Evidence Based Teaching?
Using Student Test Data to Improve Classroom Instruction

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Abstract

The past decade has seen increased testing of students and the concomitant proliferation of computer-based systems to store, manage, analyze, and report the data that comes from these tests. The research to date on teacher use of these data has mostly been qualitative and has mostly focused on the conditions that are necessary (but not necessarily sufficient) for effective use of data by teachers. Lacking from the research base in this area is objective information on how much and in what ways teachers actually use student test data, even when supposed precursors of teacher data use are in place. This paper addresses this knowledge gap by analyzing usage data generated when teachers in one mid-size urban district log onto the web-based, district-provided data deliver and analytic tool. Based on information contained in the universe of web logs from the 2008-2009 school year, we find relatively low levels of teacher interaction with pages on the web tool that contain student test information that could potentially inform practice.

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1. Introduction

Schools and teachers are increasingly being called upon to utilize student performance data in making decisions about policy and practice. Indeed, actors in the K-12 arena are likely to be seen as out of touch and behind the times if they are not engaging in "data driven decision making" or do not claim to be "data driven schools" or "data driven teachers." As recently as 2005, however, Wayman reported that "…the use of student data for educational improvement has not been widespread. Until only recently, examining student data was a difficult chore for most educators" (Wayman 2005). The recent proliferation of web-based tools to present and assist in the analysis of student performance data has eased this concern and so the questions now turn to how are schools and teachers using the new tools to improve student outcomes.

This paper provides some answers to this question by examining how teachers in one mid-size urban district, Cincinnati, use a web based tool designed to provide them with student achievement information that can potentially improve their practice. In particular I seek to answer two questions: *how much* do teachers in the Cincinnati Public Schools (CPS) use the web tool and *in what ways* do CPS teachers use the tool? Solid answers to these two questions are critical as the field moves forward in trying to better utilize the vast amounts of student performance that is now collected every year. For even as we generate more and more test data on students and urge schools and teachers to use that data in ways that will improve student achievement, the research base that could guide these efforts is very thin.

This project is the first of which I am aware that captures and analyzes objective information on teacher usage of student performance data presented through a web based tool. The primary data for this research effort come from web logs that are generated each time a CPS teacher logs into the district's web-based tool that is designed to present student data to teachers in user-friendly formats. This system, the CPS "Dashboard" system, was developed in-house and brought online at the beginning of the 2005-2006 school year. The analysis in this paper is based on web log data from the 2008-2009 school year. For that school year I analyze teacher logins to the Dashboard system, the types of pages in Dashboard that teachers view when logged in, and the amount of time teachers spend on the different kinds of pages.

A simple theory of action for using student test data to inform and improve a teacher's classroom practice would have the following components:

1. Test a teacher's students.
2. Provide the test results to the teacher in a manner that fosters meaningful analysis.
3. The teacher accesses the test data.
4. The teacher analyzes the test data.
5. The teacher draws knowledge from that analysis that can inform her practice.
6. The teacher knows how and has the ability to alter practice based upon the new knowledge.
7. The teacher acts on the new knowledge and classroom practice is altered.

A break down in any one of these steps would prevent the effective use of student test data as in input to instructional improvement. This project examines the third step in the model: to what extent do teachers access data when it is provided to them? In particular I analyze the extent to which core subject (math, English, social studies, and science) CPS teachers in grades 3 through 8 accessed the test data of their students via the Dashboard web tool during the 2008-2009 school year. In a preview of the findings, the average CPS teacher of a core subject in grades 3-8 logged into the Dashboard system just less than once per week during the 2008-2009 school year, and 43 percent of these teachers spent a total of only one hour or less during the year viewing Dashboard pages that would have test data information on their students (17 percent spent 20 minutes or less during the year on student level pages). These relatively low usage levels leave one concerned about the extent to which the average CPS elementary or middle school teacher is using Dashboard-presented student test data to inform practice.

The remainder of this paper is organized as follows. In the next section I discuss the literature on teacher use of student performance data. This is followed by a discussion of the data used for this project in section 3, a presentation and discussion of the results of the analyses of the data in section 4, and then a concluding section 5.

2. Prior Research

The recent push for schools and teachers to use student test data as inputs to decision making rests on a relatively recent and thin research base. Studies of how districts, schools, and teachers utilized data began only a decade ago and the first research in this area tended to be case studies describing the many ways in which data was being used to support education decisions (Pardini 2000; Feldman and Tung 2001; Protheroe 2001; Lachat 2002).[1] Following this early optimistic assessment regarding the role data could play in assisting school improvement efforts, Ingram et al. used interviews and focus group data from nine schools to caution against assuming that the mere presence of data from standardized tests would translate into the use of that data by schools and teachers (Ingram, Louis et al. 2004). Nevertheless, the increased testing of students combined with the falling price of computing and data storage and the proliferation of data management and analysis tools meant that schools would both be awash in student performance data and subject to pressures to use those data to increase student achievement.

One can get a sense of the rapid growth of the use of education data that was occurring during last decade by looking at looking at the growth in revenue from data management and analysis software and services in the K-12 sector. A 2003 report estimated that between 2000 and 2003 vendor revenues in this area grew from $98.8 million to $145 million (Stein 2003). This same report ventured that the (then) recent passage of the No Child Left Behind (NCLB) meant that school districts were facing new data reporting challenges that few were prepared to meet, thus suggesting a market ripe for additional investments in data management and analysis tools.

Spurred by both the testing and the reporting requirements of NCLB, and the desire to use student test data for school improvement and student achievement gains, the push was on to develop systems that could store, manage, present, and help practitioners analyze student data. The resulting development and proliferation of software and web-based tools designed to make data analysis both cheaper for districts and more user-friendly for teachers and administrators, helped foster a series of studies of how the field was using data and a focus on the factors that seemed to promote or hinder effective data use. District and school-level surveys, interviews, case studies, focus groups, and ethnographic studies were all employed to better understand what made schools and teachers "data driven" (e.g., Brunner, Fasca et al. 2005; Chen, Heritage et al.

[1] This work is summarized in Wayman et al. (Wayman, Stringfield et al. 2004).

2005; Kerr, Marsh et al. 2006; Marsh, Pane et al. 2006; Datnow, Park et al. 2007; Crawford, Schlager et al. 2008). A summary of this research falls into three areas. First, the probability of teacher data taking hold in a school is increased when a "culture of data use" is developed in the school, when the school has strong leadership that is supportive of teacher use of data, when there is sufficient professional development around data use, when there is allotted time for data use, and when teachers are provided with data systems that are easy to navigate. Second, factors that affect self-reported levels of teacher data use include the timeliness of data that is turned back to teachers, the perceived validity of the test data, and flexibility in the ability to alter instructional practice and pace, particularly vis a vis curriculum pacing guides. Third, teachers reported using data to gather information on new students at the beginning of the year, group students for instruction according to student needs, and determining class-wide strengths and weaknesses.

The one nationally representative study on data use from this period is a 2008 report prepared for the U.S. Department of Education and based on national survey data from district technology coordinators and teachers from 2005 and 2007 (U.S. Department of Education 2008). Teachers in the survey reported a substantial increase in access to student data systems between 2005 and 2007 (48 percent to 74 percent), but they also reported a greater likelihood of access to grades and attendance data than to student achievement data in 2007, and they expressed a desire for more professional development around data use.

In summary, the availability of and opportunities to use student performance data have both grown substantially in the last decade. A research base regarding what we think needs to be in place and what needs to occur if teachers are to intelligently use data has also developed apace. Noticeably absent from the research, however, is objective information on *how much* teachers actually use student achievement data when it is made available in accessible and usable formats and the hypothesized conditions for fostering teacher data use are in place. That is, despite the proliferation of data storage and management systems, the development and dissemination of software and web-based analytic tools, and the investment of substantial professional development resources aimed at promoting and supporting teacher data use, no study to date has provided reliable statistics on how much teachers in a given setting actually use computer-resident student test data or what they spend their time on when they do access the

data. This paper addresses that knowledge gap by analyzing the universe of web log records generated from teacher interactions with the Cincinnati Dashboard web tool during the 2008-2009 school year.

3. Benchmark Testing, the Dashboard System, and the Resulting Data

Cincinnati has made substantial investments in a system that (1) regularly tests their students in grades 3-8, (2) feeds this test information back to CPS teachers and administrators via the Dashboard tool, and (3) provides professional development to CPS teachers on how to utilize the information on Dashboard in ways that can inform their classroom practice. In addition to the end-of-year state level assessments, CPS students in grades 3-8 take four Benchmark assessments through the course of the school year, and students in 15 schools in the CPS "Elementary Initiative" take a pre-test in September and a post-test in January.[2] The Benchmark tests are designed to provide feedback regarding the extent to which CPS students are making satisfactory progress toward mastering material that will be on the end-of-year state exams. Using Dashboard, a teacher can access his students' data on a just-completed Benchmark exam within 24 hours from the time the teacher turns in test results to the CPS assessment office. Each teacher has access to the complete testing record, current and historical, of every student he is teaching in given year. Teachers cannot view information on students they are not teaching that year.[3]

The Dashboard tool was developed in-house during 2004 and brought online in September of 2005.[4] While the district seems to realize the importance of providing training and support to teachers around Dashboard use, CPS teachers tend to report uneven amounts of training and support, with some teachers reporting sufficient levels of support and others

[2] The 15 elementary schools in the CPS "Elementary Initiative" were low-performing schools targeted with extra resources during the 2008-2009 year.
[3] Dashboard also provides teachers with student level information in areas such as number of absences, number of detentions, etc. I do not analyze teacher usage of this information in this paper.
[4] Sarah Trimble-Oliver, CPS Academic and Assessment Administrator, and an invaluable source of information on this study, was the developer of the CPS Dashboard.

reporting little support in how to navigate and use Dashboard.[5] The primary source of training and professional development around Dashboard usage comes from the district's Instructional Support Teams (IST), seven teams of (usually) six individuals—a former principal, a math coach, a language arts coach, a science coach, a social studies coach, and an individual who specializes in special education. The role of the ISTs is to "audit schools and assist with academic improvement."[6] During the 2008-2009 period of this study all five of the IST's working at the elementary level were assigned to the fifteen "Elementary Initiative" schools, and one of their primary responsibilities was to help the teachers in these schools utilize Dashboard in ways that would inform and improve their classroom instruction.

Thus, Cincinnati has in place a connected system of regular student testing, the ability to turn that test data back to teachers in a timely manner via a tool that provides relatively easy access and usability, and district support and encouragement around teacher data use for instructional improvement. Given this system, how much and in what ways do CPS teachers access data on Dashboard?

The data source for addressing these questions derives from the web logs that are generated every time a CPS teacher logs into the Dashboard system. These web logs capture, among other things, the employee id number of the teacher who has logged in, the day and time of the login, the pages that are viewed during each Dashboard session, the sequencing of the teacher's journey through the pages, and the time the teacher spent on each page during the session.

CPS administrators supplied me with the universe of raw web log files that were generated from every teacher login that occurred between August 3, 2008 and May 31, 2009.[7] In converting these web logs into analytic data files a key task was coding the Dashboard pages into common groups. Individual pages were grouped into the following page-type categories:

- *Class level* pages that have information on a given class of a given teacher's

[5] This information is based on four different focus group discussions with teachers from four CPS elementary schools conducted in December of 2008 by the author and Amy Wooten.
[6] Taken from the district's 2006-2001 Strategic Plan.
[7] The 2008-2009 school year was from August 19th, 2008 through May 28th, 2009.

- *Students level* pages that have information on multiple students in a teacher's class
- *Individual-student level pages* that have information on individual students in a teacher's class
- *Item* pages that have information on particular test items
- *Resource* pages that have resource information for teachers such as model lesson plans.

Figure 1 gives an example of a "class" level page for class taught by a hypothetical 5th grade teacher. This page tells the teacher that on the language arts Benchmark test given on 11/30/2009, her students answered, on average, 44 percent of the questions correctly compared to 39 percent for all the students in her school and 45 percent in the district. Similar statistics for the Benchmark math test are displayed below the language arts results.

<Figures 1-5 about here>

Figure 2 gives an example of a "students" level page from this same class on the math Benchmark from 11/30/2009. Here the score of each student in the teacher's class is displayed in ascending order down the column. A click on a student, for example Suzie (fictitious name) who got 55 percent correct, would take the teacher to a page with information on Suzie.

Figure 3 gives an example of an "individual student" level page, in this case the page with information on Suzie's responses to all of the questions on the math Benchmark on which she scored 55 percent correct. A click on "1" takes the teacher to a page that displays the first question in the Benchmark which, in this case, Suzie answered incorrectly.

Figure 4 gives an example of an "item" level page, in this case the first test item in the aforementioned math Benchmark exam. The item level pages give teachers the exact test question along with the grade level "indicator" and the state "standard" being tested by that question.

Figure 5 gives an example of a "resource" page in Dashboard. In this case the resource page is a list of the grade level indicators for 5th grade math in Ohio. The bottom part of Figure 5 shows a second resource page which is the page the teacher would be taken to if she were to

click on one of the indicators. This resource page then has links to a model lesson plan to teach that indicator, along with other links to related resources for the teachers.

The pages in Figures 1-5 are meant to be examples of the page type groupings that were created for this analysis. Under each of the groupings (class, students, individual student, item, and resource) there are many different pages that can be accessed on Dashboard.

In addition to the coding pages as to "page type," other variables that were necessary or convenient for later analysis were created from the raw web logs in the process of converting the web logs into an analytic data file. Following the processing of the web log files, information from CPS teacher personnel files, course files, and student test files were merged in. The personnel and course files were used to identify teachers who taught core subjects in grades 3-8, and the course files were further used to link teachers to the students they taught in 2008-2009. The teacher personnel files were also used to generate teacher level variables such as years of experience, gender, race, etc. Once students and teachers were linked the test files were used to link student test scores from the spring 2008 end-of-year tests to a teacher's 2008-2009 students in order to get a measure of the average academic achievement level of a teacher's students at the beginning of the year.[8]

The resulting data file has complete Dashboard usage information on 429 CPS teachers who taught in grades 3 through 8 in 2008-2009, and who taught math, language arts, social studies, science, or a self-contained elementary classroom. The data set is a teacher by Dashboard-page panel with 214,779 lines of data that were generated from 14,228 separate logins between August 2008 and May 2009.

4. Results and Discussion

4.1 Teacher Use of Dashboard

[8] I thank Eric Taylor for his work in doing this matching and average test score construction based on the spring 2008 tests.

A first look at teacher Dashboard usage as captured in the web logs indicates that the average CPS teacher logged into the Dashboard system 33 times during the 2008-2009 school year and spent a total of about 7 hours on Dashboard during that time.[9] The average teacher apportioned her 7 hours during the year on Dashboard in the following ways:

- 3.2 percent on class level pages
- 26.8 percent on students level pages
- 9 percent on individual student level pages
- 6.6 percent on item level pages
- 31.6 percent on resource pages
- 5.2 percent entering student test data information,[10] and
- 17.4 percent of the time on login, password, or navigational pages containing decision nodes (links) for users, but no information beyond the potential destination pages.

Table 1 gives a more detailed view of how teachers spent time on Dashboard on a per week basis. The first row indicates that on average the 429 CPS teachers logged into Dashboard slightly less than one time per week during the 2008-2009 school year. The second column in the first row indicates that conditional on ever logging in during a week, the average number of logins is about two times per week. The mean time logged in per week across all teachers is about 10 minutes per week, and conditional on having logged in at least once during a week the mean time logged in per week is almost 30 minutes.[11]

<Table 1 about here>

The next rows in Table 1 provide statistics on the extent to which teachers are viewing student test data during the time they are logged into the Dashboard site. We are particularly

[9] The median number of logins was 28 and the median time spent logged into the Dashboard system was about 3 ½ hours.
[10] Some of the grade 3-8 teachers also teach in grades K-2 and teachers of these grades enter student test scores directly into Dashboard.
[11] Note that the 30 minutes online could be accumulated in one or more than one Dashboard session during the week.

interested in the time that teachers spend on "students," "individual student," and "item" pages, since these are the pages that provide teachers with student test data and test item information.

The average teacher spends about 2.3 minutes per week on "students" pages and slightly over half a minute per week on "individual student" pages. Among teachers who spend any time on these pages during the week, the mean times are 7.6 minutes on "students" pages and 6.33 minutes on "individual student" pages. The comparable times for the average teacher and the average conditional on spending any time are 0.57 and 12.9 minutes on "item" pages and 3.17 and 51.86 minutes on "resource" pages.

Focusing attention on "students" and "individual student" pages, since it is those pages that contain the most information on student test data, Table 1 indicates that the average teacher "hits" or views a "students" level page about 2.5 times per week and an "individual student" level page only about once every two weeks (0.58 hits per week). Among teachers who view one of these types of pages at all during a week the mean number of times that a "students" level page is viewed is 8.22 times and the mean number of times an "individual student" level page is viewed is 5.69 times.

There are two ways that teachers can use Dashboard to access student test data. They can view the information online, the focus of the analysis thus far, or they can use Dashboard to print out student test data information. The bottom rows of Table 1 provide information on this latter method of interacting with Dashboard. On average teachers go to pages that print "students" level information only about once every three weeks (0.35 times per week), and they go to pages that print "individual student" level information only once every 6 weeks (0.16 times per week). These print statistics suggest that teaches use Dashboard more as an interactive tool than as a tool for printing off student test data.

While the usage statistics in Table 1 are suggestive regarding the extent to which and the ways in which teachers use Dashboard, we can get a better sense of teacher usage by looking at patterns of teacher usage by week throughout the year. Figure 6 provides information on the pattern of Dashboard logins by CPS teachers during the 2008-2009 school year. In Figure 6 and other figures to follow, key test dates are marked with vertical lines: blue for the Fall pretest given to the 15 Elementary Initiative schools, green for each of the four Benchmark tests given

during the year, maroon for the January posttest given the Initiative schools, and red for the end-of-year state tests. Following each test a two week period is shaded in with the corresponding color. This two week period represents the period during which test results from that test will be appearing on Dashboard, with the results for most classes available within two weeks of the test administration.[12]

Figure 6 shows variation through the year in the percentage of teachers who login to Dashboard during the week. In particular, Figure 6 suggests higher percentages of teachers logging into Dashboard in the weeks following a Benchmark assessment than at other times during the year, ranging from about 45 percent on the Fall pretest and the 1st Benchmark to slightly over 70 percent of the core subject CPS teachers in grades 3-8 logging in immediately after the last Benchmark in March.

Figure 7 gives weekly information on the median time spent logged in per week, among teachers who ever logged in during that week. Except for just before and just after the final Benchmark in March, all of the median login times in Figure 7 are around or less than 10 minutes per week.[13]

Figures 6 and 7 provide information on *how much* teachers use Dashboard, and a glance at these figures suggests that on any given week somewhere around 10 to 40 percent of the CPS teachers we are studying logged into the system that week and that the "average" teacher who logged in spent somewhere around 6 to 8 minutes online with Dashboard during the week. Since these are the first objective teacher usage statistics of which we are aware, there is no benchmark comparison for determining whether this represents substantial or casual use of this tool. One way to think about the level of usage is to consider two elementary school teachers who each have self contained classrooms of, say, 21 students. Assume that one-third of each teacher's students are struggling and that Benchmark tests have just been administered. With 50 percent or

[12] Following a Benchmark test the teacher turns the test sheets into CPS central office where they are scanned for scoring and posted to Dashboard within 24 hours. Teachers are responsible for scoring the relatively few open-response test items of their students and this can sometimes cause a delay in getting the tests in to central office. Also, a teacher may delay turning in test sheets to allow a student who was absent a chance to take the Benchmark test upon return to school.

[13] Mean login times range from close to zero during the middle of October to about 40 minutes in the week following the last Benchmark.

fewer teachers logging in each week according to Figure 6, we can assume that only one of the two teachers would go to Dashboard to get information that might help her with her seven struggling students, and Figure 7 suggests that the teacher who did turn to Dashboard for information spent only about one minute per struggling student logged into the system (7 struggling students and a median login time of around 7 minutes per week for those who ever logged in that week). While only a rough barometer, this back-of-the-envelope example and estimation suggests that the average CPS teacher may not be making extensive use of Dashboard.

A second question pursued in this project is *how* do teachers use Dashboard, and in particular, to what extent do teachers view student test data information? Since the bulk of student test data is presented on either "students" pages or "individual student" pages we will focus on teacher usage of those pages for now. Figure 8 displays information on the mean amount of time CPS teachers spent each week viewing Dashboard "students" pages. Averaged across all teachers, including those who never logged on during the week, Figure 8 indicates that on average CPS teachers spent from one to four minutes per week viewing "students" pages, with the exceptions of 6 and 9 minutes per week spikes after the 2nd and 4th Benchmark tests.

Under a model where more intensive Dashboard usage is represented by teachers who "burrow" deeper down in Dashboard to the level where test data on individual students is presented, the information in Figure 9 is somewhat discouraging. In Figure 9 the average CPS teacher spends less than 2 minutes per week viewing "individual student" pages, even during peak weeks. As we learned earlier in Table 1, the mean time per week spent on "individual student" pages is only 0.6 minutes per week for all teachers, and 6.33 minutes per week for all teachers who viewed an "individual student" page in a given week. There is a long right-hand tail to the conditional distribution, however, as the median time on "individual student" pages among those with non-zero values in a given week is only 1.4 minutes, and the 25th percentile is half a minute. These statistics and Figure 9 suggest that the bulk of CPS teachers are rarely spending substantive amounts of time on Dashboard viewing student performance data at the individual student level.

Figure 10 provides information on how teachers apportion their time on Dashboard between viewing student level information and using the web-based tool for other purposes such as looking at lesson plans or reviewing state standards. According to Figure 10, teachers who login to Dashboard spend from 20 to 50 percent of their time looking at student performance data, figures that seem reasonably high given all of the other types of information a teacher can access on Dashboard. Thus, concerns about how much teachers are using student performance data on Dashboard to inform and improve their practice should focus more in whether they login at all and how much time they spend while logged in, rather than in what they are doing while they are on Dashboard.

As mentioned earlier, one issue that might cloud our understanding of how teaches use student performance data to inform their practice and how they utilize the Dashboard tool in this endeavor is the extent to which teachers use Dashboard as a tool for accessing and printing out performance data. Supporting what we learned in Table 1, Figure 11 suggests that teachers' primary use of Dashboard is as an interactive tool rather than a "printing tool." In every week of the school year the number of "viewing" hits by teachers on "students" and "individual student" pages easily dominates the number of "printing" hits on these pages.

Figure 12 summarizes the information thus far about the extent to which CPS teachers use Dashboard to view and analyze student performance data. Figure 12 displays the distribution of total time during the year spent by CPS teachers on "students" and "individual student" pages combined. According to this figure 17 percent of the core subject grade 3-8 CPS teachers (73 of 429 teachers) spent a total of 20 minutes or less during the entire school year viewing "students" or "individual student" pages and 43 percent of the teachers (187 out of 429) spent an hour or less during the year on these student level pages. There is a long right hand tail to this distribution, however, and a third of the teachers spent more than two hours during the year on these pages and 20 percent spent more than three hours

4.2 Further Examinations

The fact that we can combine other Cincinnati data sources with the Dashboard web log information allows us to examine correlates of Dashboard use. From the CPS personnel files we obtain information on teacher characteristics such as gender, race/ethnicity, years of experience teaching, and education level. From the CPS student files we obtain individual level student test score information from the state tests in the spring of 2008. We then use the course files to match teachers to the students they teach in the 2008-2009 school year. With these two pieces of information we can construct measures of the average achievement level of a teacher's students at the beginning of the 2008-2009 school year. This "baseline" (beginning of the year) mean student achievement variable is the average of the prior year's standardized state exam math score and standardized state exam reading score (both mean zero, standard deviation one variables). If both scores were not available to construct the average then the available score was used instead. [14] This baseline measure of student achievement has a mean of -0.052 and a standard deviation of 0.512.

Table 2 shows the results from OLS regressions of the natural log of total time spent during the year on "students" and "individual student" pages on a set of teacher characteristics including:

- the baseline mean achievement level of the teacher's students at the beginning of the year along with an indicator for whether the baseline level was imputed,
- an indicator for whether a teacher taught in grades 3 through 6 relative to grades 6 through 8,[15]
- indicators for gender and race/ethnicity, years of teaching experience, and indicators for education level.

Based on the estimates in column A the only predictor total time spent during the year viewing "students" and/or "individual student" pages is the grade level indicator. If we associate

[14] We are unable to link 59 teachers in our sample to prior year student test score data. For these teachers we impute a mean student achievement level using the full set of teacher characteristic variables available to us and we then include a dummy variable imputation indicator in all regressions.
[15] The dummy variable indicator equaled one for the 311 teachers who taught in any configuration of grades 3 through 6, and zero for the 9 teachers who taught in a grade 6 through 8 configuration and zero for the 89 teachers who taught in grades 7 or 8 or a grade 7 and 8 combination.

teaching in grades 3 through 6 with traditional elementary grades and the configuration of grades 6 through 8 or grades 7 and 8 as middle school grades, then elementary grade teachers in CPS spent less time looking at individual student data on Dashboard than did teachers in the middle grades. With a mean total time spent on the two types of pages of about two hours during the course of the year (mean = 122.0 minutes with standard deviation = 137.2), teachers who taught in grades 3 through 6 spent about 38 percent less time viewing these student level pages than did observationally similar teachers who taught in middle schools or taught middle school grades.[16]

<Table 2 about here>

To explore the possibility that school fixed effects could explain the extent to which teachers spent time during the year viewing student level data a school fixed effects model was fit. The estimates from this model in column B are very similar to the column A estimates.

A second question we can pursue is potential time dependence as a factor predicting CPS teacher use of Dashboard as a tool for viewing student performance data. For example, it might be the case that relative to other times of the year, CPS teachers spend more time examining data on Dashboard either just before a Benchmark exam or state test (as they prepare students for the upcoming test) or more time just after a Benchmark (when they would supposedly be viewing data from just-completed Benchmark). We explore these possibilities by fitting a model on a teacher-week panel where we have created indicator variables for whether a given week in the school year was a week before a Benchmark or state test, within two weeks after a Benchmark or state test, or the week when the Benchmark or state test was administered. Estimates from this simple model are in Table 3. In this model the excluded time category is any week that is not before, during, or within two weeks after a Benchmark or state test. For narrative purposes we call these weeks the "off test" weeks.

<Table 3 about here>

The first estimate in column A of Table 3 indicates that CPS teachers are not spending more time per week viewing student level pages in Dashboard in the week just prior to a

[16] Calculated as exp(-0.486)-1.

Benchmark test than during the "off test" weeks. In fact they spend about 13 percent less time in any week before a Benchmark than they do during any "off test" week. CPS teachers do, however, spend more time viewing student level pages in the two weeks after a Benchmark test. They spend about 50 percent more time per week in the two weeks just after a Benchmark test than during the "off test" weeks.[17] The estimates in the first column also indicate that teachers spend less time during and after the state exams than during "off test" weeks.

The second and third columns of Table 3 explore the extent to which the timing of teachers' use of Dashboard to view student level pages can be explained by teacher characteristics (column B) or by school fixed effects (column C). The estimates from these specifications are very similar to those of the basic model in column A.

5. Conclusions and Further Research

This paper has drawn upon a unique data set to present some of the first objective estimates of how much and in what ways teachers actually use student performance data presented through a relatively easy to use web tool. Though only descriptive in nature, the information in this paper should help to fill a void in our understanding of how student performance data might inform and improve classroom practice. In any theory of action model teachers must actually view student performance data if there is any hope that they will use these data to inform their practice. To date there has been virtually no information on this critical step in using student performance data as a tool to improve teachers' instructional practice. This paper fills that knowledge gap, at least as it concerns one mid-size urban school district.

While there is no other district against which to compare the teacher usage statistics from Cincinnati, it is fair to say that the results from the 2008-2009 school year in Cincinnati are less than encouraging. Three years after the launching of the Dashboard system, and well into a substantial district effort to encourage and support teachers in the use of Dashboard, the level of teacher usage is relatively low. In particular, when we examine the extent to which teachers are viewing (or printing) student level pages, the Dashboard pages that contain student performance

[17] Calculated as exp(0.415)-1

information, the results are disappointing. On average teachers view pages with student level information (i.e., either "students" or "individual student" pages) only about 3 minutes per week. Perhaps more telling, CPS teachers view individual student-level pages an average of only 36 seconds per week during the course of the school year. Conditional on a teacher viewing an individual student-level page the mean time per week is 6.3 minutes. It is hard to say whether this 6.3 minutes per week is itself very much time. If a teacher was focusing her time on one, two, or three students for those 6 minutes, then perhaps she is taking an in-depth look at their performance. If, however, the teacher is skimming over the results of many students over the course of 6 minutes then it is not clear how much she is learning that can inform her classroom practice.

Focus group research we carried out in CPS during December of 2008 suggests some reasons that CPS teacher usage of Dashboard may be sub-optimal. In four different meetings with 6 to 8 teachers from each of four different CPS elementary schools, teachers were quite candid in expressing their opinions about and experiences with Dashboard. One factor that arose in three of the four groups was an expressed concern that the Benchmark tests lacked some validity because they often tested material that the teachers had yet to cover in class.[18] A second factor that was supported across several of the groups was a perceived lack of instructional time to act on information that a teacher might gain from Dashboard data. In particular, teachers expressed frustration with the lack of time to "reteach" topics and concepts to students that had been identified on Dashboard as in need of "reteaching" based on their performance on a given indicator. A third common barrier to Dashboard use cited by the focus group teachers was a lack of time for Dashboard-related data analysis.

Regarding this last point, in spite of the investment in the student testing and data provision system of which Dashboard is central, it is not clear what model the district has in mind when it comes to time use and teachers interacting with Dashboard. If teachers are expected to spend time different amounts of time analyzing student performance data now relative to some pre-Dashboard time then either:

[18] We note that all of the schools in the district are presumed to be operating on the same grade level curriculum pacing guides so theoretically this should not be an issue.

1. the district expects time-saving efficiency gains from Dashboard such that time spent on Dashboard during the work day makes other essential tasks less time consuming,
2. the district expects teachers to reallocate time from some other task(s) that is (are) not essential to time spent on Dashboard,
3. the district feels that there is slack time during a teacher's work day that can be used for Dashboard data analysis, or
4. the district expects teachers to analyze Dashboard data during out-of-school time.

Articulating to administrators, teachers, parents, and other stakeholders in the district which of the above scenarios is one envisioned by district leaders could help define future priorities and provide greater teacher buy in. For example, if teachers anticipate that the district has an unstated scenario #4 in mind, then it is unlikely that data analysis on Dashboard will ever be a significant factor in informing a teacher's practice even if all of the supposed precursors of effective data use such as good building leadership, district support and encouragement, a good data analysis tool, etc., were in place.

This work is admittedly a first and less than complete look at the phenomenon of how teachers interact with student data on a web tool. Future research needs to explore more causal linkages between teacher use of performance data and student achievement. We will begin to explore these causal linkages in Cincinnati as we bring additional student test data into our web log analysis. In the meantime, this study should provide information to districts that are investing in benchmark testing systems and web-based data systems aimed at teacher use. The evidence from this study is that one should be careful in assuming how much teachers may actually base their teaching on the evidence that comes from a even a carefully designed system that tests students and then provides that data to teachers as inputs to their instructional practice.

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Figure 1. Example of a “class” level page from Dashboard.

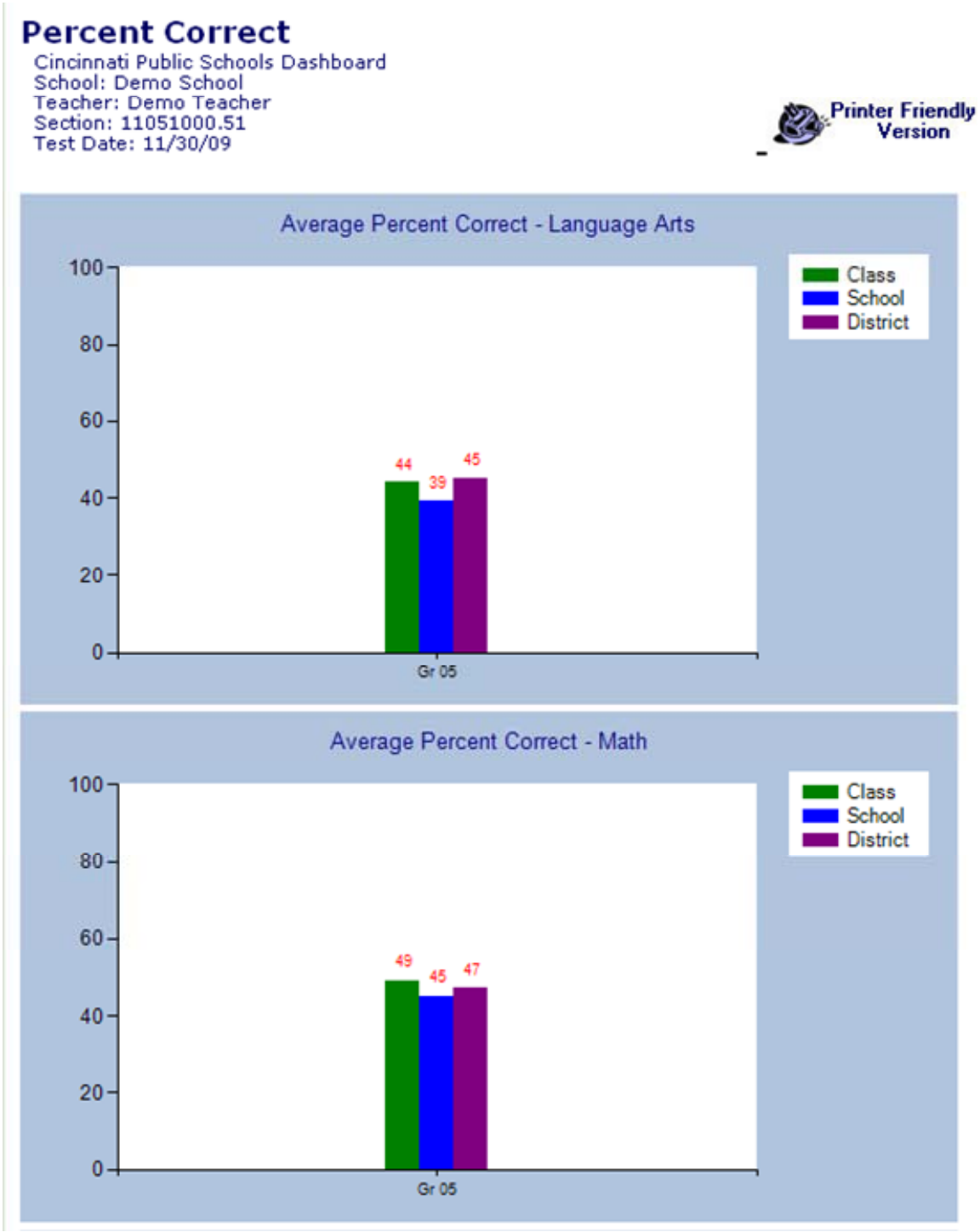
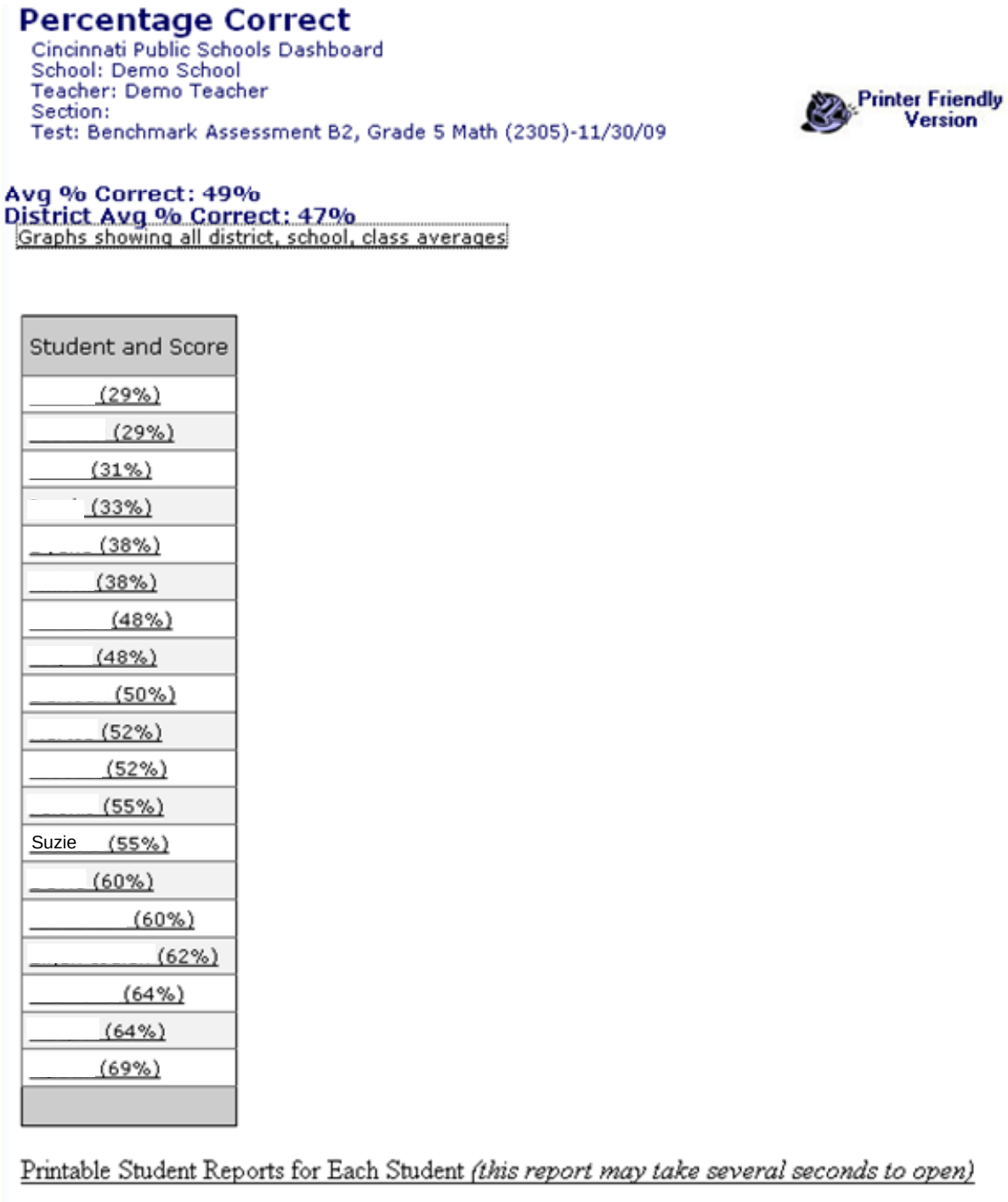


Figure 2. Example of a “students” level page from Dashboard.



Percentage Correct

Cincinnati Public Schools Dashboard
School: Demo School
Teacher: Demo Teacher
Section:
Test: Benchmark Assessment B2, Grade 5 Math (2305)-11/30/09

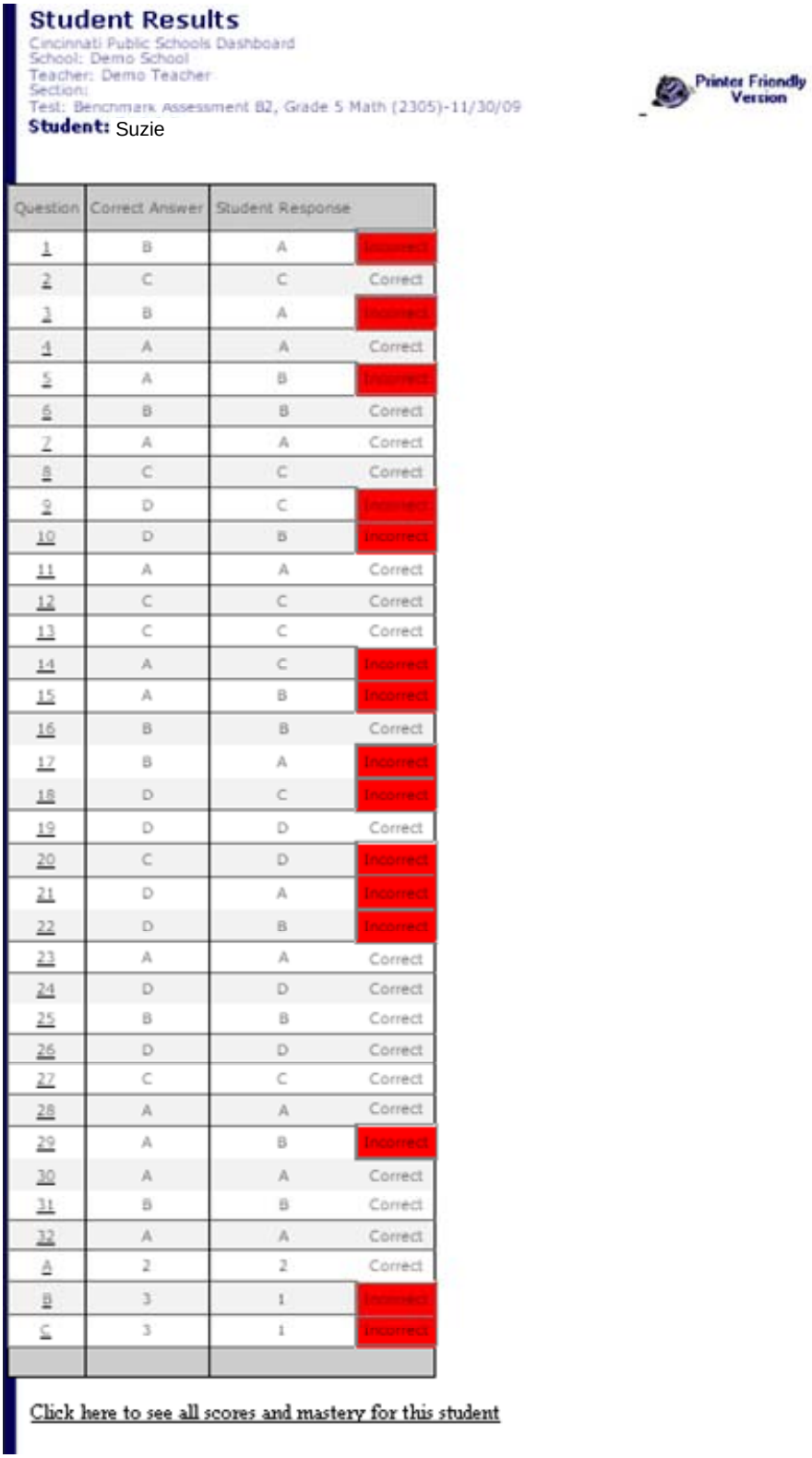
Printer Friendly Version

Avg % Correct: 49%
District Avg % Correct: 47%
Graphs showing all district, school, class averages

Student and Score
(29%)
(29%)
(31%)
(33%)
(38%)
(38%)
(48%)
(48%)
(50%)
(52%)
(52%)
(55%)
Suzie (55%)
(60%)
(60%)
(62%)
(64%)
(64%)
(69%)

Printable Student Reports for Each Student *(this report may take several seconds to open)*

Figure 3. Example of “individual student” page from Dashboard.



Student Results

Cincinnati Public Schools Dashboard
School: Demo School
Teacher: Demo Teacher
Section:
Test: Benchmark Assessment B2, Grade 5 Math (2305)-11/30/09
Student: Suzie

Printer Friendly Version

Question	Correct Answer	Student Response	
1	B	A	Incorrect
2	C	C	Correct
3	B	A	Incorrect
4	A	A	Correct
5	A	B	Incorrect
6	B	B	Correct
7	A	A	Correct
8	C	C	Correct
9	D	C	Incorrect
10	D	B	Incorrect
11	A	A	Correct
12	C	C	Correct
13	C	C	Correct
14	A	C	Incorrect
15	A	B	Incorrect
16	B	B	Correct
17	B	A	Incorrect
18	D	C	Incorrect
19	D	D	Correct
20	C	D	Incorrect
21	D	A	Incorrect
22	D	B	Incorrect
23	A	A	Correct
24	D	D	Correct
25	B	B	Correct
26	D	D	Correct
27	C	C	Correct
28	A	A	Correct
29	A	B	Incorrect
30	A	A	Correct
31	B	B	Correct
32	A	A	Correct
A	2	2	Correct
B	3	1	Incorrect
C	3	1	Incorrect

Click here to see all scores and mastery for this student

Figure 4. Example of “item” page from Dashboard.

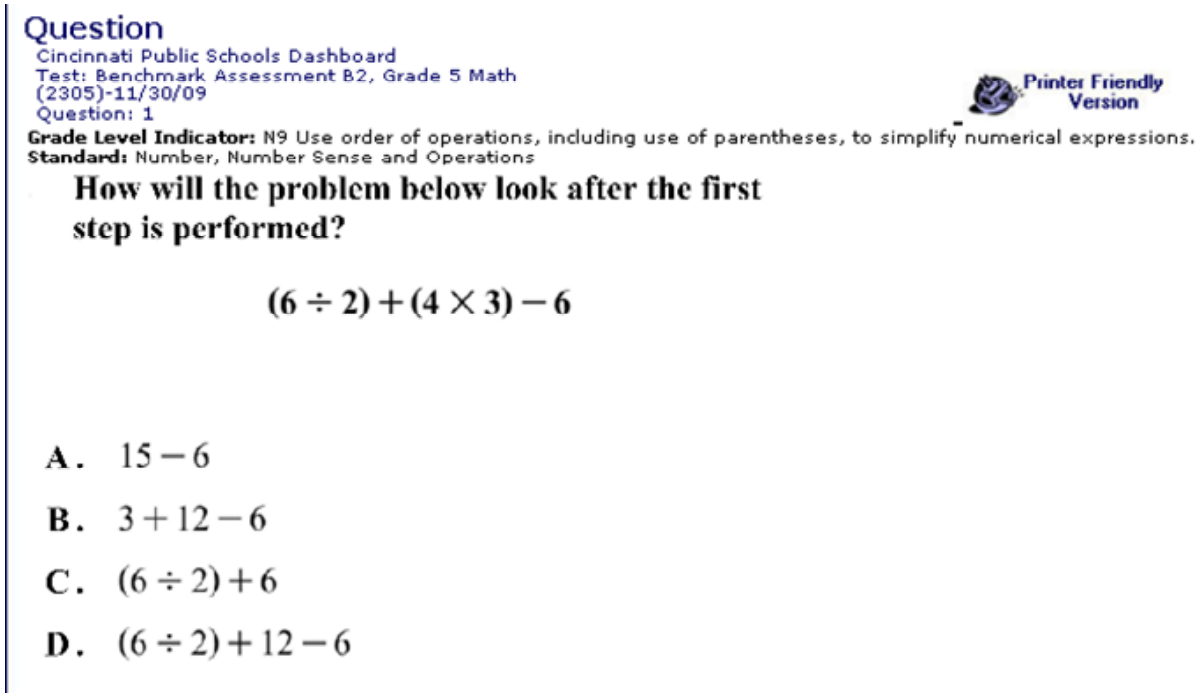
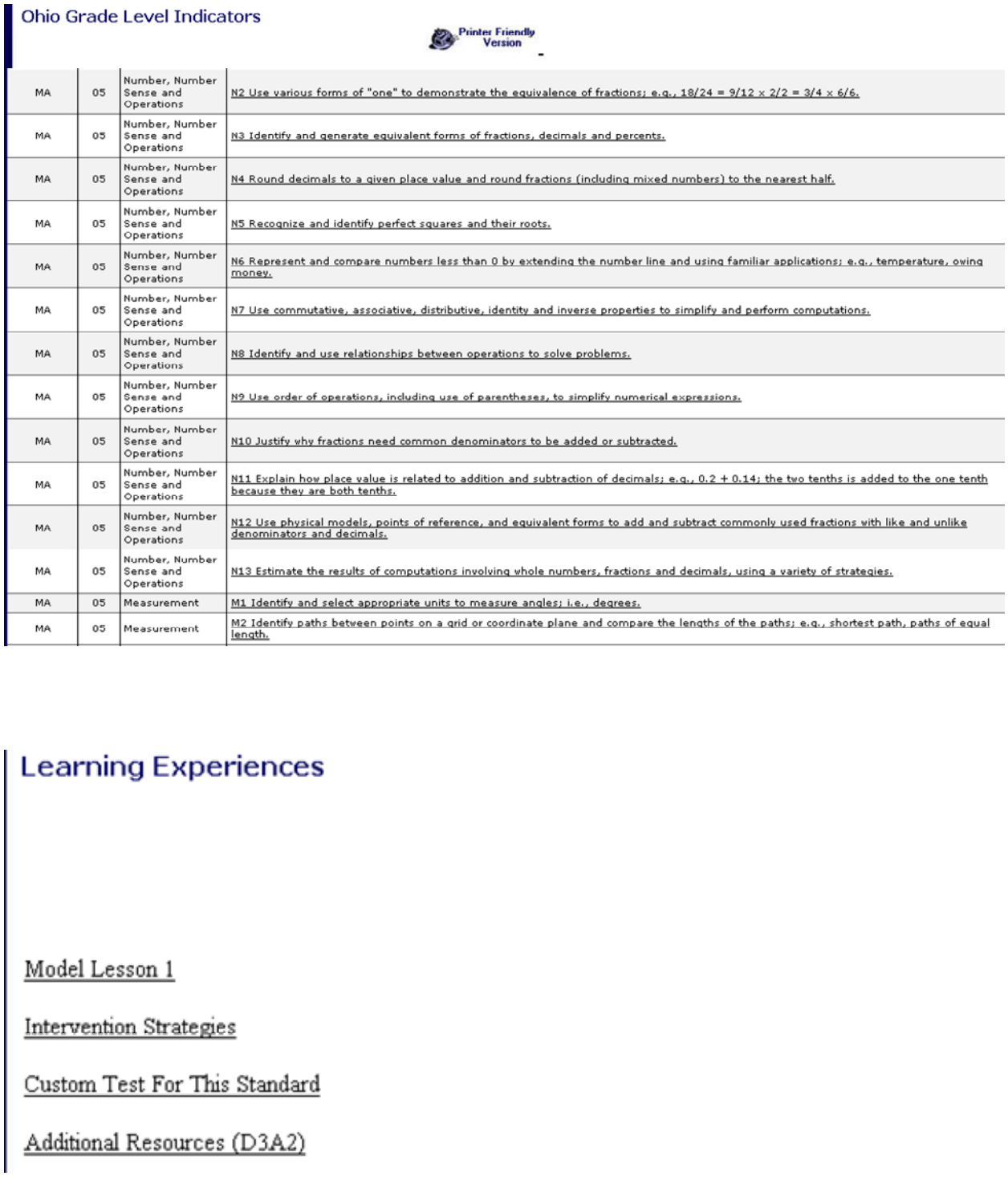


Figure 5. Example of “resource” page from Dashboard.



Ohio Grade Level Indicators

Printer Friendly Version

MA	05	Number, Number Sense and Operations	N2 Use various forms of "one" to demonstrate the equivalence of fractions; e.g., 18/24 = 9/12 x 2/2 = 3/4 x 6/6.
MA	05	Number, Number Sense and Operations	N3 Identify and generate equivalent forms of fractions, decimals and percents.
MA	05	Number, Number Sense and Operations	N4 Round decimals to a given place value and round fractions (including mixed numbers) to the nearest half.
MA	05	Number, Number Sense and Operations	N5 Recognize and identify perfect squares and their roots.
MA	05	Number, Number Sense and Operations	N6 Represent and compare numbers less than 0 by extending the number line and using familiar applications; e.g., temperature, owing money.
MA	05	Number, Number Sense and Operations	N7 Use commutative, associative, distributive, identity and inverse properties to simplify and perform computations.
MA	05	Number, Number Sense and Operations	N8 Identify and use relationships between operations to solve problems.
MA	05	Number, Number Sense and Operations	N9 Use order of operations, including use of parentheses, to simplify numerical expressions.
MA	05	Number, Number Sense and Operations	N10 Justify why fractions need common denominators to be added or subtracted.
MA	05	Number, Number Sense and Operations	N11 Explain how place value is related to addition and subtraction of decimals; e.g., 0.2 + 0.14; the two tenths is added to the one tenth because they are both tenths.
MA	05	Number, Number Sense and Operations	N12 Use physical models, points of reference, and equivalent forms to add and subtract commonly used fractions with like and unlike denominators and decimals.
MA	05	Number, Number Sense and Operations	N13 Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies.
MA	05	Measurement	M1 Identify and select appropriate units to measure angles; i.e., degrees.
MA	05	Measurement	M2 Identify paths between points on a grid or coordinate plane and compare the lengths of the paths; e.g., shortest path, paths of equal length.

Learning Experiences

Model Lesson 1

Intervention Strategies

Custom Test For This Standard

Additional Resources (D3A2)

Figure 6. Percentage of CPS teachers who logged into Dashboard by week.

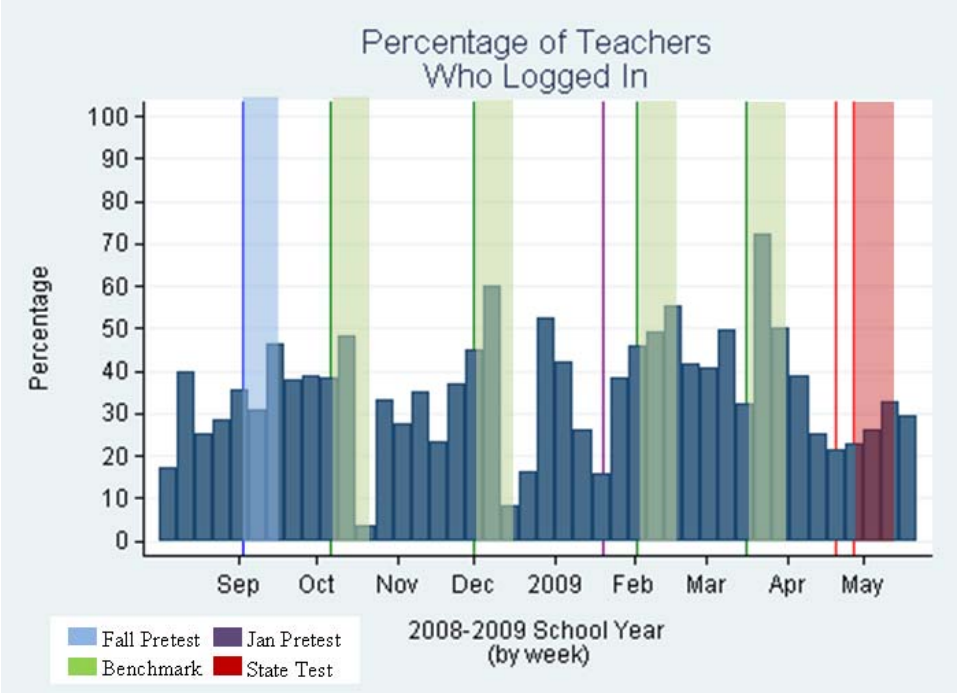


Figure 7. Median time logged in among teachers who ever logged into Dashboard during a week, by week.

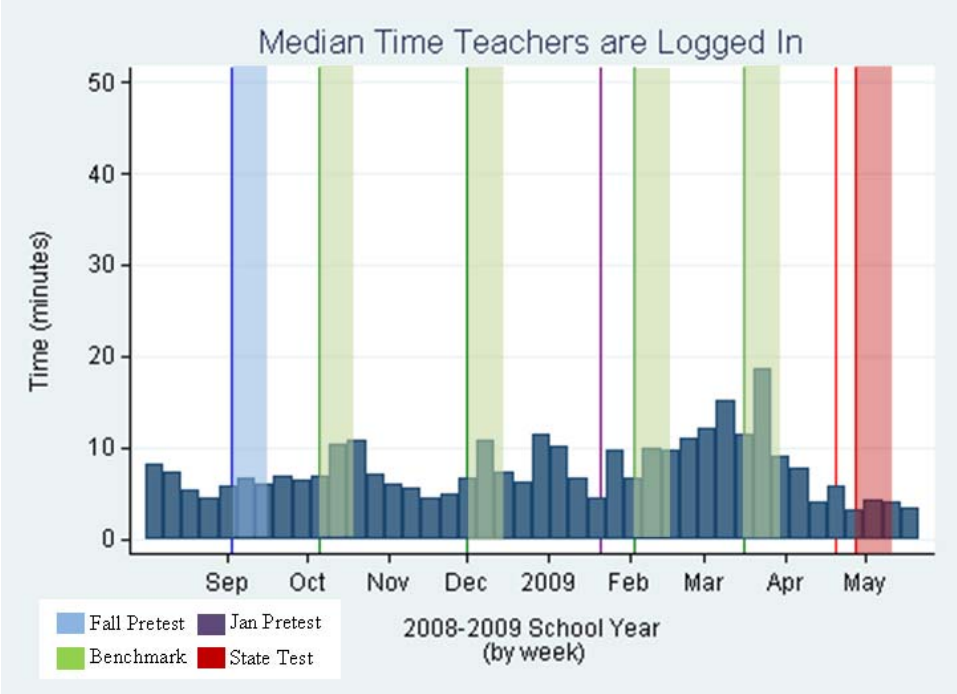


Figure 8. Mean time spent on “students” pages by week.

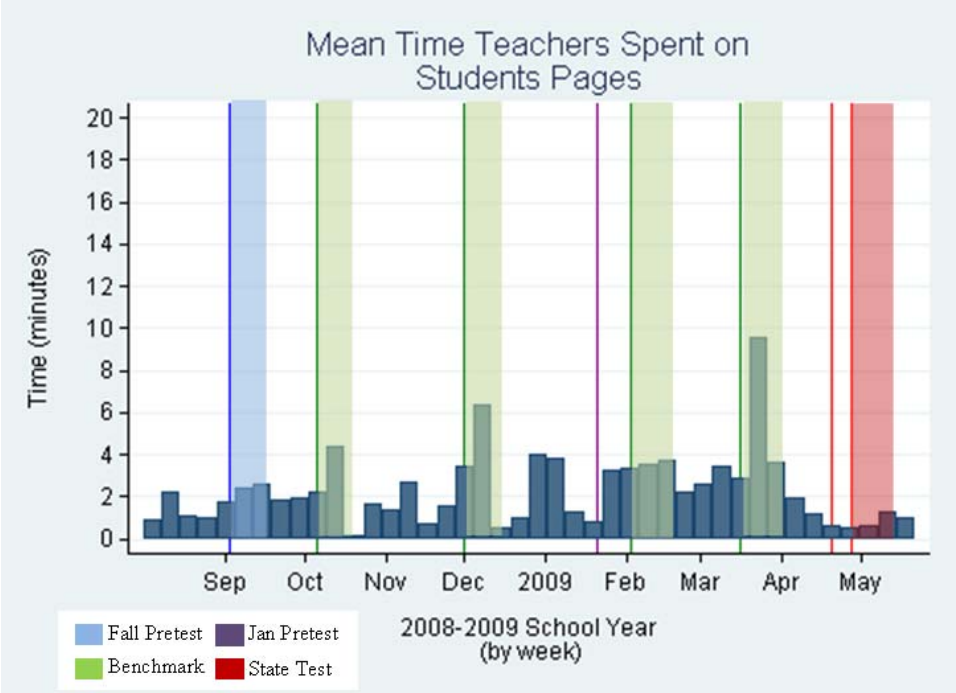


Figure 9. Mean time spent on “individual student” pages by week.

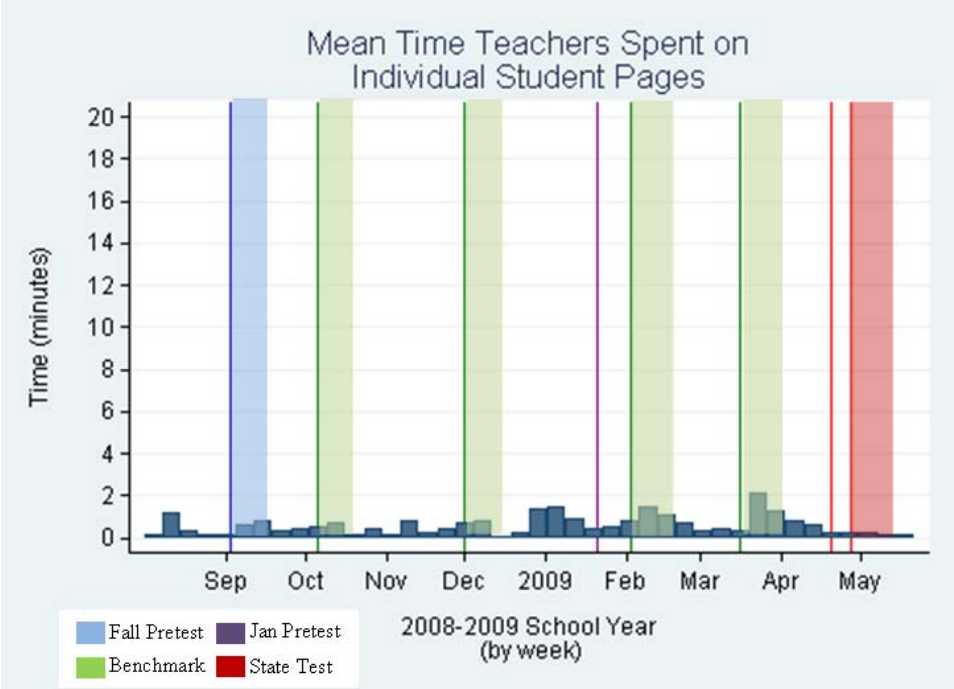


Figure 10. Proportion of total login time spent on “students” and “individual students” pages.

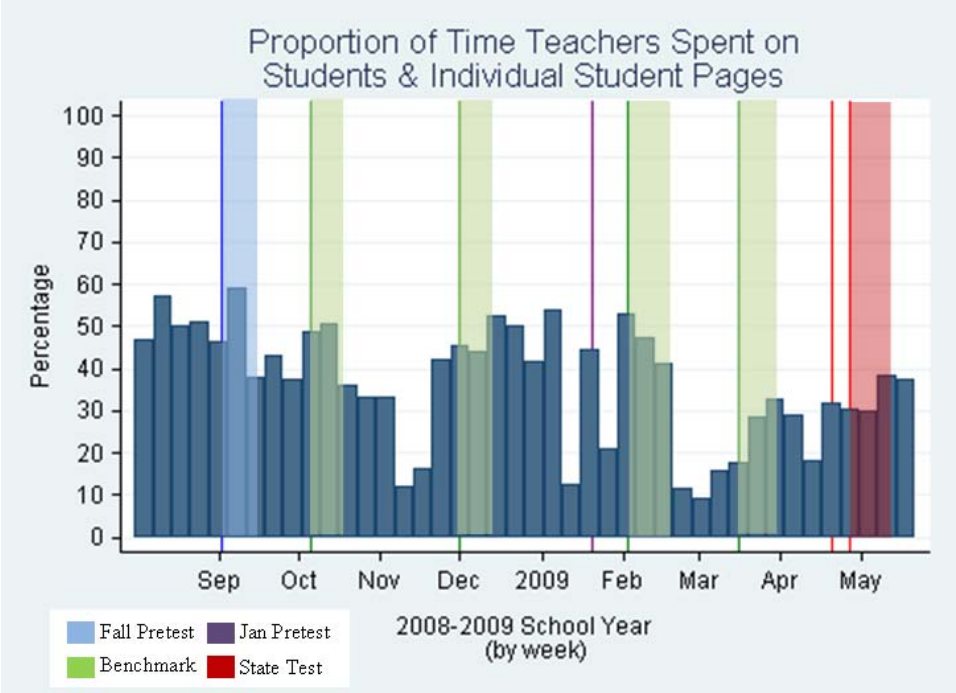


Figure 11. Comparisons of mean viewing page hits versus mean printing page hits for “students” and “individual student” pages by week.

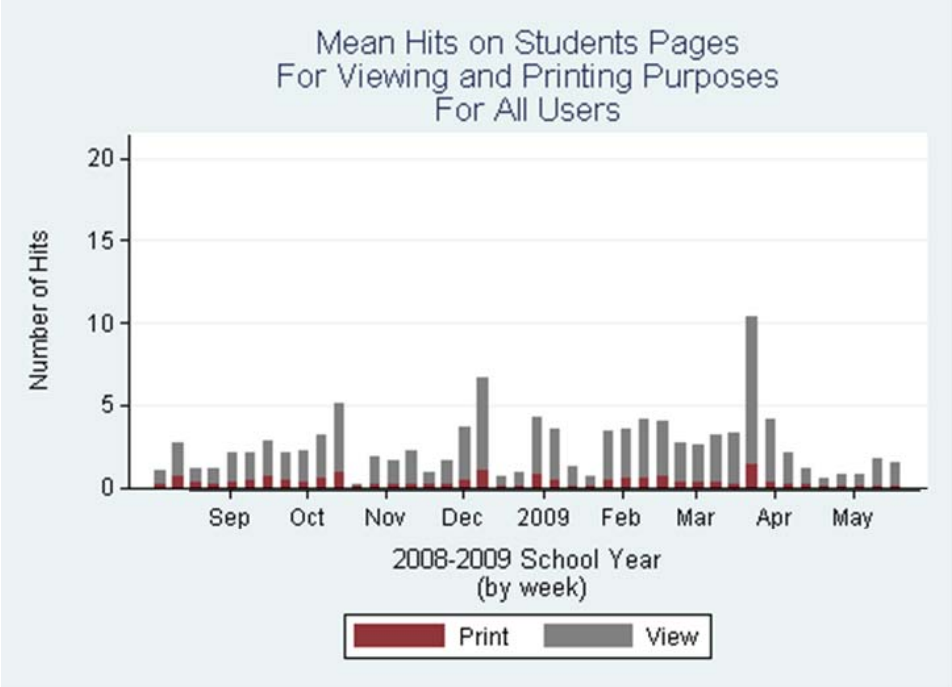


Figure 12. Distribution of total time spent on “students” and “individual student” pages during the 2008-2009 school year.

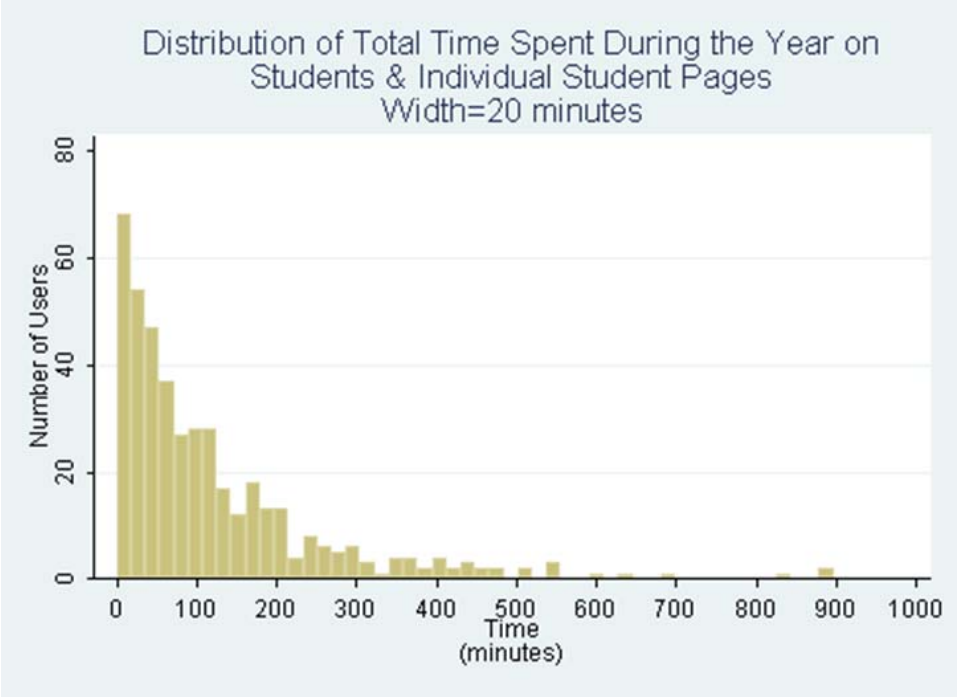


Table 1. Descriptive statistics on various per week Dashboard usage measures for all teachers and conditional on teachers who have non-zero values of the measure under consideration (all time is in minutes).

	All teachers	Conditional on having a non-zero value
Average # logins	0.79 (1.60)	2.22 (2.01)
Mean time logged in	9.99 (115.38)	28.29 (192.78)
Mean time on class pages	0.25 (2.03)	2.84 (6.20)
Mean time on student pages	2.31 (8.37)	7.64 (13.83)
Mean time on individual student page	0.60 (5.14)	6.33 (15.58)
Mean time on item pages	0.57 (6.05)	12.90 (25.85)
Mean time on resource pages	3.17 (96.96)	51.86 (388.82)
Mean hits on class pages	0.28 (1.31)	2.97 (3.19)
Mean hits on student pages	2.52 (6.70)	8.22 (9.98)
Mean hits on individual student pages	0.58 (4.32)	5.69 (12.41)
Mean hits on item pages	0.49 (3.76)	10.48 (14.08)
Mean hits on resource pages	0.33 (2.11)	4.83 (6.51)
Mean hits on print class pages	0.04 (0.46)	2.66 (2.42)
Mean hits on print student pages	0.35 (1.56)	4.04 (3.63)
Mean hits on print individual student	0.16 (1.71)	3.77 (7.56)
Mean hits on print item pages	0.13	10.83

	(3.41)	(29.36)
Mean hits on print resource pages	0.00	4.00
	(0.14)	(4.82)

Table 2. OLS estimates from regressions with log total time during the year spent on "students" and/or "individual student" level pages as the dependent variable (robust standard errors in parentheses).

	A[1]	B
Baseline average student achievement level	-0.372	0.144
	(0.270)	(0.204)
Indicator for imputation of average achievement level	-0.261	-0.330~
	(0.217)	(0.186)
Elementary grade teacher	-0.486**	-0.344*
	(0.180)	(0.173)
Female	0.100	0.032
	(0.237)	(0.207)
Black	0.100	0.014
	(0.169)	(0.158)
Hispanic or Asian	-0.596	-0.421
	(0.540)	(0.648)
Years of experience	-0.006	-0.001
	(0.010)	(0.009)
Bachelors degree plus	-0.212	-0.190
	(0.281)	(0.304)
Masters degree	-0.028	-0.012
	(0.272)	(0.280)
Masters degree plus	-0.0758	-0.096
	(0.290)	(0.317)
School fixed effect	No	Yes
N	409	409
R-squared	0.061	0.179

1. Standard errors clustered at the school level.
** = significant at the 0.01 level
* = significant at the 0.05 level
~ = significant at the 0.10 level

Table 3. OLS estimates from regressions with log total time during the week spent on "students" and/or "individual student" level pages as the dependent variable (robust standard errors in parentheses).

	A[1]	B[1]	C
1 week before a Benchmark exam	-0.128*	-0.152**	-0.158**
	(0.056)	(0.056)	(0.056)
The week during a Benchmark exam	0.022	-0.006	-0.006
	(0.065)	(0.065)	(0.065)
2 weeks after a Benchmark exam	0.415**	0.393**	0.389**
	(0.052)	(0.052)	(0.052)
1 week before the state exams	0.056	0.049	0.040
	(0.092)	(0.093)	(0.092)
2 weeks during the state exams	-0.285*	-0.260*	-0.264*
	(0.125)	(0.124)	(0.124)
2 weeks after the state exams	-0.558**	-0.536**	-0.516**
	(0.116)	(0.116)	(0.114)
Teacher Variables[2]	No	Yes	Yes
School fixed effect	No	No	Yes
Number of teachers	409	409	409
Number of observations	5,569	5,463	5,463
R squared	0.025	0.056	0.074

1. Standard errors clustered at the teacher level.
2. Including beginning of year average student ability of teacher's students, years of teaching experience, and indicators for elementary teacher, African-American, Hispanic or Asian, whether average student ability was imputed, and education level of teacher.
** = significant at the 0.01 level
* = significant at the 0.05 level
~ = significant at the 0.10 level