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# America's Challenge: Effective Teachers for At-Risk Schools and Students

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# CHAPTER 1



*Linking Teacher Quality  
and Student Outcomes*



# Chapter 1

## Linking Teacher Quality and Student Outcomes

**Laura Goe, Ph.D., ETS**

Although it is almost universally accepted that teacher quality is the most important school-based factor affecting student learning, there is no clear consensus in the education community on what dimensions of teacher quality matter most. The ability to recognize teacher quality is important for the following reasons:

- Hiring the highest quality teachers available is a primary goal of schools and districts.
- Determining teacher quality among teachers already in classrooms is important for understanding the distribution of teacher quality, particularly in relation to student poverty, minority students, and students with disabilities, as well as for determining teacher effectiveness.
- Evaluating the effects of policies and programs (such as alternative certification and National Board for Professional Teaching Standards [National Board] certification) is important in terms of establishing their links with teacher quality.
- It is crucial to learn more about how specific professional development programs (which may include learning about new practices, techniques, and strategies) impact teacher quality.

*Teacher effectiveness*, here defined as the contribution a teacher makes to his or her students' achievement, is perhaps the most important dimension of teacher quality because schools and school systems are increasingly being held accountable for student achievement. Parents, policymakers, and taxpayers want to know about the ways in which teachers contribute to student learning, no matter how qualified teachers may appear to be on paper and regardless of their personal characteristics and their classroom practices.

Now that the 2005–06 No Child Left Behind (NCLB) deadline for all states to fill their classrooms with highly qualified teachers (HQTs) has passed, the focus is shifting as states and others try to figure out whether they have teachers in every classroom who will contribute appreciably to students' learning. As research on the link between teacher qualities and student outcomes has shown, identifying effective teachers is an arduous endeavor.

In recent years, as the emphasis on measuring student learning has increased, the focus has shifted from holding *schools* accountable for student achievement to holding *teachers* accountable for student learning. Teachers have been studied and evaluated for years, usually in their classrooms; however, more accurate and easily available teacher information—along with advances in statistical software and computing power—has led to an emphasis on evaluating teachers by focusing on specific qualifications and characteristics rather than on their classroom behavior. The most common approach is trying to measure teachers' contributions to student achievement using growth models or value-added models.

**In recent years, as the emphasis on measuring student learning has increased, the focus has shifted from holding *schools* accountable for student achievement to holding *teachers* accountable for student learning.**

As recently as 1978, using student achievement data to establish teacher effectiveness was still a somewhat unfamiliar idea. For example, eight ways of measuring teacher “effectiveness” were described at the Conference of the International Association for Educational Assessment, and only *one* of them focused on measuring teacher

effectiveness through the analysis of students' achievement scores (Schlusmans, 1978). At that time, student achievement was used to evaluate teacher effectiveness in only "some exceptional cases" (Schlusmans, 1978, pp. 19–20). The other seven methods focused on examining teacher characteristics using "existing educational, psychological or sociological theories"; pupil evaluations; and the opinions of experienced professionals, such as principals.

Times have changed; now the push toward establishing teacher quality by measuring teachers' contributions to student achievement is seen as legitimate and is often even preferred over other methods. The rapid expansion of policies using value-added models at the district and state level is testimony to the increased interest in this way of measuring teacher quality. In addition, the policy expansion has been facilitated by increasingly sophisticated data systems that permit student achievement scores to be linked to teachers.

In the past, most teacher quality studies focused primarily on *inputs*, such as a teacher's

tests, and teacher quality is thus defined empirically by students' test scores (see Fetler, 1999; Monk, 1994; Rockoff, 2004; Vandevort, Amrein-Beardsley, & Berliner, 2004). This outcomes approach includes using value-added models, such as the model developed by William Sanders, which has been used for many years to evaluate teachers in Tennessee (Sanders, Saxton, & Horn, 1997).

To help organize thought and discussion around the various dimensions of teacher quality, Goe (2007) developed a framework for analyzing the categories of teacher quality, as represented in Table 1. There are four dimensions (teacher qualifications, characteristics, practices, and effectiveness) associated with three broad categories (inputs, processes, and outcomes) that can be used to analyze teacher quality.

Both teacher qualifications and teacher characteristics are considered *inputs* because they are what go into the making of a teacher. Teacher practices are considered *processes* because they are what teachers can be observed doing in classrooms in the process

Table 1. Categories and Dimensions of Teacher Quality

Dimensions	Categories		
	Inputs	Processes	Outcomes
Teacher Qualifications	X		
Teacher Characteristics	X		
Teacher Practices		X	
Teacher Effectiveness			X

education, certification, or experience, rather than on what teachers actually do in the classroom (see Ferguson & Womack, 1993; Goldhaber & Brewer, 1999; Milanowski, 2004; Mullens, Murnane, & Willett, 1996; Sanders, Skonie-Hardin, Phelps, & Minnis, 1994). Some research has defined teacher quality by *outcomes*—that is, by how much students actually learn in the classroom. Student learning is typically measured by standardized

of teaching. Teacher effectiveness is considered an *outcome* because it involves student learning, the end result of teaching.

There is a natural division among the four categories: teacher *effectiveness* is determined by student test scores, while teacher *qualifications*, *characteristics*, and *practices* can all be used as determinants of teacher quality, independently of student achievement.

In other words, a teacher has certain qualifications and characteristics and exhibits certain practices, whether or not these categories are ever linked to student achievement. Teacher effectiveness, however, is determined wholly by measuring student achievement: teacher effectiveness cannot be determined in the absence of outcome measures, such as standardized test scores. Qualifications, characteristics, and practices can be theoretically connected to student learning and measured by standardized test scores, but these categories exist whether or not student learning is measured. In contrast, effectiveness (as defined by student achievement) does not exist without linked student-teacher data.

Many policies in force today, such as those intended to ensure that poor and minority students have access to highly qualified, experienced teachers, use some combination of inputs and processes to define teacher quality. There is, however, no large-scale policy that uses teacher effectiveness—as determined by teachers’ contribution to student learning—to define teacher quality for policy purposes, such as the equitable distribution of effective teachers.

**Teacher Qualifications.** Commonly called teacher inputs, teachers’ qualifications are part of the resources they bring with them to the classroom. Inputs are generally thought to be important in establishing who should be allowed to teach. The strong reliance on paper qualifications to determine teacher quality is probably practical: These qualifications are easily measured. For example, how many courses a teacher candidate took in his or her subject area or what score was obtained on a licensing test are not difficult to determine.

Inputs can also include teachers’ coursework and grades, subject matter studied, degrees, test scores, experience, certification, and credentials, as well as evidence of participation in continued learning such as internships, induction, supplemental training,

and professional development. Experience can also be considered an input because it is counted as a qualification for many reasons, including determining the equitable distribution of teachers for NCLB purposes.

NCLB has used input qualifications to define *highly qualified* relative to a specific teacher assignment, and *teacher quality* has often been conflated with the idea of an HQT. For NCLB purposes, HQTs must possess the following inputs (paper qualifications): full state certification, bachelor’s degree, and demonstrated subject matter competency in each of the academic subjects taught. It is obvious, of course, that simply meeting the NCLB requirements is, in itself, no guarantee that teachers will be “high quality,” in the sense of being effective in their classrooms, even when they have been classified as having highly qualified status for their teaching assignment. The advantage

**There is no large-scale policy that uses teacher effectiveness—as determined by teachers’ contribution to student learning—to define teacher quality for policy purposes, such as the equitable distribution of effective teachers.**

of using qualifications is that they allow educational decision makers to use documentation *alone* in an attempt to predict a teacher’s potential effectiveness for licensing and hiring purposes, prior to any determination of a teacher’s suitability for a specific teaching position or demonstrated effectiveness in the classroom. The major disadvantage of using qualifications as the definition of teacher quality is that a teacher can be deemed to be of high quality on paper and yet perform poorly in the classroom. By the same token, teachers who do not appear to be high quality on paper may actually be desirable teachers for specific contexts.

**Teacher Characteristics.** A second category for defining teacher quality focuses on teachers' characteristics, which include changeable attributes and attitudes of teachers, as well as immutable (or assigned) characteristics such as race and gender. Research linking such characteristics to student outcomes is still relatively scarce. The advantage of this view is that it expands the scope of teacher quality and thus creates an opportunity for greater precision in our definition. The main drawback to defining teacher quality in this way is that it focuses on characteristics that are often logically, ethically, or practically beyond the teacher's (or school's) ability to change.

**Teacher Practices.** A third category of teacher quality focuses on teachers' actual classroom practices and on correlating those practices with student learning outcomes. The following examples are ways of examining teacher practices: evaluating teachers' questioning strategies and linking them to student learning, documenting their classroom management strategies, determining how they interact with students, looking at lesson plans, and recording lesson delivery. By this definition, teacher quality is ascertained not by what qualifications teachers have on paper but by what they actually do in the classroom with their students.

Higher correlations with what are considered "better" practices thus define good teaching. The focus is not on assessing the connection between what individual teachers do and what their students learn but rather on the correlation between certain practices recommended for all teachers and student-learning outcomes.

The advantage of assessing teacher practices is that this method focuses on the classroom—where the teacher and student interact and where learning actually takes place. The chief disadvantage of this approach is that evaluating teachers in their classrooms is difficult to do with acceptable validity and reliability. It is also time-consuming, expensive, and subject to

the complications of context (e.g., differences among urban and rural schools, high-poverty and wealthy schools, schools serving large numbers of English language learners [ELLs], or a classroom that includes students with severe behavioral problems).

Another disadvantage of this approach is that although researchers may focus on looking only at whether teachers are using a small number of specific "best" practices, it is likely that teachers using these best practices are also using other best practices at the same time. For example, a teacher who uses a particular questioning strategy, like "wait time," may be more likely to use other good questioning strategies (e.g., asking higher order thinking skills questions or calling on students by a random method rather than calling on only those who raise their hands). Thus, linking student learning outcomes to one best practice (and excluding all others) is virtually impossible.

Similarly, another limitation of measuring teacher quality by examining teacher practices is that it is difficult to control for other contributions to student learning (e.g., a classroom climate that is conducive to learning) or distractions that prevent students from learning (e.g., a disruptive classmate).

**Teacher Effectiveness.** The fourth category of the framework for defining teacher quality is analyzing teacher effectiveness—by looking at their students' learning gains. This is typically measured by using standardized achievement tests. This category most closely approximates a comprehensive measure of *teaching* quality, rather than *teacher* quality. Teachers might be considered HQTs if their students learn significantly more than would have been predicted, given those students' prior achievement.

A major disadvantage of the effectiveness definition is that it provides no mechanism for *predicting* who will be HQTs *prior* to their actual teaching. In other words, if teacher quality is to be determined solely by effectiveness, how will we decide who should

be allowed to teach in the first place—before any student gains can be assessed? How can we best ensure that students are protected from exposure to ineffective teachers?

The difficulty in measuring teacher effectiveness is that there are many things that contribute to student learning, making it difficult to sort out “teacher effects” from “classroom effects” or even “school effects.” For example, two Grade 4 teachers with similar qualifications and experience teaching in two different schools may have different results, even if they are both competent teachers. This is because there are other contributors to (and detractors from) student learning besides teacher quality that may impact learning conditions and thus affect student performance. Although the following list is not exhaustive, it includes many of the variables often correlated with differences in student achievement:

- School climate
  - Students’ peers
  - Absenteeism
  - Students’ fluency in English
  - Community support for schooling
  - Parental “press” for schooling
  - Availability of resources (textbooks, supplementary materials to support learning, laboratories, computers, Internet connectivity, libraries)
  - Appropriate facilities (orderly, safe, and comfortable, with adequate space to conduct a range of learning activities)
  - Instructional offerings appropriate to the grade level
  - Time on task without intrusions (from announcements, disturbances in the halls, disruptive classmates, other adults or students entering and exiting the classroom)
  - Alignment of curriculum with books and materials
  - Alignment of books and curriculum with the standardized test
- Appropriate support for teachers (induction, mentoring, and high-quality professional development opportunities)
  - Teachers’ sense of community and collegiality
  - Release time during regular school hours for teachers to engage in professional development (observing colleagues’ classrooms, engaging in collaboration, and attending professional development)

Thus, substantial differences among these context variables may impact how similarly qualified and experienced teachers actually perform when student achievement is used to define teacher quality. This is an important cause for concern when using value-added models to compare teachers to one another.

Some researchers, particularly Sanders who designed and implemented value-added models for ranking Tennessee teachers, have argued that because students’ prior test scores are used as controls in the calculations, there is no need to take into account other variables such as those listed above (Sanders & Horn, 1998). The theory behind this belief is that demographic variables (e.g., race, poverty, and parental education) and context variables (e.g., school climate, peers, and access to appropriate curriculum and materials for learning) change little over time. These variables affect student test scores, so they are assumed to be included in the test scores. This theory only holds if the context variables actually do not change. Given the myriad variables that go into the making of a school or a classroom within a school, it is difficult to ensure that, after controlling for students’ prior achievement, teachers alone are the sole contributors to students’ test scores.

Not everyone agrees that the current generation of value-added models has sufficient validity and reliability to be used for teacher evaluation (Braun, 2005; Kupermintz, 2003; Lockwood, Louis, & McCaffrey, 2002), and using them to measure teacher effectiveness and determine teacher quality remains highly controversial.

Another practical issue with using value-added models to measure teacher effectiveness is that the score tells us virtually nothing about what happened within a particular classroom. What did the teacher do, and what occurred in the classroom that impacted student achievement and thus yielded a particular value-added score for the teacher? Although a score for each teacher may be useful in identifying classrooms in which more or less learning than expected is taking place, education professionals, administrators, and policy makers learn nothing about how to improve teaching from such analyses.

In addition, using value-added models to measure teacher effectiveness is not well suited to evaluating teachers of students with disabilities or ELLs because these students' performance on standardized achievement tests may reflect different rates of growth in language ability or in other abilities for which they require special curriculum and instruction. Thus, predicting future achievement for students with disabilities or ELLs is problematic, making the evaluation of their teachers based on those scores uncertain at best.

**More research needs to be conducted before rewards are given or remediation efforts are undertaken based solely on students' gain scores on standardized tests.**

## Findings

Goe (2007) presented summaries of more than 50 recent studies that measured some aspect of teacher quality, including teacher qualifications, characteristics, and practices. Other studies used value-added models to suggest that certain scores reflected teacher quality, although these studies do not identify what these teachers are doing in their classrooms or which particular qualifications and characteristics they possess. In that sense, using value-added models to identify teacher quality is a measure that holds promise but

provides little information without conducting additional research into the backgrounds of teachers and their classroom practices.

The end result of synthesizing these studies was to find some evidence that suggests that particular qualifications matter, but in most cases, the evidence is either weak (i.e., there does not appear to be a significant effect on student achievement) or mixed (i.e., some studies suggest that a particular qualification, characteristic, or behavior was significantly related to teacher quality, while other studies found that it was not). There are, however, some findings that are both consistent and strong. These findings are described in the following section.

## Interpreting the Findings

**Caveats.** It is important to note that measuring teacher quality by student achievement is problematic. In some studies, factors that would logically and theoretically be related to student achievement may appear to be only weakly related or not related at all. This might be a sample size issue (smaller sample sizes make it difficult to determine effects), or it could be that the theory is wrong or that student mobility or data quality is the culprit. In addition, the measurement tools and statistical analyses might not be sensitive or precise enough to capture effects that are actually present.

State standardized student achievement tests are not ideal for measuring the effects of changes in instructional practice because they were designed to measure student learning, not to identify differences in teachers based on student gains. The achievement tests commonly used throughout the United States have not been designed or validated for purposes of sorting teachers. This makes the results of such efforts difficult to interpret. More research needs to be conducted before rewards are given or remediation efforts are undertaken based solely on students' gain scores on standardized tests.

Another concern is that in many of the studies reviewed, the measurement instruments used may not be appropriate for detecting subtle

differences in teacher practices. For example, most of the scales used for teacher evaluation or for survey research are simple Likert scales. Likert scales indicate a level of agreement with a particular statement, usually on a 4- or 5-point scale from “strongly agree” to “strongly disagree.” Problems with the use of these scales include the tendency that respondents have to avoid the “extreme” answers and to choose only the middle answers and an unwillingness to answer in ways that might be considered “wrong” by others. When evaluating a teacher with a 4-point scale, it is unlikely that a teacher will score an average of 1 or 4. Instead, he or she will probably score a few 1s, mostly 2s and 3s, and a few 4s. The average score will thus probably fall between 2.5 and 3.5. When the spread of the teachers’ scores on this instrument is so constrained, it is very difficult to correlate the scores with student achievement and find meaningful, statistically significant effects. Thus, improving instruments to increase the range and precision of scores from surveys and evaluations may produce more useful results.

Finally, doing teacher observations in an attempt to link particular strategies or practices with student achievement gains is a complex endeavor. As noted above, teachers who are found to use one promising strategy for improving student learning may be using others as well, but if observation instruments are only noting the specific strategies of interest and ignoring others that may also contribute to improved achievement, this could create a false impression that the strategy of interest to the evaluator is causing the improved student achievement when, in truth, a constellation of good strategies might be operating simultaneously. Similarly, a teacher who is using a good strategy may be working in a classroom or school context that is not optimal for student learning. In such a case, it may appear that the strategy of interest is not effective; therefore, it is important to consider the repertoire of teaching strategies as well as teaching context when determining the impact of a particular teacher practice on student achievement.

### **There Are Subject Matter and Grade Level Differences in What Matters**

A teacher’s certification to teach mathematics and a teacher’s degree in mathematics are positively correlated with students’ mathematics achievement in all grades but particularly so in secondary school. This is not to say that certification does not matter for social studies, science, and other important school subjects, but the evidence is inconsistent on whether there are significant gains in student achievement based on teachers’ certification status in these areas. It remains to be demonstrated that subject-specific coursework, degrees, and certifications in these other areas are essential for high levels of student learning.

It may seem puzzling that mathematics is apparently more sensitive to instruction than, say, reading. There is, however, an interesting theory that may explain why teachers who take more mathematics courses and are certified to teach mathematics have a stronger impact on student learning. Nye, Konstantopoulos, and Hedges (2004) have theorized that “mathematics is mostly learned in school and thus may be more directly influenced by teachers [while reading] is more likely to be learned (in part) outside of school” (p. 247). Thus, if students are exposed to mathematics concepts and are given opportunities to explore and practice mathematics in only one place—the classroom—it is very important that the teachers be fully competent to guide their students’ learning. The evidence is not clear on how important it is for teachers in other subjects to have focused competence and adequate courses in their subjects.

Does this mean that requirements for mathematics teachers should be stricter than for other teachers? At this time, there is no evidence that suggests tightening requirements for mathematics teachers would improve educational outcomes for students.

Even if it were evident, the practical issue of supply and demand must be resolved before attempting to tighten requirements for

mathematics teachers. Mathematics teachers are in short supply (National Commission on Mathematics and Science Teaching for the 21st Century, 2000; The Urban Teacher Collaborative, 2000; U.S. Department of Education & Office of Postsecondary Education, 2005). The supply of mathematics teachers is unlikely to increase as long as there are few salary incentives to become mathematics teachers and many salary incentives to go into other careers in which mathematics skills are highly valued.

For years, differential pay has been considered to attract more mathematics teachers, but there is no convincing evidence that such a strategy has actually increased the number of highly qualified mathematics teachers, particularly in at-risk schools.

It should be noted that the same supply-and-demand considerations apply to special education teachers. Appropriate training and certification are particularly important for this group because of the highly specialized nature of instruction involved in working with students with disabilities, yet in some areas, appropriately certified special education teachers are in short supply.

**For years, differential pay has been considered to attract more mathematics teachers, but there is no convincing evidence that such a strategy has actually increased the number of highly qualified mathematics teachers, particularly in at-risk schools.**

### **Teacher Experience Matters, but Only in the First Few Years of Teaching**

The research summarized in Goe (2007) suggests that teachers reach their peak performance by increments within the first four or five years of teaching. After that, student learning is affected little by additional years of teaching.

This suggests that we need to continue efforts to ensure that the most *inexperienced* teachers, particularly teachers in their first year or two of teaching, are not routinely assigned to schools where the challenges are greatest, such as schools with large percentages of students living in poverty, minority students, ELLs, students with disabilities, and low-achieving students.

As part of NCLB's HQT requirements, states are under increasing pressure to ensure that highly qualified, *experienced* teachers are equitably distributed among schools. Few states appear to have effective policies in place to ensure that beginning teachers are *not* placed in hard-to-staff schools. States, however, will need to develop, implement, and evaluate targeted strategies to address the problem because of the pressure to demonstrate improvements in teacher distribution.

Teacher turnover patterns suggest that poor and minority students are more likely to be taught by inexperienced teachers (Clotfelter, Ladd, & Vigdor, 2005), and as teachers gain more experience, they move to schools with higher achievement, fewer minority students, and fewer poor students (Lankford, Loeb, & Wyckoff, 2002; Useem & Farley, 2004).

Keeping teachers in at-risk schools long enough for the students to have the benefit of their teachers' increased experience may require new policies and incentives. For example, North Carolina began paying mathematics teachers a bonus of \$1,800 per year for teaching in certain at-risk schools. The bonus appeared to have an impact on teachers' retention in these schools, and the teachers most likely to stay were those with more experience (Clotfelter, Glennie, Ladd, & Vigdor, 2006). Other similar efforts to provide incentives for teachers to remain in at-risk schools are under way. These efforts are hampered because it is not known how much money is enough to keep teachers in at-risk schools, especially because the amount may differ among schools—teachers may want more money to stay in some particularly challenging schools.

Furthermore, it is impossible to predict with certainty which teachers are likely to transfer, so the incentive money may be given to all teachers meeting a similar requirement (e.g., teaching mathematics), even if many of them have no intention of transferring. Thus, it is not simply a matter of paying \$1,800 to each teacher who intends to transfer but \$1,800 to each teacher in a particular category, regardless of his or her intentions. This is one of the serious limitations of “blanket incentives.”

Targeted incentives are far more cost-effective; they apply funds only to certain individuals. Putting such policies into place is often difficult, however, because of collective bargaining agreements and policies that discourage differential pay.

## Recommendations

### Toward a New Definition of Teacher Quality

The definition of teacher quality is currently in flux, but there are some factors that seem likely to contribute to a more progressive definition. Such a definition of teacher quality (and perhaps teacher certification) might encompass two stages: (1) an initial set of qualifications tied to the subject matter and grade level being taught that must be met before a teacher is allowed to take charge of a classroom and (2) mechanisms for evaluating a teacher’s effectiveness in producing student learning—with the caveat that teaching experience must be taken into consideration as part of this evaluation, given that teachers appear to incrementally gain increasing ability to impact student learning in the first five years or so of teaching. In this two-stage

process for determining teacher quality, teachers would be evaluated initially on their *paper qualifications* and later on their *effectiveness* once they have begun instructing students in the classroom. The effectiveness component may involve some combination of expert and/or peer evaluation, teacher portfolios, and value-added scores.

The expert and/or peer evaluation component will ensure that a teacher is meeting expectations as judged by another education professional. The teacher portfolio component will ensure that teachers also have a way of documenting what they know and can do. The value-added scores provide additional documentation of teachers’ effectiveness from the standpoint of student achievement scores.

**As part of NCLB’s HQT requirements, states are under increasing pressure to ensure that highly qualified, experienced teachers are equitably distributed among schools.**

Using any of these measures as the *sole* means of determining teacher quality would be problematic, but combining such measures may result in the identification of HQTs, which makes sense empirically as well as practically.

## Bringing Quality Online

The National Comprehensive Center for Teacher Quality's *Teaching Quality (TQ) Source* website ([www.tqsource.org](http://www.tqsource.org)) is the premier source for information on teacher quality and leadership quality.

The *TQ Source* website offers links to policy and publication databases, interactive data tools, and exciting regional and national programs and initiatives relating to teacher quality. The site also includes *TQ Source* Tips and Tools, with user-friendly guides to emerging strategies as well as established practices for enhancing the quality of teaching and learning in our schools.

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- Interactive Data Tools
- Publications Databases
- Exciting Initiatives
- *TQ Source* Tips and Tools: Emerging Strategies to Enhance Educator Quality

# Data Sources Used to Define Teacher Quality

## Surveys

### Author-Developed Teacher Surveys

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### National Assessment of Educational Progress (NAEP) Questionnaires

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### Trends in International Mathematics and Science Study (TIMSS) Questionnaires

- Marcoulides, G. A., Heck, R. H., & Papanastasiou, C. (2005). Student perceptions of school culture and achievement: Testing the invariance of a model. *International Journal of Educational Management*, 19(2), 140–152.

### **National Education Longitudinal Study of 1988 (NELS: 1988)**

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