



FORUM GUIDE TO DEMYSTIFYING DECISION SUPPORT SYSTEMS

A Resource for Educators and Education Constituents

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**National Center for Education Statistics
National Cooperative Education Statistics System**

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January 2006

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Suggested Citation

National Forum on Education Statistics. (2006). *Forum Guide to Demystifying Decision Support Systems: A Resource for Educators and Education Constituents* (NFES 2006–XXX). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

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This document was developed through the National Cooperative Education Statistics System and funded by the National Center for Education Statistics (NCES) of the U.S. Department of Education. A volunteer task force of the National Forum on Education Statistics (an entity of the National Cooperative Education Statistics System) produced this document.

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ACKNOWLEDGEMENTS

The Forum Decision Support System Literacy Task Force wishes to acknowledge the efforts of individuals whose contributions assisted in the development of this publication. In particular, Ghedam Bairu and Lee Hoffman of the National Center for Education Statistics, provided guidance and insight to the Task Force.

The Task Force recognizes the influence of the publications and website developed by Daniel J. Power on this document. His work is a valuable resource for more detailed information on the development of decision support systems.

Dr. Larry Fruth, Executive Director of the Schools Interoperability Framework Association, was most helpful to the task force as a resource for the discussion of interoperability.

Carol Dodd, Superintendent of Local District D (retired), Los Angeles Unified School District was most helpful in describing the need for a decision support system to be used for positive change through effective communication between administrators and teachers.

Throughout this document, there are references to various publications produced by the National Forum on Education Statistics. The Task Force highly recommends these documents as they represent the work of practitioners in the education community from across the country.

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FORUM GUIDE TO DEMYSTIFYING DECISION SUPPORT SYSTEMS

A RESOURCE FOR EDUCATORS AND EDUCATION CONSTITUENTS

INTRODUCTION

The phrase “data-driven decision making” has been heard often in schools and education administrative offices across the country. Recognition that data can assist in the decision making process is relatively new in the education community, but it is a concept that has taken hold. The use of data has become indispensable in schools, districts, and state departments of education. Often, the sources, organization, and tools for the use of data to develop information create confusion in the minds of educators. As more data become available, opportunities for confusion will continue to abound.

The purpose of the *Forum Guide to Demystifying Decision Support Systems* is to help decision-makers ask the right questions about acquiring, designing, and using a decision support system (DSS). The guide begins by describing what a DSS is and some ways to use it, as well as including some suggestions on how to determine the specific needs of an organization. The document also discusses other pertinent issues, such as security and data confidentiality along with some possible components of a DSS. The guide presents models for using databases already in service within an organization, enhanced with tools for integrating and analyzing data. Along with supplemental information in appendixes, the guide provides an extensive glossary of terms.

The data used to make decisions come from such disparate sources as attendance sheets, student assessment results, athletic team rosters or bus routing information. Census data might be involved when figuring out where to build a new school. Some data are entered directly into computer systems at schools when collected by traditional paper-and-pencil methods; other data are downloaded from different computer systems at districts or state departments of education. National testing companies may provide data to districts or directly to schools. Data may reflect information from the current or past years or may even be real-time data describing something that is happening at that moment.

DSS technology permits staff to organize and link these data. Once organized, staff can perform analyses and create **graphic**, **tabular**, and **narrative** reports to transform the data into understandable and useful information for any level of the education community. Board members, administrators, teachers, and others who review or create data reports, can be trained to use this information to make more informed decisions, draw conclusions, and take appropriate actions.

Some data can assist teachers in strengthening instruction and increasing student learning. Other data can assist staff members in placing children in the right supplemental programs or can help to improve nutrition for students by determining which healthy foods are eaten and which are discarded. Districts and state departments of education may use data to develop comparisons between achievement levels of different schools, to track academic growth patterns for high and low achieving students and to identify the impact of staffing and placement policies on student learning.

It may be difficult to comprehend how much can be accomplished by using a decision support system for those who have never worked with this powerful tool. With increasing degrees of sophistication in

the tools and their uses, data analysis, reporting, and graphing programs will facilitate better planning processes. Staff members will be able to monitor progress toward pre-defined goals and make quicker adjustment to new conditions and situations. Goals can be developed based on action research and observation of trends previously invisible to education leaders. By using DSS tools effectively, staff members can move from the mindset that decisions that “data-driven” toward “data-informed” decisions that balance data with wisdom.

The use of decision support systems in the K-12 education community is relatively new when compared to the use of these systems in the business community. In adapting the concepts and tools of these decision support, seek practical applications and examples through the use of paradigms and structures found in other industries. Appendix D of this guide contains some descriptions of decision support systems in various fields.

The terminology employed by DSS software vendors may be unintelligible to educators. Conversely, software developers may not understand the terminology used by educators. This guide will help define commonly used words and phrases in the glossary and throughout the document.

The bottom line in education is student achievement. The guide will focus primarily on uses of a DSS that will assist teachers and administrators in making curricular and instructional improvements in the classroom. A DSS used by a district a business manager to maximize the impact of available funds or by the maintenance department to improve climate controls within school buildings, to cite only two examples, also have an impact on student learning. Administrators in state departments of education will use a DSS for purposes with broader impact than at a single school. The principles are the same; the only difference may be the way data are used.

A task force of members of the National Forum on Education Statistics developed *Demystifying Decision Support Systems*. The Forum operates under the auspices of the National Cooperative Education Statistics System (<http://nces.ed.gov/forum/about.asp>) and consists of representatives from state departments of education and local education agencies. Forum members have a strong interest in using information derived from data to improve decision making throughout the education community.

It is the intent of this “literacy” publication to provide an overview that will increase the level of comfort of administrators and others involved in the purchase and use of a DSS. The National Forum on Education Statistics has produced a number of technology related publications available on the Forum website at <http://nces.ed.gov/forum>. Where practical, this document will provide links to chapters in these publications to expand upon comments made here.

WHAT IS A DECISION SUPPORT SYSTEM?

There are many different definitions of a Decision Support System (DSS). In most other fields and in the DSS literature, definitions of decision support systems focus solely on the hardware and software that comprise the DSS tools. One such definition states that Decision Support Systems are “...computer-based information systems that provide interactive information support to managers during the decision-making process.”¹

Another definition states that,

Decision Support Systems (DSS) are a class of computerized information systems that support decision-making activities. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to complete decision process tasks.²

The task force definition that follows includes the people who use the software and tools. In essence, a decision support system is not worth much to the education community unless its intended users can employ it effectively. These users might include state and local board of education members, administrators from state departments of education and districts, as well as principals and teachers. For the purposes of this document, the task force believes that a Decision Support System is an approach to data use that includes

- tools for managing, analyzing, and communicating information;
- understanding of the data and the implications of data use for the future; and
- use of that knowledge by decision-makers for intelligent planning and action.

Users of DSS need usually to be able to combine data from various locations. The information can answer questions about the effectiveness and/or efficiency of educational programs for student groups or for individual students. A DSS can inform administrators about financial and other operational matters to assure that taxpayer funds are spent wisely and assets protected. To add to the complexity, effective DSS tools provide appropriate information for each set of users enabling them to share data between computer systems and levels of the education community.

Administrators and teachers at both the district and school levels could certainly make use of a system that will allow them to answer basic questions about their students and school programs. To provide an overview of the power of a decision support system, here are some examples of questions asked of a decision support system.

- Do students with teachers who have degrees in mathematics perform better on math assessments than the students with teachers whose degrees are in other areas?
- Are all the students in the fourth grade progressing at the same rate or is there a group of students from a specific third grade teacher from the past year doing better than others do?
- Are the students who receive Title I services progressing at the same rate as others?
- What is the difference in the academic progress between Hispanic students and students from other ethnic backgrounds?

¹O'Brien, James A. (2004) *Introduction to Information Systems with MISource v.2 and Powerweb*. McGraw-Hill/Irwin.

²Power, D.J. 1995-2005 *Decision Support Systems Resources*. Retrieved (August 2005) from <http://dssresources.com>

Decision support systems may also respond to questions outside the classroom:

- Do our district's students perform at a level equivalent to those in other districts with similar demographics and expenditures per pupil?
- Are the students participating in Supplemental Educational Services programs (SES) showing greater academic growth on large scale assessment and/or attendance?
- Does a reduction in staff injuries correlate with specific training or other measures taken to improve safety?
- Are the lower performing schools taught by a smaller percentage of veteran teachers than the higher performing schools?

Educators in state departments of education might want to be able to ask these questions:

- Is there a correlation between school effectiveness and proportions of school district funds dedicated to early childhood education?
- Are there fewer highly qualified teachers in urban and rural districts as compared to suburban districts?
- Is there an increase in the number of students taking higher-level algebra courses in middle schools?
- Has there been a reduction in the statewide dropout rate since assignment of state level student identifiers?

Slicing and Dicing

The questions cited as examples above are very broad. Administrators and teachers may want to use a DSS to go to a deeper level, looking beyond information about broad groups to slice the information for more detail. For example, educators are required under the No Child Left Behind Act (NCLB) to gather information on sub-groups, with the help of a flexible DSS that includes an instructional management component a school or district would be capable of going to the next level of classroom-based assessment. This component, or module, could link the assessment score data to instructional objectives or specific skills. Teachers would be able to use this information to identify specific weaknesses of individual students and develop instructional action plans.

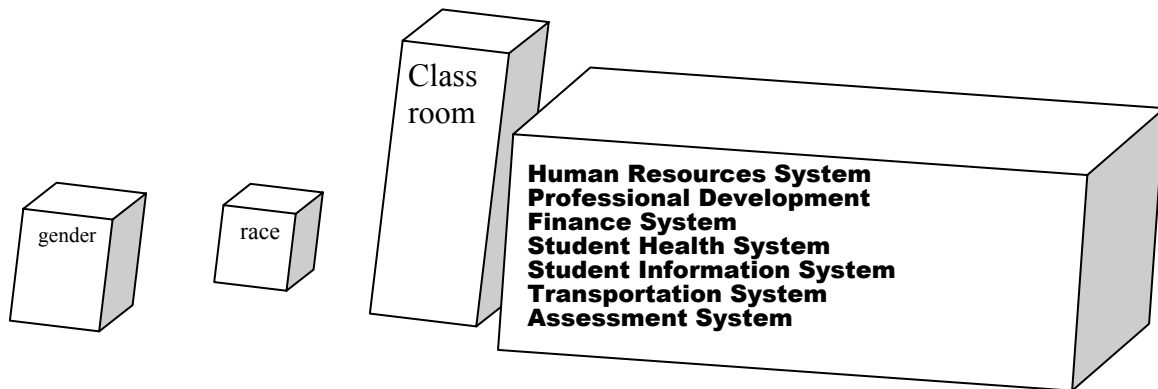
With a DSS, data can be “**sliced-and-diced**” in a variety of ways. When data, or dimensions, are sliced from the loaf, the slice can be reorganized to produce information. These data can be “diced,” or chopped up into cubes, in different ways to produce information that enables data-based decision making.

Slicing-and-Dicing

(Graphic designers: the graphic below is supposed to be a loaf of bread, a slice and cubes or croutons!)



(Use a more realistic picture?)



The creation of data reports and the process of analysis take a great deal of practice and experience to answer questions raised. Some people even talk about analysis and data reporting as an art form. An efficient DSS allows sophisticated responses and enables the examination of information—sliced and diced—in ways that are helpful when looking at the instructional program.

A decision support system brings together data from many computer programs and systems, such as student information systems, special education management programs, and human resource systems. An effective DSS will also bring together financial, demographic, perceptual, and school process data.³ Student performance data, including **longitudinal** entries from a variety of sources will be included as well. The inclusion of these data enables school officials and policy-makers to formulate decisions based on verifiable knowledge and defensible projections rather than, in extreme cases, a few anecdotal statements. Teachers, for example, are able to make instructional decisions about individual students based on specific and comparative information.

Effective reporting tools are a major element of a DSS. The ability to analyze information in several ways and view it in various formats will provide decision-makers and other stakeholders with a clearer understanding of issues. This will often lead to more effective data driven decision-making.

By using a DSS, “data-driven” decisions can become “data-informed” decisions.

³ Bernhardt, Victoria. (2004) *Data Analysis for Continuous School Improvement 2nd Edition*. Eye on Education.

(Note that some people have begun to abbreviate “data-driven decision making,” with the letters “D3M.”)

Communication

It is the desire of educators to use information generated by a decision support system to support positive change; however, this can be a challenge. Successful change takes place in an environment of trust and support where principals and teachers are comfortable using tools such as those provided by a DSS. Administrators will want to develop techniques enabling them to point out areas of need and to provide leadership in suggesting corrective activities. Activities might include collaborative discussions among teachers or assistance provided by curriculum experts from outside the school. This assistance is certainly not a reprimand. Instead, the support is an opportunity to develop skills.

Managing the Business of Education

As noted above, the use of decision support systems is a relatively new phenomenon in education. Most education organizations have some components of a DSS, but relatively few have moved beyond basic management of data from multiple sources, such as student information and assessment results, into using the full power of technology to improve instruction and increase learning.

Technology can be a tool to improve instruction and increase learning.

Often, the most difficult part of using data to make informed decisions is not in finding and using the technology. Rather, it is knowing what questions to ask, what data to collect, how to identify new data elements and indicators that can be collected or calculated, and how to apply the data to organizational or classroom performance. A frequently used approach to data analysis in education, for example, has involved teachers looking at **item analysis** reports from standardized assessments. Typically, the teacher will identify items most often missed by his/her students, then place more emphasis on the skills related to the item or items in the following school term. Similarly, school officials in the past may have looked at the school or district level averages on those same assessments and assumed, because the averages were relatively high, that all was going well in the district.

A DSS enables supervisors and teachers to examine data in detail and point out specific areas that need more attention. The ability to develop reports based on these data does not come automatically. Sophisticated training is required to develop the skills necessary both to understand data and to create the variety of reports that are possible.

The focus of training may be to demonstrate how a decision support system works. While this training is important, it is not enough. The main purpose of a DSS is to provide tools that allow the interpretation of data. Staff development is necessary to teach stakeholders skills in both interpreting information and implementing the necessary activities. For example, once staff knows to improve reading levels in a particular grade in a particular school, what should be done? What are the specific skills within the reading program to address and what does the teacher need to do.

Interpretation of data and implementation of solutions in the school or classroom is the art of education.

The education community will recognize the statement that often starts with, “If educators ran their operation more like a business, then” Educators have responded that since students do not generate profits (or create losses) there are inherent differences between the education environment and the

business environment. However, the use of tools that are effective in the business realm can be adapted for use in education agencies and schools.

Robin Jessani delineates the goals of a decision support system in the business community when she states:

The vision is deceptively simple. Companies take advantage of in-depth reporting tools and predictive models to analyze data and learn what happened in their business, why it happened and, eventually, what will happen. This yields a deep, fact-based understanding that complements experience and intuition and leads to exemplary decision-making and dramatic competitive advantage.⁴

At first glance, it might not seem that this description is appropriate for educators, however; an effective DSS in the education “business” provides information for decision-makers that will enable them to make the appropriate decisions to improve the education and educational environment of their students. While this may not create the “competitive advantage” described above, a DSS can provide concrete tools that enable administrators and teachers to understand the status and progress of individuals and groups in their schools and classrooms. Such information can help improve instruction and tailor programs for particular students or groups within the school or district.

Questions to Ask

- What questions does the organization want the DSS to answer?
- How are principals and teachers informed about indicated areas of improvement?
- What issues are involved in making the underlying databases communicate with each other?

⁴ Jessani, Robin (2004) *Creating an Effective Data-Driven Decision Support System*, Data Warehouse Report, Vol. 6, Issue 1. A Teradata Publication.

ASSESSING THE NEED: WHO NEEDS A DECISION SUPPORT SYSTEM?

Representatives throughout the organization need to be involved at the beginning when the organization is trying to determine whether to purchase or build a decision support system. Since the tools that comprise a decision support system will assist staff in many areas of the organization, developing a system that meets the needs of the organization will be easier if everyone is communicating from the start.

A needs assessment team consisting of representatives from departments in the organization (e.g., research, curriculum, site administration, technology) will need to define the requirements for the DSS together. There is a natural tendency to focus on areas that directly affect the instructional program. However, the needs assessment team will want to include members of the organization who manage such areas as transportation, facilities, and food services. These departments do impact the education program of the organization.

Once it is determined that a DSS can serve the organization, staff members will want to see which decision support tools will best serve them. Short-circuiting the time-consuming needs assessment process will often result in systems with redundancies, missing components, inadequate support after deployment, or that do not meet the needs of all stakeholders. An inclusive needs assessment process will make it less likely that some stakeholders will make demands for expensive modifications after the implementation of the system. For example, some decision support systems developed to meet the needs of central office administrators did not include tools to provide principals and classroom teachers with appropriate student information. Correcting this problem was an expensive process.

Throughout this document, examples describe various ways the tools embedded in a DSS can assist administrators and teachers. Each organization, however, is different. The needs assessment process will enable staff to determine the specific requirements of the system for the organization. A great deal of staff time will be necessary in order to define these needs and to develop the formal needs assessment documentation. For a more in-depth look at these issues see, “Determining Your Technology Needs: *Forum Unified Technology Suite*”.⁵

A DSS does not make decisions; it only supplies information, presented efficiently, to help staff make decisions.

For those who may not be familiar with the benefits of a DSS, it might seem difficult to know where to begin the needs assessment discussion about a DSS. One suggestion is to discuss how the organization makes decisions. Some type of decision-making process exists in every organization. Ask questions regarding who really makes the decisions at different administrative and instructional levels. Figure out how supporting information gets to decision makers. Determine how technology, if any, supports this process.

Following discussions of the existing decision making process; it is beneficial to ask how those procedures might be improved. For example,

⁵ National Center for Education Statistics. (2005) *Forum Unified Education Technology Suite*. See: http://nces.ed.gov/pubs2005/tech_suite.

- Do central office administrators have the tools necessary to provide assistance to school site administrators?
- Do principals have the tools to help their teachers? and;
- Do teachers have the tools that enable them to identify areas where individual students need some additional help?

It is helpful to see an actual decision support system in action as part of the needs assessment process. Ask which districts (or states) have existing systems at state or local administrators' meetings and if it would be possible for your needs assessment team to see demonstrations of some of these systems.

It would be best if the needs assessment process were an outgrowth of the annual plan or improvement plan that monitors progress toward the educational goals and objectives of the organization. The initial stimulus for thinking about developing a DSS might occur when there are questions that need answers but staff cannot respond without difficulty, if at all. Throughout the needs assessment process, remind staff that a DSS does not make decisions. Instead, it supports the decision making process by providing tools to analyze and discover areas of need.

Questions to Ask

- Who should be involved in the Needs Assessment Process?
- What do we need a decision support system to do?
- When do we think about the “look-and-feel” of the system?
- Where can we go to find out more information about the Needs Assessment Process?

PUTTING TOGETHER A DECISION SUPPORT SYSTEM

Data Acquisition: A Foundation of a Decision Support System

The foundation for any decision support system is the data. Quality data are achievable in a school or district through the collaborative efforts of all staff. The *Forum Guide to Building a Culture of Quality Data: A School & District Resource*⁶ goes into detail with recommendations to assist education organizations in developing this “Culture of Quality Data.”

Administrators responsible for developing a DSS will want to know the procedures that ensure the quality of the data in each of the computer systems, or underlying databases, that will be part of the DSS. Data flowing into a DSS can come from a variety of sources and from a variety of computer systems. When embarking on the path leading to a DSS, the accuracy of the data in each of these systems is one of the first questions considered.

It is necessary for the organization to have appropriate procedures in place to enter data into a computer, transfer data between computers, and to review those data to ensure accuracy. Additionally, it is essential to review the validity of the reports generated. These procedures are critical for the success of any technological solution. It makes sense to delay the development of an integrated DSS while the organization develops and implements effective processes for managing data.

Accurate generation, storage, analysis, and communication of data, involve a constant effort on the part of schools, districts, and state departments of education. Building an environment in which a culture of quality data flourishes requires identifying all the stakeholders, bringing them together through processes that include defining, revising, and communicating policies that relate to the collection, maintenance, cleansing, and reporting of data. It creates this environment by emphasizing that quality data are the responsibility of everyone, not just the office staff.

Quality data are the responsibility of everyone in the organization.
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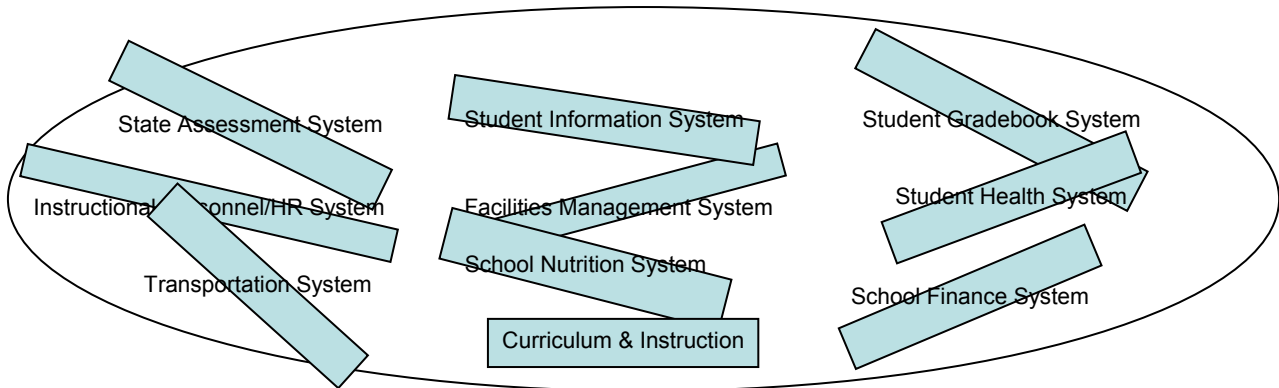
Interoperability

The National Education Technology Plan, *Toward A New Golden Age In American Education--How the Internet, the Law and Today's Students Are Revolutionizing Expectations*, recommends that states, districts, and schools “ensure interoperability” which is described as a set of rules and definitions that enable software programs to share information, even when the databases use different formats. While there are other means of achieving interoperability between systems, the National Education Technology Plan recommends the consideration of the “Schools Interoperability Framework (SIF) Compliance Certification in all RFPs and purchasing decisions.”⁷

Interoperable computer systems, or **underlying databases**, allow the organization to move toward a decision support system more easily since the systems are already able to communicate with each other. The process involving the development of interoperable systems will include the tasks described below.

⁶ The National Forum on Education Statistics (2005). *Forum Guide to Building a Culture of Quality Data: A School and District Resource: 2004* (NCES 2005-801). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

⁷ The National Education Technology Plan. (2004) *Toward A New Golden Age in American Education--How the Internet, the Law and Today's Students Are Revolutionizing Expectations*. See: <http://www.ed.gov/about/offices/list/os/technology/plan/2004/index.html>



Underlying Databases

Extraction, Transformation and Loading

The underlying databases are not coordinated or **interoperable** in most organizations. When looked at as a group, they will seem to be askew, as in the diagram above. It is necessary to go through a complex process of extracting data, transforming it and loading the transformed data into a specific repository when this condition exists. The **extraction, transformation, and loading (ETL)** process is important because although the data may have been entered accurately into the underlying database or information system, there may be inherent differences in the actual data among systems. There may be differences in what a particular piece of data means from one system to another. It is vital either to link computer systems so that they are **interoperable** or to transform the data so that the information from any of the systems, or databases, is understood when the data is integrated into a DSS.

Entering similar information into different systems at different times in different ways will likely be the norm if systems are not **interoperable**. Even something as simple as the name of a student can become problematic. In the example that follows, staff entered the name and the address of Mary Smith into three different systems in three different ways. Staff entered Mary's grade in two different ways.

Example 1 -- Student Name

Student Info System

Mary R. Smith

Financial System

Smith, Mary R.

Human Resources System

Mary

Ruth

Smith

Example 2 – Student Address

Student Info System

123 N Elm St Apt 6

Financial System

123 North Elm #6

Human Resources System

123

North

Elm

St

#6

Example 3 –Student Grade/Course

Student Info System

B -10th Grade English

Gradebook System

3 – 01 10 234 451 01

Although it may seem that staff entered the data incorrectly, that is not the case. They just entered the data entered differently based on the criteria built into each system. The student’s name is Mary Smith; her address is 123 N. Elm St. #6; she received a “B” in 10th grade English. Even though each of the computer systems requires that the information be entered using different criteria, the information is needed in the data repository, also known as the **data warehouse**. Unless there is an **ETL** tool, with appropriate rules for copying and converting the data into one recognizable format, the **data warehouse** will be a jumble of disparate bits and bytes. While there are software **ETL** tools available, organizations will need to determine the specific rules to implement.

Metadata

If the data exist in systems as described in the case above of Mary Smith, decisions will need to establish which of the different definitions will be acceptable. This is important to reduce confusion or misinterpretation of the data used in reports. Descriptions of data elements enable the comparison of data from different underlying databases. Carry on discussions with each stakeholder group to develop the acceptable definitions for the entire organization. **Metadata** is the recognizable format of the data element along with a clear, accurate and precise definition.

Descriptions of data elements enable the comparison of data from different databases.

Another way of describing **metadata** is to say that they are necessary to establish a data dictionary, with an entry for each data element. According to DJ Powers⁸, that dictionary would include

- Business definitions of the data
- Accurate, understandable descriptions of data types
- Potential values
- The system from which the data originated
- Data formats
- Names of variables
- Length of fields
- Valid values

Personal information is not the only area where confusion could result unless the organization spends the time and effort to develop **metadata**. Precision is necessary when a district needs to determine where to build a new school due to a growing population. If it is difficult to decide which definition for the data element “school” to use, how can the administration determine where to build? What if

- the student information system defines a school as the place a student attends;
- the facilities system defines a school as one entity, or building, on a physical site that contains many buildings;

⁸ DJ Powers page 133

- the transportation system defines a school by the pickup/drop off locations; or
- the finance system divides schools into subsets based on the allocation of funds?

Confusion could be the result with these conflicting definitions. **Metadata** enable terminology used by different departments in an organization to mean the same to everyone.

It is to the advantage of each organization to find the standard way of defining a particular data element. A resource that would be of assistance is the NCES Handbooks Online available on the NCES website.⁹ According to the website, “The NCES Data Handbooks provide guidance on consistency in data definitions and maintenance for education data, so that such data can be accurately aggregated and analyzed.” For example, the NCES Handbooks Online treats “student name” as an “entity” that can be divided into several “elements”:

Domain: Student

Section: Personal Information

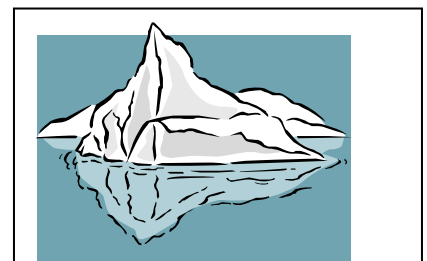
Category: Name

Entity: Student

1. **Element:** First Name
2. **Element:** Middle Name
3. **Element:** Middle Initial
4. **Element:** Last/Surname
5. **Element:** Generation Code/Suffix
6. **Element:** Personal Title/Prefix
7. **Element:** Alias
8. **Element:** Former Legal Name
9. **Element:** Last/Surname at Birth
10. **Element:** Nickname
11. **Element:** Tribal or Clan Name

Cleaning all the data needed in a **data warehouse** and including the addition of **metadata** definitions to data elements can be a time consuming and expensive process.

However, this **ETL** process will ensure that the necessary components of the underlying databases needed to build tools for analysis and reporting are able to link together. These tasks are necessary to ensure that a DSS has the ability to examine the relationships of data. It is beneficial to reiterate that many **ETL** issues will be easier to deal with if the underlying systems are already **interoperable**, as discussed previously.



The pretty face – the interface is just the tip of the DSS iceberg. What is under the surface? (**adjust graphic**)

When working with a vendor who is demonstrating a DSS with a pretty **interface** and exciting “bells-and-whistles,” ask about their **ETL** process. Some of the questions might include

- What does it cost?

⁹ The National Forum on Education Statistics (2003). *NCES Nonfiscal Data Handbook for Early Childhood, Elementary, and Secondary Education: 2003* (NCES 2003-419). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

- How often is it necessary to repeat the process?
- What other organizations have worked with this vendor on the ETL process?
- Does the vendor have the tools to clean the data or does the organization need to develop the tools?

The cleansing of data, making data consistent, and the creation of metadata are necessary tasks. Staff will need to do this work when developing interoperable databases. When systems are not interoperable, staff will need to do these tasks when designing a DSS.

Questions to ask

- Is there a “Culture of Quality Data” in the organization?
- Can the staff vouch for the reporting process in existence BEFORE a DSS is considered?
- When developing a new DSS, what are the ETL procedures?
- Have metadata definitions been applied to data elements?

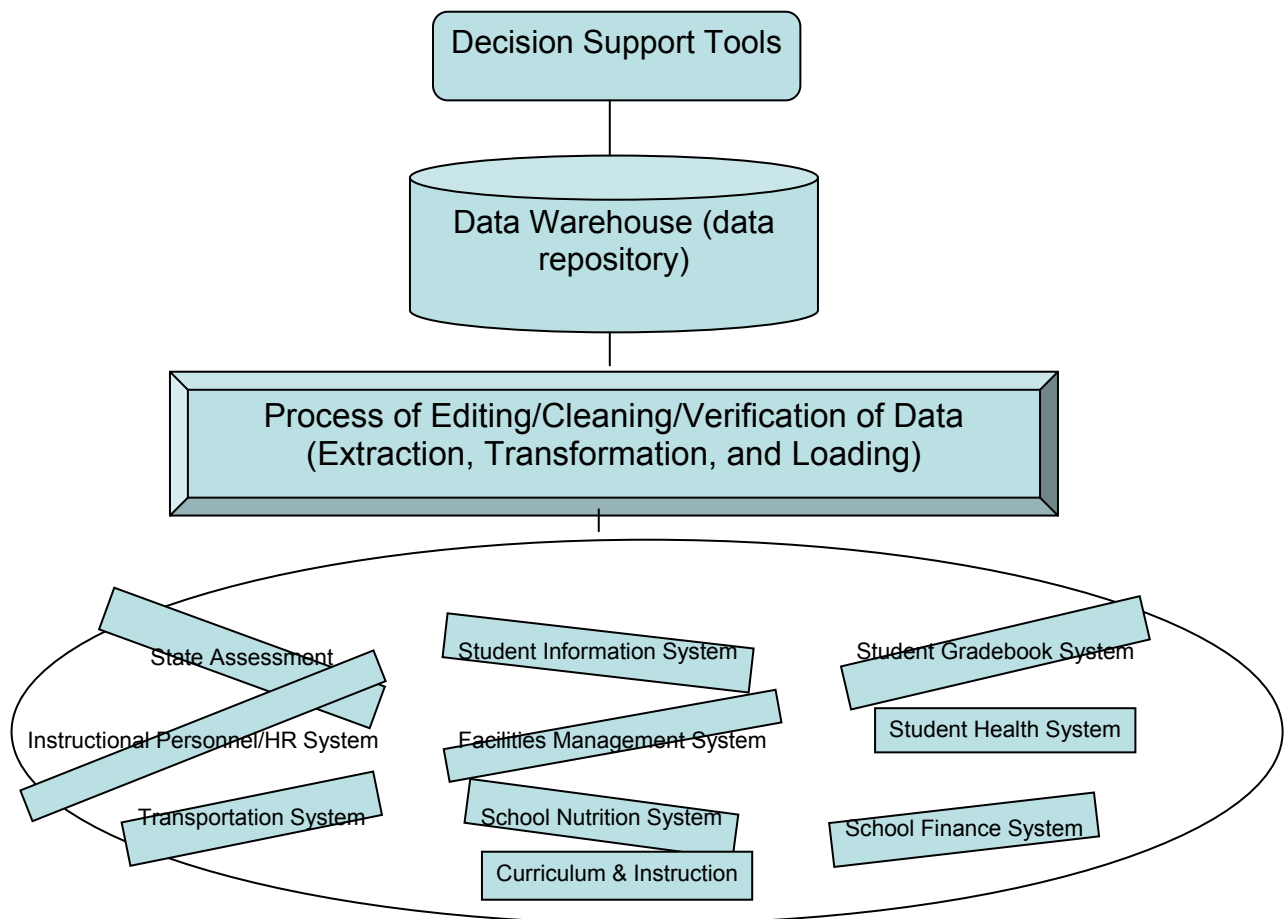
MODEL DECISION SUPPORT SYSTEMS

There is not one correct model for a decision support system. The DSS that will best serve the organization will depend on the specific needs of the organization, the state of existing technology, the structure of existing databases and, of course, the cost. The important needs assessment process, as staff discusses what they need a decision support system to do, will help clarify the structure of the proposed system.

Educators have been successful in developing computer systems for specific aspects of the organization. To meet the challenges of today, with information flowing from many different parts of the enterprise, it is important to bring the data in these systems together. Sometimes it is possible to revise and upgrade the databases themselves, to make them interoperable. Sometimes it is necessary to retain the disparate structures of existing databases and use an **ETL** process to transform the data used in a DSS.

Decision Support Systems using a Data Warehouse

The first model below describes one possible structure for a DSS. A hierarchical relationship exists between the underlying systems and the total decision support system. Since the databases are not interoperable, **ETL** processes provide a compatible structure for the data. Often, the final piece of an **ETL** process is to load the data into a repository, or **data warehouse**.



It is not possible to build a decision support system without underlying databases. Without data, data-informed decisions cannot be made. Using those databases, especially when they are **stovepipe** systems that stand alone, can be a challenge that requires a great deal of planning.

In the model above, the data warehouse “receives validated data from an extraction, transformation, and loading tool (ETL).”¹⁰ Data from the underlying databases go through a cleaning process when they are moved to an efficient data repository. From the **data warehouse** the DSS reporting tools are able to obtain the specific data required for analysis and the development of reports.

Decision Support Systems with a Data Aggregator

The cost and length of time it takes to build a DSS depend, largely, on the structure of the existing, underlying systems. These disparate databases need to link together in order to “communicate” with each other. This is often a difficult, time consuming, and expensive process. This task may be more difficult because the existing underlying databases were probably developed at different times, with different structures, and consist of different definitions for the same or similar items.

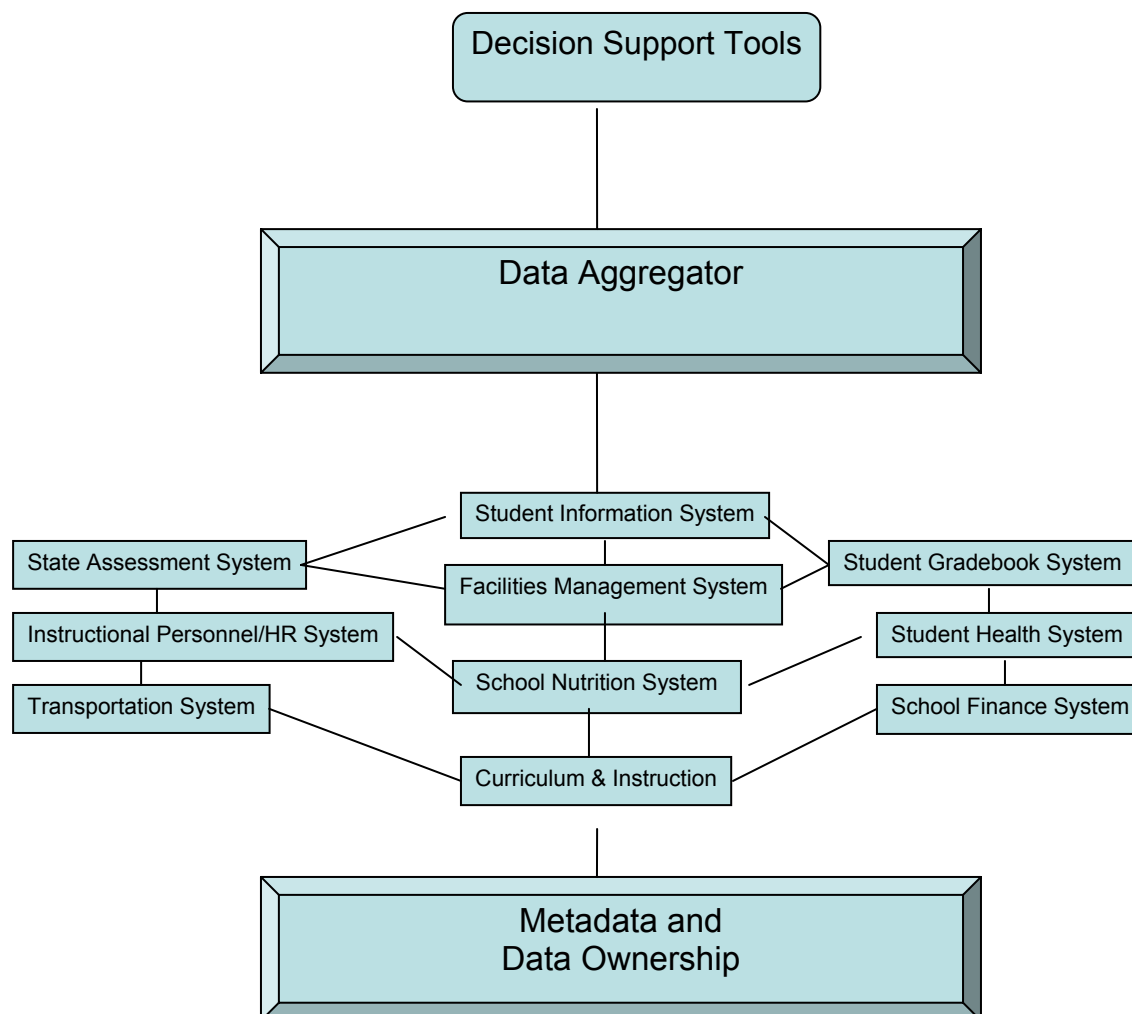
The discussion of **Extraction, Transformation, and Loading**, above, assumes that the underlying databases are not interoperable. It is certainly preferable to create interoperable databases at the outset, for the databases to link together and for staff to do the work creating **metadata** when first creating or upgrading the databases.

It is often true within an organization that different groups or departments “own” different databases. When developing **metadata it is important for an organization to** establish a regulation so that specific departments may only change rules and definitions only for particular data elements. For example, changes to bus routing definitions are the responsibility of the Transportation Department, the Facilities Department defines a building, the department that oversees the student information system establishes the rules for entering names and addresses, etc.

One of the major advantages of developing interoperable underlying databases is that staff enters information one time only. After the entry of the name and address of a student in the student information system, it will appear in the food services system, the bus routing system, and in any other system where staff decides to place the data. Because data is entered one time, staff will save time and there will be fewer mistakes.

Since the databases are already interoperable with data definitions established, it is unnecessary to go through an **ETL** process and create a separate **data warehouse**. Instead, a **data aggregator** tool gathers the specific data requested used by the decision support analysis or reporting tools.

¹⁰ Stein, Matt. (2003) *Making Sense of the Data, Overview of the K-12 Data Management and Analysis Market*, Page 12. Eduventures, Inc.



Combining Real-Time Data with Longitudinal Information

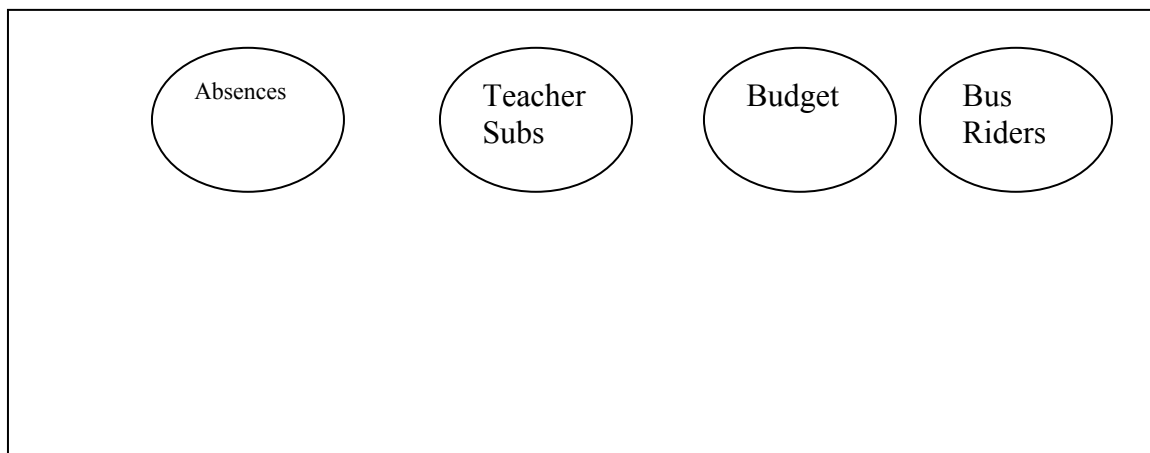
Decision support system tools are valuable when staff wants to examine student achievement, and/or to evaluate successes and challenges that have developed over a period of years. Additionally, it is possible to for the DSS to display “real-time” data on a **dashboard**¹¹. The metaphor of the **dashboard** is used because, just like the dashboard of a car, there are gauges and dials that give indications of the condition of the entity—the car or the education organization.

A **dashboard** enables a user to access real-time data, to have information available as events unfold rather than after the fact. Where organizations have developed **dashboards**, different users have displays depending on their need. The **dashboard** of the business manager, for example, will be different from that of a school principal.

¹¹ Often “Portal” and “dashboard” are used interchangeably. However, a portal can be the door to the DSS, while a dashboard is a screen specifically created to obtain pre-defined reports.

The buttons on a decision support system **dashboard** can allow a principal to check on the enrollment in school at a given point in time or provide a “real-time” –nearly instantaneous- report/graph of the enrollment. In addition to school enrollment statistics, in case of a bus accident, a **dashboard** could direct a principal or a bus route manager to the list of students on that particular bus, with their emergency contact information. Examples of other real-time reports that available to specific system users from a DSS **dashboard** could be

- attendance data, placed in historical context;
- Food services information;
- numbers of substitutes needed and/or assigned for the day;
- account balances; or
- incident reports.



(Graphic Designers: A better dashboard model will follow.)

A **dashboard** does not take the place of any other analysis or reporting capability provided by the decision support system. The ability to develop these different methods of providing information to users is another benefit of a DSS.

Questions to Ask:

- Do the underlying databases exist, enabling a DSS to be constructed?
- Are these underlying databases interoperable?
- Has the organization examined different decision support system models?
- Have staff members seen a DSS **dashboard** used in a school?

ANALYSIS TOOLS: DATA BECOMING INFORMATION

No matter which of the models described is used, staff will need to analyze and format data for reporting. Analysis may include a deeper examination of the relationships between data elements to answer questions related to predicting outcomes and performance to implement intervention plans. Examples of these questions are

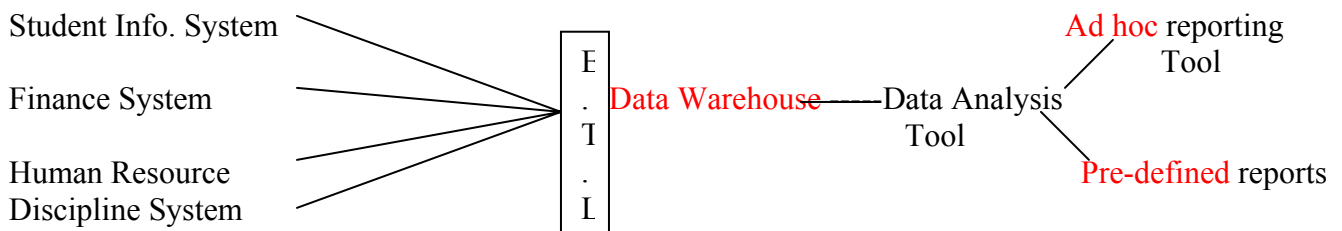
- Which factors best predict students that are at risk of becoming High School dropouts?
- Which instructional strategies implemented are having the greatest impact on student achievement?

One of the exciting effects of a decision support system is that data is available to many people. Some members of the staff who have not received data analysis training may want to produce reports. While it is good to have data available, it is best to produce reports by those who understand what the data represent. It is important for staff members conducting research and analysis duties to have training in statistical analysis including awareness of

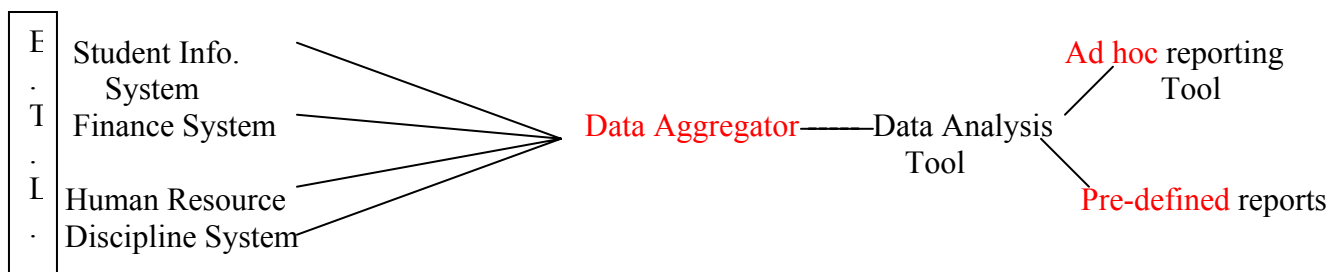
Provide training for staff responsible for producing DSS reports.

- the limitations of data;
- research designs and their limitations, and
- the guidelines and assumptions underlying **parametric** and **non-parametric** statistical data analysis.

Example 1.

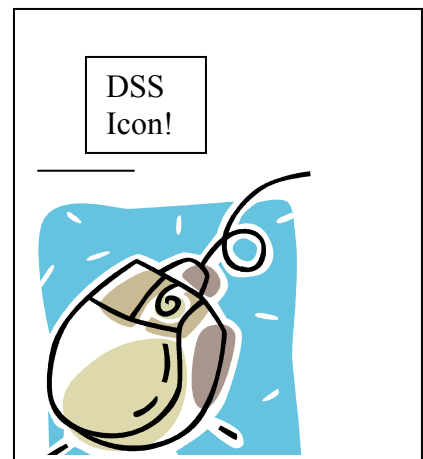


Example 2.



Fitting a Data Analysis Tool into a Decision Support System

Pre-defined reports sometimes referred to as “Canned” reports, are often developed and available to the people who use the DSS. For example, district personnel might want to check student attendance each day. A DSS screen could provide access to this **pre-defined** report with the simple click of a mouse.

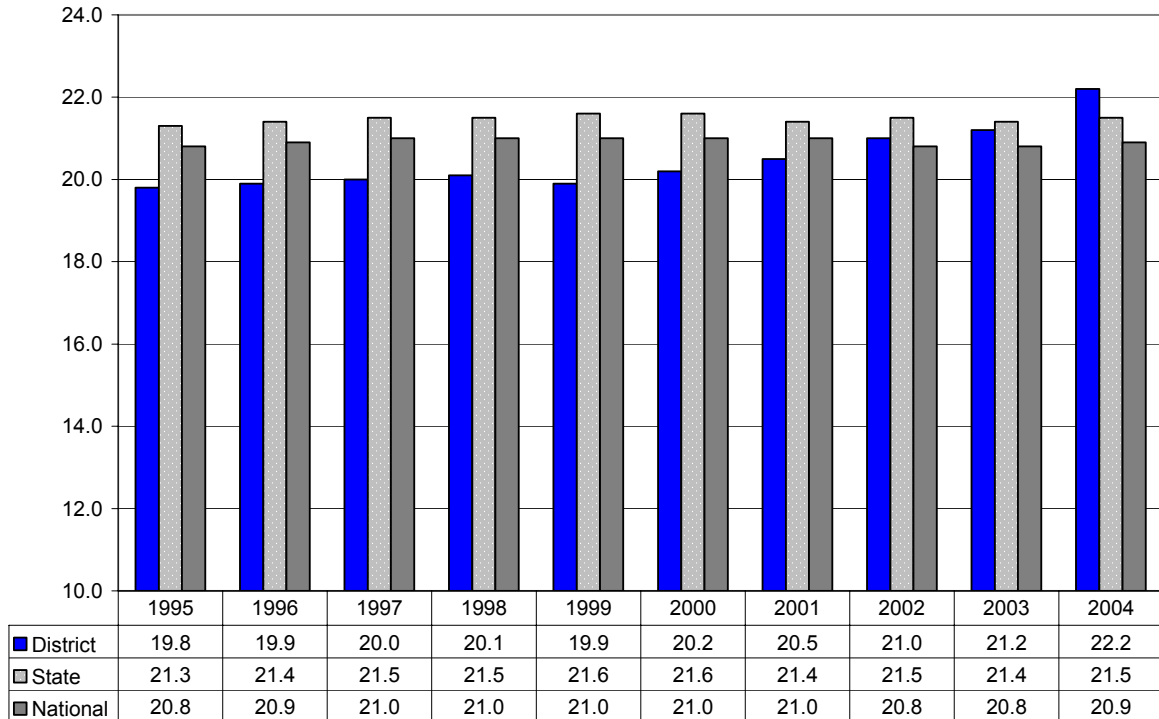


Many times, a **pre-defined** report will not be enough to meet the needs of a DSS user. Whenever there is a request for information and existing reports cannot provide the appropriate response, DSS tools are available to create **Ad-hoc** reports. An **ad-hoc** report might measure the progress of specific groups of students. An example could be a report generated to see if students in the fourth grade are all progressing at the same rate or if there is a group that matriculated from one specific third grade teacher doing better than other students do.

An analysis tool can develop reporting templates for annual data reporting. These templates could be stored for just one user or shared with multiple users. An example would be a template for a district or statewide summary report of student achievement levels on a state test generated every year for each content area and grade level assessed. The design of the template can allow the user to add the additional data or modification to the template and not have to start the process from scratch, thus increasing efficiency.

The information in the **graphic report** below is an example of what a DSS could do using an analysis tool. The template demonstrates the ability to display longitudinal data representing ACT scores as the data become available in future years.

**Sample School District
ACT Average Composite Score Results - Spring 1995 - 2004
District, State and National Score Comparison**



Using a DSS with effective analysis tools enables education organizations to develop detailed reports that will assist school administrators and teachers to develop educational plans for classrooms, groups of students, or for individual students. An efficient DSS allows sophisticated responses and the examination of data **–sliced and diced–**in ways that are helpful when looking at the instructional program. In some cases, the questions asked will be beyond the statistical analysis capabilities of a

typical DSS. In that case, districts/schools that tend to ask such high-level questions will want to make sure the DSS they select is capable of exporting the data necessary for use with the appropriate statistical analysis software.

A very flexible DSS allows the user to generate **ad-hoc** queries or reformat demographic data groups. These capabilities enable organizations to respond to the unique questions and non-standard inquiries that come up over time.

Is the DSS capable of exporting data to statistical analysis software?
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The capacity of a DSS to incorporate school or district developed benchmark assessments, purchased assessments, or standards-based grade books in the analysis tool will further increase the efficiency and effectiveness of the educational organization. Schools may wish to include their curriculum documentation, mapping, and lesson plans into an electronic format. The documentation would be standards-based. Any **formative assessments**, grade books, and continuous improvement monitoring at the school or student level can be tied to the standards. With this information, staff would be able to conduct data analysis on the formative assessments and determine where the trends, strengths, and weaknesses are at the school, grade, or student level. A few of the benchmark assessment systems also incorporate distracters that allow teachers to clearly identify the level or type of cognitive error demonstrated by students and thus modify instruction accordingly. In effect, they are taking some of the guesswork out and increasing the efficiency of teacher's instructional decision-making.

Questions to Ask

- What are some uses of an analysis tool?
- What does the tip of the iceberg represent? What is beneath that iceberg?
- What are some ways to display information?

REPORTING TOOLS

To create the information and reports described, a decision support system has reporting tools to assist people when they want to use data. A reporting tool will generate easy to read tables, graphs, and charts. The tool will also enable a user to

- place headings, titles, and explanatory information within the charts and tables as needed;
- add borders and shading as needed to clarify and highlight important information and groupings;
- sort and separate out groups across pages with page breaks, and other formatting tools;
- move, edit, or delete columns and rows of data as needed;
- export data in various formats (e.g., ASCII delimited, Excel®); and
- output reports in various formats (e.g., html, pdf®, email, paper).

Creating Reports using Graphing Tools

One of the benefits of an effective Decision Support System is the ability to generate reports in many different ways. As such, a good data analysis tool will accommodate the selection and incorporation of data into various graphing formats. The tool will allow staff to assemble the graph according to specifications. Additionally, the tool would be able to

- determine the colors or patterns used to identify different groups or assessment scores;
- specify the legend explaining the groups or assessment scores in the graph.
- allow different styles and sizes of fonts; and
- include the data values or a data table.

Sometimes, a graphic representation can demonstrate a point more effectively than a traditional [tabular report](#). While the phrase “a picture is worth a thousand words” might be trite, effective DSS reporting tools enable the presentation of information in many different ways. This is an important feature of a DSS because it allows the display of complicated information for those with little background in statistical analysis. When staff received the information below, they were able to view the longitudinal relationships of Group One students and Group Two students at the top two (i.e., proficient and above proficiency) levels across the table, from 2000 to 2004. What was more difficult was comparing the progress of the Group One students to the Group Two students.

Using graphs as reports enables complicated data to be presented to people in ways that are easily understood.

Sample School District State Assessment Program Longitudinal Data 2000-2004

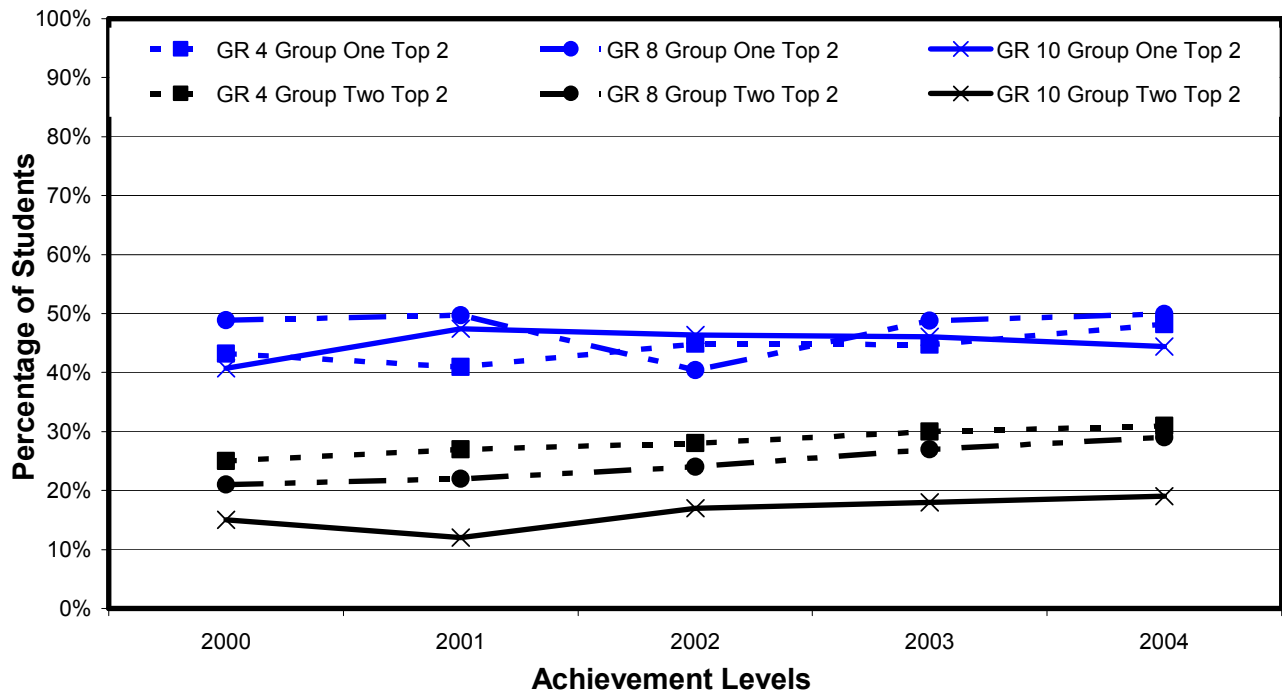
Comparing Group One and Group Two student performance at the top two levels

Mathematics	2000	2001	2002	2003	2004
GR 3 Group One Top Two	45%	50%	55%	56%	60%
GR 7 Group One Top Two	40%	45%	51%	53%	55%
GR 11 Group One Top Two	30%	35%	38%	39%	40%
GR 3 Group Two Top Two	15%	17%	18%	20%	21%

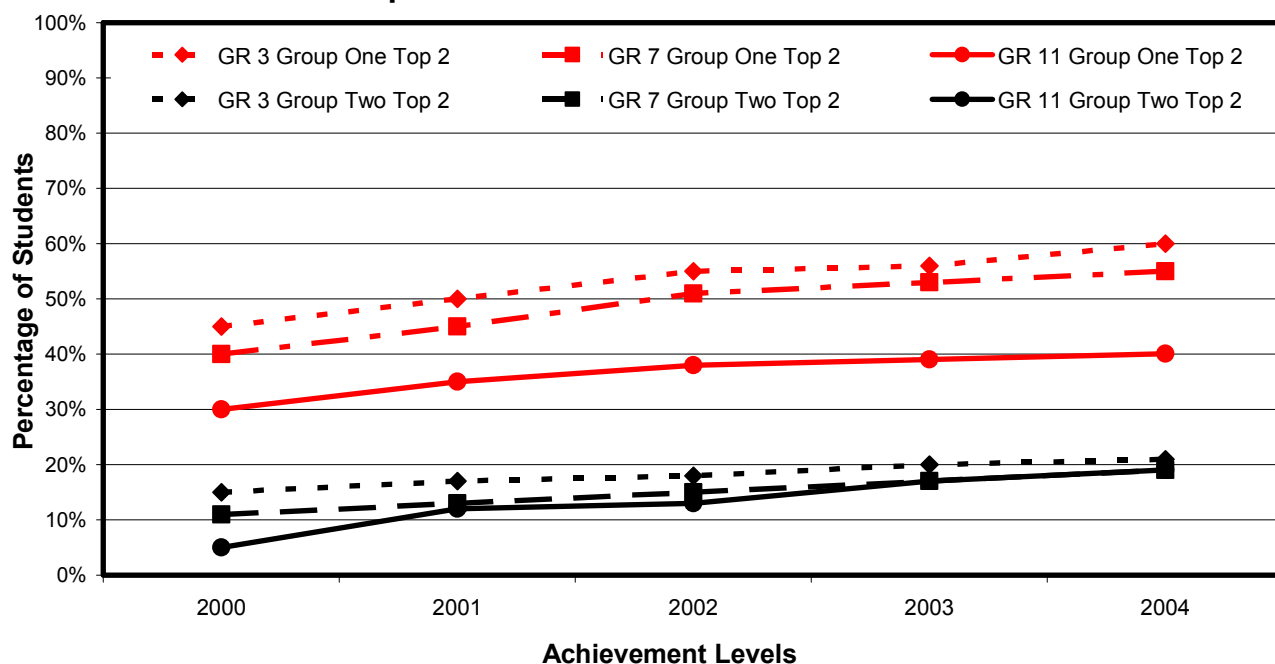
GR 7 Group Two Top Two	11%	13%	15%	17%	19%
GR 11 Group Two Top Two	5%	12%	13%	17%	19%
Communication Arts	2000	2001	2002	2003	2004
GR 4 Group One Top Two	43%	41%	45%	45%	48%
GR 8 Group One Top Two	49%	50%	40%	49%	50%
GR 10 Group One Top Two	41%	47%	46%	46%	44%
GR 4 Group Two Top Two	25%	27%	28%	30%	31%
GR 8 Group Two Top Two	21%	22%	24%	27%	29%
GR 10 Group Two Top Two	15%	12%	17%	18%	19%

The intent of the examples in this chapter is to demonstrate a few of the ways to display reports. When information about Mathematics and Communication Arts from the report above was displayed using linear graphs below, administrators were able to recognize immediately the differences between performance levels of the two groups.

**Sample School District State Test - Mathematics
Longitudinal Comparison of Group One and Group Two
student performance at the TOP Two levels - 2000 to 2004**



Sample School District State Test - Communication Arts Longitudinal Comparison of Group One and Group Two student performance at the TOP Two levels - 2000 to 2004



There are many different ways to display information. Tools might include, but are not limited to bar graphs (including stacked bars), pie charts, bar and line graph combinations, multiple axis graphing, and scatter plots. It is to the advantage of the organization to have staff that are familiar with these tools and are able to develop the appropriate reports based on the information requested. Where no such staff members are in place, it is necessary for the needs assessment process to address the issue. It may be necessary to train personnel to work with data and develop reports or it might be necessary to hire additional staff.

Appendix C of the *Forum Guide to Education Indicators* provides information on report design and display techniques. It also displays examples of different graphs and suggests that organizations create a style guide to develop consistent approaches when graphs are used. The guide points out that good report design reflects clear thinking. Effective reports are

- easy to read and clearly state a well-defined message that readers can understand and use;
- accessible to the target audiences, both physically and linguistically;
- accompanied by adequate interpretive information;
- supported by evidence; and
- coordinated with other resources from within the reporting organization or system.¹²

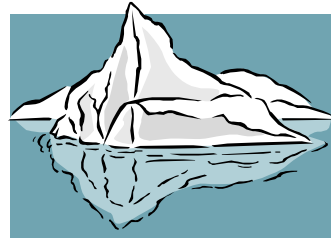
¹² The National Forum on Education Statistics. (2005). *Forum Guide to Education Indicators: 2005* (NFES-2005-802). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office

Reviewing Reports Produced by a Decision Support System

When reviewing a report it is easy to be overwhelmed by the presentation, by the colors, by the lines or bars. Before making the report public, or presenting the information to supervisors, review the numbers. Does everything make sense? It is imperative that personnel receiving a report developed from a DSS ask questions about that report.

The technology used to produce the report may work perfectly and the analysis tool may provide the ability for the creation of a beautiful report. Nevertheless, people are still responsible for the design of the report and people are, at some point, responsible for the initial data entered. Since the visible information only represents the tip of the iceberg—a small part of the data used to create the report; it is a good idea to ask questions about the computations that are below the surface.

Here is another iceberg!
Remember that the pretty report is just the tip of all the data and computations that are below.



While it is true that there might be a problem with the process used to develop a report there are many good reasons for what may seem to be a discrepancy in a report. For example, if a column that purports to represent all students does not add up to 100% of the students, is that a problem? Or, can the apparent discrepancies be explained? The differences in the data may be due to the rounding-off of numbers (i.e., 21.4% may be reported as 21%, while 21.6% might be reported as 22%). Cell suppression, not reporting extremely small numbers to protect the identity of individuals represented, might be another explanation for the discrepancy.

It is almost a certainty in this technological age that a member of “senior staff” has made a request for information and gotten two or three different answers to the question. Sometimes the distance between the senior staff making a request for information and the data analyst is a chasm. It is like the childhood game of “telephone” where the message that started out becomes something completely different at the end. It always makes sense to review the report with the person who produced it to be certain that the original question is the one answered.

Even with a DSS in place, the existence of appropriate data cleaning tools, and a culture of quality data, the organization will want to devise processes to ensure that confusion does not result information is required. For example

Trust, but
verify!

- Is there a Data Steward responsible when a “senior staff” member asks a question?
- Is the data analyst allowed to request clarification directly from the staff member making the initial request for information?
- What background information is required when delivering the report?
- What is the review process for the reports that result from requests?

Often, staff will expect an administrator to explain and support a report produced by the DSS. This is especially true if the report is going to the board of education, legislature, media, or directly to the community. Therefore, it is to the advantage of the person receiving the report carefully to review the report. In other words, “Trust, but Verify!”

Questions to Ask

- What is the decision making process in the organization?
- What are the procedures for reviewing reports?
- Does the DSS honor the information needs of students, teachers, staff and other stakeholders?
- Will the DSS help to improve student achievement?

SECURING THE CONFIDENTIALITY OF PERSONAL INFORMATION

A decision support system is more than hardware and software for managing data. Central to its effectiveness are the quality and kinds of data included. For education organizations, these data often include personally identifiable information about students and staff. In addition to the need for accurate data, agencies must have strong policies and procedures to insure the confidentiality of personal information and compliance with state and federal statutes.

It is important for educators to understand the issues involved and the resources required to comply with policy regulations. These policies and procedures are necessary whether a DSS exists in the organization, or not. When a DSS does exist, the potential for misuse of data is exacerbated by the ease with which data are available.

Information security policies are necessary whether or not a DSS exists in the organization.
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Each organization will need policies governing who may access what information. With input from administrative staff, information technology personnel will need to create the access rules to restrict release of confidential information to those parties with authorization. For a more detailed discussion of these issues, refer to the *Forum Guide to Protecting the Privacy of Student Information*¹³

Confidentiality of Information

Most education organizations are aware of the need for security in computer networks. The Internet may be the source of threats from hackers, hostile viruses, etc. Internal security is required for compliance with several federal statutes, which authorize limited access to student data, even by officials. They are:

- The *Family Education Rights and Privacy Act* (FERPA)
 - FERPA protects all personally identifiable information about students, except for a handful of items designated as directory information. Even directory information may be restricted if parents object to the release of that information for their own children. The website is at <http://www.ed.gov/policy/gen/guid/fpco/ferpa/index.html>.
- The *Health Insurance Portability and Accountability Act* (HIPAA)
 - HIPAA protects medical information, not only for students, but also for employees and anyone else whose medical records may be included in the system. While HIPAA controls fewer kinds of records, this law is much more restrictive than FERPA in how they may be collected, stored, and shared. The website is located at <http://aspe.hhs.gov/admnsimp/pl104191.htm>
- The *Individuals with Disabilities Education Act* (IDEA)
 - IDEA adds another layer of protection for information about students with disabilities. This is explained in more detail at http://www.access.gpo.gov/uscode/title20/chapter33_.html.

These confidentiality provisions require control of access by the school, district, or state organization. This protection applies all the way down to the data field level in databases.

¹³ The National Forum on Education Statistics. (2004) *Forum Guide to Protecting the Privacy of Student Information: State and Local Education Agencies: 2004* (NCES 2004-330). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Human Subject Research Standards

Research organizations such as universities, have institutional review boards to assure that research involving human subjects complies with established standards. Recently, as more data have become available to educators, there is a strong movement for local districts, schools, and even teachers to conduct action research. Education organizations need to be aware of the standards that protect human research subjects from harm that could be the result of research procedures.¹⁴

While formal accreditation may be an unjustified step for education agencies that are not deeply and regularly involved in research, the standards and processes available from the organizations listed below are instructive and could be used to develop policies that will help and protect even a small district from stumbling into poor practices.

Confidentiality Policies

Even with the assistance of this guide, FERPA, HIPAA, the justice department, etc., there are instances where the administrator may not be certain about the release of personal data. The *Forum Guide to Protecting the Privacy of Student Information* addresses this issue by stating,

When uncertainty occurs about when and with whom information should be shared, individuals in schools should act with caution and understand that their fundamental obligation is to maintain confidentiality. School personnel should never share with another individual—even a professional—more than is necessary to benefit the student. Legal counsel and school officials are available to interpret matters where privacy issues are involved. Teachers, paraprofessionals, and principals should not hesitate to consult these individuals when they are uncertain about their obligations or responsibilities.¹⁵

Confidentiality issues can result when available information enables people to identify individuals. This problem can occur when the number in a cell is very small. For example, when reporting average test scores for African-American students in a classroom, and there are only two African-Americans in that class, it is most likely that the **cell size** is too small to report. Conversely, there are circumstances where aggregated data for large groups may have confidentiality issues. An organization may not release when the information in a cell is:

- so small that there is a high probability that individual students can be identified, or
- so large that it includes all, or nearly all, students in a known group, such as a class or school.

¹⁴ Such standards are addressed at the Department of Health and Human Services Office of Human Research Protection website at <http://www.hhs.gov/ohrp>. Additionally, the Partnership for Human Research Protection, Inc. (<http://www.phrp.org>), a collaboration of the Joint Council on Accreditation of Healthcare Organizations (JCAHO) at <http://www.jcaho.org> and the National Committee for Quality Assurance (NCQA), <http://www.ncqa.org> provide a voluntary accreditation process and online standards for accreditation that may be accessed at no cost.

¹⁵ The National Forum on Education Statistics. (2004) *Forum Guide to Protecting the Privacy of Student Information: State and Local Education Agencies: 2004* (NCES 2004-330). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

This prohibition on disclosure is in place whether data could be embarrassing to individuals or, even, communicate positive information about an individual. Most organizations have policies in place that do not allow the reporting of data under these circumstances.

While violations resulting from reporting positive assessment results, for example, may not result in any complaints or sanctions against a district or state department of education, it is necessary to address the issue of both large and small cell size in policy and practice. The concern is not the number of individuals represented by the number in a cell. It is a violation of privacy rights if, through a large or small number in a cell, individual students can be identified. The implementation of these policies can result in **cell suppression** and not reporting that data.

The transfer of disaggregated data from districts to state departments of education presents new issues. It is just as important for state education personnel to be aware of the security and confidentiality procedures as for district staff.

System Security

Confidentiality of data is a concern at many different levels. In addition to the issues concerning the uses of data, the physical protection of data stored on the computers is a critical component of each agencies data security plan. Part 5 of the *Forum Unified Technology Suite* contains an extensive discussion of system security issues. In brief, the Guide suggests that, “The goal of security is to protect your technology system without unnecessarily limiting its utility.”¹⁶

Personnel in both districts and state departments of education need to be aware of data privacy and security issues.

In a number of cases, some or all of the computers and servers used for DSS might be housed in places that are not under the control of the agency. In those circumstances, the agency will want to understand the security precautions taken by the vendor.

One of the great challenges for educators in this information era may be in providing the right amount and right kind of information to make available to parents, community leaders, and others. The purpose is not to withhold information, but to provide stakeholders with a complete, detailed picture of a situation while not overwhelming them with excessive and extraneous data that could create confusion or suspicion.

Questions to Ask

- What policies are in place to secure personal data?
- What is the organization policy for suppressing data in small cell sizes?
- What provisions exist for the physical security of computers and servers?

¹⁶ The National Forum on Education Statistics. (2005) *Forum Unified Education Technology Suite*. See: http://nces.ed.gov/pubs2005/tech_suite.

STAFF DEVELOPMENT AND TRAINING

A decision support system provides unique professional development challenges for organizations. Users of the system will retrieve data in many different ways. Some people will access **pre-defined** reports; others may want to create their own **ad-hoc** reports. People from different departments in the organization will have specialized needs. Training for these users is important for effective implementation of the DSS.

Some staff members will make decisions based on information received from the DSS. It is necessary to provide professional development for staff related to quality decision-making. The ability to read reports and understand the information displayed is a learned skill. Full advantage of the DSS will not be possible unless staff is trained to use the information appropriately, and to know the possible limitations of the data.

Depending on the complexity of the DSS, a great deal of training may be required to make people comfortable with the system. The organization will need to determine if there is knowledgeable staff within the organization to provide professional development, if the vendor will be training staff or, if other outside contractors will provide professional development.

Staff development and training are critical for success of the decision support system.

The importance of staff development cannot be overemphasized. When developing technology systems such as a DSS, even though staff may spend an appropriate amount of time on the needs assessment process and on system development, there is a tendency to consider staff development as an afterthought. This is a mistake. If the DSS is going to be used to assist in data-based decision making in the classroom it is necessary to spend time talking with teachers to see what reports will be useful to them. Additionally, staff working with curricula will want to develop training modules to help teachers convert the reports into action. The same issue is important when the business manager considers how staff will use the DSS.

Those responsible for professional development in the organization may want to contact other education organizations that have worked with the vendor who developed the DSS to see how they have been able to integrate the DSS into their business and instructional practices. Asking these questions may provide some help in determining the professional development needed. Staff will want to know

- how much professional development was needed to implement the system;
- who was trained in which specific positions;
- how much ongoing professional development is needed; and
- what support did the vendor provide?

Some vendors have developed modules to train personnel. These may be effective tools if the modules use real data that exists within the organization, rather than simply using generic example information. The use of data from the organization in the professional development process enables staff to get used to the information they will work with after the training. Conversely, using only generic data in training may result in problems. Organizations may have to re-train their staff using their own information.

Use real information for training rather than generic data.

Decision Support System Stakeholders

Throughout this document, the emphasis has been on the effect a DSS will have on the instructional program. The publication has highlighted the reporting capabilities of a DSS that allow administrators and teachers to make data-based decisions that can have an impact on what happens in the classroom. Other stakeholders have an interest in the DSS. These stakeholders may include the business office responsible for such things as ordering food for lunch, real estate departments that want to build new schools, and transportation experts who are developing bus routes.

One of the challenges faced as the DSS is developed is to create a system that will meet the needs of the different types of users. When an organization introduces a DSS, data are available for analysis by people inside and outside the organization. While access is constrained by state, or federal laws that protect individual data, state or federal law and/or district regulations may require that data be available to the public. Organizations will need to have procedures in place to respond to the needs of parents and, perhaps, reporters from various media.

From parents to teachers, from business managers to superintendents: DSS training is critical.

Some school districts allow parents to log into a school Decision Support System to find out the progress of their child. Parents may be able to

- find out about test results;
- review grades;
- check attendance; or
- see the latest homework assignments.

Other community members who are interested in achievement scores and incident reports from schools may want to use the DSS. Additionally, people from outside of the area considering on buying a home, will want to examine the results of achievement tests.

It is not likely that parents would use a reporting tool to access these data. Parents would probably generate **pre-defined** reports through some type of **portal** or **dashboard**. However, they might ask questions not answered by these **pre-defined** reports. Media representatives may also want to have information not readily available. The data requests of parents or reporters are not new to districts or state education agencies. What is new is that the availability of information received from the **pre-defined** reports on the DSS will whet the appetites of the community users for additional information. This is not a bad thing; it is important for the community to be knowledgeable about their school systems. As discussed above, the organization will need to establish procedures for answering these questions and for explaining what local, state, or federal regulations allow.

Develop written procedures to respond to community requests for information.

Differentiated Professional Development

Since different staff members use the DSS in diverse ways, it will be most effective for the development of separate professional development modules for different types of users. Differentiated professional development is a key to a successful implementation of a DSS. As with other systems, professional development will include the processes and procedures for the basic users to complete their job tasks.

For the power users, professional development will include the “why” and “how to” aspects of the system. It is only with a fuller understanding of the functionality and full potential of the system that the power users will be able to make the most use of the system to meet their various needs when problems arise long after the end of training.

A superintendent, business manager, or other central office administrator may not have the time to learn how to create **ad-hoc** reports. Nevertheless, members of senior staff need training that will address their special needs. When senior staff requests information, or when they simply access **pre-defined** reports through their individualized **portals**, their ability to interpret information impacts decisions based on the data. The organization will want to give senior staff the tools to review, interpret, and ask questions on the information provided.

Differentiated professional development is a key to a successful implementation of a DSS.

Personnel who develop reports and graphic displays using the analysis tools such as those described above will need specialized training. Staff development on the different types of reports and graphic displays is essential. Administrators need to be confident that the staff creating these reports understand the data and are able to present the data effectively. Additionally, these staff members need to know how to protect the data that resides in the **data warehouse**. Unintentional destruction of data by people who do not have sufficient technical expertise and training is an unacceptable occurrence. It can even leave school officials defending themselves against charges that they are intentionally trying to deceive their constituents.

The specialized staff development for principals and teachers must emphasize the value of the reports that use real data and demonstrable outcomes. A teacher, for example, will need more from a report than a listing of areas of effective instruction or areas where improvements are necessary. Helpful professional development for school personnel will include such items as,

- accessing school wide or classroom reports;
- using the reports;
- information on how to use data to improve achievement of an individual student or groups of students; and
- instruction on how to present information to a principal or a teacher.

The need for effective communication throughout the organization hierarchy was mentioned earlier in this publication. It is important to emphasize the power of information. It can lead to frustration and discouragement unless data are used to enhance skills and achievement. In the hands of poorly trained supervisors, reports indicating areas where a teacher or principal might improve could be instruments to punish or to demean an individual. Conversely, skilled administrators are able to let staff know where there are areas of improvement using tactics that make the person receiving the information feel able to move forward and make the changes necessary to be more successful.

When using data from a DSS, staff development will need to emphasize effective ways of presenting information to those who need to develop skills in particular areas. If a student is having trouble with third grade math, an educator will devise ways to help. The same is true for a teacher having problems teaching a third grade math concept; educators need to provide assistance rather than making destructive comments. Through trust and honesty, great improvements are possible.

Ongoing Professional Development

The purchase or development of a new technology makes staff development necessary. Through training, the system becomes available to staff. Follow-up training for existing employees to maintain skills and training for staff hired after the system is another component of a comprehensive professional development program.

Procedures for ongoing training and documentation are necessary when existing systems are upgraded. Web-based follow-up training, CD/DVD based refresher training modules and/or software supported help menus could also be available for later user reference. If the district has the capacity, streaming video, PowerPoint™, or other media based refresher training modules can train users on the key procedures and processes.

This chapter contains a number of staff development options. The *Forum Unified Education Technology Suite*¹⁷ has many additional suggestions to assist staff in developing effective professional development procedures for technology systems in education. Parts 7 and 8 of the Technology Suite emphasize the need for training or professional development for the staff responsible for maintaining the new infrastructure (i.e., hardware, software and networks) as well as the training necessary for all who will be using the system. It also contains suggestions for evaluating staff readiness to use technology.

Technology is just a tool.

Decision-making is a human skill.

Questions to ask

- Is professional development and training an integral part of DSS development?
- How are DSS reports presented to teachers and principals?
- Is there a staff development module related to making good decisions using information from a DSS?
- Is professional development differentiated for different stakeholder groups?
- Is there a policy for communicating to parents and the media?

¹⁷ The National Forum on Education Statistics. (2005) *Forum Unified Education Technology Suite*. See: http://nces.ed.gov/pubs2005/tech_suite.

WHAT ARE HARDWARE AND NETWORK NEEDS?

For a decision support system to be successful, access to the system will need to be available to everyone who is expected to use it. From the superintendent to the business manager, from the principal to the teacher, a computer needs to be on the desktop. If there is limited access, the use of the system will be limited.

All intended users of the DSS need to have access from their desktop. This is especially true for teachers.

The organization will want the network to be robust enough to allow data to pass through securely and quickly. While each system is unique, the needs assessment process will enable the technology group of the organization to determine the hardware, network, and system security needs.¹⁸

One of the items to consider is the physical location of any new servers and the technical training that will be required to maintain the hardware and any additional software. Factor in the costs of the hardware, software, and technical training into the overall cost of the decision support system.

During the needs assessment process most members of the staff will be concerned with outcomes. They will want to know what a DSS can do and how it can be used to make their jobs more effective. It is important for the technology representatives (e.g. information technology staff) to be present at these discussions because it will help them understand the needs of the organization. It is appropriate to note that a Decision Support System is not a technology project; it is an approach to data and information supported by technology.

A DSS is an approach to data and information. It is not a technology project.

During the needs assessment process those people responsible for technology will want to consider the security implications of an enterprise-wide network, if one does not already exist. Having computers on the desks of teachers and other staff, with access to DSS data and information creates some unique problems. Since individual student data may be available, system security is a primary concern. Password protection plans can assist the organization when determining which members of staff can have access to the various parts of the DSS. Then stakeholders not permitted by FERPA or other regulations to access specific data will not be allowed to do so.

“The use of passwords,” according to *The Forum Guide to Creating a Culture of Quality Data*, “is important for securing the privacy and confidentiality of student and personnel information. Guidelines for the use of passwords might include the following:

- Make sure that your password consists of both alphabetic and numeric characters.
- Do not share or “loan” your password to another person.
- Change your password frequently.
- Memorize your password instead of writing it down.¹⁹

¹⁸ The National Forum on Education Statistics. (2005) *Forum Unified Education Technology Suite*. See: http://nces.ed.gov/pubs2005/tech_suite.

¹⁹ The National Forum on Education Statistics (2005). *Forum Guide to Building a Culture of Quality Data: A School and District Resource: 2004* (NCES 2005-801). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Questions to ask

- What are the plans for securing the underlying databases?
- How frequently is data backed up and where is the backed up data stored?
- What is the disaster plan? How many hours after a disaster will computer systems and networks be operational?
- Are there plans to have desktop access to the DSS for every teacher and principal?
- Have the technology personnel developed a plan to secure data and does that plan include data security in the classroom?

CONCLUSION

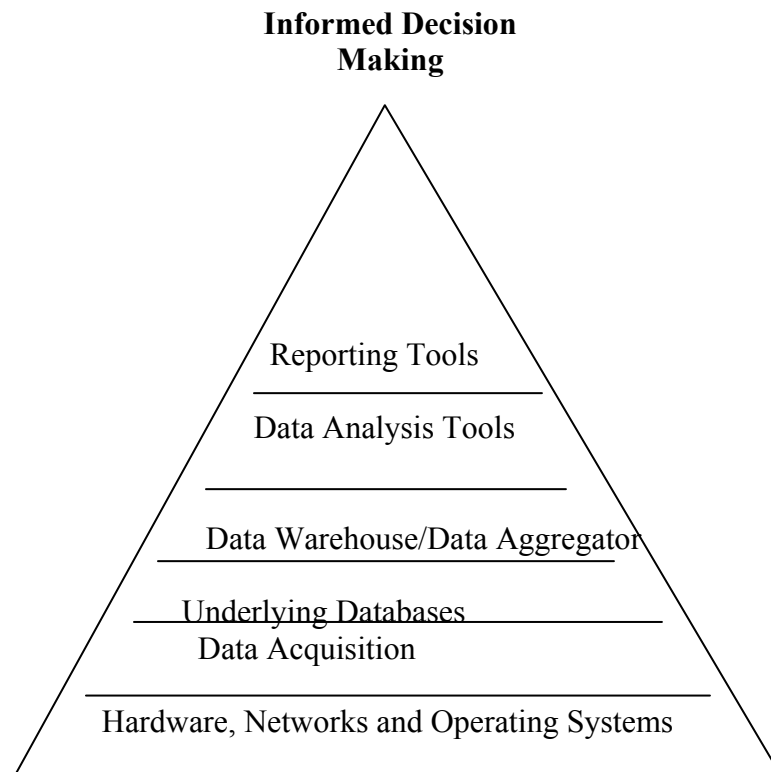
The Decision Support System Triangle

The purpose of this document has been to give people an overview, or primer, on decision support systems. The document has defined a decision support system and described the pieces that make up a DSS. Additionally the document provided tools to determine

- if a DSS would be useful for the organization;
- how reports can be created and used;
- how to secure information; and
- what types of staff development would be helpful.

A non-threatening environment allows the DSS tools to be agents of change in schools and in classrooms.

There has been an emphasis on the hierarchical nature of a DSS throughout this guide, building each component of the system on another. The triangle is another way of looking at these hierarchical relationships. Each layer of the decision support system builds on the other. If the foundation of the infrastructure and underlying databases are in place, it is possible to erect the triangle. If any of these building blocks are missing, it will be difficult, if not impossible to build an effective DSS.



(Design team: we need to discuss the format of the “DSS Triangle.”)

While each level of the triangle is important, in the rush to get a system operational, there might be a tendency to emphasize some development efforts over others. It is worth re-examining the components below.

- Do not short circuit the needs assessment process.
 - Time spent at the beginning will make everything else flow more smoothly.
- Do not short circuit the data cleaning process.
 - Recognize that the data cleaning process is ongoing; it continues to be important even after a DSS is operational
- Do not short circuit professional development.
 - Many technology-based systems are not successful because staff development and training are not integral components of system development and maintenance.

Questions to Ask

Often when talking with vendors about their systems or when reviewing systems developed by other organizations, there is a tendency to pay too much attention to how good the system looks. Many times the ease with which people demonstrating are able to move the mouse around to create beautiful reports can mask system development issues. Always remember the iceberg: the look and feel of a system is important, but there is more underneath the surface.

The publication contains some helpful questions the end of each chapter. The purpose of these questions is to assist staff in thinking about developing or using a decision support system. Some of the questions are appropriate for staff to ask each other while going through the needs assessment process. Other questions are appropriate to ask vendors. The questions follow under the chapter titles.

What is a Decision Support System?

- What questions does the organization want the DSS to answer?
- How are principals and teachers informed about indicated areas of improvement?
- Do the underlying databases exist, enabling a DSS to be constructed?
- What issues are involved in making the underlying databases communicate with each other?

Assessing the Need: Who Needs a Decision Support System?

- Who should be involved in the Needs Assessment Process?
- What do we need a decision support system to do?
- When do we think about the “look-and-feel” of the system?
- Where can we go to find out more information about the Needs Assessment Process?

Putting Together a Decision Support System

- Is there a “Culture of Quality Data” in the organization?
- Can the staff vouch for the reporting process in existence BEFORE a DSS is considered?
- When developing a new DSS, what are the ETL procedures?
- Have metadata definitions been applied to data elements?

Model Decision Support Systems

- Do the underlying databases exist, enabling a DSS to be constructed?
- Are these underlying databases interoperable?
- Has the organization examined different decision support system models?

- Have staff members seen a DSS **dashboard** used in a school?

Analysis Tool: Data Becoming Information

- What are some uses of an analysis tool?
- What does the tip of the iceberg represent? What is beneath that iceberg?
- What are some ways to display information?

Reporting Tools

- What is the decision making process in the organization?
- What are the procedures for reviewing reports?
- Does the DSS honor the information needs of students, teachers, staff and other stakeholders?
- Will the DSS help to improve student achievement?

Securing the Confidentiality of Personal Information

- What policies are in place to secure personal data?
- What is the organization policy for suppressing data in small cell sizes?
- What provisions exist for the physical security of computers and servers?

Staff Development and Training

- Is professional development and training an integral part of DSS development?
- How are DSS reports presented to teachers and principals?
- Is there a staff development module related to making good decisions using information from a DSS?
- Is professional development differentiated for different stakeholder groups?
- Is there a policy for communicating to parents and the media?

What are Hardware and Network Needs?

- What are the plans for securing the underlying databases?
- How frequently is data backed up and where is the backed up data stored?
- What is the disaster plan? How many hours after a disaster will computer systems and networks be operational?
- Are there plans to have desktop access to the DSS for every teacher and principal?
- Have the technology personnel developed a plan to secure data and does that plan include data security in the classroom?

A DSS effort involves the whole organization; it is not merely a technology project. While the project will necessarily include representatives of the technology group, it will succeed only with the active participation of the DSS stakeholders. School site administrators and teachers, business members of the organization, those who provide curriculum leadership and central office administrators all need to participate in the development of the system.

A decision support system effort is not just a technology project. To be successful, stakeholders need to be involved!

The collaboration of stakeholder groups is just as important after the system is developed. Representatives of each group of stakeholders could form a DSS support group to monitor the ongoing uses of the system and to provide a forum for recommendations to modify and improve the system.

Members of the task force believe that technology in general, and decision support systems specifically, can assist decision makers in schools, districts, and state departments of education. Therefore, this guide will end as it began by mentioning the phrase, “data-based decision making” and reminding those who are thinking about developing a DSS that these systems do not make decisions by themselves. It is easy to underestimate what it will take to build a decision support system, but the benefits will outweigh the challenges when the DSS helps the instructional program to move forward and the business practices of the organization to improve. Through efficient development and appropriate ongoing support, decision support systems can supply information using effective reports. This process will help staff make better decisions, data-informed decisions, throughout the organization.

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of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

APPENDIX A

GLOSSARY

Ad hoc Query: A question or query that is not pre-defined or planned.

Ad hoc Report: A report that is not pre-defined or established. A report that is developed using tools as needed, rather than one that was previously created.

Aggregate or Aggregated Data: Summarized data.

Breadcrumbs: On websites, a form of navigation where the current location being viewed is indicated at the end of a list of pages. Names of the pages, above the page being viewed, are listed hierarchically.

Buckley Amendment, The: See Family Education Rights and Privacy Act

Business Rules: The policies, practices, procedures and decision processes of an organization.

Business Intelligence: Describes a set of concepts and methods to improve decision making by using fact based support systems.

Cell: A box into which a piece of data is entered. A spreadsheet is composed of rows and columns of cells.

Cell Size: The amount of data reported in a cell.

Cell Suppression: Controlling the data reported in a cell in order to protect the identity of individuals represented. Many organizations will provide a rule to suppress data if, for instance, there are less than a particular number of people to report.

Cognitive Overload: Too much information.

Confidentiality: Guarantees that personal data will not be released that allows it to be tracked to an individual.

Criterion-referenced test: A test that allows reviewers to make score interpretations in relation to a functional performance level, as distinguished from those interpretations made in relation to the performance of others.

Cross Tabulation: The simultaneous tabulation of two or more variables.

Dashboard: A display of information that enables individuals and businesses to access, analyze and present critical data graphically, usually in real-time. **See Portal**

Data Aggregator: An information provider or tool that gathers content from several sources and brings it together.

Data Architecture: The framework for organizing the planning and implementation of data resources.

Data Cleaning (AKA Data Cleansing or Data Scrubbing): The process of removing or correcting data previously introduced into a system.

Data Cubes: Consisting of dimensions and measures data cubes allow data to be viewed in multiple dimensions.

Data Dictionary: Definitions of data elements.

Data Driven Decision Making (D3M): The act of making decisions based on data, or information received.

Data Mart: A collection of databases, designed to help managers make strategic decisions about their business. Whereas a data warehouse (q.v.) combines databases across an entire enterprise, data marts are usually smaller and focus on a particular subject or department

Data Mining: The use of statistical and visualization techniques to uncover trends and relationships within massive databases.

Data Model: A collection of descriptions of data structures and their contained fields, together with the operations or functions that manipulate them.

Data Quality (also Quality Data): Accurate, timely, meaningful, and complete data.

Data warehouse: A collection of data designed to support management decision making.

Decision Support System: The term refers to a computerized system that gathers and presents data from a wide range of sources, typically for business purposes.

Demographics: Data related to the characteristics of human populations.

Disaggregating: An analysis of data differentiated by subgroup or subcategory.

Drill down: Allows a user to move between levels of data ranging from the most summarized (up) to the most detailed (down).

Extraction, Transformation, and Loading (ETL): The process of getting data from existing databases, transforming these data into an interoperable (q.v.) format and loading data into a formal repository.

Family Educational Rights and Privacy Act (FERPA): is a federal law which mandates confidentiality of student records, while assuring parents access to the records. See 20 U.S.C. §1232g (AKA The Buckley Amendment)

Feasibility Study: Determining the needs of the organization, technical support necessary and overall cost of a system before developing it.

Formative Assessment: Allows staff to determine what part of a task a student knows and does not know.

Front end: The part of the software program first seen by the user, usually with icons or text links to the underlying functionality of the application.

Geographic Information System (GIS): A system that presents data spatially, using maps.

Granularity: The level of detail at which information is viewed or described. The more “granular” the smaller bits of information are presented.

Graphical User Interface (GUI): A front end (q.v.) that uses pictorial representations of information in addition to straight text that enables the use of a mouse, or other pointing device, to move around the page.

Graphic Reports: Presenting data using pictorial representations.

Item Analysis: Identifying the how many students within a population selected each answer to a specific question on an assessment.

Interface: The visible part of a computer system or database allowing the user to select items to view and enter information into the system.

Interoperable: Computer systems or databases that are Interoperable use a set of rules and definitions that enable these software programs to share information, even though the databases might be from different companies. Interoperable rules are platform independent and vendor neutral.

Local Education Agency (LEA): An LEA might be a district, county or other intermediate educational organization.

Legacy System: An old hardware or software system which may be out-dated in some way, either based on obsolete hardware or using an older user interface (e.g., a character-based interface rather than a GUI). A system that may not be able to interact easily with other computer systems.

Longitudinal Study: A study that analyzes data for subjects who continue to participate over an extended period.

Metadata (or Meta Data): Data that describe the data contained in the database. Clear, accurate and precise definition of data to reduce confusion or misinterpretation.

Narrative Report: Using a report to tell a story or plot.

Nonparametric Statistical Data Analysis: Data that does not have to conform to specific parameters or rules.

Normalization: The process of reducing a complex data structure into its simplest, most stable structure.

Norm-referenced test interpretation: A score interpretation based on a comparison of a test taker's performance to the performance of other people in a specified reference population.

Open data Base Connectivity (ODBC): A set of functions developed by Microsoft that provides access to databases.

Online: The status of being connected to a computer or network or having access to info that is available through the use of a computer or network.

On-line Analytical Processing (OLAP): A category of software tools that provides analysis of data stored in a database or data warehouse.

Parametric Statistical Data Analysis: Analysis of data that meets the parameters needed for higher-level tests of significance. Some of the key parameters are large sample sizes, normally distributed data, etc. (q.v. Nonparametric Statistical Data Analysis)

Portal: A website or service that offers a broad array of resources, such as e-mail, forums, search engines, and online shopping malls. The first web portals were online services, such as AOL, which provided access to the web; now most of the traditional search engines (e.g. Yahoo ®, Google ®, etc.) are web portals, modified to attract and keep a larger audience.

OR

A website that acts as a "doorway" to the Internet or a portion of the Internet, targeted towards one particular subject.

Pre-defined Report: A report that has been previously developed. A “canned” report.

Privacy: The principle of protecting private information about people, especially in shared or collaborative systems, and of helping to keep people free of distractions.

Prototyping: When developing an enterprise-wide system, using a smaller version of that system to test how it will work.

Relational Database Management System (RDBMS): A type of database management system that stores data in the form of related tables.

Scalability: Refers to anything whose size can be changed. How a hardware or software system can adapt to increased demands.

School Indicators: The combination of data such as norm-referenced and standards-based assessments, dropout rates, completion rates, etc., that together provides information about the success of a school in fostering successful student learning.

Schools Interoperability Framework (SIF): An application product standard that allows a computer system to interact with other software functions.

State Education Agency (SEA): Usually a state department of education.

Security: Protecting equipment, performance, and contents when using technology.

SIF: See Schools Interoperability Framework

Slice and Dice: Refers to the ability for end users to view multidimensional data by navigating interactively -- rotating and pivoting how the dimensions are displayed as rows and columns, and drilling down to lower levels of detail.

Stovepipe System: A legacy system that cannot be upgraded without great difficulty and/or is not interoperable (q.v.) with other systems in the organization.

System Architecture: A description of the design and contents of a computer system, including a detailed inventory of current hardware, software and networking capabilities; a description of long-range plans and priorities for future purchases, and a plan for upgrading and/or replacing outdated equipment and software.

System Integration: The combining of two or more computer systems and or software packages enabling these systems to work together efficiently.

Tabular Reports: Reports formatted to look like a table.

Transactional System: An information system designed to store and record day-to-day business information. Systems developed for storing data, but not for analyzing that data.

Transparency: The use is obvious or intuitive.

User Interface: The way a user interacts with data or communicates with the system.

"What-If" Analysis: The capability of "asking" the software package what the effect will be of changing some of the input data or independent variables.

Appendix B

ELEMENTS OF A DECISION SUPPORT SYSTEM REQUEST FOR PROPOSAL (RFP)

Anyone who has participated in public bids is aware that the procedures may be lengthy and complicated. While it is not the intention of this handbook to provide detailed information in the technicalities of writing Requests for Proposals (RFP), some issues that organizations will find useful when considering the purchase of technological materials and services are more complex than purchase of school supplies, vehicles, and other common items.

Scope of Work

One of the most important aspects of preparing a good RFP is careful and complete planning prior to advertising for proposals. If the organization has staff with expertise in use of data and decision support systems, these individuals will be able to identify, in detail, all of the design features that are important and seek further information from potential users of the system. Consider sending people to look at other systems to learn about possible pitfalls and about features and processes have been particularly successful. Finally, if this is impractical or if the staff does not know what questions to ask, then it might be desirable to secure the services of IT professionals to assist the district in defining its needs and writing the proposal. Chapter 5 of the Forum publication *Weaving a Secure Web Around Education: A Guide to Technology Standards and Security*, at http://nces.ed.gov/pubs2003/secureweb/ch_5.asp, is another resource to review when thinking about a bid process and the development of an RFP.

Scope of work issues to address in the RFP, whether purchasing an off-the-shelf product or seeking design of a custom system, include the following:

Components of DSS Technology – The RFP will need to address a scope that addresses at least the four major components of the technology necessary to support DSS. These components are:

1. the data warehouse where data from multiple sources will be housed for manipulation and analysis;
2. the import/export interface, which may be solely the software code that permits data from multiple formats to be brought into the data warehouse through a manual or automatic process, or may involve integration servers that permit one part of the DSS to automatically communicate with another and extract information through transparent processes;
3. the analysis tool that aggregates, disaggregates, performs statistical analysis or other procedures, and transforms the raw data into meaningful, useful information, and
4. the reporting tool that translates the analysis results into graphic, tabular, or other formats to permit users to make sense of the results and communicate those results clearly to policy-makers, parents, community members, educators, and others who may have a need to know or an interest in the results.

Multiple RFPs from various vendors, combined for optimum system performance may separately secure these components. Alternatively, they may be in a single, fully integrated system. Information needs, staff technical expertise, and other factors unique to the organization will dictate the optimum configuration.

- **Performance Features** – What, specifically, is the DSS required to do? This includes everything from data transfer in and out, to statistical or other analysis capabilities, report formatting, and automated tasks.
- **Scalability** – How much computing power is required now, and what is the anticipated growth for the expected life of the system?
- **Interoperability** – What other software will be part of the DSS and will involve sharing of data between applications? Is it important that the data transfer is automatic and seamless, or is manual export and import an acceptable means of data exchange?
- **Platform** – Will the data management system operate on the Internet, an internal Intranet, or through another closed networking system?
- **Ongoing Support** – What level of support service is available, and at what cost? What are the hours of operation for the support services, and how quickly can the vendor correct problems?

Legal Issues

- **Ownership of Code** – What is the level of protection for the organization if the software developer goes out of business? Will the organization have the right to modify the program and to share the code with other operations inside or outside of the organization?
- **Copyright Protection** – What is the legal protection for the organization if the vendor violates copyright or patent laws?
- **Mediation of Disputes** – What are the rules to settle any disputes that arise during development/installation, or after implementation of the system?

Deliverables and Cost

- **Cost Basis** – Will the proposal involve a fixed cost for the entire scope of the project, or a negotiated price based on a scope that is developed with a bidder selected on the basis of qualifications and a proposed outline of deliverables?
- **Schedule for Deliverables and Progress Payments** – What is a reasonable schedule for development of a custom program, or installation/modification of an off-the-shelf system? What documentation will be required for progress payments? On what schedule? In what increments?
- **Timelines and Liquidated Damages** – What guarantees can the vendor provide that the system will be ready to run within the period needed by the organization? Does the organization want to consider a financial penalty to the vendor for failure to meet the promised schedule?
- **Total Cost of Ownerships** – Frequently, components of a DSS will be licensed or leased rather than purchased. It is important for the RFP to address ongoing cost of licensing, upgrades, and associated expenses, including system support. While vendors are reluctant to make predictions far into the future, the organization may be able to lock in a price for three years, or more, of support and upgrades.
- **Documentation** - There needs to be complete documentation of all data included in the system. Documentation includes what the data fields are called, where the data are, what the parameters are for inclusion into that data field and valid codes for that data field.

Professional Development

- **Initial Training** –Who will be responsible for professional development of staff? Does the professional development include all levels of users, from Superintendent to teachers? Does the staff development include modules to ensure that teachers, principals or other staff will not be subjected to intimidation while addresses issues delineated by the DSS reports?

- **Ongoing Training** –What provisions are in place for ongoing training? How will people new to the organization be trained? Are there provisions for training after system upgrades?

APPENDIX C

The National Education Technology Plan: Part 7

The National Education Technology Plan, *Toward A New Golden Age in American Education--How the Internet, the Law and Today's Students Are Revolutionizing Expectations* is available at <http://www.ed.gov/about/offices/list/os/technology/plan/2004/index.html>

According to the US Department of Education website the National Technology Plan is based on input for students, educators, administrators, technology experts and educational organizations. While the plan covers many aspects of technology in education, the focus in this publication is on Part 7, section 7, entitled *Integrate Data Systems*, in particular the last bullet describing support for system interoperability, which follows.

Integrated, interoperable data systems are the key to better allocation of resources, greater management efficiency, and online and technology-based assessments of student performance that empower educators to transform teaching and personalize instruction.

Recommendations to states, districts and schools include:

- Establish a plan to integrate data systems so that administrators and educators have the information they need to increase efficiency and improve student learning.
- Use data from both administrative and instructional systems to understand relationships between decisions, allocation of resources and student achievement.
- Ensure interoperability. For example, consider School Interoperability Framework (SIF) Compliance Certification as a requirement in all RFPs and purchasing decisions.
- Use assessment results to inform and differentiate instruction for every child.

Appendix D

Decision Support Systems in Other Fields

A decision support system allows educators to bring together data of many kinds, often from disparate sources, to perform more extensive and meaningful analysis and reporting. However, even as data use is increasing in schools, teachers and other school officials continue to struggle with understanding the full scope of power offered by data in assessing students, school and district performance and in seeking the means to improve that performance.

While education has unique challenges and needs, there are parallels with other professions. Other professions also collect data from disparate sources, use evaluation tools for accountability purposes, and track behaviors to improve performance.

The following section provides some examples of how data and data support systems are used in other fields.

Field	Example
Economics	<p>Tracking the behavior of markets and the economy in a variety of circumstances has led to identification of indicators that are correlated with specific market responses. These indicators have become very useful in predicting inflation, deflation, stagnation, unemployment, and many other economic conditions. The indicators are not perfect predictors, and are constantly adjusted as new market behaviors are observed.</p> <p>Decisions on setting the prime interest rate, opening and closing the stock market, and other economic policy are based heavily on what economists are able to learn from the data feeding the economic indicators.</p>
Medicine	<p>Medical facilities, from the largest hospitals to the neighborhood doctor's office, are required to report the incidence of diseases to the Center for Disease Control in Atlanta. These data help to identify the introduction of new disease to a local school and to track the most virulent diseases to their possible sources. These data help to predict where epidemics are likely to occur and allow health professionals to place adequate supplies of the proper medications where they are most needed. Additionally, alerts from CDC can alert residents of areas threatened disease and advise them in measures they can take to avoid exposure, and possibly avert the epidemic.</p> <p>Decisions about distribution of medical resources, patient treatment regimens, shipment of foods and other goods, and a host of other health related policies and practices are driven, at least in part, by the data that are collected, managed, and analyzed by CDC and medical researchers who have access to CDC data.</p>
Pharmacy Practice	<p>Practicing pharmacists can receive almost daily updates regarding new medications, harmful drug interactions, and research in efficacy of treatments, dosage calculations, formulations, indications and contraindications, and a host of other topics.</p> <p>Decisions about drug selection, combinations, dosage, and frequency of administration are supported by the best and latest information available by using a</p>

	DSS.
Business	<p>Software tools known as “Business Intelligence” automatically mine vast amounts of data, creating new analyses by disaggregating and combining data in hundreds or thousands of ways, then alerting users to suspicious patterns, new trends, and significant deviations from normal or desirable status. Because of the power of the computer to conduct so many calculations so fast, the business intelligence tool can, search a multitude of dead ends in identifying a single, but perhaps crucial, anomalous pattern. This can be done for a minimal cost. Conventional researchers who must consider the cost of time spent pursuing avenues that have little likelihood of success might not even have explored such patterns.</p> <p>In addition to decisions about what research to pursue further, other business decisions about manufacturing, distribution, suppliers, product development, and every other aspect of business operations and growth are informed by research generated automatically by the business intelligence tool.</p> <p>Return on investment, distribution of goods, production needs, and prediction of customer behavior are just a few of the planning and process areas affected by use of data support systems.</p> <p>Understanding of the real-time data facilitates decisions that help to keep expensive inventory low, invest company funds in the most profitable operations, and improve customer service, product reliability, and delivery speed. In short, by combining high quality data with the wisdom and insight that is uniquely human, businesses can increase profits while decreasing prices and improving customer satisfaction.</p>
Postal and Courier Services	<p>Real-time tracking of packages has changed the face of business throughout the world. Knowledge of delivery speed and dependability help individuals and businesses decide on the best means of transporting goods to assure that they arrive in the proper time frame and at the lowest cost.</p>
Banking	<p>Automatic Teller Machines and other on-line financial transactions provide consumers, businesses, and financial institutions with almost instantaneous access to the resources needed to carry out their mission and move forward in life. Without the electronic standards and technology that permit worldwide online banking, business growth and transactions would slow significantly.</p> <p>Credit history, credit scores and credit reports are possible because of the high-speed exchange of vast amounts of information about individuals. The instantaneous use of data about individuals’ credit use and payment histories have made a huge difference in availability of loans, interest rates that are based, in part, on past performance of the borrower, and the ability of potential borrowers to assess their own best strategy for securing needed funds and maintaining access to needed resources.</p>