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Making Use of District and School Data

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This paper describes how districts can better use their extensive student databases and other existing data to explore questions of interest. School districts are required to maintain a wealth of student information in electronic data systems and other formats. The meaningfulness of the data depends to a large degree on whether they can understand the information and use it to guide their efforts. The considerations and guidelines presented here are organized into six components which include identifying the broad area, creating specific questions, roles and trust, sample and methodology, presentation of results, and outcomes and further directions. Two examples are used throughout the paper to illustrate each component. One is from a study of high school mathematics in an urban school district, the other is from a teacher-initiated effort to better understand students' perceptions of their middle school. Recommendations are offered throughout for encouraging effective data use in decision-making.

In this era of accountability, school districts are required to maintain comprehensive longitudinal student databases complete with information including attendance, demographics, mobility, discipline, state test scores, course enrollment, and grades earned in courses. Data systems created by districts are only useful in transforming schools when they provide meaningful data stakeholders can use to raise questions, identify issues, and make informed decisions (Schmoker, 2008). The capacity of student data to make improvements is quite large; unfortunately, much of it remains untapped because of a lack of time in personnel's busy work days, limited resources, or insufficient knowledge. Coburn and Talbert (2006) purport that a good data system allows for different types of evidence to be used for different purposes within different levels of the school district. Evidence comes in the form of research outcomes, evaluation studies, school improvement plans, or achievement data (Honig & Coburn, 2008).

This article describes how districts and schools can better use their extensive student databases, as well as other existing data that may not be electronically housed, to explore areas of interest to them. The guidelines and considerations presented here are organized into six, somewhat sequential, components: 1) identifying the broad area of interest, 2) creating specific questions, 3) establishing roles and trust, 4) making decisions about the sample, time frame, and methodology, 5) formatting and presenting results, and 6) outcomes and further directions. The information presented in this article is useful for districts that are just beginning to use their data as well as districts that are already engaged in using some form of evidence. It is also informative for university faculty and researchers who work with schools to improve student learning.

The components were developed based on information gathered from the literature and the author's own experiences working with schools and districts. To illustrate each component, two

examples of using data are incorporated. One example is from a large, urban school district. District and school personnel were concerned about students' low math performance on the state test across all high schools. It involved the analysis of multiple indicators of students' mathematics performance (such as coursework and course grades) within each of the ten high schools in the district over a period of four years (Parke, 2008; 2012). The other example is a teacher-initiated investigation of school climate at one middle school (Parke & Taylor, 2008). Prior to presenting the components, existing research on factors that promote and inhibit data use is summarized below.

Research on Districts Using Data

Research on data use ranges from conducting analyses on broad reform initiatives at the central office level (e.g., Coburn & Talbert, 2006) to investigating how principals lead data-driven decision-making in their schools (e.g., Lachat & Smith, 2005) to examining how teachers incorporate data to inform daily instruction (Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006). In a review of 30 years of literature on districts' evidence use, Honig and Coburn (2008) describe how current federal policies have placed unprecedented demands on central office personnel to incorporate many sources of evidence or data. These include conducting research in the content areas such as math and science to inform curriculum choices, evaluations of programs to determine if they are working, and using student performance data to help focus school improvement efforts. Occasionally, practitioner knowledge and feedback from parents or students are used to support the more formal forms of evidence.

There are several factors that promote or inhibit effective use of data. Two major promoting factors are strong leadership and coherency of goals. Inhibiting factors include the lack of a comprehensive data system; lack of knowledge and skills; perceptions, quality, and timeliness of data; and lack of support for personnel. To begin, strong leadership and a supportive culture created by district or school leaders can lead to staff placing a greater value on incorporating evidence to direct their efforts. Leaders with technology skills and the resources to put structures in place to facilitate data use are especially successful at improving a staff's comfort level with data and their conceptualization of what it means to use evidence (e.g., Lachat & Smith, 2005; Coburn & Talbert, 2006). For instance, one central office instituted data teams and data coaches to maintain a data focus in their reform process (Lachat & Smith, 2005). The data coach was someone skilled in data analysis who served as a role model. Responsibilities of the data team were to ensure the accuracy and timeliness of data files, disseminate data, target goals, help staff analyze data, and monitor improvement.

Another factor promoting data use is coherency, which refers to a focused and coordinated set of goals. However, research shows that this is difficult to achieve. Individual units within a district often operate in isolation from one another and are involved in their own grant-funded initiatives (Coburn & Talbert, 2006). Due to lack of time, communication among units is minimal and can lead to misalignment among the purposes for using data (Kerr et al., 2006). In some districts, professional ties influenced the initiatives. Administrators were hesitant to be involved in something "outside their expertise…and as a result there were very limited attempts to coordinate and discuss instructional issues across professional boundaries within the district" (Spillane, 1998; p. 58). It is not necessary for each unit or school in a district to be working on the same issues, but there needs to be a shared knowledge of where their particular piece fits into the big picture.

One of the first inhibitors to using data is the data system itself. Most large school districts have been maintaining comprehensive and longitudinal databases for several years now. However, many smaller districts are still struggling to get a good system in place that captures all data coming into schools, as well as all data generated by schools, in one central electronic location (Carroll & Carroll, 2002). When data is maintained in several locations and by different people or departments, it is difficult to integrate multiple sources of information which are essential for productive use of evidence. Furthermore, the system not only needs to house

the data, it must have the capacity to sort and disaggregate data, to enter new data in a timely manner, and to ensure its accuracy. Finally, it must also be accessible and user-friendly to school personnel.

A second inhibitor is a lack of knowledge and skills. Districts with relatively new data systems are often overwhelmed with the sheer amount of data. When administrators and other school personnel lack the skills and knowledge necessary to make data meaningful, they are in the situation of being data rich and information poor (Carroll & Carroll, 2002). User-friendly statistical software is widely available. However, if the user has little knowledge of statistics, inaccurate results may be produced, leading to erroneous interpretations and conclusions. Many administrators and teachers understand the dangers of running analyses without knowledge, and thus they are hesitant to work with the data at all.

Some university faculty have recognized that not all masters and doctoral programs provide adequate preparation for administrators and teachers. For example, a weakness in many statistics courses is that they do not provide sufficient examples of how data analysis is beneficial in an educator's environment (Creighton, 2001). There are signs, however, that programs may be changing for the better. The Carnegie Project on the Education Doctorate (CPED), established in 2007, is working on a redesign of the current doctorate in education. They are engaging in a collaborative effort among 25 colleges and universities to develop a new professional practice doctorate relevant for preparing school practitioners, academic leaders, and professional staff (Perry, in press).

Another inhibitor is the quality, timeliness, and perceptions of data. A district's database is only as good as the data entered. There must exist a person or department whose responsibility it is to maintain the system by monitoring external and internal data coming into it and ensuring its accuracy and timeliness. School personnel's perception of the data's validity can either increase or decrease its usefulness. Kerr et al. (2006) found that school staff had doubts about the state test data. They said the results were not a good measure of what students know and can do. Instead, the staff placed greater value in classroom assessments and student work samples. Research indicates that when the culture and climate is one that incorporates many sources of student performance and demonstrates how various data can provide worthwhile information at the classroom level, then there will be greater buy-in, thus leading to more effective data use (Kerr et al., 2006; Honig & Coburn, 2008).

Finally, support for personnel in terms of time and resources is often an inhibiting factor. One way that top-level administrators can help is to organize departments so that they each have a clear and distinct responsibility and efforts are not being duplicated (Lachat & Smith, 2005). For instance, one unit's focus might be on integrating new information into the data system and manipulating the data, another unit's focus could be to produce the necessary reports that are mandatory for school and program accountability, while a third unit works with administrators and teachers who are using data in the ways described in this paper. Principals can also build time into teachers' schedules for them to discuss issues and use data. The simple act of carving out time on a regular basis demonstrates to teachers that their principal values this work and is willing to support them. Another option is for leaders to seek partnerships with local organizations or educational researchers interested in working with schools (Honig & Coburn, 2008).

Component 1: Identifying the Broad Area of Interest

Deciding where to start can be difficult for school personnel who are new to the process. In most schools and districts, there is no shortage of issues and concerns from which to choose. Identifying the most pressing needs is one way to select a starting point, however, it is important to avoid getting involved in too many areas at a time, especially if resources and personnel are at a minimum. Choosing multiple areas often results in a haphazard approach that tends to lose focus. It is also important to identify goals that are attainable and realistic. For instance, a goal for first time users

of data should not be one of overall school improvement. This is too broad. Instead, suppose there is a general concern about low attendance in the district. A first pass through the data could be for the purpose of gauging the extent of the problem and where it is occurring (specific grade levels, schools, demographic characteristics and so on).

Another starting point for using data is to examine whether a new program or initiative instituted in schools or classrooms is worthwhile. A district may want to find out if their efforts to improve parental involvement are working, or a school may want to know whether it is beneficial to continue a peer mentoring program. In both of these instances, it is important to recognize that some data are probably in the database, but additional data may exist in other formats or may need to be collected through surveys, interviews, or other measures that are unique to the situation.

For districts that are already using data, one issue is to identify how the new area of focus will fit in with other efforts. Are similar studies taking place concurrently, or have they been conducted in the recent past? For instance, if there is an interest in examining reading instruction at one school, the personnel should find out whether classroom studies in reading are occurring in other schools. This is especially necessary if the district is large. Literature shows that a lack of communication across schools and within central office departments has a detrimental effect on the ability to use evidence in ways that ultimately improve schools and student learning (Coburn & Talbert, 2006).

A final aspect to consider is ensuring that there are other people who value the topic and are interested in knowing the results. This is a practical consideration, but important nonetheless. If no one cares about the topic, it is likely that the outcomes will have no impact. If there is interest in the topic, however, then now is the time to begin thinking about who is willing to be involved in collaborating on data analysis, interpreting results, and communicating them to others. At this early stage, it is beneficial to get a feel for the roles and responsibilities of those involved in the effort. There will be more on this topic later in Component 3.

Example 1: District high school math performance

The use of data in this urban school district stemmed from a partnership between the district, faculty at a nearby university, and members of a community educational organization. The partnership was created initially to develop annual School Progress Reports (e.g., A+ Schools, 2007) that allowed administrators, teachers, and parents to access a variety of demographic, contextual, and performance indicators in a form that was not available elsewhere. The data in these reports served as starting points for discussion about the strengths of each school in the district as well as the challenges faced. Supplementary analyses followed the release of each Report with the purpose of further examining areas of interest to the district (Parke, 2006; 2008; 2009).

The analysis used as an illustration in this article was high school math performance (Parke, 2008; 2012). It was undertaken due to the district's and community's growing concern about the consistently low math scores on the state's grade 11 assessment. For years, the district reported percent proficient data on the state assessment as well as two additional large-scale assessments administered in grades 9 and 10. These internal reports described differences in performance between demographic subgroups (i.e., achievement gaps), but there was no systematic analysis of relationships among the math achievement data. Another source of untapped data was math coursework. The district's database was extensive and contained longitudinal student data on math courses taken each year and grades earned, but previous analyses did not comprehensively examine this data nor were relationships between test scores and grades explored.

Therefore, the broad area was to investigate multiple indicators of high school math performance which included the state assessment, two additional standardized assessments, and three math coursework variables. The overall goal was to provide a broader picture of students' performance than the data they had been using to meet

accountability requirements mandated by the No Child Left Behind Act.

Example 2: School climate in a middle school

The use of data in this example came about because a team of teachers in one middle school had concerns related to their school's climate, especially issues regarding respect and tolerance of others (Parke & Taylor, 2008). Although the majority of students (78%) were Caucasian, the remaining student population was culturally and ethnically diverse. Over 20 countries were represented. On their own, the team of teachers modified an existing high school student survey (Webb-Dempsey, 1997) previously used in their district which focused on overall student perceptions about academics, student success, and school climate (including respect, safety, and decision-making issues). Items appropriate for their needs were retained and modified for use at the middle school level. The teachers also developed and piloted new items that reflected their specific tolerance issues as well as other reform efforts within their school such as teaming, integration of technology throughout the curriculum, and the creation of a safe and secure learning environment for all students.

The teachers administered the survey to all 6th, 7th, and 8th grade students every year for three consecutive years. They intended to analyze the data, but it did not happen in a systematic fashion. Teachers browsed through completed surveys after they were collected, and some informally discussed what they saw in the responses. Identifying the issue had been easy for them, and they worked hard to collect the data they needed. However, boxes of completed surveys sat in a room. Their well-intentioned efforts led to "existing data" that was left untouched and therefore, meaningless.

Component 2: Creating the Question(s)

First and foremost, the motivation for creating the research question(s) to be investigated should always come from the needs of the district and schools. This may sound like an obvious consideration, but sometimes there is pressure from a political standpoint or possibly from a researcher's own agenda to use the data to answer particular questions. In situations in which other agendas are being followed that are not geared toward the purpose of helping schools, there will likely be a lack of support and collaboration around the effort and, in turn, the outcomes will be of little use.

Secondly, each question should be specific in nature. A common question heard from school personnel who are new to using data is: "What does our data tell us about…?" Suppose an administrator identified the decrease in high school enrollment as their district's broad area of interest. Instead of haphazardly perusing through tables of data and reports, breaking down the issue into smaller parts helps create a specific set of questions that will guide a focused analysis. Some questions might be: 1) When are students exiting the district (grade 9, 10, 11, or 12)? 2) What are the reasons for exiting? 3) Do schools differ in terms of when and why students exit? and 4) What are the demographic and achievement characteristics of students who exit?

Concurrent with creating each question, it is important to determine whether the necessary data is available. A database might allow for determining the grade level at which students exit, but may not contain specific reasons for each student withdrawal. A benefit of having specific questions is that it forces personnel to plan ahead before entering the data system. Possibly, the data is available in a different electronic location or in the form of written reports or files. If the data is only available in print form, then the district or school must determine whether it needs to be processed in some way first. For example, is it beneficial to take the time to convert reasons for withdrawals located in hard copy files to an electronic format? Or can this data simply be analyzed in its original print format? Therefore, agreeing upon which specific questions to ask will likely lead to a more efficient data analysis process and useful end results.

Example 1: District high school math performance

In order to investigate multiple indicators of math performance in high school, one of the first decisions made was to focus the questions on students who stayed in the district for the previous

four years, from 9th grade to 12th grade. By doing so, this would provide longitudinal student information regarding patterns of math course-taking and math grades which had not been systematically examined in the district up to this point.

The district's database was quite comprehensive and contained a wealth of information. All data was housed in the central data system, so there was no need to obtain data from other locations or formats. Decisions were made to examine math scaled scores on the three assessment indicators (TerraNova in grade 9, the New Standards Reference Exam in grade 10, and the state assessment in grade 11). With regard to math coursework data, a decision was made to obtain the total number of math courses taken from 9th to 12th grade, the type of math course taken in each grade, and the grades received in each course.

Because this was a large investigation that spanned two years of the partnership, there were many specific questions generated on this set of data. After answering one set of questions, another set of questions emerged. Four questions are stated below. The first two are descriptive in nature. Obtaining a summary of data on each variable is usually helpful in obtaining an overall picture of the data. The third question focused on identifying the strength of the relationships among math indicators. The final question was created because of an interest in knowing which factors (demographic and math indicators) were most influential in explaining variance in math scores on the state test. Grade 12 data was not used for this question.

1) What are the average scores on assessments taken at each grade level?
2) How many math courses did students take across the four years? What math course did they take each year? What was the average math grade received each year? What percent of students failed a math course?
3) What are the relationships among scores on the three assessments and the three coursework indicators?
4) Which indicators are most influential in explaining variance in math scores on the state assessment in grade 11?

Example 2: School climate in a middle school

There were several reasons why the team of teachers were not able to use their survey data. First, the sheer amount of data was overwhelming. The survey contained 46 Likert-type items and five open-ended items. Nearly 400 students responded to these items for each of the three years. Secondly, they did not know what to ask of the data, thus there was no clear set of questions. Third, they were unsure of the best procedures for analysis.

As part of being a Professional Development School, a faculty liaison attended regularly scheduled meetings before the start of the day with teachers who were team leaders at each grade level. During one meeting, they mentioned the survey data. There was a realization that they were sitting on a wealth of potentially meaningful data from their students. With the liaison's assistance and direction, they finally felt comfortable moving forward and making the analysis of data their top priority as a group.

After the liaison became familiar with the history of the survey's development and administration as well as their reform efforts, the first step was for the teachers and the liaison to spend a few consecutive morning meetings talking about the type of questions they would like to ask. Some teachers felt they could not state specific questions until they looked at the data. However, after participating in the brainstorming session, many questions were generated by all teachers. They discussed which questions the data could and could not answer. After examining a long list of potential questions, they decided to tackle three of the most important ones, then see where the outcomes led them. The first question focused on the overall school climate during each year. The second question examined responses from a cohort of students as they progressed throughout the grade levels. The third question asked how students responded to one of the five open-ended survey items.

1) Which items on the survey had the highest positive responses across all students within each year of the survey's administration? Which items on the survey had the lowest positive responses across all students within each year of the survey's administration?

2) How do the responses of 6th grade students in Year 1, 7th grade students in Year 2, and 8th grade students in Year 3 change over time?

3) What are the most common positive and/or negative comments from students in response to the open-ended question "When I come into this school I feel…"

Component 3: Roles and Trust

Prior to moving forward, there must be an agreement as to the roles and responsibilities of all those involved. For internal collaborations, one scenario is that a team works together on all aspects of the process. In another scenario, responsibilities might be distributed among different people or units. A staff member in the assessment office may extract the data, another person with statistical knowledge is selected to conduct the analysis, and administrators and teachers meet to interpret the meaning of results. Of course in this situation, all members of the team must have the same goals and intentions. It is also helpful to have a discussion about whether structures are already in place to conduct the work. Is time available to carry out the tasks? If not, will the administration be willing to carve out the time and make resources available? Do individuals have the appropriate knowledge and skills to analyze and interpret data? If the answers are no, then they may need to involve external entities in the collaboration.

Possible external partnerships include local community/educational organizations and faculty and researchers at universities or other institutions. Depending upon the question(s) investigated, they can provide expertise in various areas of specialization such as methodology and statistics, assessment, school psychology, counseling, special education, or educational leadership. The district should feel comfortable that external members have the district's best interests at heart and do not have alternate agendas. Likewise, external members need to make a few considerations before deciding whether to work with the district. Will they have access to extract data on their own, or will they need to request the necessary data from the district staff? If the answer is the latter, then the external member must have conversations with the staff to be sure they understand the type of data needed and its format. If the answer is the former, they will need support from the district to learn the intricacies of the database which include how tables or files are extracted, the names and operational definitions of variables, and codes for all variables. Data systems are not consistent from one district to the next. Even though external collaborators may have technological and statistical skills, they need to know the unique aspects of the data system so they can find the appropriate data to answer the questions. Becoming familiar with the system is not an insignificant factor, therefore time should be allotted for doing so.

Regardless of whether the collaboration is internal or external, a level of trust must be established among all those involved. When analyses are conducted at the administration level, the presentation of information to teachers should not have accusatory tones. Instead, leaders should make it clear by their words and actions that teacher input is valued. Opportunities to engage in collective sense-making must be made available. Likewise, teachers must have a willingness to review and discuss results. The creation of a solid, trusting relationship may take time, but it is key to the ultimate use of evidence that will make a difference in schools (Honig & Coburn, 2008). In an external partnership, trust and cooperation must go both ways. External members should work with the school to address their needs and be willing to make alterations along the way to ensure alignment with the goals. Likewise, the school or district needs to be open to hearing negative results. When they view results as threatening, they are decreasing the usefulness of outcomes and possibly shutting themselves off from further collaborations.

Example 1: District high school math performance

Because the annual progress reports (e.g., A+ Schools, 2007) were produced prior to the supplementary investigation, a certain level of trust was already in place among the three entities. The district's role in the partnership was to provide access to the database as well as the support and time of central office staff. Personnel in the assessment and data management office were invaluable to the university researcher in terms of becoming familiar with the format and contents of the extensive database.

The researcher extracted the necessary data and was responsible for conducting all quantitative analysis in the progress reports as well as the analysis for the supplementary investigation. The executive director of the community organization along with several staff members were responsible for non-quantitative information about schools in the report, for its overall content and format, and for its distribution to all parents in the district. All three entities met periodically. The researcher produced a complete report for the supplementary investigation in a format that encouraged all members of the collaboration to interpret the data and make meaning of it. It was distributed to district personnel and members of the community organization and was also housed electronically on the organization's website so that parents and other interested parties would have access.

Example 2: School climate in a middle school

Because the middle school was a Professional Development School, there was a history of teachers reflecting on their practice and developing reform-based efforts to improve instruction and learning. However, for this endeavor they realized they needed to involve a person with specific knowledge and skills to help them get the most out of their data. The collaboration between the team of teachers and the liaison occurred naturally. An unfamiliar person was not thrust upon them and told to take charge. Rather, there was an atmosphere of mutual respect and trust in which the liaison was excited to help them learn from their data, and they were glad to have the assistance and guidance of someone who had previous experience working with middle school teachers on student achievement, attitudes, and dispositions.

Some support structures were already in place to begin the study (Parke & Taylor, 2008). For example, the ongoing before-school meeting with team leaders allowed time for planning how to answer the questions and analyze the data. Also, the administrators were supportive of teachers in their past reforms and continued to value their efforts by providing the necessary resources and time that teachers would need for this endeavor. For instance, one of the first necessary steps was to transfer all Likert item responses on the survey to a spreadsheet. An assistant was made available to complete this task. The administrators also showed a strong interest in learning the outcomes of the data analysis. Finally, there was one teacher leader who oversaw the whole process. She had excellent leadership skills and was valued and trusted by other teachers, the administration, and the liaison.

Component 4: Sample and Methodology

Most likely the sample will be somewhat defined as the questions are developed. Carefully crafted questions typically include the grade level(s) of interest, whose data is being extracted (students, teachers, administrators, other personnel), and the time period. Depending on the purpose for examining the area of interest, data may be obtained at only one point in time or longitudinally. For some investigations, it is also important to indicate how the sample compares to the population. Suppose that reading achievement was examined in two of five elementary schools in a district. A description of how students in these schools are similar to, or different from, the entire population of elementary students is necessary.

Methodology refers to the procedures and data analysis used to answer the questions. Of first concern are the variables and how they appear in the database. It may be necessary to alter their format in some way. A variable containing many categories may require consolidation into fewer groups,

especially if the sample is relatively small and there are only a few data points in certain categories. Also, a continuous variable may need to be converted to a categorical variable. Other forms of data preparation may involve linking student data on variables from year to year or preparing qualitative data for analysis.

After variables are operationally defined, the next step is choosing the analysis to answer the question. Of utmost importance is to ensure that the analytical procedures selected are appropriate for the measurement scale of the variable. This is critical when dealing with student achievement. Reports of assessment data often contain performance level results (e.g., below basic, basic, proficient, and advanced). A common misperception is that statistical tests of group means (e.g., t-tests) can be conducted on this type of data (Carroll & Carroll, 2002). This is incorrect because performance level data is not on an interval scale; that is, the differences between adjacent performance levels are not equal.

In many cases, performance levels are the only form of assessment data that schools have used up to this point, and it is one reason why teachers and administrators have negative opinions of state assessments. A common critique is that two students with similar, but not equal, scores may be placed in different levels (e.g., proficient versus basic). Of course this is a characteristic of many categorical variables derived from continuous data, but the way to eliminate the problem is to use scaled scores in statistical analysis rather than performance levels. When schools make the decision to move beyond prepared reports distributed by states, they can produce more meaningful and accurate results.

Example 1: District high school math performance

Data for the study were obtained from the district's data system, which was a web-based interface providing access to the school's server. In addition to all information being consolidated in a centralized location, other features made it a strong database. One department in the central office was responsible for developing and maintaining the database. It was staffed by people with assessment, data management, and technical experience. Also, training and support for teachers and clerical staff to use the database were offered on a regular basis. To obtain the necessary variables for this study, data from demographic, assessment, and coursework tables had to be linked for each student. Data were also merged across school years in order to select all students in the cohort.

The sample of cohort students were then compared to the rest of the high school student population not examined in the study. Cohort students had significantly higher percentages of female students, White students, and students not from low-income families as compared to the non-cohort. Academically, the cohort had significantly higher mean scores on the large-scale assessments at each grade level than the non-cohort. Therefore, results for this study generalized only to those students who remained in the school district throughout high school. A later study focused more heavily on cohort and non-cohort differences as well as reasons why students left the school system (Parke & Keener, 2011).

An example of a variable that was modified for certain analyses was the course type indicator. The original variable included categories for algebra 1, geometry, algebra 2 (the three core math courses in the district), trigonometry, elementary functions, pre-calculus, calculus (three advanced math courses), general math, and an SAT preparatory course. To answer certain questions, percentages of students taking each of these courses were obtained. However, it was also useful to have a modified course type variable that was dichotomous in nature, indicating whether a student took only core math courses from grades 9 to 12 or took the core courses plus at least one advanced math course.

The majority of data analysis procedures selected to answer the first two questions were descriptive in nature. Correlation analyses were used to answer the third question about relationships. Correlations were also obtained within demographic subgroups (ethnicity, gender, and socioeconomic status), and Fisher's r-to-z transformations were used to determine if correlations between subgroups were significantly

different. For the last question, a regression analysis was conducted. Separate regression equations were also obtained for each ethnicity subgroup. These data analysis techniques were not overly complex, yet they were statistically sound. Complex statistical analysis is not always necessary for answering questions in schools. It is important to remember that the results must be easily accessible and interpretable in order for them to be useful.

Example 2: School climate in a middle school

Before any analyses in the middle school study could take place, the data had to be transferred from the surveys in boxes to a spreadsheet in a statistical software program. Conversations surrounding how to make this transformation and set up the spreadsheet allowed teachers to become more familiar with their data, understand the scale of measurement for each variable, and to determine which type of analysis would be appropriate.

Unlike the district study on math performance, this investigation contained a large amount of qualitative data in the form of student responses to several open-ended items. To begin the process, the lead teacher and liaison developed an initial coding scheme for one item after becoming familiar with the variety of student responses. During a regularly scheduled meeting, they presented it to the team of teachers, providing examples of students' responses for each coding category. Then, the teachers independently coded a set of responses assembled by the liaison for the purpose of illustrating the coding scheme. After everyone finished coding, the independent codes were tallied, and the group had lively discussions about their agreements and disagreements. At the end, they came to a consensus regarding modifications to the scheme.

The next step was to code approximately 1,300 student responses to the item. During an all-day Saturday workshop at the school, they gathered to individually code another small packet of responses and then compared codes across the team until everyone felt they reached a shared understanding. In the afternoon, teachers began the actual coding by working in pairs to improve inter-rater reliability. Over the following two weeks, teachers coded the rest of the responses on their own time. Approximately 25% of all student responses were coded independently by two teachers in order to estimate inter-rater reliability throughout the process.

Component 5: Formatting and Presenting Results

Results can be presented in a variety of formats depending on the purpose of the analysis. If teachers analyzed student work, results may be shared in a face-to-face group setting. Lively discussions often occur around these informal descriptions of outcomes. In many situations, however, there is not an initial meeting where results are provided with time for questions and comments. School personnel might receive a document in their mailbox or on their desk, and they will have a choice as to when to read the report and how much time to devote to it. Careful thought and planning should go into formatting the presentation of results so they will be enticing to readers; but at some point in the sharing process, there should always be at least one meeting around which the outcomes are discussed.

The format and content of a report will also vary depending on the audience; that is, who will benefit from knowing the results. If the area is of interest to many stakeholders, multiple reports may be distributed. A report containing detailed results for each question, similar to a results section of a research paper, might be given to staff members in the data and assessment office who have statistical expertise. Another report containing all results, but with statistical terminology removed, could be developed for central office administrators. It might begin with an executive summary describing the major outcomes and recommendations. Then, if appropriate to the purpose of the study, a report for teachers would include a description of how the results are meaningful to their classroom instruction. Carroll and Carroll (2002) provide a series of excellent suggestions for communicating results to a variety of audiences.

Example 1: District high school math performance

The complete set of results was contained in one report prepared for the district. It consisted of many sections that could be extracted and used for various purposes. The first section was a description of the purpose for the investigation, reminding everyone why answers to the questions were important. An executive summary followed, serving as an advanced organizer for the entire document or as a brief description of the important outcomes for central office personnel and interested community members. A detailed table of contents made for easy navigation through the many results. It helped readers know where to find the specific area in which they were most interested. Each results section was essentially stand-alone, which was useful for having discussions with different groups of people.

Results were presented in easy-to-interpret tables or figures with a brief paragraph that introduced their contents. After each table/figure, a series of bullets were used to convey the meaning of the numbers without using complex statistical terminology. In many cases, multiple ways of describing the results were stated (e.g., "another way to summarize the results is to say that…"). When appropriate, bullets contained information on what the results do not say so that readers do not make conclusions beyond what the data actually shows. Finally, appendices included complete tables, figures, and the necessary statistical evidence to support the statements as well as evaluations of model assumptions.

Example 2: School climate in a middle school

In the middle school study, results were presented for interpretation during a series of formal meetings and workshops. Various combinations of the team of teachers, the liaison, administrators, and other school faculty were in attendance. The discussions were informative and often quite lively. Each session typically led to additional slices of the data. For example, after hearing results across all students within each school year, teachers who taught in the Extended Studies Program were interested in knowing whether their students had different perceptions of the school compared to students not in the program. Because the meetings were ongoing, they encouraged this type of interaction with the results and the resulting exchange of ideas.

Some of the data confirmed what the teachers believed about their school. Students strongly agreed with statements about teachers' high levels of expectations and about the school preparing them to be successful in the future. Teachers were also pleased to see that the level of agreement increased in the third year on items about the use of computer technology across all classrooms since it was one of their reform efforts. With respect to tolerance and respect, there was also an increase in positive student responses in the third year compared to the previous two years. Interpretations of results for the cohort of students from 6th to 8th grade were also informative and led to discussions about what takes place at the different grade levels.

Component 6: Outcomes and Further Directions

Results become meaningful through conversations that place them in the school's context. In districts with broad-based school improvement plans, connections should be made to other related efforts. Results can also be situated within the context of literature in the field. Most district personnel are not familiar with the larger research base, so it may be beneficial for them to have conversations about how their results compare with those obtained in other districts across the country.

One possible outcome from data analyses is a decision, especially if the purpose was to evaluate a program. However, a decision will not always be the outcome, and it may be frustrating to district leaders who expect an answer based on the first pass through the data. Being able to recognize that data use is an ongoing process with multiple phases is important. Answers from initial questions will likely raise additional questions that can be answered through more nuanced quantitative analysis or by employing a qualitative approach that examines classrooms and instruction.

Probably the most common outcome of data use is that it directs and focuses the district's or school's efforts, resources, and time. It can help identify learning atmospheres and classroom environments in which students are doing well and pinpoint the reasons for success. Although there is not much written about the use of evidence, Honig and Coburn (2008) indicate that in most cases districts use results to strengthen student and school performance, to confirm or discount prior beliefs based on anecdotal evidence, and to help change beliefs.

Example 1: District high school math performance

This investigation did not set out to make a decision, but rather to produce information that highlighted areas warranting further attention. One interesting outcome, that has since produced in-depth examinations of data, is the nature of the relationship between scores on the state assessment and whether students took an advanced math course.

Although all correlations were positive, indicating that students who took an advanced math course tended to score higher on the assessment, the correlations were found to be significantly weaker for Black, low socioeconomic (SES) students than for White, non-low SES students. Additionally, the regression analysis showed that taking an advanced math course was less influential in explaining Black student performance on the test than White student performance. This result raises a question about the experiences in upper-level math courses for students from different ethnicity and SES backgrounds.

Simply enrolling in an algebra course early or taking advanced math in high school does not necessarily promote math learning and understanding. First, students must be developmentally ready to take the course. Secondly, the content and instructional strategies must be sound in order for students to succeed. If students are in an environment that does not provide worthwhile and meaningful learning experiences, they will not benefit from those courses (Ma & Wilkins, 2007).

One avenue for further exploration is to examine the implementation of course curriculum in each of the ten high schools. Do teachers know and understand the math concepts they are teaching? Overall, are some schools better than others at preparing students for success in mathematics? To begin answering these questions, additional analysis examined math course-taking at each grade level within each high school (Parke, 2009). One school, often described as "low-performing", had especially troubling results. In comparison to all other district high schools, they had the largest proportion of 9th grade students taking, but also failing, geometry. The majority of these students exited the district after 9th grade. Did the students have the necessary prerequisite knowledge for learning geometry? Geometry is one of the district's core courses, but when taken in 9th grade it is considered "advanced". Research on course requirements in math indicate that it may be detrimental to place students in a math course before they have the necessary skills (Finn, Gerber, & Wang, 2002; Lee, Croninger, & Smith, 1997). A look inside the school and classrooms is now necessary to answer questions about the criteria used to determine when a student takes geometry and also the content, instructional techniques, and assessment in the course. If students have not demonstrated adequate prior knowledge, it is a disservice to them to be set up for failure.

Example 2: School climate in a middle school

In the middle school study, teachers and administrators said the content analysis of open-ended student responses was very informative and provided additional insight into the quantitative data obtained from the Likert items. They were pleased to learn that the majority of students made at least one positive comment to the prompt "when I come into this school I feel…" The most frequent positive comments were that they felt happy, satisfied, welcomed, and safe. A small percentage of students had only negative comments which included being tired, bored, insecure, or stressed about getting a good grade. When examining results by grade level, teachers were initially concerned that lower percentages of 7th and 8th grade students, compared to 6th grade, said they felt safe or

welcomed.. These two comments were grouped together under one coding category. During discussions of results, teachers felt it would be helpful to obtain separate percentages of students who felt safe versus felt welcomed. They expected that the "welcomed" comments would most likely appear more frequently in 6th grade since there was a focus on making students feel comfortable in the new middle school setting. Similar discussions around other results also led to further analysis of their data.

In addition to learning about students' perceptions of their school, another outcome of the process was that teachers grew professionally and gained an appreciation of the value in using a systematic approach to collect and analyze data. Rather than relying only on anecdotal information, teachers were able to obtain a more complete perspective of the entire student population.

The process encouraged collaboration among teachers around a shared goal that everyone felt was important; that is, finding out how their students feel about the school they attend every day. Teachers commented that the conversations were professional, meetings had a purpose, and they used real data to support their statements. Moreover, as a Professional Development school, they trained several preservice teachers. Interns participated in various stages of the investigation and it was beneficial for them to see teachers involved in such a process. As someone said, teachers were not just talking the talk, they were walking the walk (Parke & Taylor, 2008).

Final Remarks

School districts are maintaining a wealth of student information in electronic database systems and other formats. The meaningfulness of the data depends to a large degree on whether they can understand the information and use it to guide their efforts. A district official said, "we have oceans of data, what can it tell us about our students that will help set priorities and improve our schools?" The components in the approach described here are intended to help districts and schools make the most of their data. With specific questions, careful planning, involvement of people who have the knowledge and skills to work with data, shared goals, and a systematic but simple approach to data analysis, the data can be put to good use and ultimately fulfill the intended purpose to improve the teaching and learning process.

The district example used to illustrate the components was one part of a whole. It was not the first nor the last investigation conducted through the partnership. It was also not the only use of data in the district going on at that time. Several other school reform initiatives and evaluations were being conducted concurrently at the district level, school level, and classroom level. This is somewhat typical of other districts that use data to guide their efforts (Kerr et al, 2006). A particular strength in this district was the meticulous record-keeping of students' math coursework over time. Because of the web-based interface to the system, the data tables were continuously being updated with the most current information.

The middle school example illustrated a different type of data use, one which was teacher-initiated and focused on analyzing student perspectives of their school. Both quantitative and qualitative data were incorporated. The strengths in this school were the dedication of the teachers and the support of the administrators. Faculty recognized that without the structures that were already in place at the school, it would have been difficult for them to carry out the analyses. Moreover, because administrators valued student perceptions, and demonstrated this by attending and participating in meetings, the faculty felt a shared sense of purpose and goals.

Here are a few practical steps an educator, particularly a principal, can take to encourage effective data use in decision-making. Following these steps will help create a school atmosphere in which personnel want to be involved in examining data. First and foremost, know your data. In other words, take the time to become familiar with *all* the data available to you, not only the data accessed on a regular basis. If the district houses a central data system, then learn about the information it can

provide. In large districts, there are typically two departments, the computer personnel who maintain the database and the assessment personnel who create reports for accountability and other purposes. The knowledge that exists in both departments can help you access the data as well as how to understand, interpret, and use it. Establishing a good, working relationship with the computer personnel is essential. These folks can give you a description of all available data and its attributes, for example whether it is student-level data or teacher-level data, if it is tracked longitudinally, and how it can be linked to other data. The assessment personnel can guide you in selecting what is needed to answer your questions. They may also be aware of other district or school data that is not available electronically and can assist you in obtaining it.

Making the data accessible to potential users in your school is the next important step. Share your knowledge of the available data with the school staff. Then, give them time to become familiar with the data. It is not necessary, or even desirable, to create questions for investigation at this early stage. Forcing an analysis of data without a reason does not always lead to useful results. Learning what the data system has to offer may take several sessions. Some schools and districts hold ongoing workshops to "get to know the data" and how to extract it for various purposes. Moreover, it is useful to become familiar with studies that may be occurring in other district schools. As mentioned earlier, coherency and communication are factors that promote data use. An awareness of other efforts throughout the district can help guide your own schools' investigation of data and ensure that the individual entities are not operating in isolation.

Facilitating staff in developing hypothesis, methodology, and appropriate data analysis is another step in the process of providing support for data use. One way is to enlist the assistance of someone with the necessary expertise to guide the decision-making at this stage. It could be a person within the district or an external collaborator, as long as everyone is operating under the same set of goals and purposes. Exposing staff to articles or reports from other educators who did similar research on the same topic is also beneficial. There are many excellent practitioner journals that contain information not only on the outcomes of data analysis, but also about the process of conducting the study. Knowing how other educators developed their hypotheses, created their questions, and analyzed their data goes a long way in increasing confidence and knowledge.

Finally, providing time in the form of regularly scheduled ongoing meetings is essential to maintaining the momentum. Moreover, as the project is near completion, it is often useful to invite other interested teachers and administrators to the sessions, share results with them, and encourage their participation in discussions that are focused on interpreting the meaning of the outcomes. Much is learned when educators communicate with each other over results from a systematic analysis of their own data.

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