

SAT Subject Tests Analysis – Physics and Chemistry

Prepared for the New Jersey Center for Teaching and Learning

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Introduction



The increasingly scientific and technical nature of the world economy creates a critical need for an education system that produces students with the analytical and content skills to succeed in 21st century jobs. Not only do more students need to be exposed to rigorous content and curricula, but they need to be given the skills, tools, and support to succeed. This report examines trends nation-wide and in the state of New Jersey on one objective measure of how schools are doing in this area: the SAT Subject Tests in Physics and Chemistry.

The SAT Subject Tests are one of the only nation-wide assessments focused on achievement in the sciences, and examining participation and performance over time shows how student performance in these subjects is changing, and, particularly, which states are showing the greatest improvement. We use a “total score” measure to assess the growth in state performance over the past 10 years, which factors in both the breadth (increase or decrease in students taking the test) and depth (average score of test-takers) of knowledge in Physics and Chemistry.

These results show the impressive track record of the state of New Jersey in increasing participation and performance in the two subjects. Over the past 10 years, no state has seen a greater increase in Physics performance, and New Jersey holds the top total score in the nation. In Chemistry, the state ranks second in both total score and growth from 2007 to 2016.

These results support a theory of change that NJCTL has held since its founding: that teacher training and certification in the sciences would bear fruit in increased student achievement. These encouraging data support that hypothesis.

Methodology

The following report considers the performance of New Jersey students on the SAT II Physics and Chemistry assessments from 2007 until 2016, the most recent year for which data are available from the College Board. Below, we detail the metrics calculated for this analysis.

- **Mean Score** – The College Board reports mean scores by state for each year in the “[SAT Report on College & Career Readiness](#)”, which is published online. We note that mean scores can often correlate negatively with participation rates; if only the highest-performing students take the test, scores will be higher. As such, we recommend interpreting mean scores with caution and considering participation rates at the same time. We also include other metrics to standardize performance across states.
- **Participation Score** – We calculate the percentage of students taking the SAT II Physics assessment by dividing the number of test-takers by the number of individuals in each state aged 15-19, as reported by the U.S. Census Bureau, times one thousand. Note that this is an approximation of the participation rate, not an exact statistic, since students may take the test at any point in high school. Rather, this approach is intended to create a standardized measure of general participation across states.
- **Total Score** – A standardized measure equal to the state mean score times the number of test-takers (i.e., total points earned) divided by the 15-19 year-old population. We recommend using the total score as a more accurate measure for comparing performance across states.

Summary of Key Findings



- ❖ Since 2007, New Jersey has seen substantial progress in both the number of students participating in the SAT Subject Tests in Physics and Chemistry and the overall performance of these students, with growth in these areas outpacing the rest of the country. Over the 10-year period from 2007 to 2016, New Jersey’s “total score” on the Physics subject test grew by more than any other state, while the total score growth in Chemistry ranked second out of 50 states and the District of Columbia.

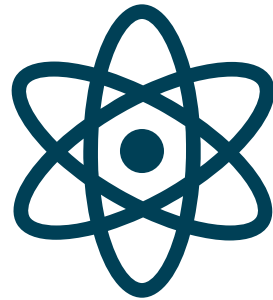


- ❖ In 2016, the relative number of students in New Jersey taking the SAT Subject Tests ranked second in both Physics and Chemistry (trailing only Massachusetts), while the total score – total points earned divided by state population – ranked first in Physics and second in Chemistry.



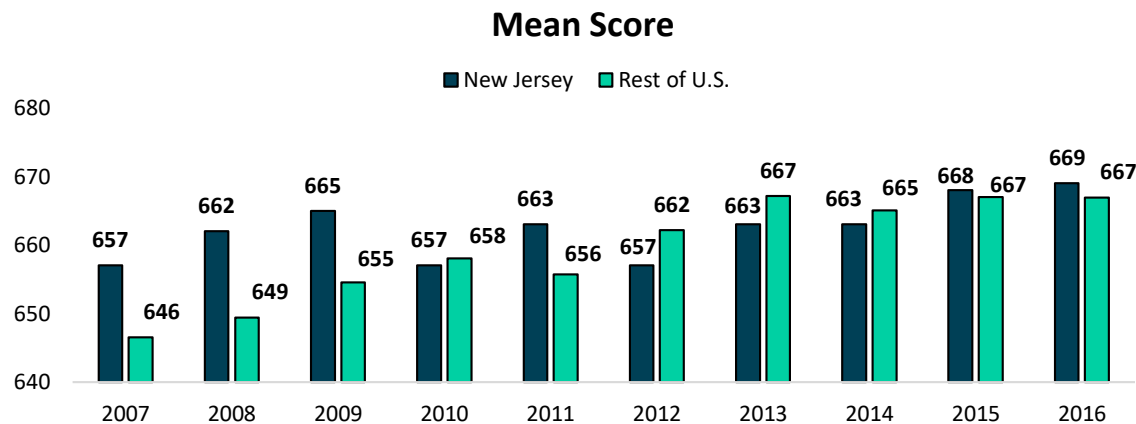
- ❖ These figures point to a broad increase in the breadth and depth of scientific education in the state over the past 10 years, placing New Jersey at or near the top of national rankings on the SAT’s subject tests in these areas.

PHYSICS



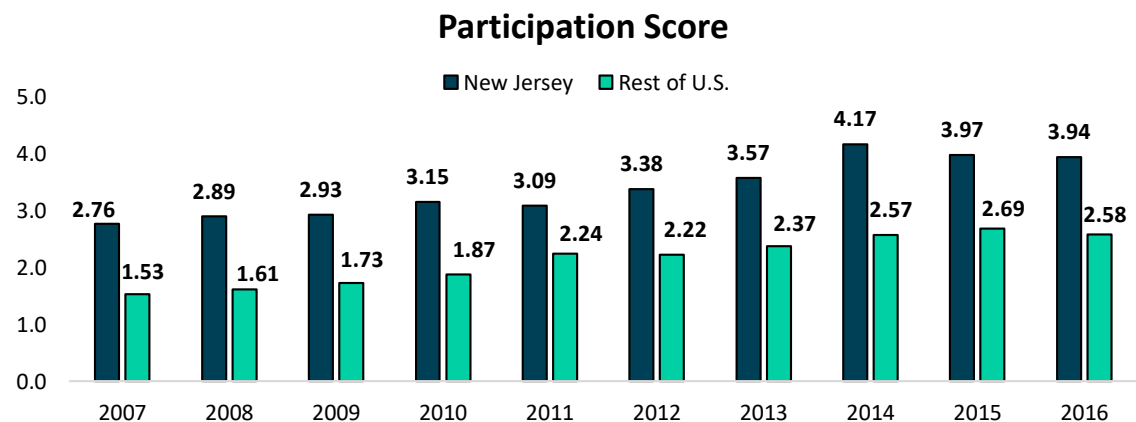
Mean Score and Participation

In New Jersey, the mean score has fluctuated since 2007, but altogether it increased 10 points from 2007 to 2016. Nationally, the mean score for the SAT II Physics exam increased 21 points from 2007 to 2016. New Jersey had a higher mean score than the rest of the country from 2007-2009, in 2011, and from 2015-2016.



Mean scores for the rest of the country are imputed from national and New Jersey averages.

From 2007 to 2016, the participation score for students taking the SAT II Physics test (measured as a percentage of all 15-19 year-olds) increased in New Jersey from 2.76 to 3.94 and in the rest of the country from 1.53 to 2.58. Notably, participation has grown faster in New Jersey than in the rest of the country since 2007.

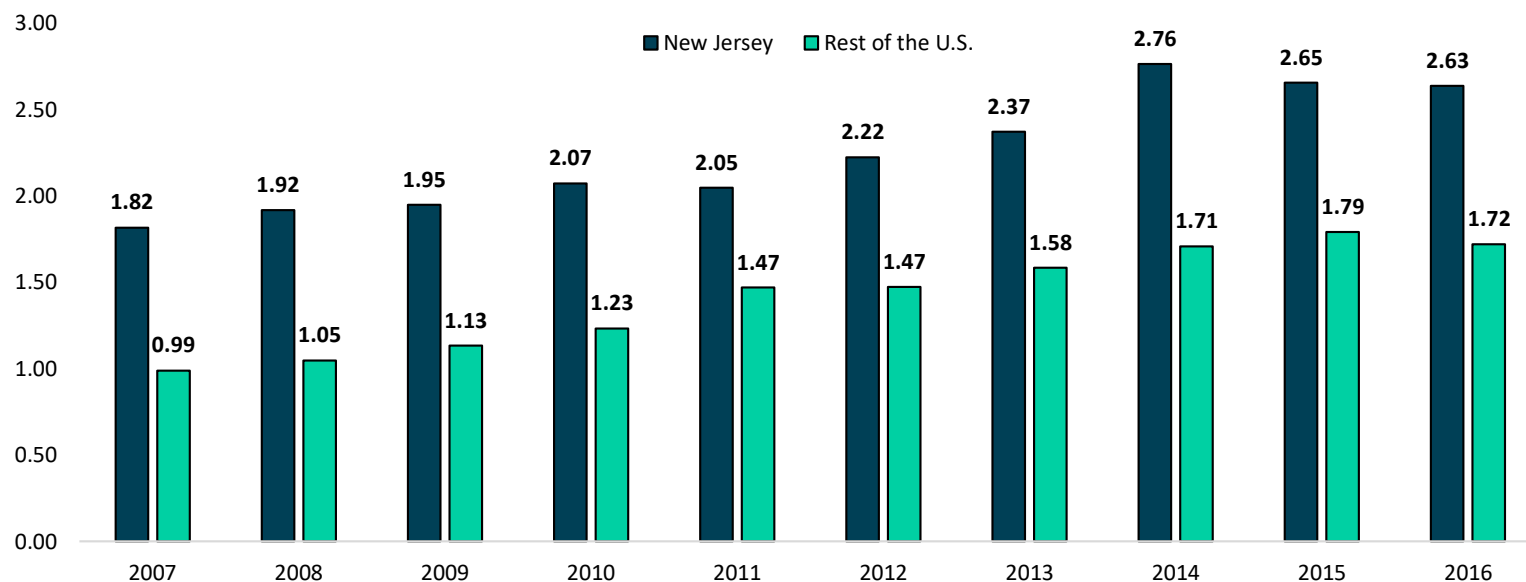


Participation score is equal to the number of test-takers divided by the number of 15-19 year-olds in the state, times one thousand.

Total Score

- ❖ Since 2007, New Jersey has outperformed the rest of the country in terms of total score (a standardized measure equal to the state mean score times the number of test-takers divided by the 15-19 year-old population) on the SAT II Physics exam. New Jersey's total score for the SAT II Physics exam also grew at a rate higher than the rest of the country, increasing by 0.81 from 2007 to 2016. Most of this growth was from 2012 to 2016.

Total Score in New Jersey and the Rest of the United States, 2007-2016



Total score is equal to the number of test-takers times the mean score for the state, divided by the number of 15-19 year-olds in the state.

Ranking Among U.S. States

- ❖ New Jersey generally ranks in the middle among U.S. states in terms of mean score performance. While New Jersey's mean score improved overall from 28th to 24th between 2007 and 2016, it dropped to 41st in 2012. The decrease from 2011 to 2012 coincided with New Jersey increasing in participation rank nationally from fifth to second.
- ❖ New Jersey consistently ranks among the top U.S. states in terms of percentage of students taking the assessment. It ranked among the top five states nationally within the past 10 years, as measured by the percentage of 15-19 year-olds statewide taking the SAT II in Physics.
- ❖ Notably, New Jersey also ranks among the top states in total score, defined as the mean score times the number of test-takers, divided by the number of 15-19 year-olds in the state. New Jersey has held the top rank in this category since 2014. From 2007 to 2016, New Jersey's rank for total score increased from third to first.
- ❖ New Jersey has also seen the greatest growth in total score from 2007 to 2016, followed by D.C., New York, Virginia, and Massachusetts.

National Ranking of New Jersey's SAT II Physics Performance, 2007-2016

New Jersey's National Rank	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mean Score	28 th	26 th	20 th	32 nd	26 th	41 st	40 th	38 th	32 nd	24 th
Participation Score	3 rd	3 rd	3 rd	3 rd	5 th	2 nd	3 rd	1 st	2 nd	2 nd
Total Score	3 rd	3 rd	2 nd	3 rd	4 th	2 nd	3 rd	1 st	1 st	1 st

Comparison to Top-Performing States (2016)

Mean Score

Rank	State	Mean Score	% Taking
1	South Dakota	721	0.2%
2	Kansas	693	0.3%
3	Minnesota	690	0.3%
4	Illinois	688	0.9%
5	Missouri	688	0.3%
...			
24 (T)	New Jersey	669	2.3%

Participation Score

Rank	State	Score
1	Massachusetts	3.98
2	New Jersey	3.94
3	Connecticut	3.36
4	New York	3.27
5	District of Columbia	3.17

Participation score is equal to the number of test-takers divided by the number of 15-19 year-olds in the state, times one thousand.

Total Score

Rank	State	Score
1	New Jersey	2.63
2	Massachusetts	2.61
3	Connecticut	2.24
4	New York	2.17
5	District of Columbia	2.10

Total score is equal to the number of test-takers times the mean score for the state, divided by the number of 15-19 year-olds in the state.

Growth Score (2007-2016)

Rank	State	Score
1	New Jersey	0.82
2	District of Columbia	0.63
3	New York	0.61
4	Virginia	0.53
5	Massachusetts	0.49

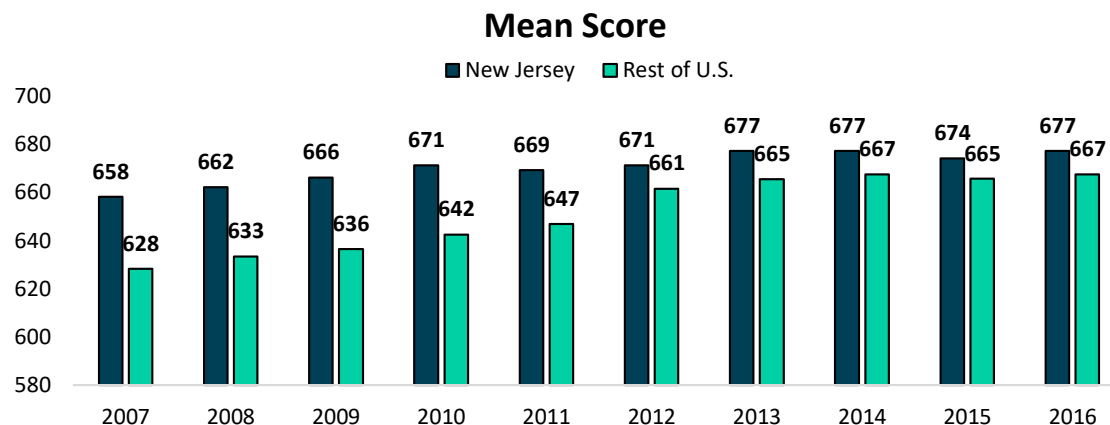
Growth score is the difference between the 2007 and 2016 total scores by state.

CHEMISTRY



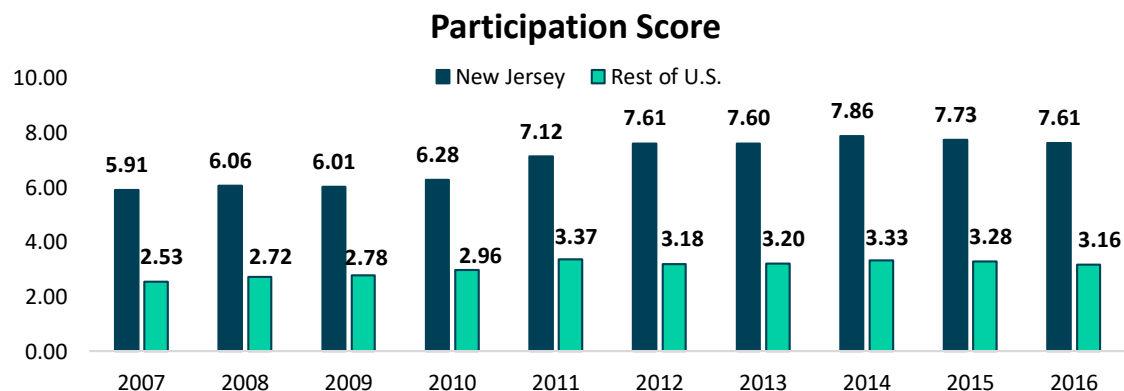
Mean Score and Participation

New Jersey's mean score on the SAT II Chemistry exam increased by 19 points from 658 to 677 between 2007 and 2016. While New Jersey's mean score is consistently higher than the rest of the country's, this gap has decreased in recent years from 30 points in 2007 to 10 points in 2016.



Mean scores for the rest of the country are imputed from national and New Jersey averages.

From 2007 to 2016, New Jersey's participation rate increased from 5.91 to 7.61, with the greatest growth period occurring between 2010 and 2014. In the rest of the country, participation increased from 2.53 to 3.16. Notably in both New Jersey and the rest of the country, the number of students taking the SAT II Chemistry exam has decreased since 2014.

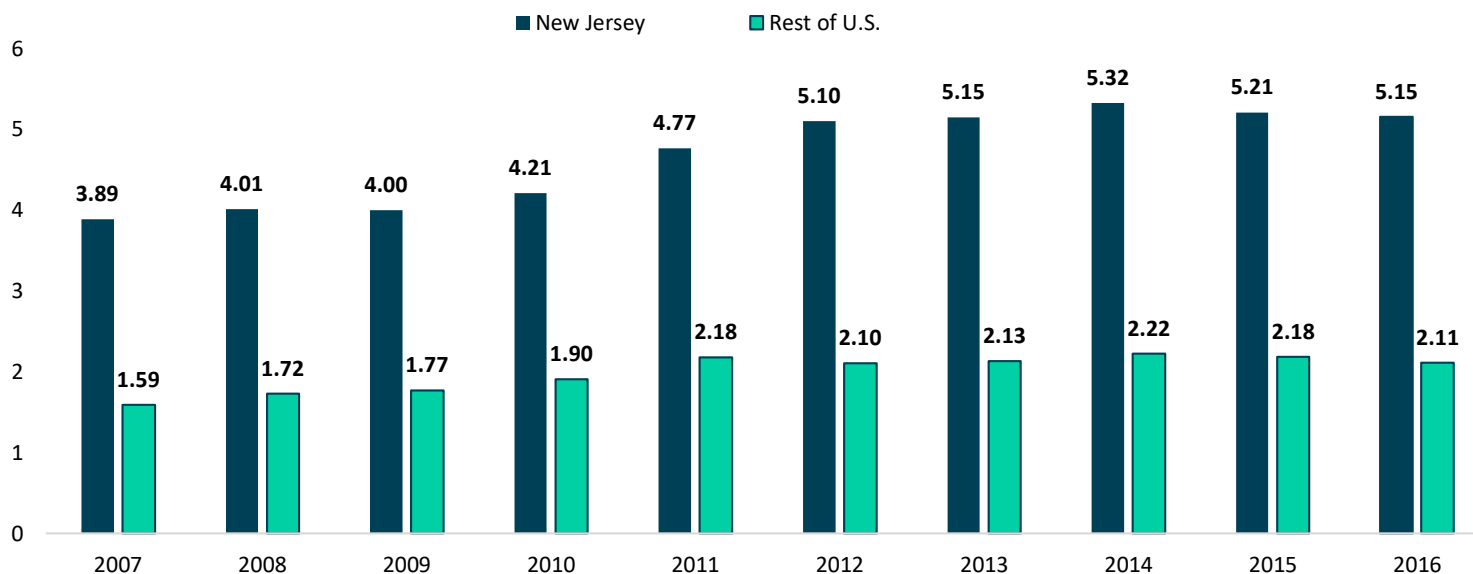


Participation score is equal to the number of test-takers divided by the number of 15-19 year-olds in the state, times one thousand.

Total Score

- ❖ New Jersey consistently maintains a higher total score on the SAT II Chemistry exam than the rest of the country. Between 2007 and 2016, New Jersey's total score also grew more than the rest of the country's; while the total score for the rest of the U.S. increased by 0.52, New Jersey's total score increased by 1.27. However, from 2014 to 2016, the total scores for both New Jersey and the rest of the country have declined.

Total Score in New Jersey and the Rest of the United States, 2007-2016



Total score is equal to the number of test-takers times the mean score for the state, divided by the number of 15-19 year-olds in the state.

Ranking Among U.S. States

- ❖ New Jersey has ranked in the top 20 states in terms of mean score performance since 2007, and ranked in 12th place in 2016. New Jersey's mean score ranking was higher from 2007 to 2010 when participation rate was lower.
- ❖ New Jersey also ranks among the top states for the number of students taking the SAT II Chemistry exam. New Jersey has held second place nationally for participation since 2014, improving from fifth place since 2007.
- ❖ From 2007 to 2016, New Jersey has consistently ranked within the top five states for total score (the mean score times the number of test-takers, divided by the number of 15-19 year-olds in the state), maintaining second place since 2014. New Jersey also had the second highest growth in total score from 2007 to 2016, following 0.2 points behind D.C. in growth, and followed by New York, Massachusetts, and Virginia.

National Ranking of New Jersey's SAT II Chemistry Performance, 2007-2016

New Jersey's National Rank	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mean Score	10 th	8 th	9 th	7 th	16 th	13 th	15 th	17 th	18 th	12 th
Participation Score	5 th	5 th	5 th	5 th	4 th	2 nd	3 rd	2 nd	2 nd	2 nd
Total Score	3 rd	4 th	4 th	4 th	3 rd	2 nd	3 rd	2 nd	2 nd	2 nd

Comparison to Top-Performing States (2016)

Mean Score

Rank	State	Mean Score	% Taking
1	Missouri	697	0.81
2	Kansas	696	0.68
3	Wisconsin	696	0.73
4	Michigan	695	1.22
5	Alabama	688	0.56
...			
12 (T)	New Jersey	677	7.61

Participation Score

Rank	State	Score
1	Massachusetts	8.32
2	New Jersey	7.61
3	Connecticut	7.22
4	District of Columbia	6.01
5	New Hampshire	5.89

Participation score is equal to the number of test-takers divided by the number of 15-19 year-olds in the state, times one thousand.

Total Score

Rank	State	Score
1	Massachusetts	5.46
2	New Jersey	5.15
3	Connecticut	4.75
4	District of Columbia	4.01
5	New Hampshire	3.82

Total score is equal to the number of test-takers times the mean score for the state, divided by the number of 15-19 year-olds in the state.

Growth Score (2007-2016)

Rank	State	Score
1	District of Columbia	1.47
2	New Jersey	1.27
3	New York	0.91
4	Massachusetts	0.79
5	Virginia	0.77

Growth score is the difference between the 2007 and 2016 total scores by state.

About NJCTL and Hanover Research

New Jersey Center for Teaching and Learning

The New Jersey Center for Teaching and Learning is a nonprofit charitable organization that provides a simple, scalable solution to the STEM crisis in education. An independent organization founded by the New Jersey Education Association in 2007, NJCTL's mission is to empower teachers to transform schools, so that all children have access to a high-quality education. The organization believes the best way to improve education is to invest in teachers by driving changes that make their work simpler, more effective, and less stressful. This belief has propelled NJCTL to create a pathway for teachers of every academic background to efficiently learn and effectively teach science and mathematics. Today, NJCTL is the #1 producer of physics teachers in the United States, as well as a leading producer of chemistry teachers. NJCTL also offers comprehensive free, editable course materials for a full range of K-13 subjects in science and mathematics. These materials are being used in New Jersey, across all fifty states, and in 185 countries.

Hanover Research

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