
Best Practices in Digital Technology Usage by Data-Driven School Psychologists

Scott McLeod

Iowa State University

Jim Ysseldyke

University of Minnesota

OVERVIEW

The professional lives of school psychologists have changed dramatically over the past few decades. The role has evolved from correlational/predictive practices to experimental practices as first distinguished by Cronbach (1957). In the school psychology literature, these approaches have been labeled *traditional* and *alternative practice* (Reschly, 1988a, 1988b). Reschly and Ysseldyke (2002) described the shift over time toward services guided by problem solving and evaluated by the achievement of positive outcomes.

The overall goal of school psychological services is twofold: enhancing the competence of individual students and building the capacity of systems to meet students' needs (Ysseldyke et al., 2006; Ysseldyke et al., chapter 3, vol. 1). In order to accomplish these goals, school psychologists are increasingly expected to use electronic devices such as desktop computers, laptops, personal digital assistants, and digital voice recorders to do their work. School psychologists also are expected to use basic office software such as word processing, spreadsheet, and presentation programs to enhance their professional productivity and their communication with parents and other education professionals. Some school psychologists have access to electronic report writing tools. Others participate in professional learning opportunities through online e-learning systems.

It is safe to say that one of the biggest influences on the school psychologist's role is the increased prevalence of digital and online technology. *School Psychology: A*

Blueprint for Training and Practice III (Ysseldyke et al., 2006) recognized the seismic societal and educational shifts that are occurring because of these technologies and so added "technology" as a specific domain in which school psychologists are expected to be competent.

In addition to these productivity and communication tools, many school psychologists are tapping into the wealth of resources available on the Internet and in other networks. Online resources include such websites as School Psychology Resources Online (www.schoolpsychology.net), the Global School Psychology Network (www.dac.neu.edu/cp/consult), and PsychWiki (www.psychwiki.com) as well as the resources available from the National Association of School Psychologists (NASP; www.nasponline.org) and the American Psychological Association (www.apa.org). School psychologists also are using online library databases such as NASP EBSCO, PsycINFO, and ERIC. Many school psychologists are using e-mail, listservs, blogs, wikis, and other connective tools to stay in touch with each other and with the communities they serve.

As *Blueprint III* notes, one of the functional competencies for school psychologists is in the area of data-based decision making and accountability. The data-driven function of school psychologists has been enhanced by technological advances since the 1990s. A variety of databases, analytical software programs, data collection devices, and other tools now exist to help school psychologists with their assessment and progress-monitoring duties (McLeod, 2005; see Silbergliitt, chapter 118, vol. 5). School psychologists must be aware

of these various tools and the advantages that they provide.

This chapter describes the various technology systems that are available in schools and school districts for storing and analyzing student data. Suggestions for school psychologists are included throughout the chapter, as are various illustrative scenarios to help make the material more concrete and actionable.

BASIC CONSIDERATIONS

In order for school psychologists to understand how they might use various technologies to enhance their data-driven decision making, they must first have an awareness of the tools that are being employed in schools and school districts across the country. These tools fall into several main categories.

Not all of these tools will be present in every school system, and, indeed, lack of access to some of these tools by economically disadvantaged school districts is an important policy concern.

Student Information Systems

Most school districts have a student information system that serves as their central information repository. Student information systems originally were created to store student contact information as well as basic demographic variables. Today, student information systems also contain a variety of other student records, including attendance, discipline, and health records. Sometimes student information systems contain student outcome data such as grades, results from state assessments, or data from periodic formative assessments. Student information systems typically are accessed through a password-protected login screen that leads to a menu of options for viewing data and printing reports. Some student information systems are integrated with electronic grade book and parent portal software, thus allowing teachers and parents to share information about student grades, homework, academic progress, and other records.

Data Warehouses

Although student information systems can be powerful tools for data storage, they typically do not contain all of the data that can be valuable for a school system's decision making. For example, data from other software systems often are of interest to school decision makers, including data from library, course scheduling, food

service, special education/Individualized Educational Program (IEP) management, transportation, curriculum mapping, human resources, and financial programs. Another shortcoming of student information systems is that their analytical tools typically are not as capable as those found in other software programs.

To remedy these deficiencies, school districts increasingly are turning to data management and analysis (DMA) systems, also known as data warehouses, which are complex technology systems that allow educators to connect disparate data systems together so that they can then investigate questions that otherwise would be impossible to answer. Data warehouses link various school software systems through the use of student, employee, program, and building identification numbers.

Like student information systems, data warehouses usually are accessed through a password-protected login screen to protect confidentiality of student and employee data. Unlike student information systems, data warehouses typically also have comprehensive analytical interfaces that allow users to analyze and report data in a variety of useful ways, including cross-tabs, tables, and longitudinal graphs.

Scenario 1: Orchard High School receives a grant to set up an after-school remediation program for disadvantaged students struggling in math. Heather, the school psychologist, is part of the project team. Heather needs the following student information to set up the program: names, math grades, last year's scores on the state math assessment, free/reduced lunch status, ELL (English language learner) status, IEP and/or Section 504 status, and after-school bus route. While schools without a DMA system will find it difficult and time consuming to get this type of information together in one place, Orchard has a data warehouse. Within minutes, Heather has located and downloaded the information she needs to identify students and implement the school's newest academic intervention.

Although data warehouses are expensive and require sophisticated technological support and training, school systems are finding that the added value of these tools makes them well worth the expense. For example, data warehouses typically contain multiple years of data and are ideal for identification and analysis of longitudinal trends in student performance. Because data warehouses allow educators to combine data from student

information systems, electronic grade books, parent portals, and other software programs, most school districts are using these tools to conduct powerful and interesting analyses, including evaluation of long-term progress toward the elimination of subgroup achievement gaps and examination of the relationships between academic or programmatic interventions and student learning outcomes. Many school districts are finding that comprehensive software systems to manage student learning data are necessary prerequisites for successfully closing student achievement gaps.

Instructional Management and Assessment Systems

As school systems augment their data-driven educational practices, they are paying greater attention to the importance of ongoing formative assessment. Although federal and state accountability systems are based on annual summative assessment practices, educators are finding that formative data from localized assessments are more helpful for instructional decision making. Instructional management and assessment (IMA) systems have emerged to help educators store, analyze, and report on the data from periodic student assessments.

IMA systems allow educators to quickly and easily administer formative assessments to students. Depending on the particular IMA system, the software and data may reside on a school network, a desktop computer, and/or a handheld computer. These systems typically come in two forms: (a) those that come with premade assessments or are modeled on existing psychometric assessments and (b) those that include item banks of questions that can be used to automatically or manually configure classroom-level assessments. Examples of the first type include the computerized assessments from the Northwest Evaluation Association, the curriculum-based measurements from AIMSweb, and Wireless Generation's handheld computer versions of the Texas Primary Reading Inventory and the Dynamic Indicators of Basic Early Literacy Skills. Examples of the second type include programs from a number of vendors, including Compass Learning, McGraw-Hill, Pearson Digital Learning, PLATO Learning, Renaissance Learning, and Scantron. In these latter systems, school psychologists and other educators can have the software program automatically generate random question sets or can choose individual questions or substrands of questions that are of interest.

Instructional management and assessment systems vary by periodicity. Some are designed to be administered once per quarter, once per trimester, or once per semester. Others are designed to be administered daily or weekly. Although some vendor systems only offer products at particular delivery frequencies, others offer suites of products that cover the full range of delivery possibilities.

Scenario 2: Westwood Middle School students take yearly state assessments in reading, math, and science. Because it was dissatisfied with the timeliness and frequency of the state's data collection and reporting, Westwood also has implemented a comprehensive formative assessment system to monitor its students' progress throughout the year. Teachers like the supplemental formative data system because it is easy to use and produces data that are more closely aligned to their daily instructional needs. The teachers also are pleased that the formative assessments can be taken quickly, which allow them to be administered frequently without having a negative impact on classroom instructional time. Westwood's school psychologist, Doug, works with departmental teacher teams to use the item banks to create modified assessments that are aligned with state standards and to then appropriately interpret the results from those assessments.

Instructional management and assessment systems also vary by their use of technology to deliver the assessments. Some systems are completely computerized and/or are online. Other systems require teacher input of data or use scannable student test forms. Most IMA systems align their item banks of questions with state curriculum standards. Some systems integrate with other software programs, such as curriculum mapping or lesson planning software.

Relational Databases and Spreadsheets

Many school districts cannot afford data warehouses or IMA systems. While sometimes these districts band together to cooperatively purchase these types of systems, often they turn to less-sophisticated tools for their data management needs. Small districts, in particular, often are reliant on relational database tools such as Microsoft Access or FileMaker Pro to link their data sets together. These tools require the manual

connection of various data sources, which can be quite time consuming for district technical staff. Relational databases also typically reside on an individual hard drive rather than being accessible by multiple individuals through a shared network and lack the powerful analytical interfaces that are present in data warehouses. These characteristics make them less useful for educator decision making.

Like other educators, many school psychologists are using electronic spreadsheet software to track, analyze, and report student learning outcomes. The advantages of electronic spreadsheets are that they are easy to learn and that they have robust analytical and presentation features. The primary disadvantage of spreadsheets is that they are not designed to handle longitudinal data and are mostly useful for short-term progress monitoring (e.g., within a given year), at least for data at the student level. Other disadvantages of spreadsheets are that everything must be created manually, much like for relational databases, and that data files typically reside on individuals' computers rather than in shared spaces like grade-level folders in local area networks.

Scenario 3: The Minnehaha school district realizes that it needs the capacity in each of its high schools to organize and analyze raw student and school data. The district invests in advanced spreadsheet and relational database training for three to eight staff members from each school building. These teachers, media specialists, guidance counselors, technology integration specialists, school psychologists, and assistant principals form the core of each school's data team. These data managers then work with other staff in their buildings to download and analyze data from the district data warehouse, combine the warehouse data with school data in other locations, and/or create customized data collection and analysis tools.

Although used often by educators, spreadsheet software products have a number of powerful capabilities that largely go untapped. For example, most educators do not know how to sort, filter, apply conditional formatting, make graphs, or create pivot charts—features that allow educators to quickly identify data patterns and trends and thus facilitate meaningful monitoring of student academic progress. These skills and others can be easily taught to educators using screencasts such as those found at the UCEA CASTLE

School Data Tutorials website (www.schooladatututorials.org), thus enhancing teachers' and administrators' ability to analyze and work with raw data instead of being dependent on preformatted reports from states, districts, and testing companies.

Computer-Assisted Instruction Systems

Computer-assisted instruction (CAI) systems complement or replace traditional, teacher-directed instruction. These interactive systems typically are focused on reading, writing, and mathematics skills. Most CAI systems use sound, graphics, animations, videos, and/or simulations to convey key concepts and then ask fixed-response questions to assess students' mastery of those concepts. Students proceed at their own pace and can work individually or in small groups. These systems maintain ongoing records of students' work and use reports and charts to display individual or classroom-level results.

Student Response Systems

Student response systems are tools that have recently emerged that may be of interest to school psychologists. Informally known as “clickers” because the devices look like television remote controls, student response systems allow educators to ask students fixed-response questions and instantly tally the results. Student response systems often can be integrated with electronic presentation software and/or can be utilized with a digital projector or electronic whiteboard. Student responses can be displayed in a variety of different ways, including bar and pie charts, and can be electronically archived for longitudinal analysis.

Summary

All of these tools facilitate the collection, analysis, and reporting of student learning data. The sophistication, comprehensiveness, and ease of use of their features vary widely. Even in school districts that possess data warehouses, many of these systems will remain disconnected from each other. School psychologists who wish to take advantage of the data from these tools thus must master multiple systems with different interfaces and features. Although some school psychologists will have access to many of these tools through their school systems, others may have to advocate for their use with local school leaders.

BEST PRACTICES

School psychologists have seen the importance of data collection and analysis grow steadily over the past few decades. The most recent iterations of the Individuals with Disabilities Education Act (IDEA) and Elementary and Secondary Education Act (i.e., No Child Left Behind) both place a heavy premium on the use of data for decision making. These and other accountability-related initiatives have spurred many state and local movements to better incorporate data into educational practice.

Perhaps the best mechanism for thinking about the intersections of data and technology for school psychologists is through the lens of the three delivery system tiers noted in *Blueprint III*. The various data systems described above can facilitate school psychologists' universal, targeted, and/or intensive interventions in productive and innovative ways. The examples that follow illustrate best practices and creative possibilities.

Universal Services

Data warehouses and student information systems contain a wealth of information that can be used to inform system-level services. In fact, most school districts are attempting to use their new data sources and technology tools to make system-level changes that will benefit struggling students. One example of this is the use of student performance results on yearly state assessments to help place students in appropriate learning environments. Although state-level assessment data typically are not detailed, they can be used to develop benchmarks as administrators, teachers, and school psychologists discuss appropriate placements for students with diverse learning needs. In some instances, state assessment data from district-level technology systems can be used as part of the initial screening process for new students.

In districts that have IMA systems or CAI systems, those data also can be used to inform general provision of services. For example, a district might administer a short reading assessment every 6 weeks to every elementary student. The assessment is designed to target key learning outcomes at each grade and to assess student readiness for the more comprehensive state assessment at the end of each year. The school psychologists in that district can work with administrators and teachers to use the results of the ongoing assessment to design academic and

programmatic interventions for all students, grouping children as necessary for smaller scale instructional initiatives.

Scenario 4. Jenn, a newly hired school psychologist for a regional education service agency, works with teachers in a number of different preschool programs. The teachers who are now faced with federal mandates to track student progress ask Jenn to create data templates they can use to monitor a few key child outcomes. Fresh from her graduate training, Jenn uses her statistical and spreadsheet knowledge to create templates for teachers to track child development indicators from the Work Sampling System, the Creative Curriculum, and the Hawaii Early Learning Profile. Jenn then works with the teachers to utilize the results to inform instructional practice and to identify additional assessments that may be needed.

School psychologists can assist school districts by aiding the identification of useful school environment, instructional climate, and student behavior assessments. If districts can administer these assessments to the majority of their students and get the results into their student information systems and/or data warehouses, then they can use those data to improve student learning. One of the biggest challenges for school systems is mapping student learning and behavioral outcomes to instructional or programmatic interventions. School psychologists can help districts configure their data systems to conduct analyses that cut across multiple data domains (Bernhardt, 2004).

Another important role for school psychologists relates to interpreting the data that reside in district-level technology systems. As Rosenfield and Nelson (1995) note, "there are few others with training, experience, and expertise in assessment comparable to that of school psychologists" (p. 2). Teachers and administrators need assistance concerning interpreting and understanding the data that they have. Without proper guidance and training, educators often make overgeneralizations or incorrect interpretations of academic and behavioral analyses. School psychologists have specialized analytical expertise that often goes untapped within their school systems. Whether interpreting norm-referenced assessments that are being used for decisions about placement or helping teachers appropriately diagnose and classify individual students in other ways, school psychologists can be integral

partners in districts' attempts to obtain maximum functionality from their data systems.

Scenario 5: Teachers at River Run Elementary would like to know the correlation between the scores that their students receive on the state reading assessment and their students' grades in reading. The school district, like most school systems, maintains two different datasets for these types of data. Before the advent of DMA systems, Keary, the school psychologist for River Run, either would have spent a great deal of time creating a combined data file by hand or would have told the teachers that they would have to forego the analysis altogether. Because Keary has access to the district's data warehouse, however, she can quickly and easily correlate the two variables of interest and break down the findings by grade level, classroom, and student demographics. The teachers thus are freed from the task of compiling the data and instead can spend their valuable time working with Keary to answer questions about the strength of the correlation, what to do when students do well in class but not on the state test, and what it means when students are successful on the state assessment but receive low class grades.

Targeted Interventions

There has been an explosion of new data collection and analysis tools since the 1990s. In addition to the tremendous growth in the use of data warehouses and student information systems, school systems increasingly are using one or multiple technology systems designed to facilitate formative assessment and ongoing progress monitoring of student performance.

There are literally dozens of IMA and CAI systems on the market. Making sense of these tools and identifying which have the greatest potential for improving student performance is a critical need for school districts. The evolving roles of school psychologists related to instructional assessment coincide with this important task.

Educators need help identifying appropriate assessments that can be used at the classroom or individual student level. Without appropriate guidance, administrators are susceptible to the latest pitch from commercial vendors, and history has proven that they are quite

apt to invest in assessment solutions that have little to no impact on student learning outcomes (e.g., *eSchoolNews*, 2005). School psychologists should be key members of districts' assessment purchasing teams in order to minimize the occurrence of such mistakes. All team members should ensure that they get answers to important questions such as these two: What evidence is there that use of these tools increases student achievement? Why are these assessment tools appropriate for the results we are trying to achieve?

Once appropriate assessments have been identified, school psychologists also can help districts identify which technology systems are best suited to administer, score, analyze, and report the data that are collected. One of the key mantras for any data-driven school system should be: If we expect educators to regularly collect student progress monitoring data, we have to give them a place to put the data and a means to easily analyze the results.

Many a district assessment initiative has foundered because the school system failed to sufficiently invest in the technology necessary to make such initiatives happen.

Even districts that cannot afford an IMA system can use relational databases for data storage and electronic spreadsheets for data analysis and reporting. Although such an approach may be less costly, it also can be cumbersome and require significant amounts of time from technology support staff for system creation and maintenance.

Once an appropriate IMA or CAI system has been purchased, school psychologists are well suited to assist teachers in proper usage of such systems. Working alongside classroom educators, school psychologists can use the data from students' periodic academic and behavioral assessments to inform classroom instruction and behavior management. Although they may need some training in the specifics of the software tools, school psychologists likely are some of the best-trained personnel in the district when it comes to being able to interpret and use the data, reports, and charts generated by IMA and CAI systems. Modeling frequent and appropriate usage of assessment software to other educators can be an important role for school psychologists.

School psychologists' training programs prepare them to design and deliver targeted interventions for students who are unsuccessful under more universal approaches. School psychologists can help teachers determine which students need additional academic or behavioral interventions and which technology and assessment systems are best suited to monitor the progress of those

particular students. Data from IMA and CAI systems often can be used to facilitate response to intervention (RTI) models by serving as pretest, posttest, and ongoing progress measures. Because most IMA and CAI systems have fairly robust analytical and reporting features, it usually is pretty easy for school psychologists and other educators to monitor the progress of students, either individually or in groups, on critical outcomes (Ysseldyke & Bolt, in press).

Scenario 6: Skip, a school psychologist serving Washington Junior High, helps teachers use a 15-minute computerized adaptive test to individually place students in leveled math instructional groups. The teachers then use the computerized assessments to periodically monitor students' math progress during the year and to help them individualize supplemental instruction. The software generates math problems that are individualized to students' skill levels and academic performance, ensuring that students continually function within their proximal zone of development. Once a week, Skip reviews teachers' daily status-of-the-class reports and assists teachers with their instructional planning. When individual students fail to make progress, alternative approaches are tried. If students' progress is too low for an extended time, they are referred for more comprehensive assessment.

The core components of an RTI approach are “the systematic ... application of scientific, research-based interventions in general education; ... measurement of a student's response to these interventions; and ... use of the RTI data to inform instruction” (National Joint Committee on Learning Disabilities, 2005). Many IMA and CAI systems are based on research-based interventions, thus satisfying the first component of the RTI approach. These tools help educators monitor responsiveness to instructional interventions by tracking student performance and also help educators use the data for instructional decision making through the creation of various reports and progress charts. IMA and CAI systems thus should be viewed as important resources for facilitating educators' implementation of the RTI model (Ysseldyke & McLeod, in press).

Intensive Interventions

As instructional interventions become more individualized, the need for larger, system-level data collection

and analysis tools diminishes. For many intensive interventions, spreadsheet software can be used for progress monitoring. For example, a team at the University of Minnesota created a variety of spreadsheets to facilitate student progress monitoring as part of the Osseo Area (MN) Schools Data Templates Project. Rather than teaching classroom instructors how to create formulas and make graphs from scratch, they simply handed them already-made spreadsheet templates into which they could enter periodic assessment scores. The district preloaded the spreadsheets with student names, identification numbers, and demographic data, and all the teachers had to do was drop in student scores. Data cells had conditional formatting rules built into them to facilitate teacher identification of struggling students. The spreadsheets also had drop-down buttons that allowed teachers to quickly see subsets of the student population. By clicking on tabs at the bottom of the spreadsheets, teachers could access a variety of premade, dynamic progress charts that generated themselves from the data entered by the teachers over the school year.

Similarly, Intervention Central (www.intervention-central.org) is a website that provides free templates to school psychologists for ongoing progress monitoring as well as links to commercial progress-monitoring tools.

Spreadsheets can be a powerful replacement for local, paper-based, academic and behavioral monitoring systems.

Scenario 7: Guided by their students' results on the September iteration of the district's periodic standardized assessment, the fifth-grade teachers at Woodland Elementary decide to focus on math computation for the year. The teachers alternate creating a 20-question common math assessment that is taken by every fifth-grade student each month. The monthly assessment, which takes 8 minutes to administer, has five questions each related to addition, subtraction, multiplication, and division. Wiley, the school psychologist, helps ensure that the questions are statistically valid and reliable. Student results are entered once per month into a spreadsheet data template that was predesigned by Wiley. The team of teachers then analyzes its students' monthly progress and utilizes the pivot chart's drop-down buttons and drag-and-drop capabilities to disaggregate the data by teacher, student, or student minority status.

The key to the success of most of these technology and assessment initiatives is for teachers to spend as little time as possible on data entry and chart creation, thus freeing them for the more important tasks of data analysis, discussion, and formulation of instructional interventions. Although it may be valuable for school systems to train a few school psychologists and other educators to have the capacity to build such tools, most educators need only a few basic skills as long as they also have access to more sophisticated structures for support and assistance. Having a school psychologist or other designer create a spreadsheet template that can be used by many is much more efficient than having multiple educators each make their own individual templates.

Student response systems appear to have great promise for certain types of student assessments. Because student response systems require almost no training of student participants and can be used by students who are very young, they seem ideal for administering any kind of short, fixed-response assessment. The software that comes with most student response systems is easily learned by educators who are not technology savvy and usually has the capability of tracking student progress over time by identification number. Scenarios are easily imaginable in which school psychologists and teachers use student response systems to monitor student progress on a few key learning outcomes.

Finally, students can be taught to create spreadsheet tables and charts as early as the upper elementary grades. Some school psychologists and teachers have found it enormously empowering to teach students to monitor their own progress through the use of basic charting and graphing tools. Students who track their growth themselves appear to have strong buy-in toward continued progress, often regardless of their individual starting points.

SUMMARY

We now live in a technology-suffused, globally interconnected world. The technological revolutions that are radically transforming other sectors of society are gradually making their way into school systems and the professional lives of school psychologists. Increased expectations regarding data collection and analysis for improving student outcomes have been accompanied by a rise in the number and types of tools available to educators for assessment, data management, and reporting.

Although it is an exciting time for some, the rapid pace of technological change also makes it a difficult or an intimidating time for others. If school districts and professional associations expect school psychologists to use digital technologies for data-based decision making, then they must pay attention to the rational fears that many school psychologists have about technological transformations and must make significant investments in high-quality professional development initiatives in order to address and overcome existing concerns. As training efforts increase their skill at using technology systems for classification, evaluation, and intervention, school psychologists will be better able to maximize the potential of all students to be academically and behaviorally successful.

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Wayman, J. C. (2005). Involving teachers in data-driven decision-making: Using computer systems to support teacher inquiry and reflection. *Journal of Education for Students Placed at Risk*, 10, 295–308.

Describes teacher use of technology systems that contain student learning data. Discusses the conditions that make data systems useful and helpful to educators.

WEB RESOURCES

Intervention Central: www.interventioncentral.org

Contains a number of resources for school psychologists, including innovative Internet applications for generating behavior report cards, reinforcer surveys, progress-monitoring charts, reading probes, and other useful tools.

School Data Tutorials: www.schooldatatutorials.org

Contains dozens of screencasts designed to enhance educators' ability to organize and analyze raw student learning data. Also includes example data collection and analysis templates for use by schools.

UCEA Center for the Advanced Study of Technology Leadership in Education: www.schooltechleadership.org

Contains a variety of resources related to data-driven education and other technology leadership issues, including articles, white papers, and podcasts.