



Causal Analysis Missing Piece of the Data Puzzle?

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MANAGING AND USING DATA

By Mary Anne Mather

Data can illuminate, clarify, and empower, but it can also overwhelm, confound, and lead users down the wrong path if they don't take the time to ask the right questions. Albert Einstein said, "If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and five minutes thinking about solutions."



This is sage advice when it comes to using data to inform meaningful change in schools. Savvy teachers who systematically dig into the "why-why-why" of student learning problems observed in achievement data are finding that they can more effectively improve their practice and student learning.

It's true that school leaders regularly consult data, but not all engage their teachers in systematic collaborative inquiry processes to analyze multiple data sources in order to pinpoint student-learning problems. Even in schools and districts where administrators feel that their teachers

have a firm grasp of how to analyze and understand data, it is not unusual to hear them acknowledge that knowing what to do next is a challenge. How do you move from data to action? The next step is causal analysis.

The Essentials of Causal Analysis

It's not so much about taking action; it's about taking the "right" action. How do you know what intervention to enact that will positively impact student achievement?

Effective causal analysis is built upon a solid drill down into achievement data that involves teams of teachers, who have collaboratively analyzed multiple data sources. These analyses draw from state standardized test data, quarterly benchmark assessments, and classroom data that include student work samples. The teams examine aggregate, disaggregate, strand, and item data for each source in order to understand specifics about skills and concepts that students misunderstand and exactly who those students are. They are able to connect the dots across multiple data sources to identify one or two student learning problems at specific grade levels.

As quintessential problem solvers, many educators feel compelled, at this point, to pick a solution and plow ahead. Instead, once the data-informed problem is well articulated, causal analysis begins. If side-stepped, outcomes can be disappointing and time consuming, as happened in one district after middle school teachers noticed students struggling with open-ended, multi-step problems related to fractions on the district benchmark exam. They made two assumptions:

1. That students did not understand the academic vocabulary used in the problems.
2. Students did not understand that each problem required multiple steps.

The teachers did not test these assumptions, nor did they explore other possible causes. Instead, they spent time introducing students to the meaning of words such as explain, demonstrate and describe. They also worked at helping students break problems into segments.

Assessing students again produced no change because the causes tackled were not accurate. Further examination revealed that the math lessons being taught did not match the level of rigor required by the learning standards. Although their students could successfully complete classroom assessments, they did not have a deep enough understanding of fractions to solve the more complex problems on the district assessments. Teachers came to realize their own need for content-focused professional development to help them better understand the standards.

On the other hand, sometimes the reason students do not succeed is simple to fix. A good causal analysis process can get at this, too. For example, in another middle school, the team engaged in test-item analysis. They found that a majority of students had difficulty with several geometry-focused problems on the standardized test. At first, they were ready to re-teach the concepts. By digging deeper, they discovered that students understood the geometry but were tripped-up by vocabulary.

Test items that defeated students referred to “vertical angles,” a pair of angles that are equal and opposite each other across a vertex. You might call them opposite angles. In fact, that’s exactly what the teachers did. Concerned that their students might be confused by the term vertical angles, teachers taught the concept of opposite angles. Students successfully solved problems in class involving opposite angles and demonstrated comprehension of opposite angles on classroom assessments. Then, the standardized test asked them to identify pairs of vertical angles, and they were lost. The issue: vocabulary used in class was not aligned with statewide assessments. Once this “why” was identified, it was easy to resolve.

Teams that know how to engage in a collaborative process of causal analysis can more effectively get at the root causes of student learning problems, ensuring that the solutions they undertake will be more likely to produce the results they desire.

How Does Causal Work?

There is no single “right” process for unearthing and verifying root causes, but these tested methods can get you started.

Why-Why-Why

This process leads a team from one question to the next. It is a method often used in business, but with direct application to education. The most important aspects of the process are that a problem is well defined and the discussion is collaborative. Collaborative inquiry is a cornerstone of effective data use, enabling educators to bring various perspectives to the table. Engaging in a collaborative Why-Why-Why discussion can peel away layers of symptoms and lead to the root cause of the articulated problem. Here’s how it works (see forms at <http://usingdata.terc.edu/resources/#causalanalysis>):

1. Define a student learning problem. Analyze at least three data sources to accurately pinpoint the problem.
2. Clearly state the student learning problem in writing. This formalizes and supports shared understanding of the issue.
3. Engage in collaborative dialogue with your team. Ask, “Why do we have this problem?” Then record the response beginning with “Because ...”
4. Continue this process by repeating step three, three to five times until you feel a root cause has been identified.
5. Discuss the causes. Do any need confirmation? What other data can be consulted? Which one seems to be the root cause—the one that, if changed, will yield results? Now your team is ready to start generating solutions.

The conversation might sound like this:

Student Learning Problem

Our English Language Learners performed lower than general education students on the state science assessment and fall benchmark exam.

Why do our English Language Learners perform lower on science assessments?

Because ... they don’t know basic science concepts and processes.

Why don't they know basic science concepts and processes?

Because ... there is a language problem.

Why is language a problem?

Because ... they get pulled out of science class for language tutoring.

Why do we allow them to get pulled out of science class for language tutoring?

Because ... we hold the assumption that all English Language Learners need remediation and are not ready to learn science.

The conversation leads to questions such as: Is this assumption valid? How does it lead us to rethink ways to raise science achievement?

Examining Causes By Categories

Thinking about causes within categories can help data teams consider a wide range of ideas that might otherwise be overlooked. This is particularly useful when a student learning problem is evident over time in trend data. Critical categories to consider include curriculum (alignment and rigor), teacher preparation (content knowledge), instruction (pedagogy), assessment, and critical supports (collaboration time, access to data, data literacy training, etc.).

The team can begin by categorizing the ideas captured during their why-why-why discussion. This might prompt new ideas under each category or ideas in categories not previously considered. Some teams organize their categorized causes on a fishbone template. Then they select causes that can be verified and with the potential to lead to meaningful change. To scaffold this process, *Using Data* offers a set of Causal Analysis Cards (http://usingdata.terc.edu/resources/workshop_resources.cfm) that suggest research-based causes for learning gaps related to math, English language arts, and science curricula and issues relevant to various student subgroups.

Stephanie Haskins, Director of Assessment and School Improvement for Staunton City Schools in Virginia, recently attended workshops hosted by the Appalachia Regional Educational Laboratory where TERC's facilitators led teams through systematic data analysis processes, including causal analysis. She called the experience a game-changer. "The workshops really triggered some re-thinking of processes we have had in

place with regard to looking at data, especially integrating a causal analysis process before identifying solutions."

Leaders like Haskins understand that even when data are used to best advantage, they are still only numbers that point to "what" is happening, not "why." To use data for real change and improved student achievement takes commitment, support and time to develop data literate administrators and teachers.

Related Resources

Five Steps for Structuring Data informed Conversations and Action in Education

The National Center for Education Evaluation and Regional Assistance (NCEE) & Regional Educational Laboratory Pacific

<http://ed.gov/fulltext/ED544201.pdf>

Using Data Tips

Step-by-step how-to from TERC's *Using Data* about each phase of data use processes

http://usingdata.terc.edu/data_tips/

Why? Why? Why? Causal Analysis Forms

<http://usingdata.terc.edu/resources/#causalanalysis>

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