Value-Added Matrix (VAM)
Methodology in Brief

- **Goal:** To compare student proficiency on standardized tests at the school district level, across grades and relative to socioeconomic status.
- **Advantages:** Builds on work by others; publicly available data sets; complete district-level analysis; basic methodology that is easily replicable.
- **Disadvantages:** No K–8 districts are included in overall VAM; one snapshot in time; includes any disadvantages of the standardized tests; does not incorporate other factors that can affect performance, such as cultural differences and pre-K education.

Many methods can be used to conduct this type of analysis. The goal here is to provide one view of the data so that districts can compare their actual performance to predicted performance based on the socioeconomic status of their students.

VALUE-ADDED MATRIX (VAM)

In order to accomplish the stated goal, state standardized tests were used from grades 4, 8, and 11 to represent elementary, middle, and high school performance (see table below). The focus was on the number of students within a district who were deemed "proficient" in a given subject. As such, the *percent proficient* was utilized, as opposed to the average test scores for the district (which gives no indication of how many/what percentage of students have met the proficiency standard). All test data was available through the Michigan Department of Education (MDE), 2012 MME Downloadable Data Files.[1]

State Standardized Tests, 2011–12

Grade	Test	Subject	Test date
Fourth	MEAP	Writing	Fall 2011
Fourth	MEAP	Reading	Fall 2011
Fourth	MEAP	Math	Fall 2011
Eighth	MEAP	Science	Fall 2011
Eighth	MEAP	Reading	Fall 2011
Eighth	MEAP	Math	Fall 2011
Eleventh	MME	Science	Spring 2012
Eleventh	MME	Reading	Spring 2012
Eleventh	MME	Math	Spring 2012
Eleventh	MME	Social Studies	Spring 2012
Eleventh	MME	Writing	Spring 2012
Eleventh[a]	ACT	All subjects	Spring 2012

[a]The ACT can also be taken in the 10th or 12th grade.

[1] Tables used: 2009-2012 MME Proficiency Data File and the 2009–2012 ACT Proficiency Data File. Available at: http://www.michigan.gov/mde/0,4615,7-140-22709_35150_47475---,00.html.

The VAM is based on previous work by the University of Arkansas,[2] along with the modification made by the Mackinac Center for Public Policy,[3] in which the actual performance of a school on a particular test in a particular grade is compared to its projected performance given the socioeconomic status of the school or community. The Arkansas study includes test scores across multiple grades, while the Mackinac Center study focuses only on high school. Both of these studies look at the individual school level for comparisons, while the focus of this analysis is at the district level in order to analyze performance in grades K–12 more holistically.

Building off the Arkansas study, an ordinary least squares (OLS) regression analysis was used to predict the percentage of students projected to be proficient for each grade/test. As with the Mackinac Center study, the number of students eligible for free or reduced price lunch[4] was used as the indicator of socioeconomic status and was the only independent variable in the regression analysis. A weighted approach was also utilized, which applies greater weight to those eligible for free lunches (EFL) compared to those eligible for reduced price lunches (ERPL). The formula is as follows:

$$\frac{(Number\ of\ students\ EFL * 2) + (Number\ of\ students\ ERPL * 1)}{Total\ number\ of\ students} * 100$$

Following this formula, school districts in which all students are eligible for free lunch would have a Socioeconomic Indicator score of 200; a district in which all students are eligible for reduced price lunch would have a Socioeconomic Indicator score of 100; and a district in which no students are eligible for either free or reduced price lunch would have a Socioeconomic Indicator score of 0.

The percent proficiency was also adjusted for each district/grade/test by the statewide mean and standard deviation for the given grade/test, to normalize the distributions to a mean of 100 and a standard deviation of 15.

$$Adjusted\ Percent\ Proficient = 100 + 15\left(\frac{Percent\ Proficient - Calclulated\ State\ Mean}{Calculated\ State\ Standard\ Deviation}\right)$$

The Calculated State Mean and Calculated State Standard Deviation used for each test were calculated based on all available percent proficiencies reported for the given test. All districts, including those with incomplete data, were used in this calculation. This Adjusted Percent Proficiency (APP) was then utilized as the dependent variable in the OLS regression, using the Socioeconomic Indicator of free and reduced price lunch as the independent variable to predict the Projected Percent Proficient (PPP). A district's APP is then compared to the PPP and adjusted so that a district that performs exactly as projected would score a VAM of 100.

$$VAM = \frac{APP}{PPP} * 100$$

[2] Jay P. Greene, et al., *The School Performance Index in Arkansas*, Department of Education Reform, University of Arkansas, 2006. Online, available: http://www.uark.edu/ua/der/Research/SPI/SPI_Full_Document.pdf. Accessed, January 2013.
[3] Michael Van Beek, et al., *The Michigan Public High School Context and Performance Report Card*, The Mackinac Center for Public Policy, 2012. Online, available: http://www.mackinac.org/17256. Accessed, September 2012.
[4] Source: Fall 2011 District-Level Free and Reduced-Price Lunch Counts. The Center for Educational Performance and Information (CEPI).

If a district performs above its projected level, its VAM would be above 100, and if it performs below its projected level its VAM would be below 100. This does not mean that districts with a VAM below 100 have a low percentage of students meeting the proficiency standards. What it does mean is that relative to how well the students are *projected* to perform, given the socioeconomic status of the student population, the district's students are not meeting expectations. For example, if 90 percent of a district's students are proficient on all tests but the district is projected to have 95 percent of students proficient on all tests, the district's VAM would be 94.74. Obviously, this district would be considered very successful.

The overall VAM is a composite of test scores for grades 4, 8, and 11. To ensure that the eleventh grade tests, for example, are not given more importance because of the quantity of tests from that grade, a VAM is first calculated for each grade level (grade 4 VAM, grade 8 VAM, and grade 11 VAM). These grade-level VAMs, representing elementary, middle, and high school performance, are then averaged together for an overall VAM score, giving equal weight to performance at each grade level, not equal weight to each test.[5]

Due to the use of fourth, eighth, and eleventh grade test scores, only those school districts that reported scores for the 2011–12 school year in all three targeted grades have an overall VAM score (a total of 560 school districts). School districts with fewer than a full complement of 12 test scores were utilized in the calculations to determine VAM scores and may have individual grade-level VAMs, but were not included in any rankings or overall VAM score.[6] The reason for their exclusion from the overall ranking, as well as exclusion from grade-level rankings, goes back to the goal of viewing a district's performance across all grade levels (elementary through high school) and the concern about unequal comparisons with districts that specialize in a particular level (such as elementary or high school only).

The VAM allows for a comparison of school districts in Michigan which removes the volatility created by a key driver of student success, socioeconomic status. Several districts ranked highly are very low-income districts that appear to perform poorly when looking only at the percentage of students that are proficient, but these districts may in fact be over-performing in terms of how we would expect them to perform given their socioeconomic status. The VAM allows us to view each district relative to *themselves,* so districts can see how they are internally performing, given what is projected. This is only one model of projected performance out of many and is intended to begin an open dialogue on how we view school and student performance.

For additional information on how calculations were performed and verified, including calculated means, standard deviations and equations, please contact Public Sector Consultants at (517) 484-4954.

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[5] For example, if six tests were available from eleventh grade and only three tests for fourth and three tests for eighth, applying equal weight to each individual test would give more weight to eleventh grade tests than fourth or eighth grade tests, which would be counter-productive to our purposes.

[6] Grade-level VAM scores for schools without a full complement of tests by identified grades present in the district are available for individuals to review and identify where a particular district would fall, in comparison to others.