Academic Leadership: The Online Journal

10-1-2011

Transforming Data into Knowledge

Lane Mills

James McDowelle

William Rouse Jr.

Recommended Citation

Academic Leadership Journal

Since the inception of the No Child Left Behind legislation, school districts have been faced with a growing need to gather, analyze and monitor more data than ever before in their leadership of schools (Blink, 2007; Kowalski, Lasley & Mahoney, 2008; Mills, 2006). The adage that schools are "data rich" and "information poor", while comical, is often true. School systems are awash in data and drowning is a real concern for new and soon-to-be leaders. The critical task for school leaders is to turn existing student achievement data into a format that lends itself to answering questions and improving outcomes for the students. Common barriers to transforming data into knowledge in educational settings often include poorly designed or non-existent data systems, disorganized record management, and temperamental gatekeepers who withhold data to preserve power, or personnel who simply fail to ask the right questions of the available data (Mills, 2006). Using data effectively does not require great statistical knowledge or high-priced analytical tools. It simply requires a desire to improve outcomes for students, staff, and school and a willingness to stop doing the same things and hoping for a different outcome (aka superstitious behavior). The ultimate goal for the training program delivered to students in the Masters in School Administration (MSA) program was to empower future principals to have the knowledge and skills to go beyond the usage of static reports and simple data views to develop skill and understanding of data as a dynamic entity to help support their leadership focus.

 Where It Began

Prior to the current focus, Masters in School Administration (MSA) students were required to complete a technology course where data skills were covered at an introductory level (i.e., filtering, sorting, counts, sums, etc.). Students were asked about their familiarity with Microsoft Excel and demonstrated rudimentary skills in the application (e.g., create a basic bar chart). This focus on low level data skills was not due to a lack of knowledge or a lack of desire to teach the student's more advanced skills but rather a function of the time period when the course was developed and the lack of access to many of the tools and applications that are now readily available in schools. The course was developed as schools were beginning to have access to the Internet beyond simple dial-up service and desktop software was available that would allow analysis of data beyond simple summation and description. After the revision of the MSA program, the technology course has evolved into an overview course on data-driven-decision-making (DDDM) and an introduction to specific software applications for analysis of data and online tools for sharing information and creating data discourse (e.g., blogs, wikis, content-management systems). The delivery of the DDDM course focused on helping students incorporate a decision-making process that incorporated six questions for students to address in their school/district setting:

1. Where are we with data?

2. What do we need to know?

3. What data exists to help us?

4. How do we make sense of the data?

5. What does it all mean?

6. Now What?

Where Are We with Data?

Students have to determine what their current level of understanding and comfort with data is as well as their school or district's level of functioning. Tapping from a broad range of districts, some student's may have access and experience with complex and rich data warehouse applications with built-in analytical tools and access to real-time data streams or enterprise resource planning (ERP) applications that manage nearly every aspect of a district and school's functioning. Other students may find their district relies on desktop spreadsheets and databases shared on common network drives with limited reliability and scale representing only a few areas of functioning. Further, as students begin to explore their district's data practices, they often start to develop a clearer picture of the climate toward data and gain insight into the formal and informal barriers to implementing DDDM.

What Do We Need to Know?

The second step for students in the DDDM process involves formulating questions, determining key areas of focus for their school, and defining school wide goals. Again, at this stage, the students are not implementing data software. Rather, their efforts are centered on establishing clearly defined goals to avoid decisions based on preconceived notions and wishful thinking. This strategy allows principals to lead with data rather than respond to data. Boudett, City, and Murnane (2005), recommend starting this task by creating a data team, taking stock of data organization and developing a data inventory. An example that is used with the students at this stage of the process follows this line of questioning:

Imagine trying to build a house by looking at the multitude of isolated tasks involved instead of starting with a blueprint and input from buyers and contractors. Not only would the building collapse around you, none of the buyers would want to live in it. What is your process for developing a solid plan and building upon a firm foundation that focuses on adding value to your school rather than merely doing various data work in isolation from the plan?

Students are encouraged to consider questions like the following to discover what they need to know: "What would success look like?" Or, "What outcomes or information do we need to monitor in order to be successful?"

The real work of managing data effectively involves all stakeholders, and getting representatives from all groups is the key. If everyone owns the data and the process, then the beliefs about its importance and usage will be much easier to address as a principal (Mills, 2006). The student's role at this stage is to build and focus support for the need for looking at data. Encouraging open dialogue about the data needed and brainstorming are good techniques for this process. Student's need to know that it is crucial to question practices and opinions to discern what deserves their focus. Additional questions to be addressed by the students for this part of the process include: "Who needs to own this data for my school to move forward?"; "How can I establish the focus on what data we need rather than what we think?"; and "Which data are the most important or part of our foundation for improving student outcomes?"

What Data Exists to Help Us?

When most educators speak of data, they often mention test scores and grades. However, there are numerous sources of data that should also be a part of the discussion at the school level. Information such as student and teacher attendance, disciplinary infractions, parental contacts, maintenance requests for buildings and technology, and community survey results are all examples of important data for school leaders to understand and apply to their efforts. For example, it is difficult to achieve gains in academic performance when students are suspended from school or absent and cannot receive instruction and teachers are not in attendance to provide instruction. Having access to critical data, while important, is not as powerful as the ability to align that data with other outcomes to lead to logical conclusions about the effectiveness of programs and practices (Mills, 2006).

While the coursework includes a heavy emphasis on the application of particular software tools to process and analyze data, the tools cannot decide what data should be used and for what purposes. One barrier to getting started with the analytical tools is simply discovering the data that school leaders have access to in existing systems, databases and spreadsheets. In fact, after asking student's to review their school or district's data sources, the difficult part is often gathering a focus due to the wealth of opportunities. At this stage, the emphasis focuses on helping students locate their data, determine if it is reliable and decide how best it could be analyzed before proceeding. At times, the data may exist but not be in a usable format for analysis. Students are encouraged to ask questions of their data like: "Is the data current?"; "Who is responsible for maintaining the information?"; and "What is its format?" (i.e., paper records, spreadsheets, data management system). Finding the data and transforming it into knowledge takes planning and commitment. These questions attempt to assist the students in this process of making the choice of the right data for the right problem.

How Do We Make Sense of the Data?

In *Leadership on the Line,* Ronald Heifetz and Marty Linsky (2002) suggest that leaders need to "get on the balcony" and view a system from multiple perspectives. This notion can be applied to how the MSA students might view their data from the perspective of students, staff and the community. In this age of accountability, the focus on student performance is of great importance, but student's do not need to use an electron microscope when the view from the balcony might be the best place to begin. One approach used with the students to develop their skill in making sense of the data involves focusing their view of the data. An example used with the students to help them gain focus of their data involves the imagery of a funnel that inputs a large amount of data and compresses it to a unitary stream of information in one specific spot. Students begin funneling their questions of the data from very broad issues (e.g., "Is our school's problem in the area of reading or mathematics?") down through the spectrum (e.g., "Is this problem in one grade only or across all grade levels at my school?") to a very granular focus (e.g., "Which students in this subject in this specific grade are struggling?").

Students are also introduced to the usage of properly designed tables and graphs for identifying areas needing intervention. Proper visual representations of data can convey a large amount of information in a powerful way in a brief format (Few, 2004 & 2009; Tufte, 1983). These visual displays convey meaning and can help a leader build a case through the representation of patterns, relationships and trends that might otherwise be missed in a static report. As students begin the task of transforming their data into information for decision-making, questions to ask include: "What format for presentation provides the best insight for the viewers?"; "Does the data presentation match the types of questions

we are trying to address (e.g., use a graph when the shape of the data tells the story)?"; and "Can everyone see the patterns or points of interest from the presentation format?"

What Does It All Mean?

Once students have identified their important data sources and are able to access them, the next step should be to develop a data management system. While a data management system might sound complicated and costly, students are introduced to a variety of common applications that can aid in their efforts.

In the DDDM course, the primary tool for exploration and analysis is Microsoft Excel. This application is typically installed on most personal computers thus avoiding the issue of availability in the school and home settings. A specific strength of Microsoft Excel involves its ability to develop pivot tables of data that allow for an initial foray into Online Analytical Processing (OLAP). OLAP allows for quick analysis of different aspects of multidimensional data and the ability to drill-down into the data to achieve a more granular focus following the funnel model students were introduced earlier in the course. Pivot tables allows students to quickly dig deeper into their data to look for common themes or patterns that might not be seen on the surface of a table of data. Jelen and Alexander (2007) describe pivot tables as a kaleidoscope that when pointed at data creates an ongoing unique perspective of the data allowing for different viewpoints and pictures. This interactive viewing allows students to segment and summarize data by simply arranging the columns and rows of a spreadsheet to create new calculations, summaries. Students use data in the same format and structure as provided by the state's accountability programs (dummy coded for security) in order to make the process meaningful, make them aware of what data is available to them in their schools and districts and help facilitate the transfer of learning to the field. For example, students examine disciplinary data to look for ways to improve student behavior outcomes. Drilling down in the spreadsheet with pivot tables, students can identify specific students and situations that warrant further exploration with staff. Other tasks involve students creating pivot tables of their testing progam data with which they can manipulate common demographic variables and drill-down to find out which individual students need remediation in a particular instructional area. The focus is on hands-on, practical applications of data-driven-decision-making using real data that has meaning now and when they return to their schools and districts.

Efforts are underway to introduce the usage of more powerful analysis applications to students after their initial work with pivot tables in Microsoft Excel. Enterprise Guide from SAS and IBM's Statistical Package for the Social Sciences (SPSS), offer additional opportunities for students to incorporate their DDDM skills. Often the focus of doctoral research in academic settings, these applications offer another avenue for students to explore their data with even greater flexibility in data and reporting formats and the addition of various analytical and statistical applications. While students often have free access to these tools while in training, the barrier to more specialized analysis software is their initial cost and annual license fees in a school or district setting. An application that students are beginning to explore that provides for rapid and powerful analytics and informative and engaging visualizations is Tableau Software. Available in desktop and web-based formats, this software's ability to produce visual analytic results from a variety of data sources with minimal training offers students a smooth transition to more robust analyses as its format and tools follows many of the techniques student's acquired in their pivot table work.

This hands-on interactive approach helps students begin to develop confidence in becoming their own "data experts". Of greater importance to their skill in using data in this process, is the way in which their new-found skills broadens their focus across more areas than accountability as their analysis leads to more questions across all areas (e.g., instruction, curriculum, operations, personnel, etc.). Rather than focusing solely on testing data, the students begin to look for linkages and explanations that may relate to what they have discovered in the data source. This hands-on approach also reinforces the idea that early and accurate identification of problems can lead to quicker intervention. Leaders that can manage their own data rather than waiting for the district office or outside consultants to provide analysis provide a timely advantage.

Now What?

At this stage of the process, students have organized their data and turned it into information and encounter the question of "Now what?". This stage can be more difficult to gain comfort with than the usage of the analytical applications for some students yet it is the most critical. Students must process the results, evaluate the implications, make a decision concerning an intervention and implement a plan in order to change or refine administrative or instructional practices. This stage is about the student assuming the role of instructional and data leader as is required of principals. At this point, discussion and planning are not based on feelings and opinions but on specific insight gained from what the data says. Pitfalls student's face at this stage of the process include the issue of not wanting to hear what the data is saying (e.g., " I thought we were doing ok in reading at our school-this is going to mean a lot more work.") or breaking from tradition and comfortable routines (e.g., "Not only are we going to have to revisit the master schedule, we are going to need to change how we work.").

While the intent of the DDDM course is not to focus heavily on instructional leadership and organizational change as other courses provide experiences with these important topics, emphasis is placed on student's using these data to lead the discussion from the data and move the faculty toward an action plan that reacts to information gleaned from the data. Typical questions that could extend the discussion from the information gathered might include: "How does our schedule align with our instructional needs?"; "How are we spending our budget to support what needs our focus?"; or "What types of professional development opportunities are focusing on the skills to address the needs we discovered from the data?" These types of open-ended questions can help ease staff into a deeper discussion about the data. Students are also provided an opportunity to explore and explain what monitoring strategies and follow-up procedures would be key to maintaining focus and ultimately success with their data-driven-decision-making.

Next Steps

Data management and analysis is a critical skill for leaders operating in all school and district environments. Gaining insight into information that can improve the outcomes of students and schools and leading schools with knowledge rather than opinions is paramount. This process for developing such skill in these future leaders is only a beginning. Simply knowing the data-decision-making steps and incorporating various software applications to provide information will only address part of the issue for future leaders. The inter- and intrapersonal skills and savvy of these future leaders in their application and delivery of these vital data to their students, staff and constituents will be a key factor in whether the information is seen as vital or just another notebook of facts on a shelf. A growing body of research supports the contention that interpersonal skills are crucial to the exercise of effective

leadership (Fernandez-Araoz 2001; Goleman, Boyatzis & McKee, 2002; McCauley 2004; McDowelle & Buckner, 2002; Mills, 2009; Northhouse 2004). The development of DDDM principles will likely necessitate the complimentary development of "soft skills" that will aid future leaders as they attempt to persuade their constituents with information and frame issues in a way to reduce the likelihood of failure while addressing the appropriate context for undertaking a change that may seem difficult or "hard to swallow". Facilitating change in an organization requires dealing with the issue from a rational perspective, incorporating an emotional linkage with the idea and addressing the environment (Heath & Heath, 2010). Simply knowing the facts is not enough to bring about change. Great data will not cause great change-it is only one component of a successful intervention.

Data-Driven-Decision-Making requires a constant eye toward new sources or streams of information that can be manipulated and digested to improve processes and learning outcomes. While one can learn much from the well-established use of data and analytical tools that have informed major business corporations for many years, these products and processes need to be tailored to the school setting. This training process will benefit from the incorporation of tools such as data warehouse applications and more advanced analytics. For example, predictive modeling software will allow students to move beyond the "How many?" and "Which ones?" questions to address the "What if?"or "How come" questions of their data with the ability to predict future levels of performance and trends by examining patterns and relationships in data from within a data warehouse. Further, data mining applications have the ability to glean through unstructured data such as notes stored in databases (e.g., student conferences, disciplinary action transcripts, open-ended climate survey questions). A recent report in eSchool News on the state of advanced analytics offers numerous examples of its application across the K-16 environment (Nastu, 2010).

Additionally, greater focus should be given to the usage and impact of applications that provide for real-time analysis of the most critical data. Many such on-demand applications are now being offered as software-as-a-service (SaaS) or "cloud-based" which could reduce the cost of entry for many school districts. Further, with the growing proliferation of powerful mobile devices that can display and process data in the field (e.g., smartphones, tablets, etc.), an emphasis needs to be placed on the use of mobile applications of data for mobile leaders. Such timely access to dynamic data will allow leaders to analyze current information about their schools to prepare for the future rather than react to "polaroids" of the past.

References

Blink, R. J. (2007). *Data-driven instructional leadership.* Larchmont, NY: Eye on Education.

Boudett, K. P., City, E. A. , & Murnane, R. J. (2005). *Data wise-a step by step guide to using assessment results to improve teaching and learning*. Boston, MA: Harvard Education Press.

Fernandez-Araoz, C. (2001). The challenge of hiring senior executives. In C. Cherniss & D. Goleman (Eds.), *The emotionally intelligent workplace: How to select for measure, and improve emotional intelligence in individuals, groups, and organizations.* (pp. 182-206). San Francisco: Jossey-Bass.

Few, S. (2009). *Now you see it: Simple visualization techniques for quantitative analysis.* Oakland, CA: Analytics Press.

Few, S. (2004). *Show me the numbers: Designing tables and graphs to enlighten.* Oakland, CA: Analytics Press.

Goleman, D., Boyatzis, R., & McGee, A. (2002). *Primal leadership: Realizing the power of emotional intelligence.* Boston: Harvard Business School Press.

Heath, C. & Heath, D. (2010). *Switch: How to change things when change is hard. New* York: Broadway Books.

Heifetz, R. A. & Linsky, M. (2002*). Leadership on the line: Staying alive through the dangers of leading*. Boston, MA: Harvard Business School Press.

Jelen, B., & Alexander, M. (2007*). Pivot table data crunching in Mircosoft Office Excel 2007*. Indianapolis, IN: Que Publishing.

Kowalski, T. J., Lasley, T. J., & Mahoney, J. W. (2008). *Data-driven decisions and school leadership: Best practices for school improvement.* Boston, MA: Pearson.

McCauley, C.D. (2004). Successful and unsuccessful leadership. In J. Antonakis , A.T. Cianciolo, & R.J. Sternberg (Eds.), *The nature of leadership.* Thousand Oaks: Sage Publications.

McDowelle, J. O. & Buckner K. G. (2002). *Leading with emotion.* Landham, Md.: Scarecrow Press.

Microsoft Excel (Version 2007) [computer software]. Redmond, Washington: Microsoft.

Mills, L. B. (2009). A meta-analysis of the relationship between emotional intelligence and effective leadership. *Journal of Curriculum and Instruction, 3 (2).*

Mills, L. B. (2006). Transforming data into knowledge. *Principal Leadership, October*, 44.

Nastu, J. (2010). September. Advanced analytics: Helping educators approach the ideal. *eSchool News*, 17-23.

Northhouse, P. G. (2004*). Leadership: Theory and practice* (3rd ed.). Thousand Oaks, CA: Sage Publications.

SAS Enterprise Guide (Version 4.2) [computer software]. Cary, NC: SAS, Inc.

SPSS Statistics (Version 19) [computer software]. Chicago, IL: SPSS, Inc.

Tableau Desktop (Version 5.2) [computer software]. Seattle, WA: Tableau Software, Inc.

Tufte, E. (1983). *The visual display of quantitative information*. Cheshire, CT: Graphics Press.

[This article was modified from a presentation at the CREATE annual conference in Williamsburg, VA , October, 2010.]

VN:R_U [1.9.11_1134]