Abstract Title Page

Title:
Replicating the Relationship Between Teachers' Data Use and Student Achievement: The Urban Data Study and the Data Dashboard Usage Study

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Abstract Body

Background/Context:
Educators have long used test scores to make educational decisions, but only within the last decade has the availability of data been systematic (Abelman, Elmore, Even, Kenyon, & Marshall, 1999). In recent years, interest has spiked in data-driven decision making in education (Marsh, Pane, & Hamilton, 2006). With technological advances and growing pressure for "data-driven" instruction under accountability reforms, many schools, districts, and states have invested significant resources in tools designed to provide educators with regular access to data (U.S. Department of Education, 2009a; 2009b; 2009c). The increased emphasis on data use is based on the belief that student data can be an important lever for improved teaching and learning. Although the relationship between data use and student achievement has face validity, little empirical evidence links educators' use of data with improved student achievement.

One recent study examined the relationship between key dimensions of interim assessment data use and student achievement. The study, known as the "Urban Data Study (UDS)," was funded by the Bill & Melinda Gates Foundation and conducted by American Institutes for Research and the Council for the Great City Schools. The study examined links between educators' data use (measured by teacher self-reported surveys) and student achievement on end-of-year state assessments. This study contributed to the field by defining a conceptual framework for the effective use of data (see Appendix B, Figure 1, for the theory of action that links data use with student achievement), creating new measures of data use practices and providing some early evidence of a relationship between data use and achievement by empirically connecting data use practices to changes in teaching and actual improvements in student outcomes.

With initial findings from the UDS suggesting an empirical link between data use and student achievement, the next step was to refine the measurement strategy and expand the type of data examined during educators' data use. The next study in this line of research is the Student Dashboard Usage Study, funded by a different foundation. The study examined educators' use of Web-based data dashboard system and employed some of the same methods as the UDS as well as some innovative measurement techniques. Although we again collected self-reported survey data from teachers about their data use, we also capitalized on the increasing availability of Web-log system usage data. Such usage data can provide an objective way to gauge the frequency, duration, and type of data review activities in which educators engage when using an online data system.

In line with the theme for the spring 2013 Society for Research on Educational Effectiveness (SREE) conference, the current study attempts to replicate the UDS findings using the new data from the Data Dashboard Usage Study. The current study will compare the initial findings from the UDS with new findings from the Data Dashboard Usage Study regarding potential links between educators' data use and their students' achievement.

Purpose/Objective/Research Question/Focus of Study:
The overarching goal of the current study is to compare and contrast findings between the UDS and the Student Dashboard Usage Study. In this project, we attempt to replicate findings from the UDS (Faria et al., 2012) to further understand the links between teacher-level data-use practices and student achievement. Both the UDS and the Student Dashboard Usage Study

answer the broad research question: *What are the relationships between teachers' data-use practices and their students' achievement?* By examining the findings from both studies together, we will better understand the relationship between data use and student achievement.

Setting:
Although both studies were conducted in multiple districts and statically modeled the relationship between teacher data use and student achievement on state tests, some key differences between the two studies should be noted. Table 1 in Appendix B provides a breakdown of district characteristics for each study. We conducted the UDS in four geographically diverse urban districts across the United States. Inclusion in the study required that districts had administered interim assessments at least three times per school year continuously for the past three years and planned to continue administering them for at least the next several years and had a data system with the capacity to meet the requirements of a quantitative study that would link school- and classroom-level data use practices with student achievement. District size ranged from one of the largest urban districts in the nation to a mid-sized district. The Student Dashboard Usage Study included five diverse districts in one southwestern state, strategically chosen by the foundation because of their demographic characteristics, location, and willingness to participate as pilot districts for the state's new data dashboard initiative.

Population/Participants/Subjects:
The UDS included teachers of Grades 4, 5, 7, or 8 (n = 1,581) in a sample of 193 randomly selected elementary and middle schools in the four participating districts. The analyses linked teacher and principal survey data about their own data use with a total of 61,798 students in those grade levels. The Student Dashboard Usage Study will include two samples. The first includes 1,361 teachers who used the online data dashboard and taught Grades 4–12 in reading or mathematics in the 2012–2013 academic year. These teachers were linked with more than 50,000 students. The second sample includes 561 randomly selected teachers who completed the self-reported data use survey and teach reading and mathematics. These 561 teachers were linked with just over 25,000 students.

Intervention/Program/Practice:
Neither study implemented an intervention, but each studied perceptions and practices related to data-use initiatives being implemented by each district. UDS focused specifically on educators' use of district-specific interim assessments and examined the link between educators' use of interim assessments and student achievement on end-of-year state tests in mathematics and reading. The breadth of the data use in the Student Dashboard Usage Study was more comprehensive than in the UDS; that is, the dashboards encompassed different types of data, including interim assessment data (i.e., the focus of the UDS) but also included attendance, behavior, grades, credits, prior achievement, student contact information, and background characteristics. Also, the Student Dashboard Usage Study will use both educators' self-reported data use by way of teacher surveys and Web-log data that captures real-time review of the data dashboards. This study empirically tests the link between teachers' data use of the more comprehensive data dashboards with student achievement on end-of-year state tests in mathematics and reading.

Research Design:
Both the UDS and the Student Dashboard Usage Study used a multilevel correlational design to empirically test links between teacher-level data use and student achievement. Neither study attempted to model a causal relationship between data use and student achievement. The proposed paper will examine the extent to which the findings from the UDS can be replicated with a new study that used some common measures of data use practices and perceptions (teacher surveys) and some new measures based on Web-log data of actual data use.

Data Collection and Analysis:
The study team had access to three types of data for these projects that are relevant to the proposed paper. In both studies, we administered multiple waves of teacher surveys about data use and collected district records, including student-level achievement scores and demographic information as well as class rosters that enabled us to link students to their teachers. In the Student Dashboard Usage Study, Web-log usage data were also available.

Teacher and principal surveys. In both studies, we developed surveys to measure key concepts in the theory of action (see Figure 1), including the frequency with which data are used and the manner and extent to which data inform instruction and decision making.[1] For subscales of data use, internal consistency was adequate with Cronbach alphas ranging from 0.70 to 0.93 for teachers and 0.76 to 0.97 for principals. The survey also included measures of teacher background characteristics, used as control variables in the analyses.

District records data. In both studies, we collected individual student-level demographic and achievement data from district databases. Our primary outcome measures are state assessment scores in reading or English and mathematics. In the UDS, these were scores from spring 2010, and in the Student Dashboard Usage Study, they were scores from spring 2013. In both studies, student characteristics and prior achievement were used as control variables in the analyses. In both studies, we used class rosters for reading or English and mathematics teachers to link teachers in the survey sample to the individual records for the students in their classrooms.

Web-log data. In the Student Dashboard Usage Study, we also received data culled directly from the data dashboard Web-logs that tracked each user's weekly activity. The data allowed us to create measures reflecting four main aspects of usage: log-ins, duration associated with use, page views, and actions. "Actions" refer to interactions with pages that did not direct users to another page. These four main aspects of usage were also used as predictors of student achievement in the Student Dashboard Usage Study.

For both studies, we used two-level hierarchical linear models that adjust for the nested nature of the data, with students at Level 1 and teachers at Level 2. All models control for key student covariates, such as prior achievement, gender, free or reduced-price lunch, and minority status. Models also include classroom-level aggregates of prior achievement as a control variable to increase the precision of the estimates of the relationship between data use and student achievement.

[1] The paper will provide additional information about instrument development.

Key differences between the models are that the UDS focused only on Grades 4, 5, 7, and 8, whereas the Student Dashboard Usage study included teachers of Grades 4 through 12. Although the key predictors in the UDS are related to teachers' self-reported data use practices, data from the Student Dashboard Usage Study allow us to conduct two sets of analyses. The first set of analyses will examine possible links between teachers' self-reported data use and student achievement (the closest replication of the UDS findings). The second set of analyses examines possible links between teachers' actual data use based on the Web-log files and student achievement. To date, all analyses are complete for the UDS. Analyses are currently under way for the Student Dashboard Usage Study and will be completed well in advance of the spring 2014 SREE conference.

Findings/Results:
In the UDS, previously presented at SREE in 2013, hierarchical linear modeling results suggested significant links between some key dimensions of teacher data use and student achievement (see Table 2 in Appendix B). Specifically, in middle grades mathematics and elementary grades reading, *Attention to Data in the Classroom* was significantly and positively related to student achievement $\beta = 0.09$, $p < 0.01$ and $\beta = 0.06$, $p < 0.05$, respectively. This key dimension was a compound construct that included the measures of *Working with Data* and *Instructional Responses*. Though not consistent across grades and subjects, *Attention to Data in the Classroom* was the strongest predictor of student achievement. Teacher perceptions of *Barriers* to using data also predicted lower student achievement in elementary mathematics, $\beta = -0.08$, $p < 0.05$. In combination, these findings partially supported the theory of action. For the proposed paper, we will replicate the models described previously using the more up-to-date and comprehensive data from the Student Dashboard Usage Study to determine whether the relationship between educators' use of data and student achievement are robust across the two studies.

Conclusions:
In the UDS, we hypothesized that specific data-use practices and perceptions would be positively related to student achievement. The findings partially supported this hypothesis. Teachers' *Attention to Data in the Classroom* were related to higher student achievement, whereas teachers' perceived data use *Barriers* were related to lower student achievement. In other words, the more that teachers and principals reported reviewing and analyzing student data and using this information to make instructional decisions, the higher their students' achievement, at least in some grades and subjects.

However, the findings varied by grade and content area, with significant links observed in both elementary grades and middle grades, as well as in mathematics and reading. To better understand the nature of the relationships between data use and student achievement, we will attempt to replicate these findings with the new data from the Student Dashboard Usage Study. Observations of similar patterns with data from the Student Dashboard Usage Study would lend confidence in the specific relationships found in the UDS. The paper and the presentation will discuss the possible reasons for consistency, or lack thereof, and will contribute to the audience and the field a set of next questions about this highly relevant policy issue concerning data-driven decision making in school settings.

Appendices

Appendix A. References

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Appendix B. Tables and Figures

Table 1: District Characteristics by Study

	Total Number of Schools	Total Number of Teachers	Total Number of Students
Urban Data Study			
District 1	126	6,500	90,000
District 2	324	14,800	311,000
District 3	155	6,000	98,000
District 4	53	1,900	24,000
Student Dashboard Usage Study			
District A	22	1,090	16,500
District B	7	220	3,000
District C	54	1,900	29,000
District D	44	1,840	32,000
District E	71	3,800	51,000

Table 2: Key Findings from the Urban Data Study.

	Mathematics	
	Elementary Grades	**Middle Grades**
Teacher Data Use Scales	***(β)***	***(β)***
Context	0.03	0.04
Supports for Data Use	0.01	–0.01
Attention to Data in the Classroom	0.04	0.09**
Barriers to Data Use	–0.08 *	–0.04
	Reading	
	Elementary Grades	**Middle Grades**
	(β)	***(β)***
Context	0.03	0.06
Supports for Data Use	–0.01	0.01
Attention to Data in the Classroom	0.06*	0.02
Barriers to Data Use	–0.02	0.00

Note. *$p < 0.05$; ** $p < 0.01$ (two-tailed)

Figure 1. Theory of Action, Revised Based on Findings From the UDS and Used to Inform Data Collection in the Student Dashboard Usage Study