education analytics

UNDERSTANDING THE WISCONSIN VALUE-ADDED GROWTH MODEL 2023-24

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OVERVIEW

Value-added modeling is the use of statistical techniques to measure the impacts of schools on student achievement. It does so by isolating the impacts of schools from the impacts of other, non-school factors such as family resources or schools attended in the past.

In practice, value-added models measure student growth on an assessment from one year to the next among students attending a given school. For example, when measuring the impact of a school in 5th-grade math, a value-added model quantifies growth between the previous year's 4th-grade Forward math assessment and the current year's 5th-grade Forward math assessment. More specifically, it compares the growth of students in that school to the growth of similar students across the state of Wisconsin. Similar students are identified by their scores on previous years' assessments and by student demographic characteristics. Schools in which students grew more than similar students statewide receive higher value-added scores.

In the sections that follow, we go into more detail about value-added modeling in general and in the Wisconsin model in particular.

VALUE-ADDED MODELS

A value-added model recognizes that a student's level of achievement at any given point in time is the result of many factors, both school and non-school related, that have accumulated over a student's lifetime up to that point in time. In contrast, a measure of average achievement, such as student performance levels on assessments, measures not only the impact of the school, but also the impacts of other schools those students may have attended in the past, as well as the impacts of a lifetime of non-school factors.

Purpose of value-added models

The purpose of a value-added model is to measure the impact of a school on student achievement by controlling as much as possible for factors outside the school's control. We do this by controlling for a wide range of student-level variables. We control for these variables using linear regression, a statistical method commonly used for measuring relationships in data between outcome and explanatory variables.

Assessments Used

In Wisconsin, the assessments used for value-added are shown in the table below.

Grade span	Assessment
Grades 3-8	• Forward
Grades 9-10	• Aspire (2021-22 and before) • PreACT Secure (2022-23 and after)
Grade 11	• ACT

Controlling for prior achievement

The most important control variables in a value-added growth model are measures of prior student achievement. The Wisconsin value-added model's control variables include assessment scores in math and English Language Arts (ELA) on the previous year's assessments. It also includes assessment scores from two years prior when available. In some cases, the model will control for past scores on a different assessment from the assessment used to measure current achievement. For example, the model of growth for the 9th-grade PreACT Secure assessment uses the 8th-grade Forward assessment to measure prior achievement; for more details, please see the annual Value-Added Technical Guide. Including assessment scores from prior years as explanatory variables substantially controls for factors relevant to student achievement, both school and non-school related, experienced by the student up to the end of the prior year.

Controlling for non-school factors

The Wisconsin value-added model also controls for a set of demographic variables. For example, the model includes a set of control variables for disability status to account for different growth patterns between students with and without disabilities. The model's demographic variables are included to better account for non-school factors that may influence student growth. For a complete list of control variables, please see the annual Value-Added Technical Guide.

Averaging student growth

To specifically uncover the impact of the school, a value-added model averages the growth of all students who attend the school. While the growth of any individual student reflects both school and non-school factors, the average growth across all of a school's students is more reflective of the school's impact as a whole. The Wisconsin value-added model measures both average overall growth and average growth for different student groups within a school. In order to reliably represent school and student group growth, value-added results are only reported for groups of at least 20 students. Results that are based on fewer students are more

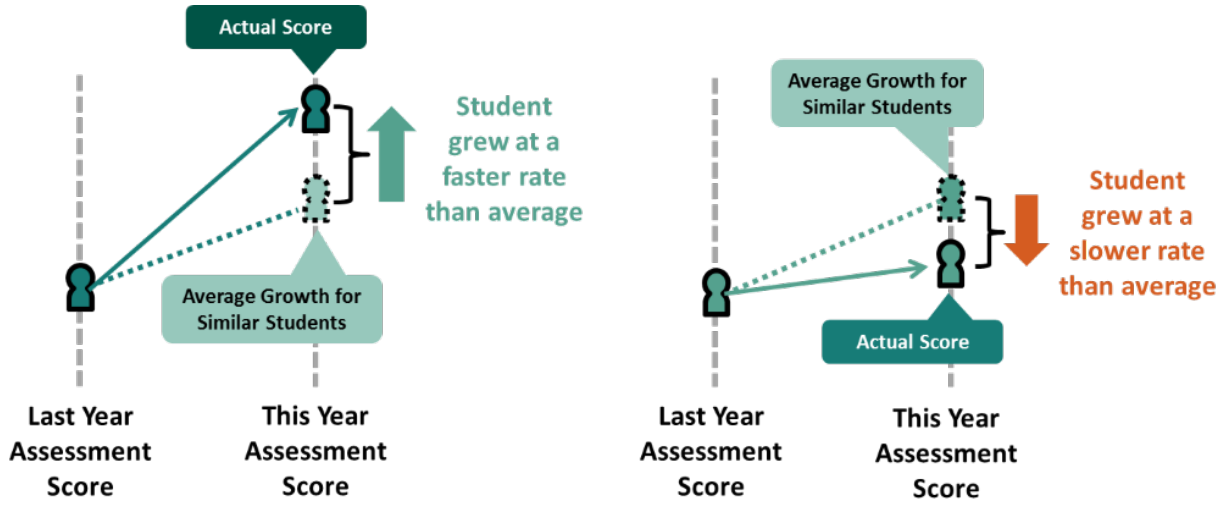
likely to move around a lot from one year to the next due to differences in the students included.

An example of measuring value-added

Value-added models start by observing each student's characteristics—including prior assessment scores and student demographics—and estimating the average growth among students with similar characteristics. They then measure the difference between each student's actual growth and that average. Students whose actual growth was greater than average growth had greater-than-expected growth. Conversely, students whose actual growth was less than average growth had lower-than-expected growth.

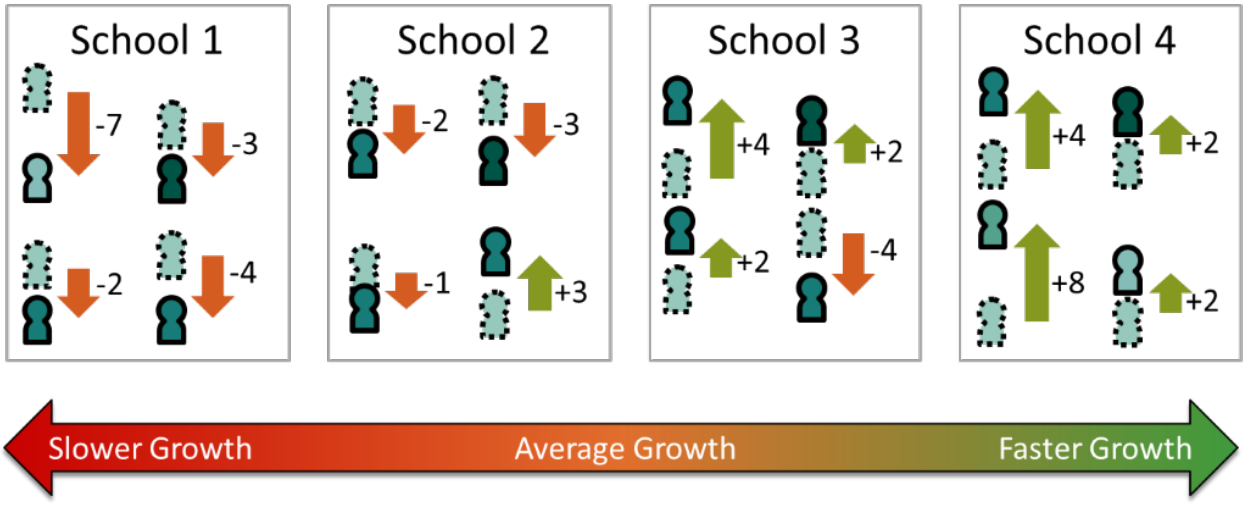
Figure 1 illustrates the comparison between actual and average growth for two similar students. Both students scored similarly on last year's assessment, and both students' scores are compared to the same average growth—indicated by the dashed green line—on this year's assessment. However, the two students scored differently on this year's assessment. The student on the left had greater growth than average between last year's and this year's assessment. In contrast, the student on the right had less growth than average.

Figure 1. Actual student growth compared to average for similar students



After computing the difference between actual and average growth for all students across the state, we average these student-level differences by school. The higher this average difference at a school, the higher the school's value-added growth score. Conversely, the lower this average difference at a school, the lower the value-added growth score. Figure 2 presents a stylized example of growth for four schools.

Figure 2. Value-added growth by school



The example illustrated in Figure 2 is substantially stylized and more technical details are presented in the annual Value-Added Technical Guide. Note that, in Wisconsin, average value-added, i.e., value-added for schools in which actual growth equals average growth, is set at a score of 3. This is discussed further in the "Scale of the value-added measures" section below.

Students included in value-added modeling

The Wisconsin value-added growth model includes students who: a) make typical grade progression, b) for whom assessment scores are available in math and ELA for the current and previous year, and c) for whom demographic data are available. When we measure growth for a given *school* and year, we only include students who were enrolled for the full academic year (FAY) in that school and year. When measuring growth for a given *district* and year, we only include students who were enrolled for the full academic year (FAY) in that district and year. District-level value-added is a weighted average of value-added for all schools in the district, plus the growth of students who were FAY district but non-FAY school. Students do not have to be enrolled or tested in the same school in the current and previous year to be included in the model. As indicated above, value-added results are only reported for groups of at least 20 students.

Value-added for student groups

The value-added model is used to produce measures that incorporate the growth of all students eligible for growth at the school. This "overall" growth measures the average impact of the school across students with varying characteristics and achievement levels. The value-added model is also used to produce separate growth measures for the following student groups.

Student group	
Disability Status	• Students *with* disabilities • Students *without* disabilities
English Language Learner Status	• Students who *are* English Language Learners • Students who *are not* English Language Learners
Economic Disadvantage	• Students who *are* economically disadvantaged • Students who *are not* economically disadvantaged
Race/Ethnicity	• American Indian/Alaskan Native • Asian • Black or African American • Hispanic or Latino • Two or More Races • Native Hawaiian/Pacific Islander • White
Membership in the target group (Target Group Outcomes priority area)	• Students *in* the target group • Students *not in* the target group
Proficiency on the prior year's assessment in the same subject	• Students who scored *proficient* • Students who scored *below proficient*

The last category described above refers to separate growth measures for students who scored proficient and students who scored below proficient in the previous year in the subject for which growth is measured. These growth measures are useful for indicating whether schools are having a greater or lesser impact on students who had been high-achieving or low-achieving in the past.

Scale of the value-added measures

Wisconsin's value-added growth measures are on a scale from roughly 0 to 6, with the vast majority of schools' scores between 1 and 5. A small number of growth measures may be less than 0 or greater than 6. This scale is not based on the scale scores of the assessment. Instead, it is a scale based on differences in growth from school to school. This scale is designed to have an average of 3 and a standard deviation of 1 across schools.

It is useful to note that this scale is based on differences in overall value-added from school to school. Very high or very low value-added measures are more common for student groups within schools, given that these measures can differ across both schools and student groups. Similarly, it is uncommon to see very high or very low value-added measures for districts, given that the district score is a weighted average of value-added growth across schools in the district.

Reported value-added as a three-year average

The value-added model is estimated separately each school year. However, the value-added scores listed on each school and district report card in Wisconsin are a three-year weighted average of single-year value-added results. This weighted average puts more weight on recent years. For example, the 2023-24 weighted average includes:

- Value-added from 2023-24, with a base weight of 1.5 (40 percent);
- Value-added from 2022-23, with a base weight of 1.25 (33.3 percent); and
- Value-added from 2021-22, with a base weight of 1.0 (26.7 percent).

Base weights are adjusted for the number of students in a given year to produce an adjusted weight.

INTERPRETING VALUE-ADDED SCORES

As noted above, a school with a value-added score of 3.0 has average growth for the state. One frequently asked question is the extent to which scores at other values (for example, 2.5 or 3.2) differ from this average. Below we present three different ways to interpret value-added scores.

1 One way to interpret a value-added score is to show how it corresponds to a percentile rank across schools. To the right is a table of percentile rankings for value-added scores across schools in 2023-24. The table identifies a school with a value-added score of 4.0 as having growth at the 87th percentile across schools. This means that average student growth at this school was greater than average student growth at about 87 percent of schools in Wisconsin.

Value-Added Score	Percentile of School Growth
5.0	98th
4.5	95th
4.0	87th
3.5	70th
3.0	**50th**
2.5	29th
2.0	12th
1.5	4th
1.0	1st

2 Another way to interpret a value-added score is to put it in the context of differences in student achievement on the Forward, Pre-ACT, or ACT assessments.

- A **one-point difference in school value-added** (for example, a value-added score of 4.0 rather than 3.0, or of 2.3 rather than 1.3) corresponds to scores being higher by about 1/10 of the difference between the Approaching and Meeting cutpoints on the Forward, Pre-ACT, or ACT assessment. This translates to students at a school with a value-added score that is one point higher scoring about **5 points higher on the Forward scale** and **one-third of a point higher on the Pre-ACT/ACT scale**.
- This follows from a one-point difference in school value-added corresponding to a difference of about 1/12 of a standard deviation of assessment scores across students within a grade, and the difference between the Approaching and Meeting cutpoints being about 8/10 of a standard deviation, or about 50 points on the Forward and three and one-third points on the PreACT/ACT.

What is a standard deviation?

The standard deviation is a measure that tells you how spread out those scores are from the average (mean) score. If the standard deviation is low, it means most of the scores are close to the average. If it's high, it means the scores are more spread out and vary a lot from the average. So, it helps us understand how consistent or varied the data is. The value-added scores have a mean of 3 and a standard deviation of 1 across schools.

3 A third way to interpret a value-added score is to put it into the context of years of learning. The difference from attending a school with a **value-added score that is one point higher** (for example, of 4.0 rather than 3.0) corresponds to about **one-fifth of an additional year of learning**. This follows from research that suggests that a year of learning (which includes not only what is learned in school, but also outside of school) corresponds to about four-tenths of a standard deviation of assessment scores across students within a grade (Lee, Finn, and Liu, 2018).

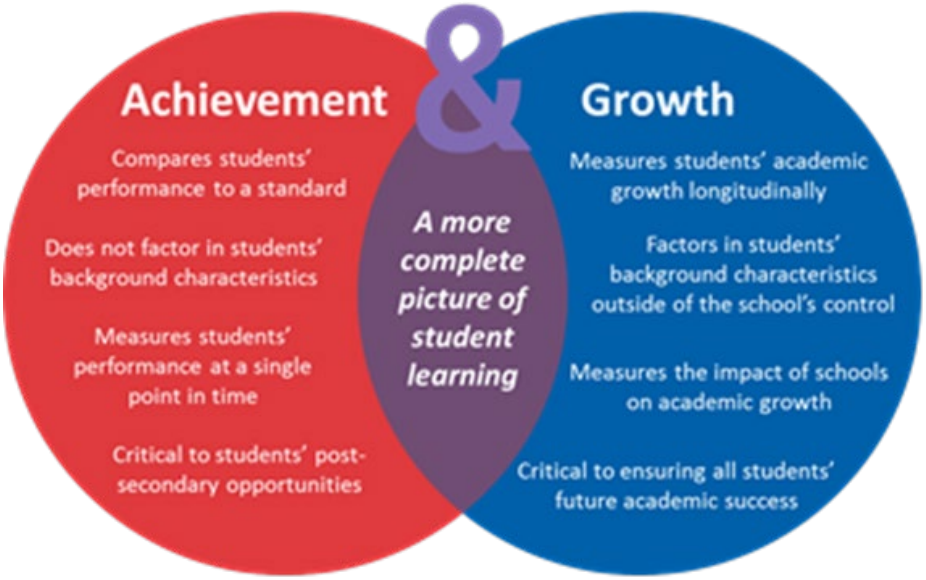
Reference

Lee, J., Finn, J., & Liu, X. (2018). Time-indexed effect size for educational research and evaluation: Reinterpreting program effects and achievement gaps in K–12 reading and math. *The Journal of Experimental Education, 87*(2), 193–213. https://doi.org/10.1080/00220973.2017.1409183

VALUE-ADDED IN CONTEXT

While value-added is a useful measure for growth in student achievement, it does not measure all aspects of a school. Other measures are important to evaluate alongside value-added growth. For example, reviewing student achievement (measured with points-based proficiency rates in Wisconsin) and student growth (measured with value-added) together provides a more complete picture of a school than looking at either in isolation. While student performance levels on assessments do not control for non-school factors, they nonetheless measure what students know at a single point in time relative to performance standards. Value-added, in contrast, measures the extent to which students at a school improve over time and better captures the contribution the school makes to student achievement.

Figure 3. Comparison of achievement and growth



An even more complete understanding of a school can be reached by looking beyond assessments to a wider array of data, such as chronic absenteeism, school-wide attendance, and graduation rates, all of which are included in Wisconsin's school and district report cards. Given that different measures provide information about different things, looking at a broad range of data provides valuable information about different aspects of a school.

FOR FURTHER DETAIL

This document provides an overview of the value-added model employed in Wisconsin. For more details on the value-added growth model, the annual Value-Added Technical Guide goes into greater depth and can be found on DPI's Report Card Resources page.