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IMPLEMENTATION AND USE OF SYSTEMATICALLY COLLECTED DATA IN
EDUCATIONAL DECISION MAKING - GENERIC ISSUES FROM U.S. PUBLIC EDUCATION.

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INTRODUCTION

The experience of educators in the United States in building and utilizing information systems that rely on the use of formally collected data has left a residue of documentation concerning the implementation of these systems that is relevant and instructive to information design projects in other contexts. Successful utilization of planned information systems in other cultural settings may be informed by observing the variability in U.S. settings in approaches to implementation strategies, the creation of information sharing and utilization networks, and the design of training and maintenance programs that have been associated with successful and unsuccessful efforts. The United States experience has been one of trial and error in educational MIS that suggests generic problems in information planning and use in educational settings.

The goal of this review is to analyze literature that addresses the problem of information system implementation and use at the school site and school district level in U.S. public schools. A major objective is the identification of tradeoffs encountered by users of information systems in U.S. public school systems. Design decisions related to the designation of users, information content, information format, report design and frequency, specification of information aggregation and disaggregation, implementation of information collection methods and frequencies, and design of networks and forums for communication of information within the system are key issues to be considered.

A second major objective is the examination of application of information system technology to general education planning issues. How has information technology integrated with other sources of information to define and inform

general educational planning decisions? The major issue in this framework is the likelihood of integrating systematically collected data with other information resources utilized by educators in assessing and managing education at the local school site and district level.

The third major objective of the review is to summarize implementation and use problems involved in the adoption of information technologies in U.S. settings that may be considered generic and relevant to other educational settings outside this context. Issues within this consideration are the training needs of information users, the necessary time allocations for system construction and implementation, the identification of major disruptions and adjustments and the review of major reasons given for the success or failure of information technology in variable settings.

INFORMATION USE IN U.S. PUBLIC EDUCATION - BACKGROUND ISSUES

Systematically collected data at the school site and school district level in U.S. public education has been characterized by a norm of underutilization in school district management and planning. Burstein (1984) argues that a rich variety of sources of information are available within public school archives concerning students, parents, teachers, and administrators. Vast amounts of information is routinely collected and stored at multiple levels including individual students, groups, classes, schools, school districts, states and Federal levels. Burstein criticizes the lack of incorporation of this rich data source, citing neglect of available technological capabilities that could effectively bring these resources to bear on educational planning and decision making.

Boruch and Cordray's (1980) study of the use of evaluation information in U.S. public schools at the school district level corroborates Burstein's

observation. Based on synthesis of the research of others and their own direct investigation of twelve school districts these investigators found evidence of little use of systematically collected data in efforts to monitor or evaluate educational practices in most school districts. They conclude that evaluation intensity is highly inconsistent between educational organizations. Collection and analysis of information was found to vary broadly in comprehensiveness and sophistication. A continuum was indicated from minimum levels of counting participants in various educational programs to a small minority of efforts involved in more complex attempts to analyze the effects of programs. Boruch and Cordray identify three primary incentives for U.S. public school districts to collect and report information; to satisfy regulatory requirements, for routine internal information management (record keeping), and to verify for others the worth of programs. Internal program evaluation and adjustment was not mentioned as a common major criteria.

A survey by Lyon et. al. (1978) of 16,000 U.S. public school districts identified only 320 districts with separate evaluation units. Results indicated that only a relatively few districts invested significant resources in evaluation. Millsap (1985) offered similar observations of the use of information to evaluate school programs in local districts. She indicated that thousands of school districts operate without access to technical skills required to evaluate program impacts and that the required data necessary to do so are routinely unorganized or incomplete.

Kennedy, Apling, and Neuman (1980) studied information use at 18 school district sites. The researchers extended their investigation to the individual school level. Observation of information use at the school building level identified few formal data sources readily available and used by building principals to monitor implementation of building policies or to manage and improve building instruction, atmosphere and morale. Information availability

was haphazard and up to principal initiative. Most issues were characterized as interpersonal and not addressed with systematically collected data. Data utilization was greatest if it was readily accessible and the principal was inclined toward analytic methods that included formal data in decision making.] *

The researchers characterized the issues faced by building principals as difficult to clarify or resolve with systematically collected data. Principals reported they considered important changes within the internal and external environment of the school amenable to direct observation. Principals indicated they often lacked data that would be considered useful in addressing the problems they considered relevant. The researchers indicated that principals lacked the analytical training necessary to facilitate data analysis and use of available data in decision making.

In sum, the context of information use in U.S. public school districts has been viewed by recent researchers as data rich, but, low in the application of data analysis capability necessary to incorporate systematically collected data in an applied way to the planning and evaluation of educational programs. Three or four important themes dominate the outcomes of this research. School districts routinely lack specialized agents trained in the collection and use of information. Data is organized in formats and patterns that are not readily accessible and utilized. Many important concerns faced by school district managers and building principals do not signal an incentive to use systematically collected data in problem solving. The level of training in analytical skills at the school district and school site level does not readily facilitate the use of systematically collected data in decision making.

The introduction of computer based data processing systems have often been introduced into U.S. schools with the intent of solving some of these problems. A review of available documentation and research concerning these efforts indicates the results of these projects have been mixed.

COMPUTER APPLICATIONS IN SCHOOL DECISION MAKING

Recently, a panel of experts from university, public school, state department of education, software publishers employers, educational technology media, and the federal government met to discuss current and future applications of computer hardware and software in U.S. educational settings. (Education Turnkey Systems 1985) Panelists indicated that uses of computers in educational administration were primarily found to support financial accounting, personnel records, student record keeping, scheduling, payroll functions, library book monitoring, bus route scheduling, food service control, and monitoring energy use patterns. Administration and management use of computers was far more pervasive in urban settings where the size of student and personnel record keeping and financial accounting applications had pushed urban districts toward implementation of computer facilities at earlier dates than rural settings.

Panelists concluded that education would be impacted by more sophistication in computer management systems. State level policies and guidelines would encourage adoption of computer applications for both instructional purposes and school management. A requirement for large scale training of personnel was seen as a necessary component of this expansion. Micro computers were seen as integrating with other technologies to enhance instructional and administrative capabilities utilizing local area networks to expand computer data sharing and efficiency

The panel cited lack of clearly defined decision making roles and responsibilities related to computer application and use planning within most school districts. Only 20% of the U.S. public schools were judged to have established comprehensive plans for computer implementation and use. Only one large urban school district, Houston, was judged to have established a

comprehensive plan related to the introduction of computer technology in district instruction and management.

The panelists revealed an apparent schism between optimism and pessimism concerning the application of computer technology to U.S. educational settings. On the one hand, bright prospects are broadly and abstractly painted for the impact of on decision making, while on the other, there was an acknowledgement of little systematic comprehensive planning for the introduction of computer technology in a large majority of school districts. Optimism and frustration have been pervasive themes in attempts to install computer based systems useful for school site and school district planning and decision making.

Research concerning the use of formal systematically collected information and adoption of computer technology can be traced through a limited number of sources documenting the effect of electronic data processing on public school management, planning and decision making. Two types of investigations are available. Projects emerging in the early 1970's were often funded through Federal contributions to school improvements and innovations which required documentation and evaluation studies. Later studies were initiated by university researchers interested in the effects of utilization of electronic data processing capabilities on school district and school sites. The primary research methodology for these investigations has been survey, interview, and observational research in local settings in several states. What follows, first, summarizes these individual pieces of research, and then, draws together conclusions and generalizations from the combined investigations.

The late 1960's and early 1970's was characterized by many attempts to rationalize school district information systems through the use of computer storage and information retrieval systems. Federally sponsored projects have left a source of formal documentation. Actual patterns of use, effectiveness in

incorporating data into decision making and problems in implementation have been researched with various levels of rigor and depth.

Foley and Harr (1968) (1972) document an early effort to establish a comprehensive data system for the state of Iowa. The project was implemented under a grant from the United States Office of Education. The CARDPAC system was a data gathering and reporting system designed to collect information directly from over 1200 school sites to be stored at a central state data bank. The major goals were to provide centralized storage of data for the use of school managers, evaluators, and researchers at the local, state, and Federal level. The collection and storage of data relied on the local school site as the unit for data aggregation. Data collection cards completed by teachers, students, and school principals were implemented for the recording of information concerning pupil characteristics, curriculum, staff, school property and buildings. The objectives of the system were to establish unit cost analysis of educational programs, establish property and inventory accounting, program efficient bus scheduling, account for building utilization, provide enrollment projections, facilitate master schedule building, and perform ability group analysis based on student achievement records.

The major thrust of the system was to establish a large scale data collection effort to provide for centralized analysis and distribution of reports from a state level data processing center. Six reports were provided by the state department of public instruction for local school use to address educational costs, dropout information, graduate follow-up studies, description of student body characteristics, records of student participation in activities, and a report indicating the relationship between selected variables.

The impact and effectiveness of the system on building principals was analyzed through structured interviews with 20 high school principals involved in the system. Results indicated that principals without clerical staff saw the

collection of information as a large imposition. Many of the principals found that motivation for teachers to follow procedures in administering data collection forms was low and sensed a lack of understanding and sympathy toward the process by instructional staff. Principals were often confused as to how to assign codes for different categories of teacher preparation. Curriculum time utilization fields were commonly misinterpreted. Principals of larger schools mentioned difficulty in establishing definitions for variables. For example, the term dropout was interpreted in a variety of ways. Transfer students caused confusion concerning the forwarding and updating of information. Almost all principals reported that feedback was of no value in school planning and decision making due to the lateness of the return of reports. Principals who checked data returned from the state against their own local records found the data to be inaccurate and often out of date.

The authors concluded that the system needed to supply information to principals in a more timely manner. Data definitions and instruction manuals needed extensive revision with more extensive use of illustrations to make them more usable. More extensive investigation was needed to evaluate the system and to gather principal input regarding reaction to the system's operation and its relevance to information needs.

An information system project with a more local emphasis was funded in the early 1970's in five counties that included the Lincoln Nebraska public schools. Funded and evaluated by the Bureau of Elementary and Secondary Education, project ADMIRE was an effort to establish a comprehensive management information system on a regional basis. The project was designed to serve Lincoln Public Schools and adjacent rural areas including twenty eight public schools, seven parochial schools and seventy rural k-8 districts.

Evaluation of the project focused on seven primary goals; 1) the provision of planning supervision information to school administrators, 2) estab-

lishment of cooperative involvement of school systems in the collection, storing, retrieving, and utilization of pupil information within a unified data processing system, 3) establishment of a data processing system for student scheduling and grade card reporting, 4) provision of data to teachers and guidance counselors for the counseling needs of individual students, 5) provision of training programs to aide educational administrators in the use of data processing methods, 6) to assist school boards in the utilization of pupil personnel data in establishment of personnel needs and financial decision making, and 7) to disseminate the program to other administrators in the state of Nebraska.

A questionnaire was developed to assess project impact and the effectiveness of the system. Responses were reviewed from 17 superintendents, 28 elementary school principals, 10 junior high school principals, and 4 senior high school principals. Results indicated that most of the superintendents rated the system highest in effectiveness in the processing of student schedules, automatic test scoring, and financial accounting. Superintendents regarded the size of the system as an inhibitor to more flexible and greater use. Most superintendents indicated that the system enhanced decision making in financial matters, test scoring and administration, and student scheduling due to the availability of more accurate and timely data. Principals indicated that participation in attendance accounting, test scoring, student scheduling, and grade reporting facilitated decision making.

The evaluation report did not use specific criteria to assess improved decision making. Superintendent and principal opinions concerning decision making were subjective assessments. The author of the evaluation concluded that design of criteria for objectively assessing observable effects on decision making was difficult if not impossible. Success of project ADMIRE was analyzed in terms of implementation variables. Hardware and software

capabilities were expanded, project staff were rated high in performance, and between 1968 and 1970 more schools implemented data processing services.

The evaluation identified problems with the system. Lack of state defined information codes and definitions in the state of Nebraska generated an apprehension concerning eventual integration problems and the potential obsolescence of the system at a later date. Little evidence accrued that the system was seen as a model to be emulated by other educational service districts. When Federal project funding was to be terminated only one school other than the Lincoln city school district, the central data processing center for the system, had indicated plans to utilize internal funds to continue the system. Evaluators concluded that considerably more effort was needed to train professional personnel to see the potential uses of computerized information in decision making.

Utilizing ESEA Title III funds, the Cincinnati Public Schools implemented an information system to support decision making at the school site level. The project termination report (1973) describes the system as serving a population of 100 principals, 65 assistant principals, 140 educational specialists, 34,000 classroom teachers, and 77,000 students. The project focused on the school as the basic unit of analysis. Data was consistently aggregated, analyzed, and reported at the school site level. System reports were explicitly dedicated to building principal decision making.

Objectives for training school administrators were to provide them with a fundamental knowledge of the system, to provide opportunities for principals to apply specific data to task situations, to assist principals in using data to set goals, to assist principals in using data in program evaluation, to facilitate principal communication of information to staff, students and public, to provide knowledge about the nature and quality of the decision information available, and to establish a relationship between decision reports and accountability. The

system relied on principal orientation to ten system reports which provided analysis of school level variables concerning pupil achievement, pupil characteristics, student, teacher, and parent attitudes, and program cost information. Descriptive information, trend analysis, and analysis of variable relationships were made available through frequency distributions, descriptive statistics, and graphical reporting.

Results of a survey of 96 principals using the system indicated that all principals understood the reports very well or rather well. Fifty principals indicated using the reports in decision making monthly, thirteen weekly, twelve annually, three daily, and twenty variably. On average, the most frequent use for reports was to evaluate aspects of the schools program, assess needs, and develop goals. The next most frequent use was for discussion in staff meetings and as a resource to answer staff questions. On average principals ranked reports concerning teacher attitudes, parent attitudes and student attitudes as most interesting and useful followed in order by goal surveys, achievement forecasts, exceptional characteristics reports for individual schools, trend reports, and finally reports that itemized raw data.

The evaluators concluded from their evaluation that, although training in data use and interpretation for school site administrators had received extensive inservice attention, more training in information use was desired by building administrators. The principals' most frequent application of the data was in needs assessment, problem identification, and goal setting. The timeliness of data was of primary importance to users.

In 1978 the Tulsa, Oklahoma public schools documented an evaluation of and plan to update a computerized information system installed in 1964. A task force was convened to identify priorities for upgrading the system. The task force sought to determine information needs of the district through a series of structured interviews with 48 school district staff members from a

cross-section of roles. An information system matrix was constructed to determine the interrelationship between department activity and required information needs.

The survey results were utilized to determine information needs in seven major areas; student data, curriculum and instruction, personnel, finance, facilities and equipment, supplies and services, and district management. Assessment of the existing system emphasized lack of capability to process payroll, track inventory, account for use of facilities and supplies, lacked immediate access to student and personnel record files, and was inefficient because of its reliance on several separate applications and stand alone files, leaving data unintegrated and unmanipulatable.

Implementation of new system components was prioritized by the task force. Twenty-six projects were ranked using multiple criteria including cost, problem solving potential, demand for new data, ease of implementation, and political feasibility. The top ten projects rated in relation to problem solving potential were; 1) student records, 2) payroll, 3) personnel records, 4) physical inventory, 5) bus scheduling, 6) student scheduling, 7) accounting and budget, 8) statistical information, 9) records of student activity funds, 10) and student information for guidance resources. Ranked on the basis of feasibility the five most desirable projects of the twenty-six considered were; 1) student records, 2) payroll, 3) guidance information, 4) personnel records, and 5) bus scheduling. A suggested time line was established for projects indicating immediate attention to payroll, personnel records, student scheduling, and budget and accounting needs. Six months to a year were suggested for the start dates for the next phase which would address student records and guidance information support.

Mellor (1977) summarizes a six month (1974-1975) study of the Oregon Total Information System. This system supplied computerized information

service to 72 Oregon intermediate education districts, 42 public school districts, private schools and other agencies. Total student population of organizations served was 15,000.

Thirty-seven school superintendents were asked to rank 20 decision areas in terms of the priority of information needs required to support the decisions. Decisions were ranked in terms of the priority of their importance. An additional inquiry asked superintendents which sources of information were commonly used in addressing these decisions, including computer data, other regular channels (print or formal communications) and informal sources (verbal or collegial sources).

Mellor found that the highest decision priority by rank for superintendents was given to budget projections, followed by curriculum development, contract negotiations, salaries, and personnel evaluation. Most superintendents judged computer information more useful than other sources of information in cost accounting, student attendance, student grades, student enrollment, grading tests, establishing district directories, equipment inventories, and scheduling students.

Mellor interpreted the data to mean that the areas ranked highest by superintendents as decision priorities were not supported by the OTIS information system. A major limitation of the system was seen in lack of programming to support complex ad hoc decision needs of district administrators. Additionally, OTIS did not provide statistical computing routines, sophisticated modeling and management techniques, or the ability to access and manipulate a user's own data from across several files. The overwhelming use of the system services was for student services, particularly files containing student enrollment data. Second in priority was personnel information followed by payroll utilization. Actual and perceived use correlated highly with district enrollment size and number of computer terminals devoted to administrative

purposes located within an educational organization. Mellor attributed this to the larger clerical and accounting needs of these districts.

Mellor concluded from the study that, although a management information system such as OTIS can achieve financial stability and offer data processing reliability to educational organizations the OTIS system lacked a highly visible research and development component. A missing element in the system was the training of administrators in information analysis and use in decision making.

Hansen, Klassen and Lindsay (1978) investigated use of computer information over two years in eleven Minnesota school districts. The researchers utilized in depth interviews with 134 employees in various educational roles. Results indicated that most computer applications were primarily operational control orientations. Operational control was defined as routine filing, data storage, and programmed transactions. Little application was identified in relation to monitoring or adjusting organizational processes to meet established goals (management control) or in defining or setting goals and objectives (strategic planning) for the educational system.

Variables that were found to enhance the level of use of computer information were the availability of full time coordinators, the larger size of the district, the background, interest and inquisitiveness, of the computer coordinator, the urbaness of the district, and district priorities set by district executive management that encouraged the use of systematically collected data in decision making.

Consistent with the operations control emphasis, the researchers found the greatest impact of the system was in freeing time from clerical tasks, supplying more accurate personnel, student and financial records, and more frequent and flexible scheduling of classes. To a lesser degree computer information was used in solving problems such as bus scheduling, and enrollment trend analysis. Although district research studies were facilitated

by computer information, these were not frequently implemented as adjuncts to school planning and decision making.

The authors concluded that computer use in the Minnesota schools was limited primarily to basic record keeping and accounting applications. The researchers indicated that this trend was consistent with their observation that many decisions in educational management demand use of types of information unavailable from computer systems. Many decisions in educational management are seen as requiring information based on experience and observation requiring personal judgement and reference to political considerations that impact school decision making. Many decisions in schools are seen by the authors as dependent on internal and external influences that are not subject to the control of local school administrators.

Yin and White (1984) conducted case studies in 12 school districts to investigate the process of microcomputer implementation in educational settings. Of twelve sites studied nine used micros exclusively for instructional purposes, two had mixed instructional and administrative uses and one was entirely administration oriented. Predominant applications for microcomputers in educational management applications at the school level were identified in scheduling, grade reporting, computer test scoring, and student records. Administrative applications at the district level included payroll, accounting, student records, and personnel files.

Yin and White were interested primarily in the process of implementation of microcomputers in educational settings. The degree of implementation was judged by the number of computers available to the site. Case study evidence indicated that systems remained at a low level of development when responsibility continued at the individual school level for initiation and development. Systems implementation became more wide spread and pervasive when district level personnel became involved in the planning and support of

applications. In higher implementation districts adopted organizational roles which regularized allocation of resources to computer applications, consolidated decision making for review and purchase of software and defined needs and arranged formal extensive training for users. Advanced implementation was associated with mixed instructional and administrative applications.

Yin and White concluded that innovation of computers in educational settings required support from the district chief executive, active planning and maintenance activity by other key actors, non-reliance on outside sources of funds, minimal delay in implementation activity and re-allocation rather than add ons to budget priorities. The process tended to be incremental, monitored by a designated interested coordinator, and relied on formalized user training and inservice involving both administrative and instructional staff. The introduction of computer applications was integrated with other organizational functions.

SYNTHESIS OF OBSERVATIONS OF COMPUTERS IN SCHOOL DECISION MAKING

If we return to the issues initially raised concerning trends in the application of computers to information storage and retrieval in public education, several patterns can be seen to have emerged. Major tradeoffs have been encountered by users of information systems in U.S. public schools systems in design decisions that weigh competing demands of transactional and operational requirements of applications useful to record keeping and financial components of school districts vs. refinement of information collection and analysis oriented toward specific decision makers. In most systems data is not consistently stored or conveniently aggregated for use in applications beyond filing and accounting purposes. Data concerning particular cases,

schools, or districts are stored in a variety of configurations at school, district, regional, or state locations. Systems most commonly import information to specific applications which are oriented toward accounting and reporting requirements.

The greatest use for these records is in the look-up and review of particular cases, such as attendance or guidance information for individual students or particular financial transactions. Organizing information for research on school outcomes and processes is minimized with these constraints. Similar to manual filing systems, the data requires preliminary planning to organize the data before questions can be asked of it. The cumbersomeness of this process is beyond the usual time availability, training, and incentive of the typical school manager at either the district or school site level. Primary users are clerical and accounting oriented roles within the school organization.

Within this typical framework networks and forums for communication of information contained within the system are minimal.

The first attempts to install comprehensive information systems were often broadly conceptualized large scale efforts. The Iowa, Nebraska, Oregon, and Tulsa experience each aimed at the creation of a single inclusive data base that would be accessed by state, local, and school site administrators for multiple purposes ranging from budget and cost accounting to records of student achievement and progress reporting. [The Iowa system used the state as the hub of the system, the Nebraska and Oregon systems utilized a regional format and the Tulsa plan called for a school district capability.] Data storage was to provide for methods of information manipulation and analysis at various levels and for different users within the system. 

Initially, the stated goal of the Iowa system (Foley and Harr 1968) was a single system that would allow a common data base for Iowa public schools to develop and construct a program monitoring system, develop and construct a

simulation and modeling capability, and establish a reporting device for school managers. Similarly, the the Nebraska project was to assist the boards of education of participating systems in the use of computerized pupil personnel data in establishing personnel needs and determining financial support for educational programs. Evaluation studies of these projects indicated little use in decision making and no use in evaluation of educational programs. Use of the Iowa system solidified around collecting information to supply the state data base. As the information was fed back to schools it was considered too late, too inaccurate and too ambiguous to be utilized by site level decision makers.

Although the Nebraska project was seen as a positive addition to decision making, use centered on clerical, accounting, and control applications. Areas receiving highest evaluation by both superintendents and principals in decision making were applications in finance, student scheduling and test scoring. Decision making was considered enhanced through the availability of more timely and accurate accounting data.

In system development planning objectives have been routinely stated for going beyond record keeping and accounting applications. In practice, however, the evaluation of goals and objectives related to impact on the instructional program are not mentioned in concrete terms. The Iowa, Nebraska, Tulsa and Houston plans articulated anticipated impact on decision making in broadly stated goals and objectives. The Tulsa plan exemplified this disparity. Goals were itemized related to management decision making in vague terms, such as greater availability of needs assessment data, improved ability to evaluate progress toward district objectives, greater awareness of the purpose and use of information, and improved procedures for the use of information. Similarly, the Houston plan called for the extensive use of micro computers in administrative management by 1995 to facilitate educational planning, budgeting, scheduling, inventory control and related administrative applications.

No further detail is given. The high level of abstraction of these goals and the absence of specified tangible objectives and clear organizational development plans designed to implement these goals established little concrete connection of information system development and higher level management activities, such as setting and monitoring goals and objectives addressing the effects of educational programs.

The Mellor (1977) study of the Oregon system and the Hansen et. al. (1978) study of the Minnesota school districts confirm a reliance on comprehensive data systems for primarily operational control activities. Utilization in Oregon centered on accounting and record filing. Similarly, the Minnesota school study found most applications were in clerically related areas. The Tulsa (1978) plan for updating the existing system focused primarily on accounting, budgeting, student scheduling, personnel and student files. Yin and White found administrative applications of micro computers concentrated in similar areas.

The Cincinnati experience offers an exception to the general trend indicated in the other studies. A major difference in system planning and implementation of the project in Cincinnati was the specific statement of priorities concerning the purpose of the system. A second major difference was the autonomy of the system from other data processing priorities and services within the organization that are dedicated to financial accounting, student scheduling, payroll production, personnel records and other clerical and operations management applications. A third major difference was the implementation of an ongoing training program aimed specifically to address the needs of school principals, the targeted users of the system. A fourth major difference was the intensity in following the use patterns of the system, and a constant iterative development of data collection instruments.

The Cincinnati project outlined specific goals and objectives and pursued these with system planning and ongoing implementation monitoring. The

building principal was designated as the primary recipient of the information. The school was designated as the unit of analysis. A purposeful decision was made to focus on information relevant to the evaluation of the educational program rather than maintenance dimensions such as student records or financial control. A specific goal was set to collect and report relevant, timely, valid information on variables related to student learning and behavior within the school. Reporting formats were given primary consideration and were iteratively constructed based on user feedback. The project based its information collection scheme on the operationalization of over 200 variables related to student behavior, characteristics, and achievement, as well as, student, teacher, and parent attitudes toward the school and its programs.

The Cincinnati experience is unusual in U.S. public education in the sense that data collection and analysis in the system was explicitly directed toward the assessment of the educational program. The system addressed organizational variables that commonly influence the use of information within U.S. public schools. These variables include a preference for readily available information, a requirement for limited time in information search, manageable training requirements, and orientation toward awareness and problem identification rather than in depth analysis and evaluation of any particular feature of the educational program.

COMPETING SOURCES OF DATA IN U.S. PUBLIC SCHOOL DECISION MAKING

A second major objective of this review is the examination of the application of information system technology to general educational planning issues. How has information technology integrated with other sources of information to define and inform general educational planning decisions? The issue concerns the potential for integrating systematically collected data

with other information resources utilized by educators in assessing and managing education at the local school site and district level.

Studies of information use in U.S. public schools have indicated a low priority for the use of formal information sources in decision making. Chorness et. al. (1969) surveyed 384 educational professionals including 48 superintendents, 64 district staff personnel and 134 principals and vice principals in 63 school districts in the San Francisco Bay area to investigate sources and use of information in school decision making. Results indicated that the most frequently relied upon source for both principals and superintendents were informal contacts with colleagues within the school system. Most communication was found to be informal face-to-face interaction within the administrator's own organization.

Principals and superintendents reported that the greatest stumbling blocks encountered in using formal systematically collected information in problem solving were an absence of defined measurable goals and objectives in educational programs, lack of time to study problems in depth, lack of applied research skills, excessive reference to financial considerations, and conflict created in satisfying many diverse groups. The largest obstacles in using formal information sources were deciding whether the statistical results of a study were sufficiently strong to warrant adopting the findings and difficulty understanding the procedures for getting relevant information from structured systems such as ERIC or other organized information sources.

In a similar study, Hood and Blackwell (1976) used field interviews and survey responses from 1328 educational professionals including, 67 superintendents, 119 central office staff and 187 principals to investigate the use of information in educational problem solving. Survey results indicated that principals ranked face-to-face communication within their own organization as both the most frequent and useful source, followed by educational

newsletters and bulletins, general educational journals, and curriculum materials. Least used were abstracts and bibliographies, technical reports and government publications, and telephone calls to people in other organizations. District administrators relied on newsletters and bulletins, discussion with people in their own organization, telephone calls to people in other organizations, office and department files, and memos and correspondence.

Information sources most likely to be sought out by principals were peers, followed by superiors, subordinates, experts, and colleagues in other organizations. Educational statistics ranked eleventh of thirteen sources as a source of favored information. The most important characteristics dictating use of current information sources were accessibility, availability of discussion and exchange within the medium, and accuracy. Principals ranked sources near at hand, that provide new ideas and viewpoints, that provide awareness of latest developments in education, and are responsive to a specific problem as the most desirable potential information sources. Sixty-one percent of principals indicated that the longest acceptable wait for information would be two to three days. Only eighteen percent said they could wait longer than a week for needed information.

District office administrators began their search most frequently with peers, then experts, colleagues in other organizations, superiors, and state department of education authorities. The characteristics determining use at this level were accessibility, accuracy, and opportunity for discussion and exchange. School district administrators indicated preferences similar to principals concerning the desirable traits of information sources. The most important characteristic of sources were responsiveness to a particular question, likelihood of having the information wanted, relevance to current developments, usually available when needed, and is authoritative, accurate, and reliable. Thirty-three percent of district office administrators

indicated they required information sought within two to three days, while only sixteen percent indicated they could wait more than a week for information.

The primary reason for securing information for principals was to keep aware of developments in education, identify new educational programs, develop alternative sources for problem solving, identify new sources of assistance, and find answers to specific questions. For district administrators the primary reasons were to keep aware of developments in education, find answers to specific questions, identify new programs, identify new sources of assistance, and develop alternative sources of problem solving. Of nine reasons, information specifically related to the evaluation of educational programs and practices was ranked sixth by principals and eighth by district office administrators.

Louis et. al (1984) found similar trends in information usage in their study of diffusion patterns of Federally sponsored research and development projects. Based on a survey of 566 educators including 92 school level administrators and 57 district level administrators, information sharing links tended to be strongest among networks of interacting peers. Most diffusion of information occurred within a recipient's own organization.

Passiveness was found to characterize both the personal and organizational uses of information. The most common personal use of information was in supporting an idea already held, followed by keeping aware of developments, encouraging new practices, expanding informational resources, and developing a better understanding of professional relationships. Lowest rank was given to discontinuing current practices based on new information, conducting research, or developing new materials. Organizational use followed similar patterns. Awareness, support of existing policy, improving understanding of educational issues and initiating a new program were ranked highest. Information use in terminating a program, preparing a position paper and changing existing programs were ranked lowest.

These studies of information sources and use provide useful generalizations concerning information preferences and styles of inquiry of educational practitioners in U.S. public education. The most frequently used sources are face-to-face communications. The Chorness et. al. (1969) and Hood and Blackwell (1976) studies indicate that there is a strong preference for an informal style that is dominated by exchange of information between colleagues within a school organization. Least likely to be relied on are written research materials that require interpretation of technical material, such as statistical summaries or abstracts. Effective decision making is seen as deficient in many instances because of lack of sufficient time to study problems, excessive focus on finance, need to satisfy many diverse groups, lack of research skills, and failure to define goals in measurable operationalized form.

Common to the Chorness et. al. (1969), Hood and Blackwell (1976), and Louie et. al. (1984) studies is administrator focus on topical and trend issues in information selection. Dominant themes are greater awareness of educational developments and greater understanding of educational issues. Information was least sought to evaluate current programs in order to discontinue or adjust practices. The Chorness et.al. (1969) study indicated that formal research studies or other analytic sources within a school system ranked tenth among fifteen forms of information preferred by school and district administrators in problem solving. Research offices within school districts ranked twenty first of twenty-six sources of information used. Given the preference for the use of informal observation and face-to-face information exchange, a high profile for the use of formal systematically collected data in problem solving in U.S. public schools must be considered an exception to common practice.

Counter to this trend the use of formal systematically collected information has been mandated in U.S. public school settings as a requirement of many Federally sponsored programs in education. Research concerning the

actual use of evaluation data in these programs have provided insight concerning the impact of systematically collected formal information in school decision making when it is routinely available to decision makers.

Alkin et. al. (1979) explored the impact of evaluation information in school decision making utilizing a case study methodology in five school district sites hosting Federally sponsored Title I programs. Eight factors were found to be important determining the use of formalized evaluation information in decision making. Pre-existing evaluation bounds consisting of precedent, mandates, fiscal, support and non-negotiable requirements were found to be contextual issues that influenced the extent, focus and use of evaluation information. The orientation of the information user which described the variety of questions asked, expectations, preferred information sources and degree of willingness to become immersed in the collection and analysis of data were determining variables related to user incentive and motivation. The evaluator's approach, including the use of formal models, rigor, role orientation and acceptance of user involvement in evaluation design were key variables related to use. The credibility of the study based on the believability of the evaluator and congruence of information with the user's beliefs and opinions were variables related to acceptance. Organizational variables related to use concerned the structural relationship of evaluation personnel to the school site, autonomy and independence of school site personnel, and other information sources that competed with evaluation information in decision making. Extra organizational factors such as community expectations, mandates, and requirements of outside agencies affected the impact of evaluation information. School administrator style organizational ability, leadership, and initiative contributed to use. The style and content of information reporting, orientation to two-way dialogue, and the congruence of information formatting with the preferences of users were important to acceptance.

The researchers concluded that highest levels of use were apparent in situations where evaluators were committed to local project needs and were able to win the attention and respect of decision makers. When evaluation reporting was primarily targeted toward external funding agents, evaluations were seen as tangential to project development and little incorporated into internal use. Evaluators often negotiated between requirements of outside agencies and internal desires for the gathering of useful information. The most effective use of information, in which evaluation findings were directed toward internal use and program adjustments, was identified in a case where a key decision maker worked closely with a competent and committed evaluator.

Using a nationwide survey Burry et. al. (1982) used responses from teachers and principals in 91 elementary and secondary schools to examine the use of test results as formal information in public school decision making. Results indicated that principals use test results in a problem identification mode as an indicator of areas that need extra emphasis and follow up. Thirty-eight percent of elementary and thirteen percent of secondary principals indicated they used tests in this way routinely, while forty-nine percent of elementary and fifty-one percent of secondary principals indicated that they sometimes used test scores for this purpose.

Tests were considered a supplementary source of information in most cases, used primarily to confirm assessments derived from other sources. Evaluation of pupil performance relied most heavily on teacher observation and teacher constructed tests. Least used were standardized tests and minimum competency tests. Less than five percent of either elementary or secondary principals used test scores routinely to evaluate staff performance. The use of test results as evaluation information appeared highly idiosyncratic with little basis for comparative analysis between classes or schools within a school district.

Stecher et. al. (1981) examined the use of evaluation information by school administrators in decision making through intensive interviews with principals teachers and project directors of 22 Title I project sites. The goal was to determine how information was used in problem solving. Critical events mentioned by respondents in school decision making were used to indicate the presence of important decisions. Content analysis of interview responses related respondent decision activity to four decision making stages: problem recognition, decision making, ratification, and dissemination.

Results indicated that more than fifty percent of the significant events referred to by decision makers were initiated by external events, such as, changes in government regulations or changing community characteristics. A categorization of decisions indicated that most were made by the principal alone (30%), or in conjunction with the whole school staff, (29.5%) or in a teacher administrator group involving a few members of a school staff (17.1%).

Decision making did not frequently rely on the use of formal sources of data contained in evaluation information. Content analysis indicated that references to beliefs and opinions dominated all stages of decision making accounting for 50% of the frequency of input, followed by program budget requirements 11.5%, reports of direct observation 8.3%, parent input 6.4%, district office staff input 5.8%, needs assessment 5.6%, external consultants 5.1%, tests, 2.6% collegial advice 2.4% and evaluation activities 1.9%. The analysis indicated that primary use of evaluation was in problem recognition contributing 15% of the frequency of input at the initial stage of the problem solving process. Although overall evaluation input was consistently low, a higher frequency of this source was related to administrative participation in the decision making process. Researchers concluded that most evaluation and test information was used as an aide in problem recognition rather than in evaluating alternatives or formally assessing the results of educational programs.

The results of studies of the use of evaluation and test information indicate a very weak presence of this type of information resource in the decision making patterns of U.S. public schools and school districts. The Aikin et. al. (1979) study indicates a cumbersome set of prerequisites related to the use of systematically collected data. Contextual variables concerning past experience with evaluation information, organizational structure, available resources, and the effects of internal and external mandates in dictating use; and personal variables including evaluator commitment and user orientation indicate a complex interaction of resources, motivation, and personal abilities that impact the use of formal data in decision making. The Burry et. al. (1982) and Stecher et. al. (1981) studies indicate a low profile for formal information in relation to informal and observational sources in schools. Observation is often considered more timely and relevant. Opinion and beliefs are dominant in both problem recognition and decision making. The role of formal information appears greatest as an indicator or awareness generator in problem recognition and is considered relevant if it is consistent with observation. Formal information is least used in assessing specific program effects and assigning program modifications based on evaluation evidence.

The influence structure and nature of problems considered by school administrators have been assessed in investigations of personal and organizational variables related to the decision making process in U.S. public schools and school districts. Some of these investigations have examined the impact of interventions that have attempted to make the process of school decision making more rational. Studies of the decision making process highlight information flows and typical coordination processes. Some data sources are consistently used in preference to others in school and school district planning.

Davis and Stecher (1980) analyzed in depth interviews with 23 principals to determine principal orientation to information sources in decision making. In

most cases the principal was either the decision maker or gave final approval to decisions. Principals were characterized as compliance or non-compliance in orientation. Compliance oriented principals referenced Federal and state guidelines and regulations as primarily criteria in decision making. Reasons for decisions given by compliance oriented principals were predominantly related to external program mandates and budget constraints. Non-compliance principals viewed the school as an autonomous unit focusing on the impact of decisions made at the school site. These individuals referred primarily to internally derived data for their reasoning with emphasis on staff input as a key decision variable.

McCloskey (1985) found similar impacts of principal personal orientation on the use of data. Survey responses from 153 Ohio principals were analyzed to assess the impact of principal management style on the use of formal and informal information in decision making. Formal sources were described as external reviews, achievement scores, formal evaluations, cost benefit analyses, surveys of parent, teacher, student and community attitudes and records of student attendance and behavior. Informal sources included personal classroom observations, observations outside the classroom, informal conversations with teachers and staff, meetings with parents, community, groups, and informal conversations with parents and community leaders.

Results indicated that principals who agreed more strongly that leadership behavior was important in their jobs indicated significantly higher use of both formal and informal information sources. Principals who reported higher levels of autonomy in decision making were also more likely to use both formal and informal information sources. Greater open mindedness exhibited a similar influence, as did training in research methods. The reserchers concluded that the use of formal and informal information sources was not a basis of discrimination between principal orientations, but, that the collection and use

of information of all categories was related to principal perceptions of leadership, autonomy, open mindedness, and training in research methods.

Addressing organizational structural variables related to information use Duncan et. al. (1977) researched the results of an intervention involving the development of problem solving teams in nine of twenty-two school sites in a midwestern school district. School staff were trained in a problem solving process that utilized seven stages related to problem identification, solution generation, and implementation. Results indicated that problem identification and assessment of alternatives relied on the expertise and awareness of staff within each school. Needs assessment was based primarily on opinions and observations of group members.

Problem solving activities were dominated by communication and housekeeping agendas which were perceived to have increased coordination within the school. Most problems addressed were related to internal coordination and communication problems. Solutions reflected this orientation with twenty-five devoted to structuring work and information flows within the school unit. Seven solutions were related to building alterations, five were devoted to securing additional resources, four to student discipline, two to instructional methods, and two addressed planned teacher and student activities. Formal data in the form of achievement test scores was referred to in problem identification in only two of the schools.

Researchers found that teachers perceived a higher level of standardization, more clear cut procedures, and mechanisms for getting things done as a result of the intervention. Organizational effects were perceived to be an enhanced ability to articulate goals and objectives to community and parents. Attempts were not made by problem solving groups to implement formal assessments of the effects of adopted solutions on student outcomes within the nine schools.

Louis and Rosenblum (1977) studied the organizational impact of the Federally sponsored Experimental Schools Project. The project was designed as an intervention into the curriculum planning processes of 45 schools located in 10 rural districts. Survey research and professional ethnographies were used to examine the relationship between the degree of implementation of planned comprehensive change within the districts and the decision making processes identified within the districts. Degree of implementation was measured by the number of students and staff involved in the program, extent of adoption was measured by the amount of time devoted to the program, degree of difference measured the degree the program differed from previous practice, and system wide change was equated with the degree the innovation required structural adjustments within the school.

Results indicated that scope of implementation was related to dominance by chief executives in planning and decision making within the school district. Change efforts required strong organizational support in the face of competitive tensions between hierarchical levels. Classroom autonomy was found to be negatively related to change. Cooperation between teachers and principals was usually a temporary planning phenomenon. An integrated administrative structure was considered a prerequisite for change.

The researchers concluded that school districts are routinely structured as segmented rather than as cooperative systems. In relation to planned change a zero-sum relationship existed between strong executive influence in planning and decision making and building autonomy. Most planned changes in the school districts studied in the Experimental Schools sample schools were handicapped by low incentive for cooperation and integration between the levels of decision making.

Louis et.al. (1981) used a combination of survey research and case study material to examine knowledge utilization patterns of adopters of National

Institute of Education sponsored products. Projects were operated in 20 states serving 300 schools. This effort was aimed at rationalizing problem solving processes and selection strategies by project schools. Facilitators were utilized to consult with schools in developing rational planning strategies for selecting innovations. The model consisted of problem identification, examination of alternative solutions, selection of a specific solution, and implementation.

The researchers found approximations to the rational model of decision making in most sites. Opinion dominated inquiry in forty-six percent of the sites in which the final solution was recognized as the restatement of a pet theory. In forty-three percent of the cases alternative decisions were not posed or considered. Problems were deemed inadequately specified in thirty-six percent of the sites. Solutions were not examined according to specified criteria in forty-four percent of the sites. No evidence for a solution's prior evidence of effectiveness was obtained in thirty-two percent of the sites. In forty-four percent of the sites no formal plans were made for implementation of a solution after selection. Once solution selection occurred, formal planning often dropped off or was discontinued.

Interestingly, the impact of the problem solving process was not found to be a good predictor of the eventual adoption of solutions. In some schools highly centralized decision making was effective, while in others decentralized staff development programs worked well. The only process variable found to be significantly related to implementation was breadth of involvement in the implementation of a solution.

Peterson (1984) investigated organizational control mechanisms in 60 elementary school districts in counties surrounding a large midwestern city. Intensive interviews with 120 principals were analyzed to determine the types of controls used in coordinating school processes between school site and

district office levels in the school hierarchy. The objective of the study was to explore the control mechanisms that direct and monitor the work and communications of school principals.

Results of the study indicated that administrative controls over school principals involved a differential application of six organizational influences. Control was seen as "zoned" with tighter control of administrative domains and somewhat looser controls over the instructional domain. The pattern was identified as a subtle balance of both control and autonomy. Direct supervision was considered a light form of control. Behavioral control was primarily identified in tasks that were easy to specify and standardize such as teacher evaluation procedures and textbook adoption. Input control was seen as a major source of influence with resources routinely budgeted per capita and with restrictions placed on budget fund transfers. Output control was frequently experienced in the form of review of standardized test results, although only four percent of principals interviewed thought the central office used test scores directly for principal evaluation. Selection and socialization of principals was seen a primary source of control with most principals selected from local personnel. Environmental control was judged as an important mechanism with fifty percent of principals indicating that the community was the primary source of information used by the district office in evaluating the school. Information concerning the evaluation of the principal's work was generated within several non-integrated sources. Sixty-seven percent of principals referred to standardized tests, sixty-four percent to public reaction to the school, forty-two percent to teacher morale, twenty-one percent to adherence to rules, eighteen percent to no problems occurring in the school, ten percent to student behavior, nine percent to quality of instruction and eight percent to the general atmosphere of the school as sources of input used to evaluate principal performance.

Peterson concluded that the use of multiple controls increased the fragmentation of the principal's work. The fragmentation inhibited the ability to define clear priorities, goals, and objectives. The multiple sources principals participating in principal evaluation increased uncertainty and stress within the principal's role.

The Louis and Rosenblum (1977), Louis et. al. (1981) and Duncan et. al. (1977) studies of decision making identify a process that moves quickly, is frequently responsive to externally imposed requirements, and is often limited to coordination and communication issues. The structure of decision making often allows for autonomy, or involves ad. hoc. groups that are temporarily convened for resolution of a problem, and then, disbanded. The segmentation of the school system emphasizes distinct spheres of influence that are dominated by teacher, principal, and district office staff. The integration of roles in the planning and decision making process is the exception rather than the rule, but, necessary for systematic planned change to occur.

Peterson's (1984) results indicate a fragmentation of control structures within the school environment. Evaluation sources are diverse and unintegrated making it difficult to identify clear goals and objectives. The Davis and Stecher (1980) and McKloskey (1985) studies indicate distinct role orientations among building level principals in reacting to the decision making environment. Preference for a wider variety of sources of information was found to be related to the degree of leadership, autonomy, and open mindedness of the principal as an information user, and the level of training in information collection and use skills.

In summary, investigations of information sources, the use of formal evaluation information, and decision making processes in U.S. public schools emphasize the informality of most school decision making. The process is dominated by face-to-face exchange in which opinion and belief based on direct

observation are frequent sources of information in problem recognition, solution generation, and choice making. Preference for information sources favor those that give topical information on current trends, are accessible, easy to use and require little or no training or assistance in interpretation. Much of the information utilized in this pattern is passively attended to for increasing awareness rather than applied to the assessment of the affects of school outcomes. The pattern of decision making follows a marginal approximation of a rationally stated decision model with greatest emphasis on the identification of a single solution and its ratification. Many decisions are externally imposed through legal mandates or adjustments to community changes. Structural roadblocks to information flows are apparent in the segmentation of the school system that encourages autonomy within hierarchical levels. Several modes of evaluation of school processes fragment attention and highlight internal and external opinion sources. The use of systematically collected information seems to require both the motivation of key role players within the school to expand the basis of inquiry and to overcome organizational inertia inherent in the structural segmentation of the schools and the creation of a more integrated decision making units.

GENERIC ISSUES IN APPLYING MIS FROM THE U.S. SCHOOL EXPERIENCE

The third major objective of this review is identification of implementation and use problems involved in the adoption of information technologies that may be considered generic and relevant to other educational settings outside the United States. Issues within this consideration are the training needs of information users, the necessary time allocations for system construction and implementation, the identification of major disruptions and adjustments and the review of major reasons given for the success or failure of information technology in variable settings.

The U.S. system is characterized by decentralization, a segmented often loosely connected control system, and multiple inputs into the decision process which make clarification of goals and objectives difficult. Although the character of the U.S. system is unique in many respects, it is that character that accentuates and frames in high relief issues generic to the implementation and use of formal information systems in decision making across organizational settings. The primary issues involve the integration of a decision making network that reduces fragmentation and forms a common understanding of the use of systematically collected data in the decision environment. These issues are as much related to organizational development and learning as they are to the design and implementation of technical capabilities.

Bank and Williams (1983) generalize from studies of information use in eight school districts studied over time in continuing evaluation use research conducted by the U.C.L.A. center for the study of evaluation. These authors identify eight elements considered essential to the creation of a usable, stable information system. Core components include; 1) the specification of users, 2) definition of system purposes, 3) the determination of the types of information required, 4) the definition of information formatting and frequencies, and 5) an on going monitoring and adjustment of system components. Contributing components include; 1) training of users in data-based decision making, 2) availability of resources to support action planning, and 3) the availability of resources for the implementation of action steps generated from the use of data analysis. Successful models identify different goals, such as the improvement of student achievement, school improvement, or staff development, yet, share common components of an identifiable network of decision makers, an established specific goal orientation, and receive organizational support through designated resources for information acquisition and analysis.

The researchers conclude that common necessary elements for the development and evolution of information systems are a stable external

environment, the existence of a key individual who pushes the use of systematically collected data in decision making, a critical mass of long term supporters, sufficient fiscal and technical resources, and six to eight years of development. Systems were not built according to blueprints or guidelines, but, emerged ad. hoc. from arrangements among individuals, sometimes connected through formal and sometimes through informal job descriptions. Successful systems utilized standard MIS and other information sources to build specific dedicated information applications customized to user needs. Successful information systems are defined as separate subsystems which have their own purposes, organizational structure, and linkages. These observations capture many generalizations available from the observation of the use of formal information sources in decision making in U.S. public schools.

The following itemization of issues summarize barriers noted in the literature that commonly frustrate the implementation of computer based information systems designed administrator use in U.S. public education. Unusual successful projects that incorporate computer technology in decision making in U.S. public schools demonstrate exceptional persistence and insight into resolving problems that appear generic in adopting this orientation in organizational decision making.

The first issue is the dominance of financial and transaction data in the implementation and development of information systems. The Iowa, Nebraska, Oregon, Minnesota, and Tulsa studies emphasized the use of systematically collected data in budget, student record filing, and payroll applications. The dominance of this type of use centered in the financial control and accounting domain of an organization often restricts the growth and development of other orientations. Similar findings have been identified in business and in private use of computer based information systems. (Danziger 1977) (Nolan 1979) Activities which primarily involve the entry, updating and

storage of data, and access to individual files and cases are often unsuitable for analytic uses of information which involve the reorganization and reaggregation of data. The Cincinnati Public School experience in the development of its School Management and Evaluation System as a separate system dedicated to the specific use of school level decision makers may indicate that this approach may be a necessary requirement to avoid this problem.

A second issue is the level of training available for decision makers in the use and application of information to organizational problems. The Cincinnati project capitalized on resources for inservice training to encourage school principals to active utilization of the information available within the system. Although reports were designed and targeted for school site use, the amount of training involved for school principals emerged as a major element considered in the overall time and expense of implementing the system. The Oregon, and Nebraska studies emphasized deficiencies in training users to frame questions and secure information from these systems.

A third issue is the iterative building and modification of successful information systems. The Alkin et. al. (1979) study emphasized continuous dialogue between evaluators and decision makers in the framing of useful questions and identification of information sources as a major component of successful information use at the site level. Raw data has minimum utility. A dialogue is necessary between the information user and the design of data collection projects and information systems to adjust the system to a format that is compatible with decisions considered and the style of information presentation preferred by decision makers.

A fourth issue is the placement of information system design and implementation at an organizational level that is intimately involved in

using the information. The Iowa experience revealed a weakness in establishing an information system at the state level to serve local decision making interests. Difficulties with consistent data definitions and interpretation across organizations was a major stumbling block in implementation. The motivation to supply accurate, reliable data to remote data gathering and analysis locations was suspect. Return of the data for timely use in local decision making was problematic. Successful implementation of information system use has incorporated efforts that localize implementation near the same level as the unit of analysis considered in decision making support.

The fifth generalization concerns the preference of administrative personnel for information that is accessible, readily understandable, requires minimal training, is not time consuming to use, and is current. The Hood and Blackwell (1976) study indicated that over sixty percent of educators in administrative positions required the information they sought for decision making within two to three days of the time of the initial request.

A sixth consideration relevant is the need of executive support and the presence of at least one committed individual within an organization that pushes for the use of this type of data as a resource in decision making. The Cincinnati project differed from other less successful projects in the presence of a committed project coordinator who insisted on the separateness of the project from other data management functions and who tied development of the system to the specific needs of building principals. Yin and White (1984) found expansion of computer use in both administrative and instructional application was associated with the presence of a committed active coordinator who furnished expertise and resources to projects. Alkin et. al. (1979) emphasized the personal characteristics of the evaluator in establishing evaluation use among decision makers. Commitment, orientation to users, and the ability to take a leadership role in the design and collection of information for decision

makers were key variables. Without directed leadership and coordination, computer data systems tended to meet minimum user requirements as sophisticated filing and accounting systems.

A seventh issue is the integration of formal information sources with other sources of information often favored by administrators in educational settings that compete with formal systematically collected data. The Steiner et. al. (1981) study indicated the frequency that opinion and belief were brought to bear on educational decision making. A national step by step model of problem identification, solution selection, implementation, and evaluation was approximated, at best, even under conditions where consultation in decision processes were supplied. (Duncan 1977) (Louis et. al. 1981). These orientations are not unique to educators and have been observed as endemic to decision making processes within organizations. (Simon 1947) (Cyert and March 1963) (Pfeffer 1981) (Weis 1983) Alkin et. al. (1979) noted that a norm of inquiry and investigation was most salient when an active assertive administrator worked closely with a competent committed researcher to jointly frame questions and design data collection methods.

The last issue concerns statement of clear objectives for the gathering and use of information in the design and implementation of information system projects. The U.S. experience has observed a plethora of abstract goals and objectives that appear to frame legitimate scope and orientation for information system projects, yet, are unrealized in the reality of implementation. The Iowa experience and the Tulsa planning exercise exemplify projects that fail to operationalize the meaning of broadly stated aims.

Two components require clear specification. The first are the technical components oriented to the planning of the information delivery system including a concrete identification of users, the purpose of use, and the source, frequency and format of information obtained. A second component is

specification of the network for information exchange. This element defines the expectations, norms, frequencies and emphasis given to systematically collected data in regular communications among organizational members. The Cincinnati School Management and Evaluation System seemed to be a positive model in its attention to these two components. The system established legitimacy among users, both because of the concreteness of its variable definitions, measurement strategies, and clear specification of a unit of analysis, but also because of the attention to a user information exchange structure. Users received training in interpretation of information for school use and in interpretation of reports to staff and community. Development of an information sharing network was a primary consideration in design of reports and the training received by users.

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