

Teacher-Friendly Options to Improve Teaching Through Student Data Analysis¹

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Introduction

We believe that the potential for an impactful use of computers lies in putting into service the vast quantities of student data already owned by schools. Schools, districts, and governments have collected large amounts of student data for years, but this data is rarely put to use, in fact, it is not unfair to suggest that schools are data-rich but information-poor. It is, however, unfair to allow an opportunity for increased familiarity with students and their situations go unused by teachers and other school personnel. Our belief is that teachers would make ardent use of data which informs their classroom practice if such data were quickly and easily available to them in forms that fit their needs and answered their questions. In this paper, we highlight software options for helping teachers improve practice through analysis of student data.

Research on School Data Use

Research on school improvement and school effectiveness has shown data use to be central to the school improvement process (Chrispeels, 1992; Earl & Katz, 2002), and there are many case studies available describing the variety of ways in which data has supported educational decisions (e.g., American Association of School Administrators, 2002; Feldman & Tung, 2001; Lachat, 2002; Pardini, 2000; Protheroe, 2001). Recent policies at the federal, state, and local levels have served to bring data use to the fore. As Earl and Katz (2002) note, data use is now not a choice for school leaders, but a must.

Data can be used to inform solutions to a wide variety of educational challenges. Streifer (2002) listed some, including exploring group differences, exploring growth over time, program evaluation, and identifying root causes of educational problems among the many ways data can be used. A study by Chrispeels, Brown, and Castillo (2000) showed data use to be a strong predictor of the efficacy of school improvement teams – data use not only increased efficacy directly, but served as a mediator for the positive effect of other factors. Kennedy (2003) included use of data as a central component of his model for raising achievement test scores.

Data also can have a positive effect on the people involved in the educational process. Feldman and Tung (2001) observed that schools involved in data use often evolved toward a more professional culture. Educators in their study became more collaborative during the data/decision process, and school business consequently became less “privatized.” Earl and Katz (2002) note that school leaders involved in data use often develop a mindset of being in charge of their own destiny, increasingly able to find and use information to inform their school’s improvement. Armstrong and Anthes (2001) found that data use was helpful in raising teacher expectations of at-risk students, noting positive changes in teacher attitudes regarding the potential success of previously low-performing students.

Although data use provides many positives, the process of increasing data use in schools is not necessarily an easy one. One obstacle in particular involves technology. Although computers supporting knowledge management have been in widespread use in areas such as business, Thorn (2001) describes that schools present difficult technical problems because of the variety of data needs and uses in school organizations. Additionally, school data often exists in disparate forms and locations, making it difficult to organize into an efficient database. To underscore this point, Thorn described a case study where a district was ready to implement data based decision making, but

technological barriers hindered the process. Recent technological advances are helping schools overcome these technological barriers, and it is forecast that schools soon will have a variety of affordable, comprehensive computer tools to aid in the data process (Stringfield, Wayman, & Yakimowski, 2003). Although comprehensive student data analysis systems are not yet prevalent, there are many tools already on the market which help facilitate analysis (Wayman, Stringfield, & Yakimowski, in press).

Recent policy decisions, such as the No Child Left Behind Act, have increased awareness of student data use. However, these policies typically do not set forth expectations of data use at the teacher level, where classroom practice can be best impacted. We propose that providing teachers easy and powerful access to data will provide new and unique opportunities to improve teaching practice through self-reflection and increased familiarity with students. It is well-understood that improved teaching practice results from a continuous, though typically informal, feedback loop involving teaching, information, and reflection. There exist educational technology tools to enable teachers to access and utilize student information like never before, and we believe introducing these tools into this feedback loop will result in greatly enhanced decision-making by teachers.

Software for Student Data Analysis

Elsewhere (Wayman, Stringfield, & Yakimowski, in press), we have examined issues surrounding currently available software for using student data. In this analysis, we concluded that while possible, the situation is rare that enables a district to build and implement a home-grown student data analysis system cheaper, faster, or more efficiently than a commercially-built system. Such an undertaking involves a tremendous amount of time and resources which most districts do not possess. As a result, we will concentrate discussion in this paper on commercially-available products. Many of the issues surrounding implementation of these products are also applicable to locally-developed software.

The aims and features of commercially-available software for analyzing student data are varied, and each company has chosen one or two aspects of student data on which to concentrate their software efforts. Companies may choose to focus on providing reports, providing easy data access, or providing assessment data, to name a few. No one piece of software accomplishes everything, though some features are more common than others. For instance, most companies offer pre-formatted reports of student data that can be generated with a mouse click. Fewer companies offer stored queries, where the user can perform a customized query of the data, then save that query for use by themselves or another user. Only two companies reviewed here offer online student work samples, or electronically accessible portfolios of student work.

These programs do share some commonalities, features that a school should expect in buying software for student data management. Almost all programs are web-based and thus offer user access from any internet connection. All programs offer at least descriptive analyses (e.g., means of different groups and sub-groups), and all offer the capacity to produce reports based on the disaggregations mandated by the No Child Left Behind legislation. All offer some form of ongoing technical support, and all companies are at least aware of the evolving Schools Interoperability Framework (www.sifinfo.org), to establish industry standards for educational software.

Thus, there are some common basic services provided by these companies, but for the most part, schools currently are required to choose software based on an area of concentration. We anticipate that as the field moves toward scale, schools will be able to choose from more comprehensive programs. At present, however, it is important that schools carefully evaluate present and future software needs, resources, and available software options, choosing software which provides the best combination.

Our technical report on student data software systems (Wayman et al., in press) contains reviews of commercially-available software for analyzing student data. Since software changes rapidly, we also have started a website, www.csos.jhu.edu/systemics/datause.htm, which will contain updated reviews as they become available. Table 1 lists the commercially-available products of which we are aware, and their websites.

Table 1
Commercially-available software programs

<u>Program</u>	<u>Website</u>
Account from SchoolNet	www.schoolnet.com
Chancery	www.chancery.com
DataPoint from NSSE	www.nsse.org
Ease-e from TetraData	www.tetradata.com
EDexplore from EDsmart	www.edsmartinc.com
eScholar	www.escholar.com
QSP from CRESST	qsp.cse.ucla.edu
SAMS from Executive Intelligence	www.execintelligenceinc.com
ScholarSuite from SCHOLARinc.	www.scholarinc.com
Socrates from CRM	www.crminc.com
STARS from SchoolCity	www.schoolcity.com
SwiftKnowledge	www.swiftknowledge.com
Virtual Education from EDmin	www.edmin.com

Note. Updated reviews available at www.csos.jhu.edu/systemics/datause.htm

Ideal Features

Since the development of such software is in the early stages, it is beneficial to speculate as to what an ideal software package might contain. No product yet incorporates all of these features, but some products include many of these features.

Our broad view is that software must be easily available for all levels of educators. We believe that educators will have little tolerance for solutions that are limiting, frustrating, or esoteric, so the best product will be one that intuitively provides a set of data analyses to the user, thus *promoting* data access and increasing educator desire to pursue the substantial range of information available in student data. Also, a product

must provide student data analysis for teachers, in addition to administrators, in order to truly inform practice. In the following paragraphs, we describe features that should be available in such software. Table 2 gives a brief synopsis of our narrative.

The presentation of the data and the quality of the data are inextricably connected. Any analysis of student data is worthwhile only to the extent that the data underlying it is worthwhile, and we anticipate that many schools will require assistance in building data sets that lead to educational improvement. A concern is that companies will see data quality as the responsibility of schools, but unfortunately, “send us your data” is a prescription for failure. Thus, a scalable program should either provide the capacity to enable near perfect underlying data, or be seamlessly compatible with a separate, affordable solution to provide clean data, and the company producing such a program should understand and assist schools/districts with the problems inherent in school data.

Table 2
Important features of a student data analysis system

Data

- Provides capacity to enable clean data
- Company accepts responsibility to facilitate data process with schools
- Software accepts many common data formats
- Data can be accessed from anywhere
- Access speed is fast and efficient

Usability

- Software is intuitive and easy to use
- Software requires little training
- Interface provides immediate access to relevant information
- Integration of different areas of information is seamless to the user

Information Access

- Multiple ways to access information
- Varied methods of representing information (e.g., tables, graphs)
- Comprehensive query tools available for every level of user
- Flexible drill-down capability from any form of data aggregation
- Wide range of data available for analysis
- Longitudinal presentation of data available at every user level
- Pre-formatted reports are clear, varied, relevant, and comprehensive

Other

- Affordable
 - Software exports data and output into common programs
 - Online student work samples available
 - Users can access electronic discussion groups
 - Easy access to learning standards information
 - Software offers capacity to link individual teacher data to student data
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Educators must be able to access such software from home or anywhere else they choose to work. Accessing a large database from a distance raises the issue of access speed, since slow response time is likely to cause frustration and almost certainly reduce data use. Therefore, program most useful for teachers would be web-accessible so school personnel may have data access to the fullest extent, and provide a response speed that enables further and deeper data querying.

To minimize user frustration and hence maximize use, the user interface of the software must be intuitive and easy to use. Given the time demands school personnel face and the fact that many are not computer experts, educators will make more and better use of data software if it is presented in a familiar form. For example, the growing use of the Internet has made many users comfortable with web-form elements (e.g., links, check boxes, and pull-down menus common to sites such as Amazon.com). A company that provides a scalable data solution will provide features that are easily used, and such a program will provide a user interface that is intuitive, and that requires little-to-no training.

When the user logs on, the interface should provide quick access to important information, and such access should serve as a springboard to easily guide the user to other forms of information. Data warehouses by definition integrate many different areas of information (e.g., attendance, demographic information, test scores) and integration of these areas should be nearly seamless. Although the underlying database necessarily must contain different areas of data, the more transparent this is to the user, the easier navigation will be. The user should also be provided with multiple methods to access information, across a range of complexities to include every level of user, and the user should be provided with multiple ways to represent this information through a variety of graphs and tables.

Although query tools (interfaces that allow for customized, ad-hoc data request) often exist for advanced users, or “power users,” it is equally important that there be query tools for less sophisticated users. Certainly, efficiency is gained when users can lean heavily on standard reports for information, but standardized features should not impose limits. Query tools should be simple to use and unrestrictive, allowing access to a wide range of data and the ability to provide simultaneous analysis of many variables. Broad “drill-down” capabilities (e.g., the ability to query a school level finding to efficiently examine a subset of data at a grade, classroom, or student level) are important features that provide maximum user ease and flexibility. This drill-down capacity should be flexible and available from anywhere in the program – users should be able to click on graphs, tables, or any form of disaggregation in order to gain more granular information at the student level.

The type of data accessible should be comprehensive and relevant. Users are limited when the information available does not answer all of their questions; further, users will grow in their analytic abilities only if provided with a wide range of information fully applicable to their situation. Therefore, items available for analysis should be varied and comprehensive, allowing thorough inquiry and examination. Students’ education takes place over a number of years, so the range of data available must also allow for longitudinal presentation, enabling the user to examine trends of schools, classrooms, and students over time. If data access is to be extensive, pre-formatted reports available to the user should be relevant and comprehensive. Such

reports necessarily must be constructed through a process of thorough consultation with a diversity of school personnel. Variables available for any analysis should never leave the user wanting more.

Additional features include:

- Online student work samples – school personnel should be able to access not only numeric data on a student, but also see samples of every student’s work online.
- The capacity to use many common formats (e.g., ASCII, Excel) to export data for further analysis.
- The ability to export graphs or other results into common programs such as Microsoft Word or Adobe Acrobat.
- Electronic discussion groups or “message boards” where users from any location can discuss issues relevant to the software. Yearly or bi-yearly user group meetings are also desirable.
- Easy access to the learning standards that drive local or state assessments.
- The capacity to link a teacher’s own student data to data accessed by the system. For example, a teacher might wish to correlate in-class grades with, say, assessment results from a state test.

Finally, and importantly, software must be affordable to schools and districts. Areas most in need of the information such systems can provide are often fiscally disadvantaged, operating with few resources.

Conclusion

We have examined issues surrounding a proposition that is prevalent in both the business management and school effects literature, the proposition that creating more nearly data- and information-rich classrooms and schools can help raise student achievement. Formal research and our own observations indicate that being “data-driven” is a phenomenon more often seen in the breach than in the basic structure of the typical school. We have also observed that the absence of data-informed decision-making is not due to an educator aversion to being informed. Rather, the wealth of data potentially available in schools is stored in ways that are accessible to teachers and principals only at substantial personal cost.

This wealth of data need not remain inaccessible. For-profit corporations and local districts have spent much of the last decade developing and refining products that facilitate the storage, analysis, and presentation of educational data in a range of levels. Advancements in computer technology have created powerful, affordable hardware to support these tools, and this technology is getting more powerful and less expensive. Although the use of this technology is not yet widespread, we believe efficient, practical implementation of data management technology is not far off, and we anticipate that software development in this area will produce even more efficient and usable tools for educators.

These new technologies, however, will not be maximally useful for schools unless they are used by teachers. Teachers are often absent from discussions and policies regarding school data use. With the availability of these new technologies, data use can be a positive, useful expectation for teachers. We foresee a situation where teachers are

the main consumers of student data, for it is at this level that decision-making and classroom practice is most useful.

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