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A Practical New Approach to Teaching Data Analysis to Future School Leaders:
Using Common Technology to Guide Data-Driven Decision Making

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Abstract

This paper discusses a course designed to prepare public school principals to use data-driven decision making to analyze authentic school data and to practice making educational decisions based on the analysis. The rapidly growing amount of data available to schools and the importance of accountability in education make data-driven decision making an essential skill for school leaders to possess. Unfortunately, preparation programs usually offer traditional data courses that emphasize methods more appropriate for researchers. This course features training in widely available technology, primarily Microsoft Excel, using authentic data from schools, including the schools at which the participants perform their internships.

The new millennium ushered in many changes for school leaders, including a growing expectation and pressure to use data-driven decision making to guide instructional improvement. Educational standards require administrators to use data when making leadership decisions, including assessment and evaluation (ISTE, 2002). The accountability and data reporting requirements of the No Child Left Behind Act provide additional incentives to use data to guide decisions (Mandinach, Honey, Light, & Brunner, 2008). In addition, the greater availability of technology has made data-driven decision making more feasible for school leaders (Wayman, Stringfield, & Yakimowski, 2004).

Problems with Traditional Approaches

Preparation programs for school leaders must respond to this new reality and offer training in data-driven decision making that meets the needs of educational practitioners. Data courses in administrator (and teacher) preparation programs all too often focus on statistical analyses that are

more appropriate for researchers, rather than on the type of data analysis that schools use to improve student outcomes (Creighton, 2001). A more practical approach for prospective school leaders would involve applying basic statistical analyses to authentic school data (McNamara, 2000) and focusing on the educational significance of the results (Earl & Katz, 2006). This curriculum would better prepare prospective school leaders for the manner in which they will use data in their careers.

Another tendency in traditional research courses in school leadership programs is to use statistical software packages that go far beyond the needs of school administrators. These programs are not standard software packages included on most computers. They tend to be expensive (for example, the *SPSS Graduate Pack* costs $199), not especially user-friendly, and more powerful than school administrators require. This combination of factors makes it highly improbable that most school leaders will use such statistical software in their professional environment.

Changes that Should be Made

The most basic factor in reforming data courses involves considering the key aspects of data-driven decision making when designing the course to meet the needs of future school leaders. A number of models have been developed to describe the process of data-driven decision making (Boudett, City, & Murnane, 2007; Kowalski, Lasley, & Mahoney, 2008; Mandinach et al., 2008). These models share several features, including analyzing data to understand the strengths and weaknesses of a school, deciding upon and implementing reforms to address the weaknesses, using data to measure the effectiveness of the reforms, reflecting on the meaning of the data, and repeating the process given the changed conditions at the school. These common topics should form the basis of a data analysis class designed for future principals.

It also is important that software match the needs of the application for which it is used. The types of data analysis school leaders use to make educational decisions involve the interpretation of descriptive statistics and graphical representations of data (Boudett et al., 2007). Given these requirements, Microsoft Excel meets the needs of most beginning school leaders, especially once they are introduced to some of the more advanced features of the program, such as conditional formatting, filters, and PivotTables (Glenn, *in press*). Excel also provides reasonable graphing capabilities for data displays.

One exception to this rule arises when working with course participants who need to learn district specific software. Some school districts have designed or purchased their own software packages for data analysis (Boudett et al., 2007), often for data warehousing purposes. A cohort in which all the members come from such a district should be taught to use the district software in addition to the usual course software, since they will need to use the district software when they become school administrators. The practical handling of this issue will be discussed below.

An Overview of the Course Content

The Education Leadership and Policy Studies program at Virginia Polytechnic Institute and

State University (Virginia Tech) responded to these issues by instituting a new course titled "Research and Data Analysis for School Leaders." The course is directed toward master's level students (called "participants" here) studying in principal preparation cohorts. The primary objective of the course is to provide participants with the opportunity to practice the various steps of the data-driven decision making process while using authentic data from schools.

The initial component of the course involves developing the capacity of each student to utilize the technology needed to manipulate data. As discussed above, the technological requirements for data-driven decision making need not be particularly sophisticated, but the participants must learn to use technology well in order to conduct meaningful analyses. Those taking the class entered with a wide variety of skill levels with regard to the most basic applications of Microsoft Excel spreadsheets. Some were fairly proficient with many features of Excel due to using spreadsheets as part of their job requirements, while others did not know information as basic as how to identify a cell. Therefore, the early part of the course concentrates on imparting the necessary understanding of the basic and advanced features of Excel spreadsheets that are most applicable to school site data analysis. The pacing was rapid during this part of the course, but participants were given multiple opportunities to learn and practice new skills.

The introduction to technology proceeded simultaneously with discussions regarding how to interpret data in order to make decisions about schools. A key element in this progression was the use of authentic data from real schools, starting with the first homework assignment. This practice was designed to prevent the participants from learning statistical concepts in isolation, without gaining a deeper understanding of the meanings captured in the numbers. The questions related to the data started at a basic level, such as "What would you be satisfied with if you were the principal at this school?" Eventually, the future principals progressed to analyzing test score data from the school at which they were doing their internship, working with a teacher or a department to understand the meaning in the numbers, and using those data to formulate an improvement plan, including identifying alternative sources of data that could be studied to gain a deeper analysis of the issue. This process taught participants the strengths and limitations of test score data, as well as the value of additional forms of data, such as walk-throughs and common assessments, to supplement test score data.

The cohorts in the program sometimes were composed of teachers from a single school district. In that circumstance, district specific software needed to be discussed and used. Participants are required to attain a level of proficiency using these applications, though they were free to meet this requirement different ways. They received credit (points) in the Virginia Tech course for attending district software training sessions, learning the system from experts at their school site, etc. The students demonstrated their proficiency with the software by using it to gather the data needed to complete the major assignments.

The primary mode of instruction in the course consisted of traditional face-to-face meetings. Time in the class sessions was divided between delivering content via lectures, discussions, and video or computer presentations and providing time to practice. The practice time enabled partici-

pants to work on the material individually and in groups, provides opportunities for peer tutoring experiences that increase learning for both the tutor and the tutee (Topping, 1996), and permitted one-on-one and small group interactions between the participants and the professor. The guided practice sessions enabled learners to work through the material in a supportive environment before attempting individual assignments. Facilitating group practice time was particularly important in this course because each student held a full-time teaching job.

A secondary learning vehicle involved electronic learning environments. The most frequently used feature was the discussion board on the university's learning management system, Blackboard. The participants reflected weekly on the material that they covered in the previous class, its usefulness in schools, and the manner in which practicing school administrators use, or do not use, the material covered in class. The students responded to each other's comments in thoughtful ways. The discussion board also provided participants with the opportunity to supply feedback to the instructor regarding their mastery of the course content. In addition to the discussion board, all assignments were required to be submitted electronically, which had the educational purposes of reducing the turn-around time for returning projects and enabling the instructor to trace student mistakes using the student's own Excel files.

Linkages with Internship Requirements

One feature of the course was linking the major course assignments with two internship requirements. This decision enabled the participants to use real data from a school at which they were fulfilling their internship requirements to complete the projects. The first of the projects involved analyzing test score data to identify "red flag" issues at the school, such as achievement gaps, areas of instructional weakness, and so forth. The second project focused on a teacher, a subject area, or a department, where participants used data to formulate a plan designed to improve instruction.

The linkages provided several benefits. First, those taking the course could develop a better feel for the meaning of data by applying data-driven decision making techniques in familiar environments rather than to canned data. Second, the assignments tied the two internship objectives together. In the past, people often identified one or more areas of weakness while doing the first internship requirement, but worked on action plans in an area unrelated to the identified weakness. In this course, more participants built on the first assignment to complete the second one, which made for a more realistic learning experience. Third, some of the projects impacted schools. Some teachers and department personnel regarded the assignment as an opportunity for improvement and worked with the leader-in-training to analyze their practice and suggest reforms. This attitude permitted the participants to experience the collaborations and conversations that are an integral part of data-driven decision making.

A final benefit of tying assignments to internship objectives came from the increased ability of professors to engage in cross-course exchanges. Two examples will illustrate the point. The course that immediately followed the data analysis course was "Instructional Leadership." The professor in that course was able to use the findings from the data analyses to build a deeper understanding of

how data can guide instructional practices. The next course in the sequence was "Technology Leadership," in which one of the major assignments consisted of designing a school improvement plan for technology. In the past, it was difficult to make the assignment realistic because the course was offered in the summer, when most teachers are not working. This made it virtually impossible for anyone in the class to gather data from observations, teacher interviews, etc. to inform the creation of the plan. Now, however, the data gathering for the technology assignment occurred as part of the data course, which provided all participants with an opportunity to gather actual educational data and improved the realism of the technology project.

The biggest drawback to using realistic assignments involved the difficulties sometimes encountered when finding the data needed to complete the projects. Participants lacked the access to data that administrators possess, which was an unrealistic aspect of the projects. In addition, many discovered that state and local data management system are not as user friendly as they could be. This finding helped the participants better understand one of the main obstacles to data-driven decision making: the difficulty of obtaining desired data, which is an important point for new leaders to grasp.

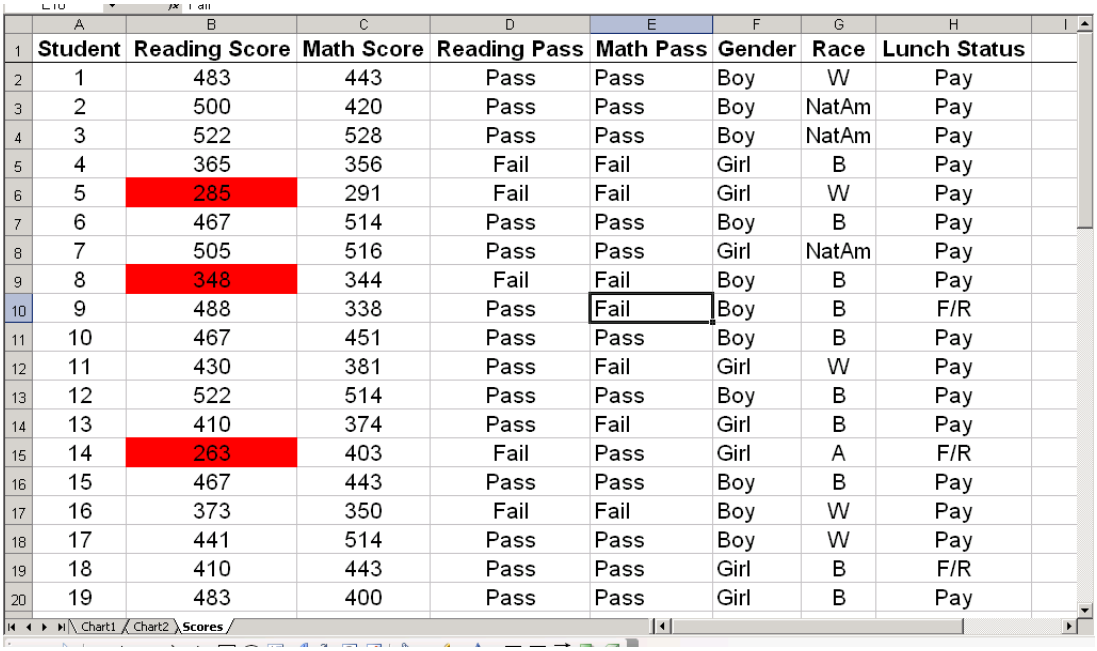
Excel Use

Excel offers school leaders a variety of tools that can help them analyze data from the school and improve student learning (Glenn, in press). This section discusses some of the ways in which participants have used Excel to analyze the data and make changes at schools.

The data used by the participants spanned the gamut of data used in schools. Some of the data were summary statistics, such as mean test scores or pass rates by race/ethnicity. At other times, students worked with an Excel spreadsheet containing individual student data for a class, a grade level, a subject area, or a school. These data included test scores results, grades, teacher placement recommendations, etc. Two of the more useful Excel applications for analyzing individual data are conditional formatting and PivotTables, which are discussed below.

One popular approach to studying individual student data involved the use of conditional formatting, a procedure that automatically highlights cells that meet a given condition (such as being above a cut score) (Glenn, *in press*). Participants typically use this tool to identify individual students who are struggling to meet a certain benchmark. In the screenshot (Figure 1), conditional formatting was used to highlight the students who were failing the state mandated reading test by over 50 points so that remedial efforts could be directed toward them. Other participants have used conditional formatting to highlight a grades column and a test score column to identify discrepancies between grading and test score results.

Figure 1. Conditional formatting used in Excel.

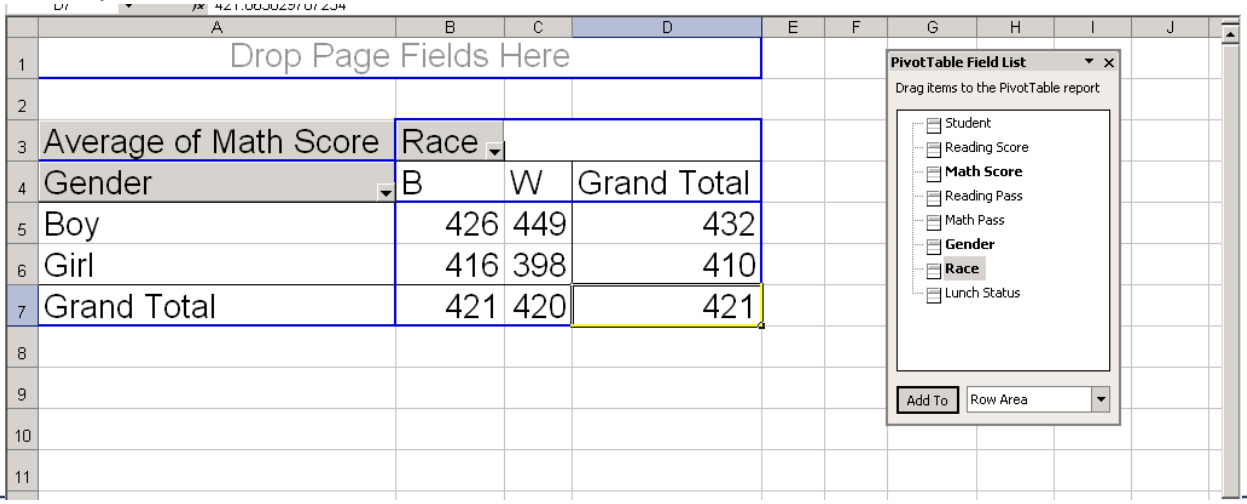


	A	B	C	D	E	F	G	H
1	Student	Reading Score	Math Score	Reading Pass	Math Pass	Gender	Race	Lunch Status
2	1	483	443	Pass	Pass	Boy	W	Pay
3	2	500	420	Pass	Pass	Boy	NatAm	Pay
4	3	522	528	Pass	Pass	Boy	NatAm	Pay
5	4	365	356	Fail	Fail	Girl	B	Pay
6	5	285	291	Fail	Fail	Girl	W	Pay
7	6	467	514	Pass	Pass	Boy	B	Pay
8	7	505	516	Pass	Pass	Girl	NatAm	Pay
9	8	348	344	Fail	Fail	Boy	B	Pay
10	9	488	338	Pass	Fail	Boy	B	F/R
11	10	467	451	Pass	Pass	Boy	B	Pay
12	11	430	381	Pass	Fail	Girl	W	Pay
13	12	522	514	Pass	Pass	Boy	B	Pay
14	13	410	374	Pass	Fail	Girl	B	Pay
15	14	263	403	Fail	Pass	Girl	A	F/R
16	15	467	443	Pass	Pass	Boy	B	Pay
17	16	373	350	Fail	Fail	Boy	W	Pay
18	17	441	514	Pass	Pass	Boy	W	Pay
19	18	410	443	Pass	Pass	Girl	B	F/R
20	19	483	400	Pass	Pass	Girl	B	Pay

Chart1 Chart2 Scores

PivotTables enable participants to manipulate tables quickly and easily in order to detect pattern and trends among students. The screen shot below (Figure 2) depicts one use of PivotTables. The PivotTable contains math scores by race and gender. The numbers show that this group of students did not have an achievement gap in math based on race, but possessed a gender gap, particularly between white boys and white girls. This type of finding raises a “red flag” that leads to participants studying whether and how the school can modify math instruction to promote better learning among girls.

Figure 2. Example of PivotTables in Excel.



Drop Page Fields Here

Average of Math Score	Race		
Gender	B	W	Grand Total
Boy	426	449	432
Girl	416	398	410
Grand Total	421	420	421

PivotTable Field List
Drag items to the PivotTable report
Student
Reading Score
Math Score
Reading Pass
Math Pass
Gender
Race
Lunch Status
Add To
Row Area

The beauty of PivotTable is the ease with which they can be manipulated to show more, less, and/or different data summaries. For example, it would be very simple to analyze reading scores instead of math scores or remove gender and/or race and insert lunch status. Moreover, a PivotTable can be used to create a PivotChart (graph) that is linked to the table and changes when the table changes. Participants who presented data to their fellow K-12 faculty members found that using PivotTables enabled them to have a more flexible presentation and respond to questions by displaying the requested data rapidly. This responsiveness facilitated data-driven decision making by making it easier for the faculty members to "own" the data, a key aspect of achieving buy-in (Boudett, et al., 2007).

Potential for Changing the Preparation of School Leaders

A common criticism in education courses is the lack of connections between coursework and practice. Virginia Tech addressed that issue within our program by offering a data analysis course that is unlike anything else offered in its region due to its emphasis on practical uses of data. Those completing the program will enter their administrative careers more prepared to use data than those who have not studied this material. As discussed above, the participants analyzed data and based educational decisions on their findings. In some cases, they led meetings focused on data analysis, presented findings to their colleagues, and held conversations based on data with administrators, departments, and teachers. The educational experiences provided the future administrators with the opportunity to mimic or actually experience important aspects of data-driven decision making in schools. It is hoped that most preparation episodes incorporate real life experiences in order to better prepare participants to enter the next stage of their professional careers.

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