



Value-Added Models in Education

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'Value-added' in education refers to the effects of schools and teachers on students' learning outcomes. In practice, year-to-year gains in students' test scores are compared to some standard, typically the average test score gains for a jurisdiction, after taking account in some way of students' family background. 'Value-added Models' describe the learning process with a complex set of statistical procedures that attempt to isolate the effects on student outcomes attributable to schooling processes from those due to family influences and other factors outside of the school.

Key Points

- Value-added is about the effects of *tractable* factors, such as the quality of instruction and classroom and school disciplinary climate. Most value-added models try to estimate it by specifying a model of learning and removing the effects of *intractable* factors, such as students' ability when they enter school and family socioeconomic status (SES).
- League table comparisons that present average school test scores can be misleading if treated as a measure of value-added.
- The assessment of value-added needs to take account of students' prior academic performance and their SES.
- The effects of *school composition* (e.g., school mean SES) on student learning cannot be easily separated from *school context* (i.e., the environment in which teaching and learning takes place). Therefore, comparisons of value-added that compare schools with markedly different mean SES can yield unfair comparisons.
- Using value-added models to assess teacher effects is problematic for several reasons. A viable approach requires a longitudinal design with repeated measures of learning outcomes over the course of a school year.

If value-added assessments are to be successful, they need to place greater emphasis on comparisons to fixed standards rather than on comparisons with other schools. They also need to be accompanied with leading indicators of policy and practice that give schools direction on how best to improve their schools.

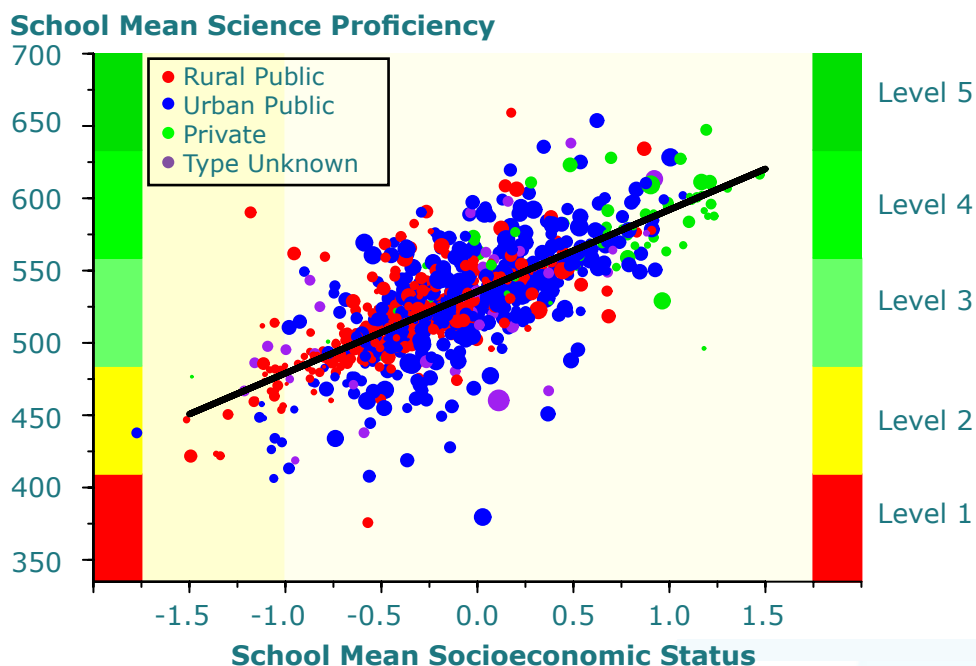
Value-added models have been around for a long time. Economists have used them in manufacturing to refer to the contribution of the factors of production – capital goods and labour – to the increased value of a product. Educators and policy-makers have recently increased their interest in value-added models as the approach is seen as a fair and unbiased way to hold schools accountable. Value-added assessments were a cornerstone of President Bush’s 2001 reform, *No Child Left Behind*, which aimed to hold schools accountable for their performance and give parents greater freedom of choice. A number of recent studies have shown that classroom teaching practices are the most important aspect of value-added, and thus the interest has shifted from assessing schools to assessing teacher performance with value-added models. In some states administrators want to use the results for personnel evaluations and merit pay programs. Shortly after the 2008 election, the US National Science Foundation and the National Academy of Education convened a workshop on value-added models to help the policy community understand their appropriate and inappropriate uses.

Canadian schools probably vary considerably in their performance. The figure below shows the variation among schools in students’ science performance at age 15 based on data from the 2006 Programme for International Student Assessment. The data describe a sample of nearly 1000 Canadian schools, which were

selected randomly from each province. Science is a useful outcome to consider as it is strongly related to reading and mathematics literacy skills, and is influenced considerably by the schooling process. In this figure, the results are plotted against a standardized measure of family socioeconomic status (SES), a statistical composite that summarizes parents’ level of education and occupational prestige and the educational, cultural, and material possessions in the home. At all levels of SES, there is a gap of about 120 points in science performance, which is equivalent to about two grade levels. The vertical distance from each school’s score and the black line (called the between-school regression line) is sometimes considered a measure of the school’s value-added. However, the calculation of value-added is much more complicated. There are at least seven issues to consider (Willms, 2008).

1. Status versus learning

Some organisations report school average test scores in ‘league tables’ without consideration of students’ family background. League table comparisons can be misleading if treated as a measure of value-added. The estimation of value-added needs to begin with a model of what learning entails, and its estimation requires an explicit model describing each student’s growth trajectory. Ideally, student growth should be measured with data collected on at least three occasions.



2. Control for SES

Children from low socioeconomic backgrounds on average acquire literacy skills at a slower pace than their peers. They also tend to lose skills over the summer months while those from high socioeconomic backgrounds maintain or even increase their academic skills (Alexander *et al.*, 2007). Value-added models that do not adjust for SES yield misleading results.

3. Control for school composition effects

The term 'composition effect' refers to the effects on student learning associated with the schools' demographic composition, such as the mean SES of the school, or the distribution of student ability upon intake. The 'contextual effect' refers to the environment in which teaching and learning takes place. It comprises factors such as students' interactions with teachers and their classmates, the disciplinary climate of the classroom, and the norms for academic success (Willms, in press). However, school composition and context tend to be correlated, and it is difficult statistically to separate the effects of composition from those associated with those aspects of context that are reasonably under the control of teachers. For example, in Figure 1 there are several schools with average school SES scores in the poverty range (e.g., below -1.0). Teachers in these schools face challenges that are seldom experienced by teachers in schools serving children who are predominantly from high SES backgrounds.

4. The critical transition

Value-added models need to take account of the level of children's literacy skills when they enter school. The transition from 'learning-to-read' to 'reading-to-learn' is a critical marker in children's academic development. For most children this occurs at about age 8 or 9, usually by the end of the third grade. Children who do not successfully make this transition tend to remain on gradual learning trajectories throughout their schooling career. Thus, schools with a disproportionate number of children who have failed to make this transition are less likely to have high value-added.

5. The right outcomes at the right level

Recent research has shown that there is greater variation in student outcomes among classes within schools than between schools; thus, the teachers children have from year-to-year and at each grade play a bigger role in children's academic development than the schools they attend. However, there is a high correlation among student outcomes at the school level, even when student-level SES is taken into account. These paradoxical results suggest that to separate the value-added of classroom instruction on different outcomes requires longitudinal designs with repeated measures over the course of a school year.

6. Attending to process

Learning is a function of *tractable* factors, such as the quality of instruction and classroom and school disciplinary climate, and *intractable* factors, such as students' ability when they enter school and family SES. Value-added is about the effects of tractable factors, but most value-added models try to estimate it by specifying a model of learning and removing the effects of intractable factors. The assumption is that after the effects of intractable factors on learning have been removed, one is left with the effects of tractable factors, that is, value-added. One problem is that it is difficult to specify all of the intractable influences of families, neighbourhoods and communities. Another problem is that not all factors can be easily classified as tractable or intractable; for example, parent involvement in children's schooling would normally be considered intractable, yet it is tractable if schools make an effort to involve parents.

7. Links to intervention

A related point is that there is a very weak link between value-added assessment and the efforts by educators to reform their schools. Proponents of value-added assessment believe that positive assessments are associated with teachers' reputations and their acceptance from colleagues and parents, and this motivates them to improve their teaching. But most teachers feel their primary rewards come through students' success in learning and emotional development, and therefore it is not surprising that many teachers are quick to dismiss value-added assessment as a top-down accountability tactic.

Leading Indicators for Assessing Value-Added

The state and provincial monitoring systems used to assess value-added are based on *trailing* indicators of student performance measured with large-scale assessments after a fixed period of schooling. Schools and districts need information on the tractable factors that affect student learning in their school. Without this, the value-added exercise simply tells schools that they are doing well or not-so-well, without offering any direction on how to improve.

Currently, about 300 Canadian schools are using an assessment system called *Tell Them From Me* (<http://www.thelearningbar.com>) which provides *leading* indicators of student engagement and wellness, and classroom and school climate. The system includes a dynamic web-based student survey and optional teacher and parent surveys, which together assess 15 aspects of classroom and school learning climate known to affect learning outcomes. These are the tractable factors, or value-added, that three decades of research have shown affect student learning outcomes. *Tell Them From Me* also collects data on 16 student outcomes pertaining to student engagement and wellness, which are not usually assessed in state or provincial monitoring systems.

An important feature of *Tell Them From Me* is that the survey data can be collected at any time during the school year, or continuously from random samples of students throughout the school year. Results are updated daily with a web-based reporting system, enabling school and district staff to chart a course of reform or to assess whether school policies and interventions are having their intended effect. When students complete the survey, they are matched to students in the previous year's database who have similar demographic characteristics. This allows school staff to compare their results to those of a 'replica school' comprised of similar students, as well as to the results for their school from the previous year and to the national average.

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About CRISP

The Canadian Research Institute for Social Policy (CRISP) is a multi-disciplinary research organization dedicated to conducting policy research aimed at improving the education and care of Canadian children and youth, contributing to the training of social scientists in quantitative research methods, and supporting low-income countries in their efforts to build research capacity in child development.

About this Policy Brief

This Policy Brief was based on a presentation prepared for the US National Research Council and the National Academy of Education. CRISP's Policy Briefs are designed to highlight the policy implications of research findings. They are available in paper form and electronically on CRISP's website at: <http://www.unb.ca/crisp/pbriefs.html>.

Further Reading

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