19	370	23
18	360	22
17	360	22
16	350	21
15	340	20
14	340	20
13	330	19

CLT	SAT	ACT
12	320	18
11	320	18
10	310	17
9	300	16
8	290	15
7	280	14
6	280	14
5	270	#N/A
4	260	#N/A
3	250	#N/A
2	230	#N/A
1	220	#N/A
0	210	#N/A

Quantitative Reasoning Scores

The concordance between the CLT and the ACT is derived from the official concordance between the SAT and the ACT, which can be found in this link:* ***https://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html*

CLT	SAT	ACT
40	800	36
39	790	35
38	780	35
37	760	34
36	750	33
35	740	33
34	730	32
33	720	32
32	700	30
31	690	30
30	680	29
29	660	28
28	650	27
27	640	27

CLT	SAT	ACT
26	620	26
25	610	26
24	600	25
23	580	24
22	570	24
21	560	23
20	540	22
19	530	21
18	520	20
17	500	18
16	490	18
15	470	17
14	460	17
13	450	16

CLT	SAT	ACT
12	430	16
11	420	16
10	400	15
9	390	15
8	380	15
7	360	14
6	350	14
5	330	13
4	310	12
3	290	11
2	270	10
1	250	#N/A
0	220	#N/A

II. Content Alignment Between CLT and SAT

II.I. CLT Content

The CLT aims to provide an assessment that is intellectually richer than other college entrance exams, with the end goal of promoting a classical curriculum that forms individuals who are "intellectually curious, think deeply, reason well, and live with integrity" (CLT, 2018, p. 4). To achieve this aim, CLT uses passages from classical works that have had a lasting influence on culture and society. The CLT consists of three main sections: Verbal Reasoning (VR), Grammar/Writing (GW), and Quantitative Reasoning (QR). There is also an optional Essay section, which, like the Essay section of the SAT, is not the focus of this study.

II.I.I. Verbal Reasoning

The Verbal Reasoning section tests a student's ability to understand and analyze a text (CLT, 2018). Students are asked to interact with a variety of texts in different subject areas and are tested on their ability to comprehend the text and synthesize its ideas. Students must be able to understand how different phrases and words are used in context, the author's purpose in a particular section, how a text is structured, and what could be reasonably inferred based on the information in the text. The Verbal Reasoning section can be divided into two domains: Comprehension and Analysis. Comprehension questions include the subdomains "Passage as a Whole," "Passage Details," and "Passage Relationships." Analysis questions include the subdomains "Textual Analysis" and "Interpretation of Evidence." One of the Interpretation of Evidence questions always refers to a chart accompanying a passage. Finally, two questions per passage test analogies based on the passage.

Each Verbal Reasoning section consists of four passages: three full passages and one passage composed of two shorter excerpts presented together. The passages are selected from the following four fields: Literature, Science, Philosophy/Religion, Historical/Founding Documents (two shorter, paired excerpts presented together). The passages in the Literature category are drawn from classic and modern literary prose, and include works by authors whose stories, style, and ideas have contributed significantly to Western culture. Examples include Flannery O'Connor, Oscar Wilde, Charlotte Brontë. The passages in the Science category are from articles, essays, and other works exploring the natural sciences, and are always accompanied by a chart. The passages in the Philosophy/Religion category are from classic or contemporary sources, and discuss issues

of truth, reasoning, ethics, and more. The paired passages in the Historical/ Founding Documents category are two brief selections that present perspectives on an important topic. The first is a historical document drawn from sources such as Plato, Cicero, and Epicurus. The second is a passage from a writer or time period essential to U.S. history. Each passage has ten corresponding questions that measure students' ability to understand and draw conclusions about the passage's main ideas, the author's tone or attitude, a character's motives, the meaning of a word or phrase in context, the structure of a passage, the evidence or support for the answer to a previous question, and passage-based analogies.

II.I.II. Grammar/Writing

The Grammar/Writing section tests a student's ability to edit and improve a text. Specifically, students are tested on their ability to correct errors within a text and to improve its readability and flow. Moreover, the section assesses students' ability to use punctuation correctly, to convey a point 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. The questions in the Grammar/Writing section can be broken down into two domains: Grammar and Writing. Grammar questions include the subdomains "Agreement" and "Punctuation and Sentence Structure." Writing questions include the subdomains "Structure," "Style," and "Word Choice." Grammar questions test a student's ability to correct agreement, punctuation, structure, and other errors. Writing questions test a student's ability to improve upon a text's style, flow, and word choice.

The passages in the Grammar/Writing section come from the following areas: Philosophy/ Religion, Historical Profile, Science, and Modern/Influential Thinkers. The passages in the Philosophy/Religion category are classic or contemporary sources that touch on issues of truth, reasoning, ethics, and more. The passages in the Historical Profile category consist of short biographical pieces on important historical figures, such as Joan of Arc or Shakespeare. The passages in the Science category are from articles, essays, and other works exploring the natural sciences. The passages in the Modern Influential Thinkers/ Issues category are similar in scope to the Philosophy/Religion category, but are drawn from more modern sources and may offer perspectives on issues faced by modern society. Each passage has ten corresponding questions. Each question requires students to either correct an error or suggest an improvement in the passage. If no change is necessary, students can select the option "NO CHANGE." Questions may

test students' ability to understand, correct, or improve on the following aspects of a text: diction (word choice), punctuation, syntax (sentence structure), flow, logical coherence, subject/verb agreement, rhetorical strength of additional/subtracted sentences, and pronoun/antecedent agreement.

II.I.III. Quantitative Reasoning

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 to assess their logic and reasoning ability across different domains. The Quantitative Reasoning section can be broken down into three domains: Algebra, Geometry, and Mathematical Reasoning. Algebra questions include the subdomains "Arithmetic and Operations" and "Algebraic Expressions and Equations." Geometry questions include the subdomains "Coordinate Geometry," "Properties of Shapes," and "Trigonometry". Mathematical Reasoning questions include the subdomains "Logic" and "Word Problems". Geometry questions constitute about a third of the section, which is more than the proportion allotted to Geometry in the SAT and is one of the differences between the Quantitative Reasoning section of the CLT and the Math section of the SAT. Another difference is the presence of Logic questions and Word Problems, which are absent in the SAT Math Test. Furthermore, CLT does not allow calculators in any part of the test. All questions are designed to be solvable without a calculator to reflect CLT's goal of testing students' logical reasoning abilities rather than their ability to do complicated calculations.

II.I.IV. CLT Scoring

Each section of the CLT consists of 40 multiple-choice questions with the scores on a 0–40 scale (CLT, 2018). The section scores are summed to obtain a total CLT score on the 0–120 scale. CLT is one hour shorter than the SAT in test administration, taking two hours to complete. Similar to the SAT, CLT does not impose a penalty for incorrect answers.

II.II. SAT Content

The main goal of the SAT is to assess the extent to which students are prepared to succeed at college and work (College Board, 2017). Accordingly, SAT scores are often used in college admissions and scholarship applications. The SAT consists of two sections: Evidence-Based

Reading and Writing (EBRW) and Math. The Evidence-Based Reading and Writing section is composed of two tests: a Reading Test and a Writing and Language Test. The contents of the Reading Test, the Writing and Language Test, and the Math Test are described below.

II.II.I. SAT Reading Test

The SAT Reading Test has 52 questions and takes 65 minutes. It measures the degree to which a student "can demonstrate college and career readiness proficiency in reading and comprehending a broad range of high-quality, appropriately challenging literary and informational texts in the content areas of U.S. and world literature, history/social studies, and science" (College Board, 2014, p. 40, as cited in College Board, 2017). The Reading Test has four key features: Words in Context, Command of Evidence, Informational Graphics, and Text Complexity (College Board, 2017). Words in Context means that the test measures students' understanding of a word's meaning in the context of a passage. Command of Evidence refers to assessing a student's ability to extract information and ideas from a text and to identify which parts of the text support a given conclusion. Informational Graphics requires test takers to interpret graphs, tables, or other graphics that display information about the content of a passage and to integrate this information with the information presented in the passage. Text Complexity refers to the fact that the passages used in the SAT cover multiple levels of complexity, ranging from grades 6-8 to college-entry level.

Importantly, students can answer the questions in the Reading Test based on what is stated in the passages, without any prior knowledge of the subjects. That is, test takers need to be thoughtful and reason judiciously to draw conclusions that are supported by a passage. Occasionally, two passages are paired to assess whether students can make connections between them in addition to comprehending them individually. The passages used in the SAT reading tests come from the areas of literature, history/social studies, and science. Literature passages include classic and contemporary texts by authors from both the US and other countries. History/social studies passages include excerpts from the US founding documents and texts that are central to the "Great Global Conversation" (College Board, 2017, p. 8), touching a wide variety of subjects such as economics, political science, and anthropology. Science passages explore both key concepts and recent findings in the natural sciences.

II.II.II. SAT Writing and Language Test

The SAT Writing and Language Test has 44 questions and takes 35 minutes. It measures the degree to which a student "can demonstrate college and career readiness proficiency in revising and editing a range of texts in a variety of content areas, both academic and career related, for expression of ideas and for conformity to the conventions of standard written English grammar, usage, and punctuation" (College Board, 2014, p. 58, as cited in College Board, 2017). The key features of the Writing and Language Test are the same as the first three key features of the Reading Test. However, their applications are slightly different. For example, Command of Evidence refers to students' ability to revise a text to strengthen the development of an idea.

The passages in the Writing and Language Test are developed specifically for the test, and include the content areas of history/social studies, humanities, science, and career-related subjects. The purpose of developing passages specifically for the test is to introduce errors in the text which students are asked to correct. Specifically, students are asked to improve the passage's development and organization of ideas as well as to correct mistakes in grammar, usage, and punctuation. As in the Reading Test, some passages in the Writing and Language Test are associated with graphics. For the questions associated with these passages, students are required to make connections between the graphics and the text, correcting the representation and/or the interpretation of the data in the passage. Importantly, the Writing and Language Test does not assess mechanical application of grammatical rules, but rather the students' ability to revise a text in recognition of its context.

II.II.III. SAT Math Test

The SAT Writing and Language Test has 58 questions and takes 80 minutes. It assesses the degree to which a student has "fluency with, understanding of, and the ability to apply the mathematical concepts, skills, and practices that are most strongly prerequisite and central to their ability to progress through a range of college courses, career training, and career opportunities" (College Board, 2014, p. 132, as cited in College Board, 2017). The goal of the Math Test is to assess students' ability to solve problems using the appropriate tools while emphasizing a deep understanding of a few subjects over a superficial understanding of many subjects. Consistent with the tests in the Evidence-Based Reading and Writing section, the SAT Math Test focuses on skills that are most likely to contribute to success at college and work. Specifically, the Math Test

focuses on four areas: Heart of Algebra, Problem Solving and Data Analysis, Passport to Advanced Math, and Additional Topics in Math.

Heart of Algebra measures students' ability to analyze and solve linear equations and inequalities. Moreover, students are required to solve systems of equations utilizing multiple techniques. While some of the questions in Heart of Algebra are simple exercises that assess a student's fluency in solving equations, others require a deeper understanding of the subject such as understanding the relationship between algebraic and graphical representations. Problem Solving and Data Analysis assesses a student's understanding of rates, ratios, and proportions. Moreover, students are required to understand and apply basic statistical concepts such as measures of central tendency and spread, the effect of outliers on measures of central tendency, and to identify patterns in a data set. The questions in Problem Solving and Data Analysis ask students to apply these concepts to scientific and career-related problems. Passport to Advanced Math assesses a student's ability to work with more advanced expressions and equations, including quadratic and higher order functions. Students are required to understand different parts of expressions such as terms, factors, and coefficients. Moreover, students are asked to rewrite expressions in different ways as well as interpret and build functions. Finally, Additional Topics in Math assesses fundamental concepts in geometry and trigonometry, such as the Pythagorean theorem. However, these topics constitute only a small portion of the Math Test.

The Math Test has a "calculator portion" in which students can use calculators, and a "no calculator portion" in which they cannot. The no calculator part includes conceptual questions for which a calculator is not useful. The calculator part includes more complex modeling problems. However, the calculator part also has some questions which may be more easily solved by reasoning instead of relying on a calculator. The purpose of such questions is to assess a student's ability to use the right tools to solve a problem.

II.II.IV. SAT Scoring

The Evidence-Based Reading and Writing section consists of multiple-choice questions (College Board, 2017). The Math test is mostly multiple-choice as well, but contains some student-produced "grid-in" questions. The Evidence-Based Reading and Writing and Math sections are both scored on a 200-800 scale, and their scores are summed to obtain a total SAT score between 400 and 1600. Students are given a total of three hours to complete the Evidence-Based Reading

and Writing and Math sections. The SAT is scored only based on correct answers, meaning there are no deductions or penalties for incorrect answers.

II.III. Comparing the CLT and the SAT

Table 1 summarizes the content coverage of the CLT and the SAT. The above review of the two tests suggests that both tests measure similar constructs. First, both tests are divided into three subtests that measure reading, writing/grammar, and mathematics. The difference is that the CLT reports scores for each of these tests, whereas the SAT reports a combined Evidence Based Reading and Writing score that includes both the Reading Test and the Writing and Language Test.

Second, the Reading Test of the SAT and the Verbal Reasoning section of the CLT measure the same abilities: the ability to extract information and derive ideas from a text, determine what conclusions are supported by it, understand the meaning and use of words and phrases in a context, understand the purpose of an author, interpret information presented in graphics and integrate it with an associated passage, and relate multiple passages to each other. Both tests measure these abilities by presenting passages in pairs and associating passages with graphics. Moreover, the Verbal Reasoning section and the Reading Test contain passages from similar fields; both include passages from literature, history, US founding documents, and the natural sciences.

Third, both the Grammar/Writing section of the CLT and the Writing and Language Test of the SAT require students to improve the development of an idea as well as to correct grammatical errors. Finally, both the Quantitative Reasoning section of the CLT and the Math Test of the SAT emphasize problem solving, reasoning, and Algebra. CLT goes a step further in measuring reasoning abilities by including questions that directly test Logic. Moreover, a greater proportion of CLT's Quantitative Reasoning consists of Geometry and Trigonometry questions compared to the Math Test of the SAT.

The main difference between the CLT and the SAT seems to focus on the goals they pursue and the types of passages selected to achieve their goals; SAT places more emphasis on testing skills that are useful at college and work environments, whereas CLT focuses on exposing students to classical texts with the aim of nurturing virtue and reason. To achieve this goal, CLT gives a

larger place to classical texts in its passages. However, the ability to understand and analyze these texts is clearly useful in college and work environments as well. Consequently, the CLT and the SAT converge in the abilities they measure, albeit using slightly different means. The convergence between the CLT and the SAT is evaluated empirically below.

Table 1. Content Coverage of CLT and SAT

CLT	SAT
Total (120 items)	Total (154 items)
Verbal Reasoning (40 items) Grammar/ Writing (40 items)	Evidence-Based Reading and Writing (96 items)
Quantitative Reasoning (40 items)	Math (58 items)

CLT - Verbal Reasoning	SAT - Reading Test
Total (40 items)	Total (52 items)
Time allotted: 40 minutes	Time allotted: 65 minutes
Multiple choice	Multiple choice
Comprehension (67.5%l) Passage Details (27.5%) Passage as a Whole (20%) Passage Relationships (20%)	Words in Context (also overlaps with Writing and Language test)
Analysis (32.5%) Textual Analysis (20%) Interpretation of Evidence (12.5%)	Command of Evidence (also overlaps with Writing and Language test)

CLT - Grammar/Writing	SAT - Writing and Language
Total (40 items)	Total (44 items)
Time allotted: 35 minutes	Time allotted: 35 minutes
Grammar (50%) Agreement (25%) Punctuation and Sentence Structure (25%)	Standard English conventions (45%)
Writing (50%) Structure (20%) Style (20%) Word Choice (10%)	Expression of Ideas (55%)

CLT - Quantitative Reasoning	SAT - Math
Total (40 items)	Total (58 items)
Total time allotted: 40 minutes	Total time allotted: 80 minutes
Multiple Choice (100%)	Multiple Choice (75-79%) Student-Produced Response (21-25%)
Calculators not permitted	Calculators permitted (partially)
Algebra (25%) Arithmetic and Operations (12.5%) Algebraic Expressions and Equations (12.5%)	Heart of Algebra (33%) Passport to Advanced Math (28%) Additional Topics in Math (10%) Problem Solving and Data Analysis (29%)
Geometry (35%) Plane Geometry (10%) Properties of Shapes (15%) Trigonometry (10%)	
Mathematical Reasoning (40%) Logic (20%) Word Problems (20%)	

III. Linking CLT and SAT Scores

This study examines the concordance relationships of the total scores between CLT and SAT, between the CLT Quantitative Reasoning scores and the SAT Math scores, and between the sum of CLT's Verbal Reasoning and Grammar/Writing scores and the SAT Evidence Based Reading and Writing Scores. Conceptually, the Verbal Reasoning section of the CLT corresponds to the Reading Test of the SAT, and the Grammar/Writing section of the CLT corresponds to the Writing and Language Test of the SAT. Given that the SAT reports combined Evidence Based Reading and Writing scores, the Verbal Reasoning and Grammar/Writing scores of the CLT will be summed and mapped to Evidence Based Reading and Writing scores. Ultimately, three concordance tables are developed to map the CLT and SAT total scores, Reading and Writing scores, and math/quantitative scores respectively.

IV. Methods

IV.I. Data

This study used three sources of data: CLT administrations that took place between 2016 and 2023, CLT and SAT scores reported by CLT partner colleges and secondary schools, and a special Florida administration on March 29th, 2023. Given that the CLT was designed for 11th and 12th grade students and is used for college admissions, we only included the scores of students who took the test in grades 11 or 12. Each data source is described in more detail below. Students who register for a CLT administration have the option of sharing their total SAT and/or ACT scores, but they are not required to submit official score reports. That is, SAT scores obtained from CLT administrations are self-reported. Moreover, students are not asked their scores on the separate sections of these tests. Therefore, the SAT and ACT scores obtained from past CLT administrations only contain total scores. However, a number of partner colleges, secondary schools, and test takers have reported official SAT and ACT scores, and these verified scores included SAT EBRW and SAT Math section scores as well. Specifically, 23 schools and 50 students reported official scores. The scores of students who self-reported their SAT could also be included in the official scores provided by colleges. Therefore, we removed duplicate records both within each data set and across data sets. Duplicates were removed with the highest total score retained as one unique test record for each individual test-taker. That is, we did not superscore but rather selected the

scores from the test attempt that had the maximum total score. On the other hand, if we had duplicate records for a student, and one of the records included EBRW and Math scores whereas the others did not, we selected the record that had the section scores.

In each data set, we examined the correlation between SAT scores and CLT scores both before and after excluding outliers. This was done for exploratory purposes – when creating the concordance tables, we did not treat outliers separately in each data set, but once in the final, combined data set. The exception was the March 29 administration, which is discussed below. By outliers, we mean bivariate outliers. These are data points which may be considered typical in their respective distributions but are outliers when considered in pairs – data points that would not be expect to occur together. To identify such cases, we calculated a z-score for each CLT and SAT score, and excluded individuals who had more than a two standard deviation difference between their converted CLT and SAT z-scores. This is because given the content similarity between the two tests, a two standard deviation performance difference likely indicates lack of effort in one of the tests or aberrant responding behaviors.

IV.I.I. CLT Administrations between 2016–2023

Between 2016 and 2023, CLT reported 32,615 scores to 24,362 unique students. 21,109 of these students took the test in grades 11 or 12. Of these, 2,677 reported a valid SAT total score. A valid SAT score was defined as an SAT score that was between 400 and 1600, and that was a multiple of ten. In addition, we had 50 official SAT total and section scores reported by these students. The sample of 2,677 and 50 individuals were deduplicated after being combined to make sure the same individual was not included in the analyses multiple times. The final sample size for this group was 2,693. It should be noted that in this sample, only the 50 students who reported official scores had section scores for the SAT.

102 of the students in this sample also had records in the official data reported by colleges. 75 out of 102 (74%) had the same SAT score in both data sets and 80 out of 102 (78%) had the same CLT score, suggesting that some students took both tests multiple times and reported different scores at different points. For 22 out of the 27 students, the difference between the two SAT scores was 50 points or less. Overall, the consistency between self-reported scores and verified scores was high.

Before excluding outliers, the correlation between the CLT and the SAT was 0.79 for total scores, 0.82 for CLT VR + GW and SAT EBRW, and 0.73 for CLT QR and SAT Math. After excluding the

outliers, the correlation was 0.86 for the total scores and did not change for the section scores. After excluding the outliers, the sample size became 2,657, meaning 36 students were identified as outliers. Table 3 shows the average CLT and SAT scores of this sample. The scores of the general CLT population are described in Table 2. The standard deviation of all CLT scores is 17.2. This means the concordance sample obtained from the past administrations is 0.4 standard deviations above the general mean.

Table 2. CLT Score Distributions for the General CLT Population

Section	Min	1st Quartile	Median	Mean	3rd Quartile	Max
CLT Total	0	64.0	77.0	75.7	88.0	120.0
CLT VR + GW	0	47.0	57.0	55.1	64.0	80.0
CLT QR	0	16.0	20.0	20.6	25.0	40.0

Table 3. CLT and SAT Score Distributions for the 2016-2023 Sample

Section	Min	1st Quartile	Median	Mean	3rd Quartile	Max
CLT Total	6.0	72.0	85.0	82.5	95.0	120.0
CLT VR + GW	2.0	52.0	61.0	59.1	68.0	80.0
CLT QR	1.0	18.0	23.0	23.4	28.0	40.0
SAT Total	400.0	1100.0	1220.0	1211.0	1340.0	1600.0
SAT EBRW	480.0	630.0	695.0	683.8	755.0	790.0
SAT Math	430.0	562.5	625.0	629.8	707.5	800.0

IV.I.II. Data Reported by Partner Colleges and Secondary Schools

This sample included total scores shared by 23 colleges. 18 of the colleges also shared section scores. Specifically, the initial sample from this data set contained 1,648 SAT total scores and 1,507 SAT section scores. After deduplicating the records and excluding invalid scores, the sample of verified SAT scores included 1,403 total scores and 1,161 section scores. 1,038 of the 1,161 students with SAT section scores also had CLT section scores. CLT section scores were identified for an additional 46 students after being merged with the 2016-2023 sample. The scores reported by colleges and secondary schools are described in Table 4. The table shows that this sample has higher ability than both the general population and the 2016-2023 sample. Without excluding outliers, the correlation between CLT and SAT was 0.86 for total scores, 0.83 for CLT VR + GW and SAT EBRW scores, and 0.81 for CLT QR and SAT Math scores.

Table 4. CLT and SAT Scores Reported by Partner Colleges and Secondary Schools

Section	Min	1st Quartile	Median	Mean	3rd Quartile	Max
CLT Total	28.0	81.0	91.0	89.0	100.0	120.0
CLT VR + GW	18.0	57.0	65.0	62.3	70.0	80.0
CLT QR	9.0	21.0	27.0	26.1	31.0	40.0
SAT Total	650.0	1160.0	1280.0	1269.0	1390.0	1600.0
SAT EBRW	380.0	600.0	670.0	654.7	720.0	800.0
SAT Math	250.0	550.0	620.0	617.8	680.0	1180.0

IV.I.III. CLT Administration on March 29, 2023

The March 29, 2023 administration was a special in-school administration that took place in Florida. The purpose of this administration was to collect additional data for this concordance study. Schools were compensated to participate in the research study. 542 students participated in the administration and 446 provided verified SAT scores. As Table 5 shows, this sample was lower in ability than the general CLT population. However, the correlation between CLT and SAT remained high. Before excluding outliers, the correlation between the total scores was 0.74. After excluding outliers, it was 0.81. In total, 11 points were excluded as outliers, and the final sample size for this group was 435. All of these students had section scores.

We excluded outliers from this data set prior to combining all the data because we had concerns about the motivation of the students who participated in this administration. Since this administration took place to collect data for this study and the schools were incentivized to participate, the students might not have been as motivated as they would be in an administration they participated on their own accord. To test our hypothesis about student motivation in taking the test, we evaluated their CLT scores in the context of their SAT scores, which allowed us to identify the students who scored much lower on one test while much higher on the other test. Given that all three datasets showed high correlations between CLT and SAT scores, it was unlikely for a student to perform drastically differently on the two tests. Furthermore, to account for population differences, we examined the joint distribution of scores in the same sample. Therefore, we calculated z-scores from the same sample of scores, and excluded students who likely did not put in the necessary effort, as indicated by more than a 2 standard deviation difference between their SAT and CLT z-scores.

Table 5. CLT and SAT Scores From the March 29 Administration

Section	Min	1st Quartile	Median	Mean	3rd Quartile	Max
CLT Total	12.0	34.0	44.0	47.0	57.0	110.0
CLT VR + GW	6.0	24.0	34.0	34.8	44.0	76.0
CLT QR	0.0	9.0	11.0	12.3	14.5	39.0
SAT Total	540.0	805.0	910.0	931.5	1040.0	1530.0
SAT EBRW	250.0	420.0	470.0	482.3	540.0	770.0
SAT Math	260.0	370.0	430.0	449.0	510.0	790.0

IV.I.IV. Final Sample for the Concordance Study

To establish the concordance relationship, we combined the three sources of data. This resulted in 4531 total scores and 1646 section scores. However, it was possible that the scores shared by colleges and the scores from the 2016-2023 administrations overlapped. Therefore, we checked the duplicate records in this combined data set one more time. The final sample included 4,404 total scores, 1,551 VR + GW – EBRW, and 1551 QR – Math scores. In this final sample, before excluding the outliers, the correlation between the CLT and the SAT was 0.86 for total scores, 0.90

for CLT VR + GW and SAT EBRW scores, and 0.87 for CLT QR and SAT Math scores. We excluded a total of 29 data points from the total scores, reaching a final sample size of 4,375. Excluding the outliers increased the correlation between the total scores to 0.89. There were no outliers for VR + GW and EBRW. There was one outlier in QR-Math, but excluding it did not affect the correlation. The final sample size for QR was 1550. Tables 6 through 11 summarize the CLT and SAT scores of the final sample, after excluding outliers. It is noted that the difference between the final sample and the CLT general population is slightly smaller than before due to the addition of the data from the March 29, 2023 administration.

IV.II. Statistical Analyses

Throughout the study, we have reported Pearson's correlation coefficient r to examine the degree to which the CLT and the SAT measure similar constructs. In the literature, a Pearson's r of above 0.70 is considered a strong correlation (Akoglu, 2018). To conduct the linking, we used equipercentile linking with a single-group design. We implemented the method using the **equate** package (Albano, 2016) in the programming language R (R Core Team, 2022). Loglinear pre-smoothing was used to smooth the score distributions prior to linking the tests. This method describes the log of a score point's density using a polynomial function of the form presented in equation 1 below:

$$log(p) = \beta_0 + \beta_1 x^1 + \beta_2 x^2 + \ldots \beta_c x^c$$

One advantage of using pre-smoothing over post-smoothing is that the methods described in the previous paragraph provide a principled way of determining how much smoothing should be applied (Kolen & Brennan, 2014). Moreover, the two smoothing methods often lead to similar results (Kolen & Brennan, 2014). To choose an appropriate value for the degree of the polynomial used in smoothing, we used the Likelihood Ratio Test (LRT), the Akaike Information Criterion (AIC) (Akaike, 1973), and the Bayesian Information Criterion (BIC) (Schwarz, 1978). The LRT is used in model selection to compare two nested models. The LRT computes the ratio of the likelihoods of the data under the two models. The LR statistic follows a chi-square distribution. Using the critical values of the distribution, one can test if the more complicated model describes the data better than the simpler model at a given level of significance. Given that we conducted multiple LRTs to test the increasing degrees of polynomials, we adjusted the significance level

using the formula in Kolen and Brennan (2014, p. 71) to control the Type I error rate. AIC and BIC also select the model under which the data are most likely while penalizing additional parameters, thereby balancing explanatory power with parsimony. Lower AIC and BIC values indicate better fit. We provide standard errors at each score point to quantify the uncertainty in the linking relationship at each score point.

V. Results

V.I. Correlations Between the CLT and the SAT

The correlation between the CLT and SAT has been discussed while describing the data collection and cleaning process. In this section, we present the results from the final sample, along with visualizations of the relationship. Figure 1 presents the correlation between the total CLT and SAT scores without the exclusion of outliers from the final data set. The correlation is 0.86. Figure 2 presents the same relationship after excluding outliers. The data points that suggest an extreme discrepancy between CLT performance and SAT performance were removed. For example, one record has a CLT total score of 31 and an SAT total score of 1600. This combination is extremely unlikely, and clearly suggests that either the student did not put in any effort into the CLT, or that the SAT score is inaccurate. After excluding the outliers, the correlation increases to 0.89, which is very high. Further, Figure 3 displays the relationship between the sum of the CLT VR and GW scores and SAT EBRW scores. The correlation is 0.90 and there are no outliers. Finally, Figure 4 shows the correlation between CLT QR scores and SAT Math scores. The correlation is 0.87 and does not change after removing the single outlier.

CLT and SAT Total Scores

Figure 1. The relationship between CLT and SAT total scores, without the exclusion of outliers.

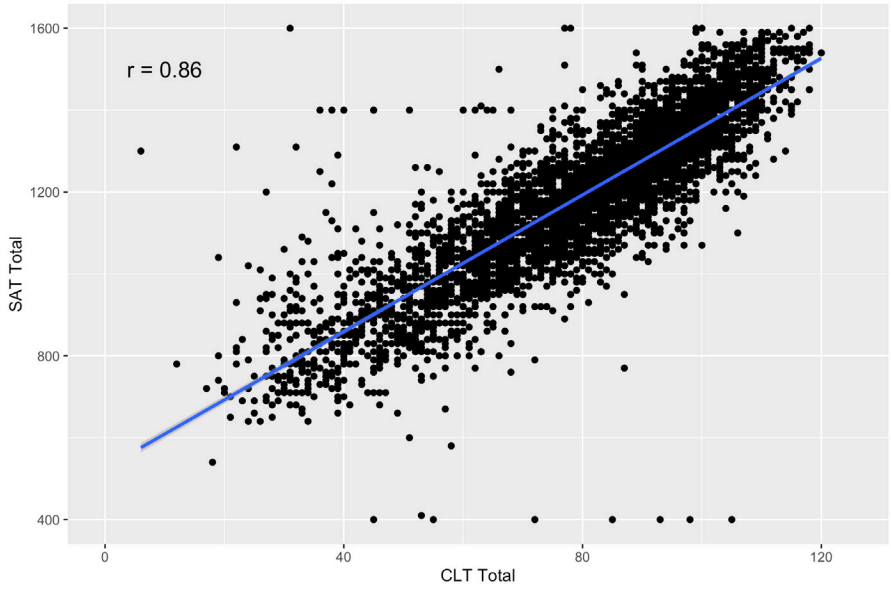
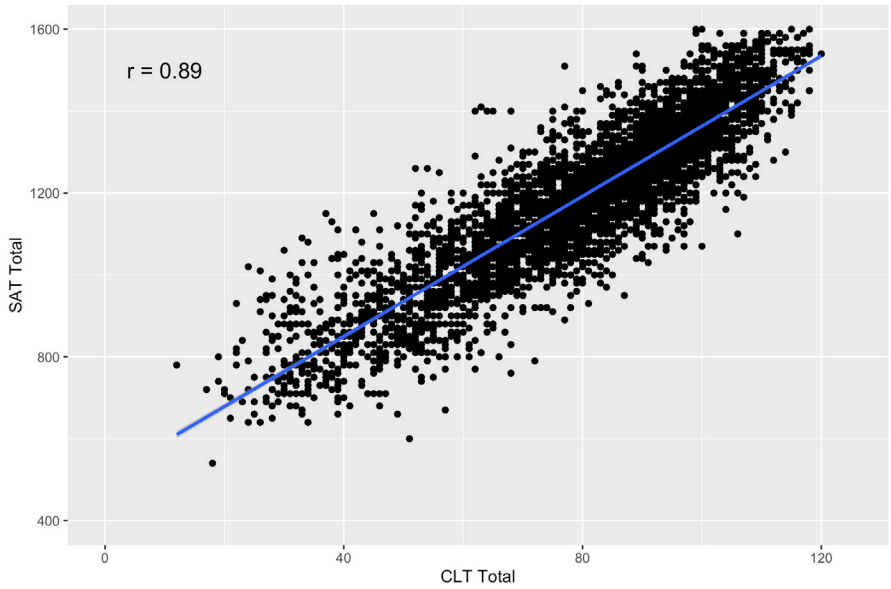
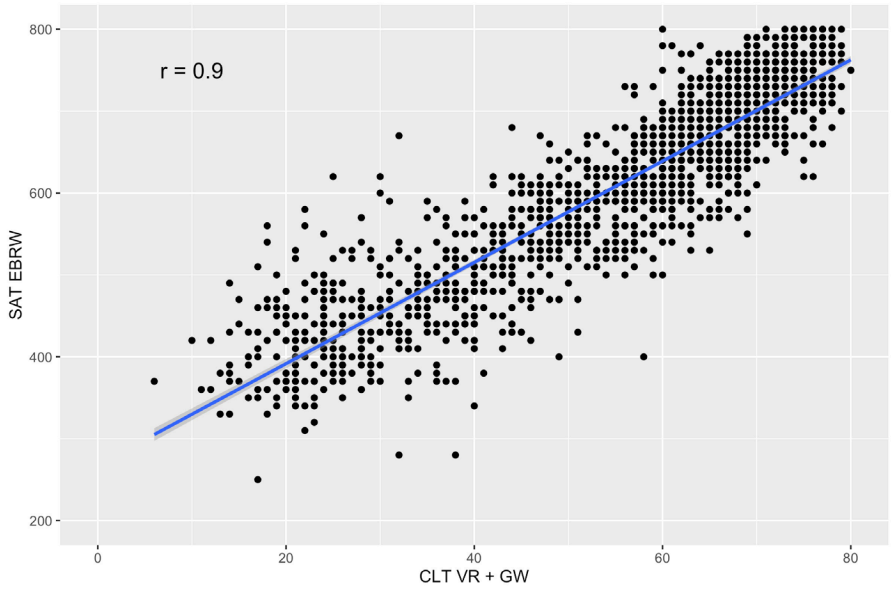


Figure 2. The relationship between CLT and SAT total scores after excluding outliers.



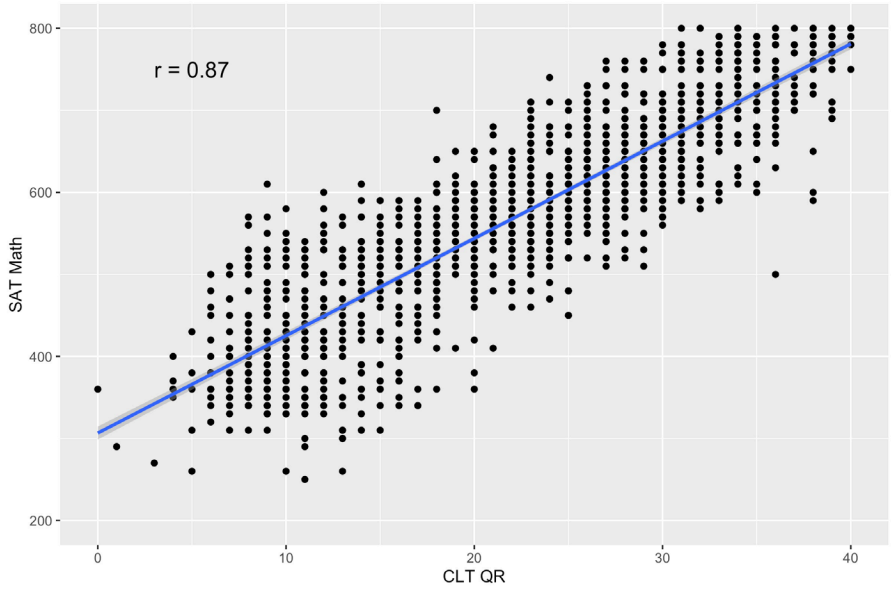
CLT VR + GW and SAT EBRW Scores

Figure 3. The relationship between CLT VR + GW scores and SAT EBRW scores. There are no outliers.



CLT QR and SAT Math Scores

Figure 4. The relationship between CLT QR scores and SAT Math scores. There was only one outlier.



V.II. Pre-Smoothing

CLT and SAT Total Scores

The LRT, AIC, and BIC all suggested that a polynomial degree of 4 described the distribution of CLT scores the best (*AIC* = 653.72, *BIC* = 667.70, $p < 0.001$). Degree 6 was selected for the SAT total score distribution (*AIC* = 670.81, *BIC* = 690.38, $p = 0.002$). Table 6 and Table 7 compare the empirical and the smoothed distributions for the CLT total scores and the SAT total scores, respectively. Since we used degree 4 for the CLT and 6 for the SAT, all the moments of the smoothed distributions match those of the empirical distributions..

Table 6. Comparison of the empirical and smoothed distributions of total CLT scores

Distribution	Mean	SD	Skew	Kurtosis	Min	Max	N.
Empirical	81.1	20.0	-0.7	3.0	12.0	120.0	4375
Smoothed	81.1	20.0	-0.7	3.0	0.0	120.0	4375

Table 7. Comparison of the empirical and smoothed distributions of total SAT scores

Distribution	Mean	SD	Skew	Kurtosis	Min	Max	N.
Empirical	1201.4	193.5	-0.4	2.7	540.0	1600.0	4375
Smoothed	1201.4	193.5	-0.4	2.7	400.0	1600.0	4375

CLT VR + GW and SAT EBRW Scores

Degree 2 was selected to smooth both the CLT VR + GW scores (AIC=640.63, BIC=647.81,p<0.001) and the SAT EBRW scores (*AIC* = 404.49, *BIC* = 410.82, $p < 0.001$). Table 8 and Table 9 compare the empirical and the smoothed distributions for CLT total scores and SAT total scores, respectively. The smoothed distributions match the empirical distributions at the first and second moments, but slightly differ in the third and the fourth moments. This is expected given that a degree 2 polynomial was used to smooth the VR + GW and EBRW distributions.

Table 8. Comparison of the empirical and smoothed distributions of CLT VR + GW scores

Distribution	Mean	SD	Skew	Kurtosis	Min	Max	N.
Empirical	54.7	17.0	-0.7	2.4	6.0	80.0	1551
Smoothed	54.7	17.0	-0.6	2.8	0.0	80.0	1551

Table 9. Comparison of the empirical and smoothed distributions of SAT EBRW scores

Distribution	Mean	SD	Skew	Kurtosis	Min	Max	N.
Empirical	606.3	117.0	-0.4	2.3	250.0	800.0	1551
Smoothed	606.3	117.0	-0.5	2.8	200.0	800.0	1551

CLT QR and SAT Math Scores

Degree 2 was selected to smooth both the CLT QR scores ($AIC = 408.00$, $BIC = 413.14$, $p < 0.001$) and the SAT Math scores ($AIC = 461.02$, $BIC = 467.35$, $p < 0.001$). Table 10 and Table 11 compare the empirical and the smoothed distributions for CLT total scores and SAT total scores, respectively. The smoothed distributions match the empirical distributions at the first and second moments, but slightly differ in the third and the fourth moments. This is expected given that a degree 2 polynomial was used to smooth the QR and Math distributions.

Table 10. Comparison of the empirical and smoothed distributions of total CLT scores

Distribution	Mean	SD	Skew	Kurtosis	Min	Max	N.
Empirical	22.2	8.9	-0.1	2.0	0.0	40.0	1550
Smoothed	22.2	8.9	-0.2	2.4	0.0	40.0	1550

Table 11. Comparison of the empirical and smoothed distributions of total CLT scores

Distribution	Mean	SD	Skew	Kurtosis	Min	Max	N.
Empirical	570.1	121.3	-0.2	2.3	250.0	800.0	1550
Smoothed	570.1	121.3	-0.3	2.6	200.0	800.0	1550

V.III. Concordance Tables

Appendix A provides the CLT-SAT concordance table established in this study along with the official SAT-ACT concordance relationship established by the College Board and the ACT (ACT & College Board, 2018). Appendix B provides the CLT-SAT concordance table with the standard errors.

VI. Summary and Discussions

The purpose of this study was to establish a concordance relationship between the CLT and the SAT. To justify linking the two tests, we showed that they cover similar content that measures similar skills, and computed the correlation between both the total scores and each section score. Noting that correlations above 0.70 are considered strong (Akoglu, 2018), we showed that the correlation between the CLT total score and the SAT total score was 0.89, the correlation between the CLT VR + GW scores and SAT EBRW scores was 0.90, and the correlation between the CLT QR scores and SAT Math scores was 0.87. All of these are very strong correlations and show that the CLT and SAT measure very similar constructs. Therefore, it is concluded that linking the two tests is sensible.

58% of the total SAT scores used in this study were self-reported. The remaining 42% were verified scores collected from partner colleges, secondary schools, and students. 100% of the section scores were verified. An analysis of the students who had both self-reported scores and verified scores showed that there was high fidelity between the self-reported scores and the verified scores. Moreover, the correlations between CLT and SAT was high in the self-reported sample, especially after excluding bivariate outliers. These results suggest that the fact that a large proportion of total SAT scores were self-reported does not pose a threat to the validity of the results.

Like all concordance tables, the one presented in this report is to some extent sample-dependent (College Board, 2018). Two of the three samples included in this study are higher performing than the general population of CLT test takers. In contrast, the students in the third sample – the students who attended the March 29 administration – were lower performing. When combined, the average CLT score of the final sample was approximately 5 points higher than the average of the general population of CLT test takers. However, their average SAT score was also higher than average (College Board, 2022), indicating that this group of students have higher ability in general. This makes sense given that many of the students in this sample either applied to or were accepted into colleges. Also, it is generally the case that students who take more than one standardized test have higher ability. However, students who are likely to apply to scholarships are also more likely to have higher ability. In this sense, the group of students included in this study resemble the group of students who will use the concordance table presented in this report. Still, users and educators should be aware of these differences in utilizing the concordance table.

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APPENDIX A:
CLT-SAT-ACT Concordance Tables

Total Scores

CLT	SAT	ACT
120	1600	36
119	1600	36
118	1590	36
117	1580	36
116	1580	36
115	1570	36
114	1560	35
113	1550	35
112	1540	35
111	1530	35
110	1520	34
109	1500	34
108	1490	34
107	1480	33
106	1470	33
105	1460	33
104	1440	32
103	1430	32
102	1420	32
101	1410	31
100	1390	31

CLT	SAT	ACT
99	1380	30
98	1370	30
97	1360	30
96	1340	29
95	1330	29
94	1320	28
93	1310	28
92	1300	28
91	1290	27
90	1270	27
89	1260	27
88	1250	26
87	1240	26
86	1230	26
85	1220	25
84	1210	25
83	1200	25
82	1190	24
81	1180	24
80	1170	24
79	1160	24

CLT	SAT	ACT
78	1150	23
77	1140	23
76	1140	23
75	1130	23
74	1120	22
73	1110	22
72	1100	22
71	1090	21
70	1080	21
69	1080	21
68	1070	21
67	1060	21
66	1050	20
65	1040	20
64	1040	20
63	1030	20
62	1020	19
61	1010	19
60	1000	19
59	1000	19
58	990	19

The concordance between the CLT and the ACT is derived from the official concordance between the SAT and the ACT, which can be found in this link:* ***https://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html*

CLT	SAT	ACT
57	980	18
56	970	18
55	960	18
54	950	17
53	940	17
52	940	17
51	930	17
50	920	17
49	910	16
48	900	16
47	890	16
46	880	16
45	870	15
44	860	15
43	850	15
42	840	15
41	840	15
40	830	15
39	820	14
38	810	14
37	800	14

CLT	SAT	ACT
36	790	14
35	780	14
34	770	13
33	760	13
32	750	13
31	740	13
30	740	13
29	730	13
28	720	12
27	710	12
26	700	12
25	690	12
24	690	12
23	680	11
22	670	11
21	660	11
20	660	11
19	650	11
18	640	10
17	630	10
16	630	10

CLT	SAT	ACT
15	620	10
14	610	9
13	610	9
12	600	9
11	590	9
10	590	9
9	580	#N/A
8	570	#N/A
7	570	#N/A
6	560	#N/A
5	550	#N/A
4	550	#N/A
3	540	#N/A
2	530	#N/A
1	520	#N/A
0	510	#N/A

Verbal Reasoning + Grammar/Writing Scores

CLT	SAT	ACT
80	800	72
79	790	72
78	780	71
77	770	71
76	760	70
75	750	70
74	740	69
73	730	68
72	730	68
71	720	67
70	710	66
69	700	64
68	690	63
67	690	63
66	680	61
65	670	60
64	670	60

CLT	SAT	ACT
63	660	58
62	650	57
61	640	55
60	640	55
59	630	54
58	620	52
57	620	52
56	610	51
55	600	49
54	600	49
53	590	48
52	580	46
51	580	46
50	570	45
49	560	44
48	560	44
47	550	43

CLT	SAT	ACT
46	540	42
45	540	42
44	530	40
43	520	39
42	520	39
41	510	38
40	510	38
39	500	37
38	490	35
37	490	35
36	480	34
35	470	33
34	470	33
33	460	32
32	450	31
31	450	31
30	440	30

The concordance between the CLT and the ACT is derived from the official concordance between the SAT and the ACT, which can be found in this link:* ***https://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html*

CLT	SAT	ACT
29	440	30
28	430	29
27	420	28
26	420	28
25	410	27
24	400	26
23	400	26
22	390	25
21	380	24
20	380	24
19	370	23
18	360	22
17	360	22
16	350	21
15	340	20
14	340	20
13	330	19

CLT	SAT	ACT
12	320	18
11	320	18
10	310	17
9	300	16
8	290	15
7	280	14
6	280	14
5	270	#N/A
4	260	#N/A
3	250	#N/A
2	230	#N/A
1	220	#N/A
0	210	#N/A

Quantitative Reasoning Scores

CLT	SAT	ACT
40	800	36
39	790	35
38	780	35
37	760	34
36	750	33
35	740	33
34	730	32
33	720	32
32	700	30
31	690	30
30	680	29
29	660	28
28	650	27
27	640	27

CLT	SAT	ACT
26	620	26
25	610	26
24	600	25
23	580	24
22	570	24
21	560	23
20	540	22
19	530	21
18	520	20
17	500	18
16	490	18
15	470	17
14	460	17
13	450	16

CLT	SAT	ACT
12	430	16
11	420	16
10	400	15
9	390	15
8	380	15
7	360	14
6	350	14
5	330	13
4	310	12
3	290	11
2	270	10
1	250	#N/A
0	220	#N/A

The concordance between the CLT and the ACT is derived from the official concordance between the SAT and the ACT, which can be found in this link:* ***https://www.act.org/content/act/en/products-and-services/the-act/scores/act-sat-concordance.html*

APPENDIX B:
Concordance Table With Standard Errors (SE)

Total Scores

CLT	SAT	SE
120	1600	0.21
119	1600	0.45
118	1590	0.51
117	1580	0.55
116	1580	0.68
115	1570	0.66
114	1560	0.65
113	1550	0.63
112	1540	0.63
111	1530	0.62
110	1520	0.61
109	1500	0.54
108	1490	0.54
107	1480	0.54
106	1470	0.54
105	1460	0.54
104	1440	0.51
103	1430	0.51
102	1420	0.51
101	1410	0.52
100	1390	0.50

CLT	SAT	SE
99	1380	0.50
98	1370	0.50
97	1360	0.50
96	1340	0.49
95	1330	0.49
94	1320	0.49
93	1310	0.50
92	1300	0.50
91	1290	0.50
90	1270	0.50
89	1260	0.50
88	1250	0.51
87	1240	0.51
86	1230	0.52
85	1220	0.52
84	1210	0.53
83	1200	0.53
82	1190	0.54
81	1180	0.55
80	1170	0.56
79	1160	0.57

CLT	SAT	SE
78	1150	0.58
77	1140	0.59
76	1140	0.58
75	1130	0.59
74	1120	0.61
73	1110	0.62
72	1100	0.64
71	1090	0.65
70	1080	0.67
69	1080	0.66
68	1070	0.68
67	1060	0.70
66	1050	0.72
65	1040	0.74
64	1040	0.73
63	1030	0.75
62	1020	0.77
61	1010	0.79
60	1000	0.81
59	1000	0.80
58	990	0.82

CLT	SAT	SE
57	980	0.84
56	970	0.86
55	960	0.88
54	950	0.91
53	940	0.93
52	940	0.90
51	930	0.92
50	920	0.94
49	910	0.95
48	900	0.97
47	890	0.98
46	880	1.00
45	870	1.01
44	860	1.02
43	850	1.03
42	840	1.04
41	840	1.00
40	830	1.00
39	820	1.00
38	810	1.01

CLT	SAT	SE
37	800	1.01
36	790	1.01
35	780	1.02
34	770	1.03
33	760	1.05
32	750	1.07
31	740	1.09
30	740	1.02
29	730	1.04
28	720	1.07
27	710	1.11
26	700	1.17
25	690	1.26
24	690	1.14
23	680	1.21
22	670	1.32
21	660	1.48
20	660	1.31
19	650	1.46
18	640	1.68

CLT	SAT	SE
17	630	2.02
16	630	1.72
15	620	2.05
14	610	2.58
13	610	2.18
12	600	2.73
11	590	3.63
10	590	3.02
9	580	4.01
8	570	5.75
7	570	4.63
6	560	6.62
5	550	10.40
4	550	7.94
3	540	12.20
2	530	20.17
1	520	33.68
0	510	44.47

Verbal Reasoning + Grammar/Writing Scores

CLT	SAT	SE
80	800	0.18
79	790	0.31
78	780	0.38
77	770	0.42
76	760	0.45
75	750	0.46
74	740	0.48
73	730	0.49
72	730	0.52
71	720	0.52
70	710	0.52
69	700	0.52
68	690	0.53
67	690	0.54
66	680	0.54
65	670	0.54
64	670	0.55
63	660	0.55
62	650	0.55
61	640	0.55
60	640	0.56
59	630	0.56
58	620	0.57
57	620	0.57
56	610	0.57
55	600	0.58
54	600	0.58

CLT	SAT	SE
53	590	0.59
52	580	0.60
51	580	0.59
50	570	0.60
49	560	0.62
48	560	0.61
47	550	0.63
46	540	0.65
45	540	0.64
44	530	0.65
43	520	0.68
42	520	0.66
41	510	0.69
40	510	0.68
39	500	0.70
38	490	0.73
37	490	0.71
36	480	0.74
35	470	0.78
34	470	0.76
33	460	0.80
32	450	0.85
31	450	0.81
30	440	0.86
29	440	0.84
28	430	0.88
27	420	0.94

CLT	SAT	SE
26	420	0.91
25	410	0.96
24	400	1.04
23	400	0.99
22	390	1.06
21	380	1.15
20	380	1.09
19	370	1.18
18	360	1.29
17	360	1.21
16	350	1.31
15	340	1.43
14	340	1.35
13	330	1.46
12	320	1.59
11	320	1.50
10	310	1.61
9	300	1.75
8	290	1.91
7	280	2.08
6	280	1.88
5	270	2.00
4	260	2.11
3	250	2.18
2	230	2.66
1	220	2.39
0	210	1.71

Quantitative Reasoning Scores

CLT	SAT	SE
40	800	0.25
39	790	0.43
38	780	0.52
37	760	0.53
36	750	0.56
35	740	0.59
34	730	0.61
33	720	0.62
32	700	0.59
31	690	0.59
30	680	0.60
29	660	0.58
28	650	0.58
27	640	0.58

CLT	SAT	SE
26	620	0.57
25	610	0.58
24	600	0.58
23	580	0.58
22	570	0.58
21	560	0.59
20	540	0.60
19	530	0.60
18	520	0.61
17	500	0.64
16	490	0.64
15	470	0.69
14	460	0.69
13	450	0.70

CLT	SAT	SE
12	430	0.76
11	420	0.77
10	400	0.86
9	390	0.86
8	380	0.88
7	360	0.98
6	350	0.99
5	330	1.12
4	310	1.27
3	290	1.45
2	270	1.60
1	250	1.65
0	220	1.58

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