

# Research Rationale for the *HiSET*™ Assessment

There is a foundational core of academic skills and content knowledge that a person must acquire in order to be successfully prepared to enter a job, a training program, or an entry-level, credit-bearing postsecondary course. While the emphasis on particular skills may differ from job to job and course to course, mastery of a core set of essential skills is required.

The *HiSET*™ assessment measures the foundational core of academic skills that represent the long-term goals of secondary education, particularly the critical thinking skills of analysis and evaluation. The *HiSET* assessment directly measures the academic skills in reading, language arts, mathematics, science and social studies that typically define high school coursework.

Based on national data collected over the past 70 years, the results of the *HiSET* assessment can be validly used to determine performance for two distinct purposes:

1. The level of academic skills and knowledge typically required to earn a high school credential
2. The level of academic skills typically required to be successful in a postsecondary education program

## Development of the *HiSET* assessment

The *HiSET* assessment has been carefully designed, developed and researched to support these two purposes. The procedures used to develop and revise the test materials are the foundation for the assessment's validity. Meaningful evidence related to

inferences based on high school curriculum content and performance standards has guided the design and development of the content. In addition to content validity, the assessment has been validated using indicators of college and career readiness.

The *HiSET* assessment has been designed and implemented according to established professional standards, in order to ensure that the assessment is a measure of what it claims to be, following the guidelines in the *Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, National Council on Measurement in Education, 1999).

**Content Validity.** The content of the *HiSET* assessment is developed through a comprehensive and iterative process during which tests and item specifications are developed to measure the knowledge and skills critical to earn a high school diploma and those critical to being successful in postsecondary programs. This process includes the review of local, state and national curriculum guidelines including the Common Core State Standards (CCSS); the input of school administrators, curriculum specialists, and secondary and postsecondary educators; and surveying of educators with respect to the relative importance and criticality of the specified knowledge and skills.

After test specifications have been developed and validated, item writers are trained to write items that elicit the intended cognition and content area knowledge and skills. All items are

reviewed extensively for accuracy, appropriateness, accessibility and fairness. All items surviving the review stages are administered to national samples of representative high school seniors to evaluate their technical quality and appropriateness.

New forms of the HiSET assessment will be developed to be consistent with shifts in curriculum and to expand the coverage of the CCSS.

**Fairness.** Concern for fairness and the elimination of bias from the assessment is a guiding principle throughout design and development. In particular, this assessment was built with careful attention to content-related sources of test bias. Development procedures addressed this source of bias through the following:

- Thorough examination of content and performance standards for the selection of the appropriate content
- Engagement of panels of experts in the review of the test specifications, items and forms
- Statistical procedures for identifying items on these tests that function differently across various groups of examinees
- Careful selection of a national sample of students to evaluate item performance prior to operational use

**Construct Validity.** The factor structure of the HiSET assessment was analyzed using exploratory factor analysis techniques. The identified factors clearly reflect the test composition and are consistent with the emphasis found in high school curricula. The first factor could be identified as a “literacy” factor, while the second factor was a “numeracy” factor. Reading contributed the most to the interpretation of the first factor, with substantial influence from language arts, social studies and science. The inclusion of the social studies and science tests in the literacy factor is consistent with the structure of the CCSS, which includes these areas in the English Language Arts Literacy standards. The mathematics

test loaded heavily on the second factor with some contribution from science.

## Alignment to Common Core State Standards

Alignment is an integral part of validity as it contributes to the evidence needed to support specific interpretations of an assessment. To that end, the alignment process used for the HiSET items provides the appropriate evidence to support the use of the assessments to measure essential components of the CCSS. All items used in assembling the initial forms of the HiSET assessment have been aligned to the CCSS by panels of professionals. Content experts, test developers and measurement experts conducted a thorough review of the CCSS and the HiSET assessment. The process was an item-by-item evaluation of the content coverage and cognitive demands of the items compared to the relevant domains of the CCSS. These domain-level alignments provide the basis for breakout reports in each subject area that will show the relative performance of examinees in dimensions of the CCSS.

Table 1 indicates the sections of the CCSS English Language Arts standards (grades 11–12) that are measured by four of the HiSET assessments. The Language Arts Writing, Language Arts Reading, Social Studies and Science assessments all align to specific standards of the CCSS in English Language Arts. In addition, the Language Arts Reading assessment includes a mix of both literary and informational texts as defined by the CCSS. Genres include fiction, poetry, science, social studies and literary nonfiction among others.

Table 2 indicates the sections of the CCSS Mathematics standards (grades 11–12) that are measured by the HiSET Mathematics assessment.

All Phase I items are aligned to the CCSS, although not all of the CCSS will be covered by the Phase I assessment. As states and adult education programs

adopt, implement and set standards based on the CCSS over the next few years, the HiSET assessment will evolve to reflect these changes.

The Next-Generation Science Standards call for assessments that capture students' competencies in performing the practices of science and engineering by applying the content and skills they have learned. These standards present significant challenges for those who will develop new assessments to measure the kinds of learning it describes. As these standards are finalized and implemented, the HiSET program will develop and introduce new materials in the Science assessment to reflect these changes.

### **Psychometric Framework for Reporting HiSET Results**

To support inferences related to high school equivalency, the HiSET item pool was calibrated and scaled in a series of studies with a national probability sample of high school students enrolled in regular programs of study leading to successful completion of local graduation requirements and receipt of a high school diploma. Thus, the HiSET reporting scales and metrics reflect national performance of the U.S. graduating class of 2012.

Parallel forms of the HiSET assessment were linked to one another using item-response theory (IRT) estimated true-score equating and the 3-parameter logistic model (3PL). Parameters for all items in the pool were estimated from the national probability sample, and these parameter estimates were used to define the base scale for ability and item difficulty and discrimination, referred to as the Base National Ability Scale. All items were calibrated with the marginal maximum likelihood method originally described by Bock & Aitkin (1981). For any given item subset within the pool, a concurrent calibration design was used to estimate item parameters. Links among item parameters across elements of the pool were established by an equivalent-groups equating

design. A series of scale transformations (Stocking & Lord, 1983) were developed to place all estimated item parameters on the base scale for the national population of high school students.

### **National Comparisons, Cut-Scores and Forms Assembly for the HiSET Assessment**

Given the Base National Ability Scale, test characteristic curves (TCCs) were used to define the relationship between raw scores on each HiSET form and the ability scale. National administrations of items from the HiSET pool were used to define the link between the Base National Ability Scale and percentiles of the ability distribution of the reference population, thus allowing for the number of correct raw scores on assembled HiSET forms to be associated with national percentile ranks (NPRs).

Once NPRs have equivalents on the Base National Ability Scale for the item pool, any number of specific applications involving cut-scores can be readily accomplished. For example, the cut-score for passing the HiSET assessment is that value on the ability scale corresponding to the 40th percentile nationally. Using results described in Welch and Dunbar (2011), cut-scores for college readiness in ELA-Writing, ELA-Reading, Mathematics, and Science can be defined on the Base National Ability Scale as well.

The assembly of test forms for the HiSET assessment was guided not only by content and alignment considerations, but also by the values of the test information function (TIF) in each domain assessed in the neighborhood of the HiSET passing score and the college-readiness threshold. TIFs for multiple forms of the HiSET assessment assembled from the pool of existing items were used to evaluate the comparability of forms relative to test information near the cut-scores for passing and for college readiness.

**Table 1 – Common Core State Standards – English Language Arts  
Grades 11–12**

**HiSET  
Assessment**

CCSS.ELA-Literacy. RL.11-12.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.2	Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.3	Analyze the impact of the author’s choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.5	Analyze how an author’s choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.6	Analyze a case in which grasping a point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.7	Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.9	Demonstrate knowledge of eighteenth-, nineteenth- and early twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.	Language Arts – Reading
CCSS.ELA-Literacy. RL.11-12.10	By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.	Language Arts – Reading
CCSS.ELA-Literacy. L.11-12.1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	Language Arts – Writing

**Table 1 – Common Core State Standards – English Language Arts  
Grades 11–12**

**HiSET  
Assessment**

CCSS.ELA-Literacy.L.11-12.2	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.	Language Arts – Writing
CCSS.ELA-Literacy.L.11-12.3	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on <i>grades 11–12 reading and content</i> , choosing flexibly from a range of strategies.	Language Arts – Writing
CCSS.ELA-Literacy.L.11-12.4	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.	Language Arts – Writing
CCSS.ELA-Literacy.L.11-12.5	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college- and career-readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	Language Arts – Writing
CCSS.ELA-Literacy.W.11-12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.	Language Arts – Writing
CCSS.ELA-Literacy.W.11-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.	Language Arts – Writing
CCSS.ELA-Literacy.W.11-12.3	Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.	Language Arts – Writing
CCSS.ELA-Literacy.W.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)	Language Arts – Writing
CCSS.ELA-Literacy.W.11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	Language Arts – Writing
CCSS.ELA-Literacy.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.	Science
CCSS.ELA-Literacy.RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.	Science

**Table 1 – Common Core State Standards – English Language Arts  
Grades 11–12**

**HiSET  
Assessment**

CCSS.ELA-Literacy. RH.11-12.1	Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.	Social Studies
CCSS.ELA-Literacy. RH.11-12.2	Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.	Social Studies
CCSS.ELA-Literacy. RH.11-12.3	Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.	Social Studies
CCSS.ELA-Literacy. RH.11-12.4	Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines <i>faction</i> in <i>Federalist No. 10</i> ).	Social Studies
CCSS.ELA-Literacy. RH.11-12.5	Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.	Social Studies
CCSS.ELA-Literacy. RH.11-12.6	Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence.	Social Studies
CCSS.ELA-Literacy. RH.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.	Social Studies
CCSS.ELA-Literacy. RH.11-12.8	Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.	Social Studies
CCSS.ELA-Literacy. RH.11-12.9	Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.	Social Studies
CCSS.ELA-Literacy. RH.11-12.10	By the end of grade 12, read and comprehend history/social studies texts in the grades 11–CCR text complexity band independently and proficiently.	Social Studies
CCSS.ELA-Literacy. RI.11-12.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.	Language Arts – Reading

**Table 1 – Common Core State Standards – English Language Arts  
Grades 11–12**

**HiSET  
Assessment**

CCSS.ELA-Literacy. RI.11-12.2	Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.	Language Arts – Reading
CCSS.ELA-Literacy. RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.	Language Arts – Reading
CCSS.ELA-Literacy. RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).	Language Arts – Reading
CCSS.ELA-Literacy. RI.11-12.5	Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.	Language Arts – Reading
CCSS.ELA-Literacy. RI.11-12.6	Determine an author’s point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness or beauty of the text.	Language Arts – Reading
CCSS.ELA-Literacy. RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.	Language Arts – Reading
CCSS.ELA-Literacy. RI.11-12.8	Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., <i>The Federalist</i> , presidential addresses).	Language Arts – Reading  Social Studies
CCSS.ELA-Literacy. RI.11-12.9	Analyze seventeenth-, eighteenth- and nineteenth-century foundational U.S. documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln’s Second Inaugural Address) for their themes, purposes, and rhetorical features.	Language Arts – Reading  Social Studies
CCSS.ELA-Literacy. RI.11-12.10	By the end of grade 11, read and comprehend literary nonfiction in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.	Language Arts – Reading

**Table 2 – Common Core State Standards – Mathematics  
Grades 11–12**

**HiSET  
Assessment**

CCSS.Mathematics- Number and Quantity	<p><b>The Real Number System</b></p> <ul style="list-style-type: none"> <li>• Extend the properties of exponents to rational exponents</li> </ul>	<ul style="list-style-type: none"> <li>• Use properties of rational and irrational numbers</li> </ul>	Mathematics
CCSS.Mathematics- Number and Quantity	<p><b>Quantities</b></p> <ul style="list-style-type: none"> <li>• Reason quantitatively and use units to solve problems</li> </ul>		Mathematics
CCSS.Mathematics- Number and Quantity	<p><b>The Complex Number System</b></p> <ul style="list-style-type: none"> <li>• Perform arithmetic operations with complex numbers</li> </ul>	<ul style="list-style-type: none"> <li>• Represent complex numbers and their operations on the complex plane</li> <li>• Use complex numbers in polynomial identities and equations</li> </ul>	Mathematics
CCSS.Mathematics- Number and Quantity	<p><b>Vector and Matrix Quantities</b></p> <ul style="list-style-type: none"> <li>• Represent and model with vector quantities</li> </ul>	<ul style="list-style-type: none"> <li>• Perform operations on vectors</li> <li>• Perform operations on matrices and use matrices in applications</li> </ul>	Mathematics
CCSS.Mathematics- Algebra	<p><b>Seeing Structure in Expressions</b></p> <ul style="list-style-type: none"> <li>• Interpret the structure of expressions</li> <li>• Write expressions in equivalent forms to solve problems</li> </ul>		Mathematics
CCSS.Mathematics- Algebra	<p><b>Arithmetic with Polynomials and Rational Functions</b></p> <ul style="list-style-type: none"> <li>• Perform arithmetic operations on polynomials</li> <li>• Understand the relationship between zeros and factors of polynomials</li> </ul>		Mathematics
CCSS.Mathematics- Algebra	<p><b>Reasoning with Equations and Inequalities</b></p> <ul style="list-style-type: none"> <li>• Understand solving equations as a process of reasoning and explain the reasoning</li> </ul>	<ul style="list-style-type: none"> <li>• Solve equations and inequalities in one variable</li> <li>• Solve systems of equations</li> <li>• Represent and solve equations and inequalities graphically</li> </ul>	Mathematics
CCSS.Mathematics- Functions	<p><b>Interpreting Functions</b></p> <ul style="list-style-type: none"> <li>• Understand the concept of a function and use function notation</li> </ul>	<ul style="list-style-type: none"> <li>• Interpret functions that arise in applications in terms of the context</li> <li>• Analyze functions using different representations</li> </ul>	Mathematics
CCSS.Mathematics- Functions	<p><b>Building Functions</b></p> <ul style="list-style-type: none"> <li>• Build a function that models a relationship between two quantities</li> <li>• Build new functions from existing functions</li> </ul>		Mathematics

**Table 2 – Common Core State Standards – Mathematics  
Grades 11–12**

**HiSET  
Assessment**

CCSS.Mathematics-Functions	<p><b>Linear, Quadratic, and Exponential Models</b></p> <ul style="list-style-type: none"> <li>• Construct and compare linear, quadratic, and exponential models and solve problems</li> <li>• Interpret expressions for functions in terms of the situation they model</li> </ul>	Mathematics	
CCSS.Mathematics-Geometry	<p><b>Congruence</b></p> <ul style="list-style-type: none"> <li>• Experiment with transformations in the plane</li> </ul>	<ul style="list-style-type: none"> <li>• Understand congruence in terms of rigid motions</li> <li>• Prove geometric theorems</li> <li>• Make geometric constructions</li> </ul>	Mathematics
CCSS.Mathematics-Geometry	<p><b>Similarity, Right Triangles, and Trigonometry</b></p> <ul style="list-style-type: none"> <li>• Understand similarity in terms of similarity transformations</li> <li>• Prove theorems involving similarity</li> </ul>	<ul style="list-style-type: none"> <li>• Define trigonometric ratios and solve problems involving right triangles</li> <li>• Apply trigonometry to general triangles</li> </ul>	Mathematics
CCSS.Mathematics-Geometry	<p><b>Circles</b></p> <ul style="list-style-type: none"> <li>• Understand and apply theorems about circles</li> <li>• Find arc lengths and areas of sectors of circles</li> </ul>		Mathematics
CCSS.Mathematics-Geometry	<p><b>Expressing Geometric Properties with Equations</b></p> <ul style="list-style-type: none"> <li>• Translate between the geometric description and the equation for a conic section</li> </ul>	<ul style="list-style-type: none"> <li>• Use coordinates to prove simple geometric theorems algebraically</li> </ul>	Mathematics
CCSS.Mathematics-Geometry	<p><b>Geometric Measurement and Dimension</b></p> <ul style="list-style-type: none"> <li>• Explain volume formulas and use them to solve problems</li> </ul>	<ul style="list-style-type: none"> <li>• Visualize relationships between two-dimensional and three-dimensional objects</li> </ul>	Mathematics
CCSS.Mathematics-Geometry	<p><b>Modeling with Geometry</b></p> <ul style="list-style-type: none"> <li>• Apply geometric concepts in modeling situations</li> </ul>		Mathematics
CCSS.Mathematics-Statistics and Probability	<p><b>Interpreting Categorical and Quantitative Data</b></p> <ul style="list-style-type: none"> <li>• Summarize, represent, and interpret data on a single count or measurement variable</li> </ul>	<ul style="list-style-type: none"> <li>• Summarize, represent, and interpret data on two categorical and quantitative variables</li> <li>• Interpret linear models</li> </ul>	Mathematics Science Social Studies

**Table 2 – Common Core State Standards – Mathematics  
Grades 11–12**

**HiSET  
Assessment**

<p>CCSS.Mathematics- Statistics and Probability</p>	<p><b>Making Inferences and Justifying Conclusions</b></p> <ul style="list-style-type: none"> <li>• Understand and evaluate random processes underlying statistical experiments</li> </ul>	<ul style="list-style-type: none"> <li>• Make inferences and justify conclusions from sample surveys, experiences and observational studies</li> </ul>	<p>Mathematics Science Social Studies</p>
<p>CCSS.Mathematics- Statistics and Probability</p>	<p><b>Conditional Probability and the Rules of Probability</b></p> <ul style="list-style-type: none"> <li>• Understand independence and conditional probability and use them to interpret data</li> </ul>	<ul style="list-style-type: none"> <li>• Use the rules of probability to compute probabilities of compound events in a uniform probability model</li> </ul>	<p>Mathematics</p>
<p>CCSS.Mathematics- Statistics and Probability</p>	<p><b>Using Probability to Make Decisions</b></p> <ul style="list-style-type: none"> <li>• Calculate expected values and use them to solve problems</li> <li>• Use probability to evaluate outcomes of decisions</li> </ul>		<p>Mathematics</p>

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