ABSTRACT
                Data collection and analysis are frequently neglected by
school leaders over the course of the decision-making process. All schools
gather large amounts of information about students and teachers, but most
data are used to satisfy administrative requirements rather than evaluate
school improvement in a systematic fashion. Apprehension regarding statistics
and statistical analysis among educators is substantially related to four
major inadequacies in teacher preparation programs. The first is a lack of
emphasis on the applicability of statistics to daily activities of teachers
and leaders who frequently fail to see the practical uses of statistics in
decision making. The second is poor use of new technologies in learning and
using statistics and a continuing emphasis on statistics as mathematical
theory. The third problem is a failure to design statistics courses for
educational leaders and teachers in favor of other areas, such as psychology
and sociology. The fourth major inadequacy is an emphasis on the inferential
statistics used in theses and research studies instead of the descriptive
statistics most likely needed in the school context. Data analysis in the
school context need not be complex, and many useful data are already gathered
in the normal course of school operation. Recent research indicates the
ability to successfully use data is an increasingly critical factor in
carrying out effective educational reforms and sustaining support for public
schools. (TEJ)

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Data Analysis and School Administration: An Oxymoron?

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Abstract

Data-driven decision making is a hallmark of good instructional leadership. But most educators shy away from statistical results, often creating instructional policy based on intuition. This article attempts to reduce principals' statistics anxiety and suggests strategies to help building principals use existing school data for improved instructional leadership. Principals and teachers can now learn to maneuver through the myriad of statistical data to help create goals and strategies for change and improvement based on solid findings.

Data Analysis and School Administration: An Oxymoron?

Introduction

Few would deny that the decision making process in our schools is shouldered by building and central office administrators and in addition, education leaders are asking (and expecting) classroom teachers to participate in this decision making. For too long many school leaders have made decisions about instructional leadership with "intuition" and "shooting from the hip." All too often school leaders do not include data collection and data analysis in the decision making process.

We are realizing that meaningful information can be gained only from a proper analysis of data and that good decisions are based on this thoughtful process of inquiry and analysis. School districts across the nation collect and maintain many forms of educational data (e.g., attendance rates, standardized and criterion reference test scores, etc.); however, most schools use the collection of these data to satisfy administrative requirements rather than to assess and evaluate school improvement.

During my many years as a classroom teacher and then as a principal and district superintendent of schools, I especially questioned the enormous amount of time we spent in collecting numbers. Thirty to forty minutes each morning were spent in collecting and reporting attendance. The annual state mandated testing procedure began in early October and seemed to exist in one form or another for the entire year. But we collected our scores, sent them to the office, and never saw them again.

School districts across the nation collect and maintain many forms of educational data. Standardized test scores, average daily attendance figures, and transcript data are required by states for funding purposes. However, most schools use the collection of

these data to satisfy administrative requirements rather than to assess and evaluate school improvement. Standardized test scores are generally reviewed only briefly before the local newspaper calls. Average daily attendance is reported to state education agencies, then filed away some place. Educators rarely examine these data to assess in a systematic way the quality of teaching and learning at their school.

This need will only become greater as society and our state departments of education ask for more accountability from our school leaders. The good news is that the advances in technology make the collection of school data almost automatic. Principals must possess an understanding of data analysis and ways to use this analysis to improve teaching and learning in the classroom.

Fewer things are more feared than the thought of *statistical analysis*. To most educators, statistics means endless calculations and memorization of formulas. Statistics is seen by most as a formal domain of advanced mathematics and represented by a course or two taught by professors desiring to make a student's life as painful as possible. Courses in statistical methods are usually taught with formal proofs of mathematical theorems and the derivation of statistical formulas as a main focus.

Is this anxiety and fear due to the fact that statistical analysis requires a level of mathematical knowledge beyond the capabilities of principals? If someone has passed a high school course in elementary algebra, he or she has acquired all the knowledge and skills required for an understanding of statistical analysis. In previous research, the author found that students report their fear is mostly related to the fact that statistics has no relevance to solving the many issues in our day-to-day living.

The educator's fear of statistics likely relates to a variety of factors, but principal and teacher preparation programs must accept the fact that the presentation of statistics in education probably lacks four important components. First, it does not emphasize the relevance of statistics to the day-to-day lives of principals and teachers. Second, it does not fully integrate current technology into the teaching and learning of statistics. Third, few (if any) statistics courses are designed for students enrolled in education leadership or teacher education programs. Fourth, and finally, many statistics courses taught in colleges of education focus a major part of time on inferential statistics as a tool in conducting research projects and dissertations. Far less time is spent on statistical strategies which might help the principal improve his/her skills in problem analysis, program and student evaluation, data-based decision making, and report preparation. A brief description of each follows:

Relevance of Statistics to the Lives of Principals and Teachers

Traditional courses in statistics result in the frequent student response: "When will I ever use this stuff?" And rightfully so, as our research indicates most courses at the college level are taught as a hard-core math course devoid of powerful and practical applications relevant to school administration and student learning. We seem to realize the importance of relevance in many of our courses such as the Principalship and Instructional Supervision, but have been slow to add the same importance of practical application to our statistics and research courses. Unless this change is made, we will continue to face high levels of anxiety in our principal preparation programs.

Integration of Recent Technology into the Teaching and Learning of Statistics

The teaching of applied educational statistics, according to James McNamara from Texas A & M, needs to move away from the traditional conception of statistics as mathematical theory, and closer to the administrator and teacher preparation programs. The advance of technology and the large selection of user-friendly computer software can assist us as we make this move toward a more practical and relevant presentation of statistics for educators. Several good statistical packages exist, including: (1) GB STAT and (2) the Statistical Package for the Social Sciences (SPSS). Better news is that we can even use our good friend Microsoft Excel to perform our data analysis. All are easy-to-use, menu-driven statistical programs applicable for analyzing student standardized test scores, attendance and drop-out data, college entrance requirements, etc. These common computer software programs are designed to allow people in the social sciences to analyze their data. They can tabulate the number of males and females in a school, calculate average grades of the students, compare test scores by gender, determine if there is a statistically significant difference between achievement of athletes and non-athletes, compare computer-assisted instruction with other methods of delivery, and test the effectiveness of whole language vs phonics instruction.

Statistical Analysis Designed for Educators

Again, many of our courses emphasize and concentrate on psychology, sociology, and other areas of the social sciences with little mention of ways that statistical analysis can assist school principals in their day-to-day decision making. We need to work with data collected from real classrooms, focusing on student instruction and assessment,

attendance and drop-out rates, college entrance tests, and instructional program evaluations.

Descriptive and Inferential Statistics

While inferential statistics are more likely to be used in research studies and dissertations, descriptive statistics are more likely to be used in the schools. Descriptive statistics help us *describe* those studied (percentile ranks, means, median, modes, range, standard deviation) and inferential statistics use sample data to *estimate* parameters and test hypotheses. In most cases, the educator encounters data in the schools which are related to populations rather than samples. In other words, data are collected from entire classes or grade levels, entire building populations, and entire district populations. Principals are not interested in generalizing their school data findings to other schools or to estimate parameters and test hypotheses. Their immediate interest is in data from their school for the current academic year. I argue for a shift in the use of statistical analysis from the traditional research and dissertation model to one of relevance and applicability to administrators and teachers.

What is this thing called statistics?

First of all, statistics is not advanced mathematics. The majority of statistical analyses useful to the principal can be completed with a basic understanding of mathematics and is more conceptual than involving complex calculations. Statistics is a set of tools designed to help *describe* the sample or population from which the data were gathered and to *explain* the possible relationship between variables.

A school principal wonders if the mathematics instruction in his school is being delivered in a manner which favors boys and girls equally.

In other words, is mathematics being presented in an equitable manner at His/her school? A simple statistical procedure called the *Pearson correlation* can help identify a relationship between math scores and gender (a simple stroke of the computer keys with the help of EXCEL, GB STATS or SPSS). If the results of the analysis indicate there exists a pattern of boys receiving higher scores in mathematics on standardized tests, the principal may want to look more closely at classroom instruction to determine if perhaps instructional strategies can be altered to address the equity issue.

A school principal is interested to know if there is a relationship between students' performance on the district writing assessment and their socio-economic level. In other words, do students who come from lower socio-economic backgrounds *really* perform lower as we are led to believe? Or are there other variables responsible for the variance in writing performance? Again, a simple correlation analysis will help *describe* the students' performance and help *explain* the relationship between the issues of performance and socio-economic level.

Data analysis does not have to involve complex statistics. Data analysis in schools involves: (a) the collection of data and (b) using available data for the purpose of improving teaching and learning. Interestingly enough, principals and teachers have it pretty easy – in most cases, the collection of data has already been done. Schools regularly collect attendance data, transcript records, discipline referrals, quarterly or semester grades, norm and criterion reference test scores, and a variety of other useful data. Rather than complex statistical formulas and tests, it is generally simple counts, averages, percents, and rates that we are interested in.

The Rationale for Using Data to Improve Decision-Making in Our Schools

Much recent research indicates why school leaders must become familiar with and use existing school data to make sound educational decisions about teaching and learning. Most recently, Philip Streifer, a professor of educational leadership at the University of Connecticut, worked with the National Science Foundation and the National Center for Educational Statistics, to develop an information-management and data-warehousing system that provides school leaders with easy-to-use access to all of their data. The system focuses on how best to use these technologies for effective school leadership and improved decision making. James McNamara, from Texas A & M University, has written extensively on teaching statistics in principal preparation programs. His research helps answer the question: *What aspects of statistical methods should be emphasized in a basic statistics course that is designed explicitly to help school principals improve their skills in problem analysis, program evaluation, data-based decision making, and report preparation?*

Departments of education administration and teacher education need to refocus their instructional delivery to help principals and teachers improve their skills in problem analysis, instructional program evaluation, report preparation, and data-driven decision-making. We must provide principals and teachers the skills and experience necessary to use data analysis for school improvement with special attention given to increasing student achievement.

So, What's the Problem?

In Holcomb's (1999) very successful book, *Getting Excited About Data,* she discusses the reasons why data are little used in our schools and why it is so difficult to generate passion to get educators engaged:

> My observations are that more than half of our teachers have graduate
>
> degrees and have taken at least one course in tests and measurements
>
> or statistics. I have four graduate degrees myself and can recall no class
>
> discussion of what to do with assessment information in planning how
>
> to help students do better. I have come to the conclusions that such
>
> courses are taught by researchers as though they are preparing researchers.
>
> As a result, the emphasis is on esoteric experimental design – which can't
>
> be replicated in a normal school setting. (p. 22)

Holcomb continues by quoting Gerald Bracey (1997), internationally recognized as one of the country's respected experts in the understanding of education statistics:

> …many of the university professors who create and use statistics are
>
> more comfortable using them than they are teaching other human beings
>
> what they mean. And in all too many instances, statistics are taught in a
>
> theoretically rarefied atmosphere replete with hard-to-understand formulas
>
> and too few examples to the daily life of education practitioners.

I am in agreement with Holcomb, and also state that the uses of school data can illustrate how statistical analysis can be applied to everyday situations found in our schools.

The Use of Data Analysis in the Principal's Office

Example One. As administrators, we are all familiar with collecting average daily attendance (ADA) figures. These numbers provide the formula used to receive our funding from the state and federal governments. In most cases, once we report the attendance to our county office or state department, we put the data away in a file someplace. Rarely do we use these data to make decisions about curriculum and instruction. Let's travel to Westside High School and look at their average daily attendance rate for 1996, 1997, and 1998. The Westside attendance data are displayed in Table 1.

Insert Table 1 here

At first glance, things look impressive. On average, over a three-year period, 93% of our students are in school every day. We reason that 93% is kind of like an "A" and is pretty good. So we report the figures to the appropriate agencies, and move on with life.

But let's take a closer look. If 93% of our students are in attendance on average, we must conclude that 7% of our students are absent on average. So in fact, on average, our high school students miss nearly two-weeks of school per year. We calculate this by taking 7% of the 180 school days (180 x .07 = 12.60). Wow! Now that's a different story. Do we not agree that 13 days of school (on average) missed has curriculum and instruction ramifications? Are there ways of adjusting our curriculum, scheduling, and delivery of instruction which might help us reduce the number of absences at Westside High School? Let's *disaggregate* or break our data down a bit further!

Insert Table 2 here

Table 1   Average Daily Attendance: Westside High School

1996	94%
1997	92%
1998	94%

Table 2   **Westside High School: Attendance on a Daily Basis**

Monday	Tuesday	Wednesday	Thursday	Friday
95%	95%	97%	91%	89%

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Now we see a different picture! To no great surprise, we notice an up and down attendance pattern during the week. But when looking at our curriculum, scheduling, extra-curricular activities, we notice that the highest attendance rate is on Wednesday – the day we hold our football rally! In addition, we notice our lowest attendance rate on Friday – the day most of our testing and assessment takes place! Perhaps the principal should consider changing the football rally to Friday and encourage teachers to do more of their testing on other days.

The above example illustrates how easy it is to use existing data to help us with the day-to-day operation of our school. Hopefully, you sense the importance of the use of data analysis and how we link data analysis to what we spend our lives with - curriculum, instruction, assessment, and student achievement.

Example Two. You serve as the chairperson of the Horizon High School Curriculum Committee. The Director of Secondary Education in your district has just notified you that she wants a recommendation from you and the committee for this year's textbook adoption. As is the practice at Horizon High School, the Board of Education allows only one subject area to have new textbooks annually. You and your committee must decide which subject area will receive this year's new textbooks.

Looking at the standardized test scores for Horizon High School, you can use the measures of central tendency and variability to help you and your committee make a wise decision and recommendation to the Director of Secondary Education. Table 3 displays some of the information we need to address our assignment.

Insert Table 3 here

Table 3   Horizon High School: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MATH	100	234	263	246.86	7.69
LANGUAGE	100	232	260	248.26	6.38
SCIENCE	100	220	276	245.41	8.51
WRITING	100	175	234	205.76	11.88

We do notice that the mean score for the writing assessments are much lower (on average) than the other subject areas. In addition, the standard deviation is higher than the others, meaning that the writing scores are a bit more spread out from the mean. Specifically, we can say that approximately 68% of the high school students scored between 194 and 218 on their writing assessment scores. The standard deviation is 11.88 (rounded to 12) and the mean is 205.76 (rounded to 206). The 12 points represents one standard deviation unit and we know that approximately 68% of a distribution falls between 1 standard deviation unit below the mean and 1 standard deviation unit above the mean.

The scores of the other subject areas are noticeably higher and the standard deviations a bit smaller, indicating that those scores are centered a little more closely to the mean. Though we need to take many other factors into consideration, the writing scores would give us reason to perhaps suggest new instructional materials for that subject area.

The Use of Data Analysis in the Classroom

Karla, who teaches Grades 3 and 4 mathematics at a small rural K-8 school district in southeast Idaho, is interested in finding out if a mathematics series adopted by the district five years ago is effective for all levels of students. Karla's hypothesis is:

> The district math program is effective with middle and low
> ability students but doesn't address the needs of the students
> with above average math ability.

Her hypothesis is based upon the belief that the district math program over-emphasizes computation and repetition but lacks the components of in-depth

investigations and problem-solving experiences. To help answer the research hypothesis, she collected four years of Iowa Test of Basis Skills (ITBS) percentile rank scores on her students. She created the following procedures:

Step 1: Ranking the students into categories of high, medium, and low. Karla based her grouping on the percentile rank scores from the first year base-line data, and categorized students scoring at or above the 60th percentile as the high group, students scoring from the 40th to the 60th percentile as the medium group, and students scoring below the 40th percentile as the low group.

Step 2: Creating a data file. Using Microsoft Excel, Karla entered the students' ITBS percentile ranks into a spreadsheet.

Step 3: Analyze the data. With a few simple mouse clicks on her computer, she discovered that:

    a. A majority (85%) of her students who were rated "below average" revealed no change or an <u>increase</u> in their scores over the four year period.

    b. An unusually high number (75%) of her students who were rated "above average" revealed no change or a <u>decline</u> in their scores over the same four year period.

After running a few more statistical tests with her student data, Karla presented her findings to her principal and superintendent. She was invited to share her data analysis with the board of education. Realizing that her analysis did not necessarily prove anything, she felt the discovered pattern indicated a need for re-evaluating the math

program and especially her teaching methods in the classroom. Karla's conclusion to the superintendent and board was:

> The district math program seemed to be challenging the lower
>
> level of students by reinforcing basic skills, but for the higher
>
> level of students (having already achieved the fundamentals)
>
> there was a need for an additional instructional forum for
>
> which to apply, inquire, and experiment with the numbers
>
> and mathematical concepts they already know.

The end of this exciting story was the implementation by Karla and her colleagues of an enrichment math program that encouraged the higher level students to think mathematically, and apply this thinking to complex and multidimensional math problems, and to be able to communicate this thinking clearly.

<u>Conclusion</u>

Collecting data without purpose is meaningless. All too often, school leaders fail to formulate decisions based on data. The effective use of data must play a major role in the development of school improvement plans. Too many of our school leaders make decisions based on "informed intuition." Meaningful information can be gained only from a proper analysis of data.

Using the many different kinds of data collected at our school site to help with decision making legitimizes the goals and strategies we create for change and improvement. It helps us identify groups of students who are improving and groups of students who are not – and helps to identify the reasons. Thus the principal can serve as

instructional leader. Data-driven decision making and instructional leadership must go hand in hand.

I am not proud to state that I feel the real culprits in this dilemma are the university administrator and teacher preparation programs. Though there are a few "bright spots" in some preparation programs, for the most part there is no attempt to increase administrators' and teachers' understanding of data analysis or the use of analysis to improve teaching and learning.

I presented earlier in this article the four important weaknesses of data anlysis as presented in most administrative and teacher preparation programs: (a) the irrelevance of statistics to the day-to-day lives of principals and teachers, (b) the lack of integration of current technology into the teaching and learning of statistics, (c) the inappropriate design of statistics courses for administrators, and (d) the overemphasis on the use of data analysis for theses and dissertations. I attempted to emphasize the importance of descriptive analysis and shift the use of data analysis from the traditional research and dissertation model to one of relevance and applicability to school administrators and teachers.

I firmly believe that until we begin to seriously evaluate and analyze the existing data in our schools, our profession will continue to be scrutinized and questioned with regard to student achievement and quality teaching and learning. There is much evidence indicating that we are loosing some of our market share to private schools, vouchers, charter schools, and some emerging for-profit enterprises. We must discontinue the practice of making decisions based upon intuition and gut feelings.

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