Locally Administered Assessments: Making Sense of **NCEs** and **Standard Errors**

What are Normal Curve Equivalents (NCEs)?

NCEs

Normal Curve Equivalents

Standardized scores used in education and other social sciences to ensure all assessment scores are on a common scale across years, grades, and subjects.

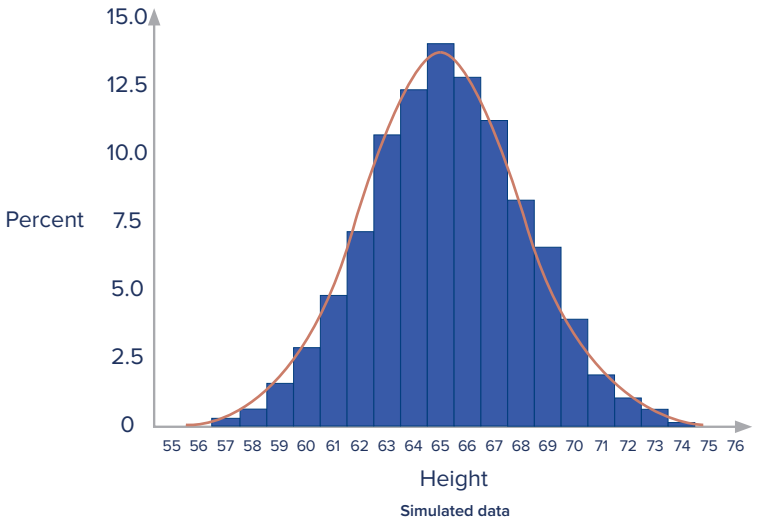
Normal Curve Equivalents, or NCEs, are standardized scores used in education and other social sciences. Student scores are often converted to NCEs to ensure that all assessment scores are on a common scale across years, grades, and subjects. NCEs are similar to percentiles in that they represent where a score falls in a distribution of scores. In PVAAS, the conversion of students' scores to NCEs is necessary in the growth standard methodology used to measure growth on locally administered assessments such as Acadience®, aimsWeb®, DIBELS®, Exact Path, FastBridge, i-Ready®, iXL, LAS Links, MAP®, STAR, and Study Island. (The CDT uses the same methodology as the state assessments and is represented as scale scores on value-added reporting.). Additionally, student achievement is represented in NCEs on the student report graphic for all assessments (state and local). This allows student level achievement to be compared across grades and years.

To further understand what NCEs are, let's first discuss distributions. The graph below depicts the distribution of heights in a group of students. Notice that the majority of the students' heights are clustered around the middle, near 65 inches, with fewer students being very short or very tall.

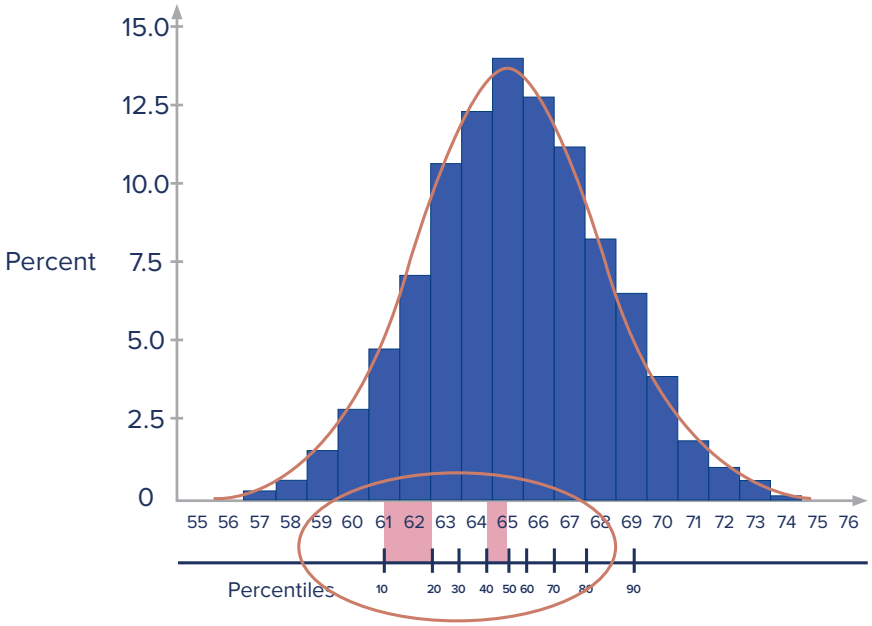
When looking at the achievement of a population of students, the distribution is similar. A large number of students are close to the center of the distribution, and there are fewer students who are very close to the bottom or top of the range. It's important to note that this naturally occurring distribution of student achievement does not result in a predetermined distribution of PVAAS Growth Measures. In other words, there is no predetermined number or percentage of LEAs, districts, or schools at any level or growth color indicator in PVAAS.

When graphed, a normal distribution will appear to be a bell-shaped curve, like the red curve in the graph above. A student's position in a distribution can be described in many ways, the most common of which is by percentile. A student whose height is at the 10th percentile is taller than 9% of other students.

Percentiles present a limitation, however, when describing movement in a distribution. Continuing with our height example, a student at the 10th percentile would have to grow about 1.5 inches to move to the 20th percentile.



However, a student at the 40th percentile would only have to grow about 0.75 inches to move to the 50th percentile, as highlighted in the figure below. Although both students would grow the same in percentile points, their growth in inches would be very different.



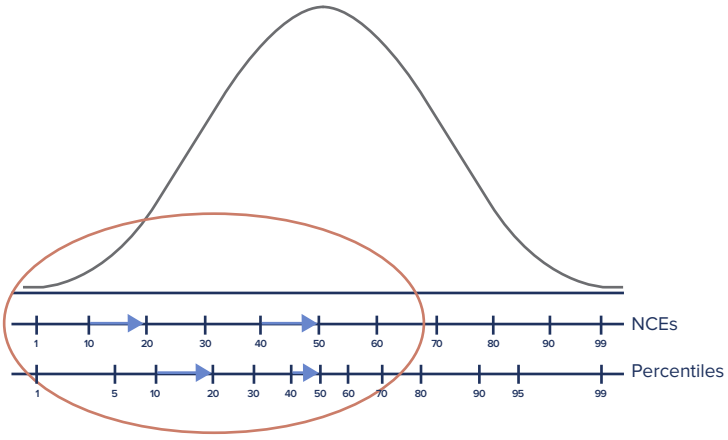
A student at the 10th percentile would have to grow about 1.5 inches to move to the 20th percentile. However, a student at the 40th percentile would only have to grow about 0.75 inches to move to the 50th percentile.

The same is true with changes in academic achievement. Movement from the 10th to 20th percentile is not comparable to movement from the 40th to 50th percentile. Notice that the percentiles are not at equal intervals along the horizontal axis.

The solution to this problem is to use NCEs.

NCEs are on an equal-interval scale. NCE stands for Normal Curve Equivalent. NCEs were developed for the United States Department of Education (USDOE), to allow for easier interpretation of movement in a normal distribution.

On an equal-interval scale, the difference between 10 and 20 is the same as the difference between 40 and 50, as shown in the graph below. This is different than with a percentile scale where the intervals are different.



*The major advantage of NCEs over percentiles is that **NCEs can be averaged.** Percentiles cannot be averaged because the distances (or differences) between percentiles are not equal.*

NCEs correspond to percentiles at 1, 50, and 99, as shown in the graphic above. By definition, a score at the 50th NCE (or percentile) is average. The major advantage of NCEs over percentiles is that NCEs can be averaged. Percentiles cannot be averaged because the distances (or differences) between percentiles are not equal.

What is growth?

In PVAAS value-added reporting, the estimated Growth Measures describe how students moved in the reference population's distribution of scores, in NCE units, from Entering Achievement to Exiting Achievement, as illustrated below. Note that differences may not be exact due to rounding when displayed in the web-based reporting.

The reference population for local assessments use national norms.

Lower Sunshine

Download Report

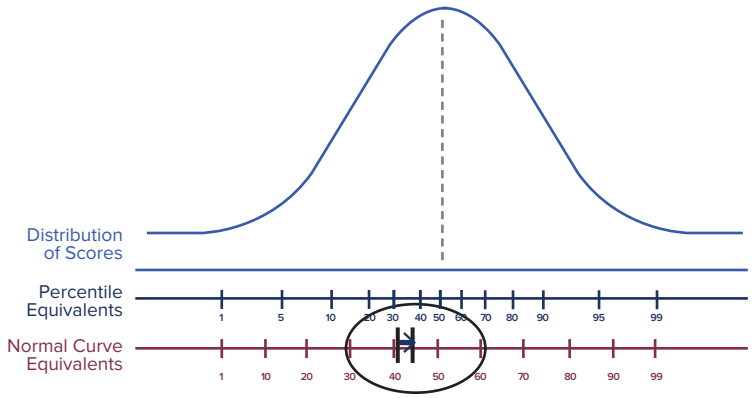
What are the trends in growth and achievement?

This report enables you to select data of interest, assess trends over time, and compare results. Use the filters on the left to explore growth and achievement data. Depending on the assessment, achievement is reported in Normal Curve Equivalents (NCEs) or scale scores and does not reflect proficiency level.

Click on a chart in the table for more details.

Subject	Year	Grade	Growth Color Indicator	Growth Index	Growth Measure	Standard Error	Achievement *Enter → Exit*	Student Count
LA1 Reading - K-12 Full Year - *BOY to EOY*	2024	1	Well Above	3.70	2.8	0.8	41.9 → 44.7	632
		2	Meets	0.44	0.3	0.7	45.0 → 45.3	771
		3	Well Below	-5.31	-3.3	0.6	47.1 → 43.8	800
		4	Well Below	-7.13	-4.2	0.6	48.7 → 44.5	830
		5	Meets	0.21	0.1	0.6	46.8 → 47.0	830

In this example, the group of grade 1 Reading students have an entering achievement of 41.9 in the reference population's distribution, and an exiting achievement of 44.7. These two numbers represent positions in the distribution, as marked by the black vertical lines highlighted in the illustration below:



The students *moved up* in the distribution approximately 2.8 NCE units:

$$44.7 - 41.9 \approx 2.8$$

Another way to express this concept is to say that the students experienced approximately 2.8 NCE units of *growth*.

However, this number is an *estimate* of growth. In the reporting, each estimate is also accompanied by its standard error, discussed in the next section.

What is standard error?

The **standard error** is specific to each growth measure because it expresses the certainty around that one estimate. The size of the standard error will vary depending on the quantity and quality of the data that was used to generate the growth measure. A smaller standard error indicates more certainty, or confidence, in the growth measure. A number of factors affect the size of the standard error, including:

- The number of students included in the analyses
- The number of assessment scores each student has, across grades and subjects
- Which specific scores are missing from the students' testing histories

In discussing what standard error is, consider an example of two schools (A and B) with the same Estimated Growth Measure of 3.0 NCE units. In simple terms, this value of 3.0 indicates that both groups of students moved up 3.0 NCE units in the distribution of scores from last year to this year.

Consider also that the two schools have different standard errors. School A is larger than School B, and the testing records from School A are more complete than those from School B, which has some missing scores. Both the quantity (amount) and quality (completeness) of the data affect the strength of the evidence in the estimate. The standard error provides a confidence band around an estimate. Because School A has more data than B and has fewer missing scores, School A will have a smaller standard error than School B.

A smaller standard error indicates that the evidence to support the measure is stronger. In our example, School A has more students, and their testing records are more complete. As a result, there is more evidence that yielded the Growth Measure. Depending on how different their standard errors are from each other, the schools could have different color-coding on their School Value-Added reports.

How is the standard error used?

The standard errors are used with the Growth Measures in two main ways within the reporting: (1) in determining the Growth Index, and (2) in applying the value-added colors, both of which are discussed below.

In PVAAS Value-Added reports, color-coding is applied based on the Growth Index which is comprised of two values: the Estimated Growth Measure and the Standard Error. The Growth Index is calculated by taking the Growth Measure and dividing by the Standard Error. In this way, the Growth Index indicates how many standard errors that the Growth Measure is away from the growth standard (0). In short, the colors are based on the Growth Index which indicates how many standard errors the Growth Measure estimate is from the growth standard. Remember, the growth standard is met when the student group maintains their relative achievement level from one year to the next. In other words, if the estimated Growth Measure is zero, then the student group met the growth standard.

Growth Color Indicators:

WELL ABOVE	Significant evidence that the school exceeded the growth standard.
ABOVE	Moderate evidence that the school exceeded the growth standard.
MEETS	Evidence that the school met the growth standard.
BELOW	Moderate evidence that the school did not meet the growth standard.
WELL BELOW	Significant evidence that the school did not meet the growth standard.

The legend in the reporting provides a verbal description of the color-coding as determined by the Growth Index and can be represented in the following way. Keep in mind that the Growth Index is simply the Growth Measure divided by the Standard Error.

The colors in PVAAS are based on the Growth Index.

DARK BLUE (Well Above) – The Growth Index is greater than +2.0. In other words, the Growth Measure is more than 2 standard errors above the growth standard (0).

LIGHT BLUE (Above) – The Growth Index is greater than +1.0 but less than +2.0. In other words, the Growth Measure is more than 1, but less than 2, standard errors above the growth standard (0).

GREEN (Meets) – The Growth Index is between -1.0 and +1.0. In other words, the Growth Measure is between 1 standard error above and below the growth standard (0).

YELLOW (Below) – The Growth Index is less than -1.0 but not less than -2.0. In other words, the Growth Measure is more than 1, but less than 2, standard errors below the growth standard (0).

RED (Well Below) – The Growth Index is less than -2.0. In other words, the Growth Measure is more than 2 standard errors below the growth standard (0).

Consider the example below, where 5th grade received a light blue color (Above), 3rd grade received a yellow color (Below), and 1st grade received a green color (Meets).

Subject	Year	Grade	Growth Color Indicator	Growth Index	Growth Measure	Standard Error	Achievement *Enter → Exit*
LA1 Reading - K-12 Full Year - *BOY to EOY*	2024	1	Meets	0.61	1.6	2.6	41.0 → 42.5
		2	Below	-1.21	-2.8	2.3	43.7 → 40.9
		3	Below	-1.80	-4.0	2.2	44.3 → 40.4
		4	Above	1.23	2.6	2.1	44.4 → 47.0
		5	Above	1.25	2.7	2.1	42.7 → 45.3

- For 4th grade, the estimated growth is 2.6 with a standard error of 2.1. This means the Growth Index is 1.23 (2.6 divided by 2.1). The Growth Color Indicator is Light Blue as the Growth Index is greater than +1.0 but less than +2.0. Another way to say this is **the Growth Measure of 2.6 is more than 1 standard error (2.1) but less than 2 standard errors above 0, so it falls into the Light Blue range of Above.**
- For 2nd grade, the estimated growth is -2.8 with a standard error of 2.3. This means the Growth Index is -1.21 (-2.8 divided by 2.3). The Growth Color Indicator is Yellow as the Growth Index is less than -1.0 but not less than -2.0. Another way to say this is **the Growth Measure of -2.8 is more than 1 standard error (2.3) below 0, so it falls into the Yellow range of Below.**
- For 1st Grade, the estimated growth is 1.6 with a standard error of 2.6. This means the Growth Index is about 0.61 (1.6 divided by 2.6). The Growth Color Indicator is Green as the Growth Index is between -1.0 and +1.0. Another way to say this is **the Growth Measure of 1.6 is within 1 standard error (2.6) of 0, so it falls into the Green range of Meets.**

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