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A Computer Needs Analysis Model for School District Testing and Evaluation Offices

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ABSTRACT. A generalizeable systems-based needs analysis model was developed to help school district testing and evaluation offices evaluate current problems with their information processing systems and identify additional computer capabilities required to upgrade their system. The model was implemented with the Pinellas County School District Department of Program Evaluation and resulted in a cost-effective prescription for improving their current computer capabilities.

Increased public demands for school accountability and instructional program effectiveness, coupled with an increase in the student population in Pinellas County, has exacerbated the need for a continuous flow of evaluative information to decision makers. While the Pinellas County School District Department of Program Evaluation uses theory-based program evaluation models and carefully developed experimental and quasi-experimental designs to evaluate their programs, their efficiency in meeting current information demands is diminished due to limited computer system capabilities.

The purpose of this paper is to describe a theoretically derived systems-based needs analysis model and to report its utility for studying the computer needs of the Department of Program Evaluation. The first section of the paper describes the literature reviewed to identify the important elements of microcomputer technology and networking systems and the systems-based needs analysis model. The second section describes the implementation of the model in Pinellas County.

Model Development

Literature

In reviewing the literature, emphasis was given to studies focusing on the introduction of computer technology into the decision-making office setting. Studies related to goal-based systems design, systems planning considerations, features of the autonomous office, and networking systems were identified.

Atwood (1986) proposed a goal-based systems theory model to guide the design of in-house microcomputer systems for decision-making purposes. Potential conflicts exist between the goals of different groups within the system and may be associated with the hierarchical structure of authority and responsibility embodied in the system. Such management conflicts can affect smooth implementation of computer capabilities within the system. He recommends that the design and development process be structured to: (1) aid the functions of relevant users so the overall goals can be achieved, (2) contribute to communication among all parties, (3) consider the needs of all parties, and (4) gather information on system functioning for revision and improvement based on all users needs.

The importance of planning for a computer system was described by Graczyk and Kiser (1986) and Dembrowski (1986). Graczyk and Kiser postulate that selecting inputs, including both strategic and tactical plans; conducting feasibility studies; and analyzing data and material inputs are extremely important features of planning to ensure effective system integration and efficiency. Besides these planning phases, Dembrowski (1986) indicates that adequate employee training sessions must be planned and incorporated to implement microcomputer systems effectively in a new setting.

Related to features of the autonomous office, Hiltz (1986) identified the following components: word processing, inter-office and intra-office communication, linkages with mainframe systems, and modems as needs that should be analyzed carefully. He also noted that good records management and careful planning appear to contribute to the efficacy of the electronic office.

Three major technical approaches to linking microcomputers to mainframes and to each other were proposed by Kerr and Hiltz (1982). These include: (1) electronic media exchanges (floppy disks); (2) telecommunications linkages, including asynchronous and synchronous connections; and (3) product or software linkages. Linking problems entail careful coordination and system design and their solutions take time since maximum use of computer resources

cannot be realized without user acceptance. Deck and Coe (1985) emphasize the importance of user involvement in each stage of planning, design, and testing for developing successful linking systems.

In summary, integrating a new system into an old system involves determining the goals of all users; planning the system carefully based on these goals and needs, involving users in planning, designing, implementing, and testing the system; and training users adequately to use the new system.

The Model

Based on the literature, a model for studying the computer needs of a school district research and evaluation office was developed, and it is included in Figure 1. The model contains four main phases including: define the department function and operations, conduct a needs analysis, analyze specific problems and potential solutions, and develop a computer network model to alleviate the verified problems. The following section describes each of these phases in detail.

The department function and operations (1.0). The first phase of the model involves carefully describing the goals and tasks of the department studied. This activity gives direction to the study and helps formulate specific questions to be answered during the study. A good way to describe the department is through a flowchart of work performed by the department in conducting their evaluation studies and in producing reports. The flowchart also helps to identify all personnel involved in the system.

The needs analysis (2.0). The needs analysis phase includes two separate studies: analyze current status and analyze desired computer capabilities. The current status study includes the following four activities:

2.1.1 Analyze Personnel Job Functions. All staff members who are involved in the management or conduct of studies and production of reports should be interviewed to determine their particular job functions within the system and any problems they have in performing their duties. Information abstracted from these interviews, coupled with the task flowchart developed during phase one, can be used to create a model of the communications flow and to locate problems with the flow.

2.1.2 Current Computer Capabilities. A model of each operational system should be developed, including its current memory, capacity, storage capabilities, amount and type of usage, and the unit's interface capability with other systems. Each system should be recorded on a separate form.

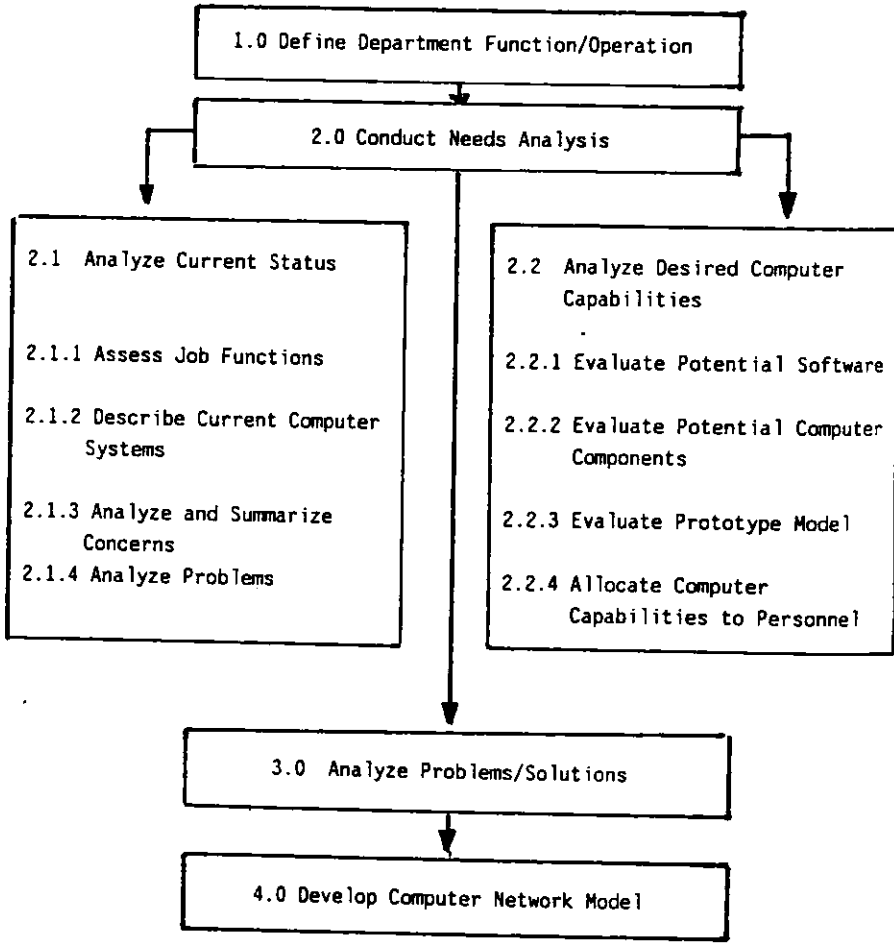

Figure 1. Overview of the Needs Analysis Systems Model

2.1.3 Analyze and Summarize Concerns. Using the job function descriptions (2.1.1) and the current computer capabilities (2.1.2), all problems identified during the job function analysis should be summarized across jobs and computers to locate common as well as unique job-by-system problems. Problem areas identified should be discussed with relevant personnel to verify the existence and interpretation of each problem. Based on these clarifications, a correct

description of problems with current tasks and systems should result.

2.1.4 Analyze Problems. Each problem identified should be analyzed to determine whether it appears, at this point, to be a personnel allocation, task allocation, management plan, or computer systems problem. Problems that potentially relate to training or other management functions and to a different computer system should be separated. Findings of the current status study should be summarized with needs clearly delineated between jobs and training on one hand and computer systems capabilities on the other.

The second phase of the needs analysis study (2.2 in Figure 1) involves determining the employees' desired computer capability, and it includes the following specific activities:

2.2.1 Evaluate Potential Software. Commercially available software that can aid the department in completing its work should be sought. Because of the highly technical nature of many software packages, an education component may need to be provided to ensure that all personnel understand each package, including functions it performs, training that may be required to use it, systems required to operate it, and the costs of obtaining it. Based on the information, personnel can be asked to rate whether each package would enhance their capability for timely task completion. Synthesizing all members' responses will identify software considered helpful for both general and job-specific tasks.

2.2.2 Evaluate Potential Computer System Components. The existing as well as the desired computer components identified in 2.1.1, 2.1.2, 2.1.3 and 2.1.4 can be listed and combined with a need-based rating scale that will enable staff members to identify their current need for each component. This part of the study will help to identify staff members' perceptions of their most pressing networking needs, thus directing attention to additional components that may be required.

2.2.3 Evaluate Prototype Model. Using the information gathered in 2.2.2, the most important computer features identified by staff members can be used to create a prototype model of the desired computer system. To verify the accuracy of the evaluator's interpretations and to gather the opinions of staff members, each member should be asked to evaluate the components of the prototype model based on his/her own needs. The particular system capabilities each member believes he/she would use and how often they would be used should also be identified. Based on this input, the prototype model should be refined (e.g. more/less printers, terminals, etc.).

2.2.4 Allocate Computer Capabilities to Personnel. Based on the various systems capabilities and employees' reported level of need for each component that were identified in 2.2.3, computer capabilities

should be allocated to each staff member based on their job and degree of need. Decisions about the number of persons who need access to mainframes, access to microcomputers, and access to printers should be made at this time. Additionally, whether each member should share or not share access should be determined. Once these allocations are made, they should be verified with all personnel in the department to certify the reasonableness and feasibility of the allocations.

Problems/solution inspection. The third phase of the model (3.0 in Figure 1) involves careful analysis of the problems that emerged from the current status and the desired status needs assessment studies. The nature of each problem and whether it can be resolved through: (1) acquisition of different software packages, (2) additional training in using the current system, or (3) new systems components and training should be discussed with stockholders. Any recommendations from the study will need to be examined for potential sources of entrophy, including conflicting agendas of users or resistance to particular recommendations. Solutions will be most acceptable if there is interactive communication among stakeholders during this problem-by-solution phase. Stakeholders should be involved in planning systems changes and judging the reasonableness of requirements for user training time.

Development of the computer network model (4.0) The final phase of the study involves developing a network model based on potential solutions negotiated in phase three of the study. The network model should incorporate existing systems components, whenever possible, and new additions to the systems. A budget should be included that describes the cost per unit of each new component recommended.

Besides the additional components and their costs, strengths and weaknesses of the proposed system should be clearly described along with the total cost of the new system. Such information will enable administrators to evaluate the recommendations.

Using the Model to Identify the Computer Systems Needs of the Pinellas County Department of Program Evaluation

The Department Function and Operations (1.0)

The purposes of the Department of Program Evaluation are to evaluate district-level and school-based programs and to manage the administration of county-wide testing programs in the Pinellas County School District. Figure 2 contains a goal-based flowchart that describes departmental tasks and the flow of work into and out of the department.

It should be noted that three of the major tasks–data entry, data analysis, and word processing–are performed outside the department by centralized county offices that are geographically separated from the Department of Program Evaluation. It is also interesting to note that the word processing unit is accessed at least three times for each report.

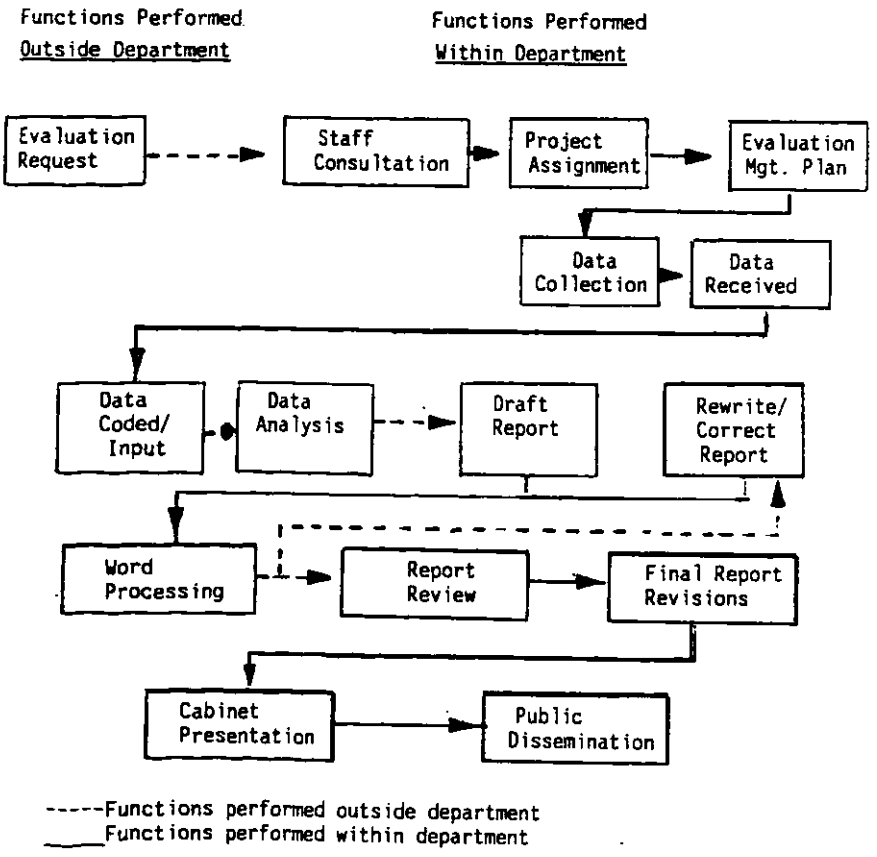

Figure 2 Goal-Based Model of Department Functioning

Needs Analysis Current Status Assessment (2.1)

Job functions (2.1.1). Personnel in the Department of Program Evaluation include the Director of Research and the Director of Testing who both report to the Assistant Superintendent. The Director of Testing is responsible for the management of all county-wide test administrations and the maintenance of pertinent student records. He is assisted by two clerical support staff members and one secretary. The Director of Research is responsible for conducting institutional research, the analysis of incoming data, and numerous administrative duties. He is assisted by two evaluation specialists, one data-entry clerk, two secretaries, and two half-time doctoral interns. While evaluation specialists do not share work responsibilities, they typically consult with each other on projects.

Interviews were conducted with each departmental staff member as well as support personnel in separate word processing and data processing units. It appears that the Department of Program Evaluation generates the largest number of documents of any administrative department in the district. Their products include evaluation reports, memorandums, attitude measures, and questionnaires. Many of the reports include 50 or more pages and require numerous revisions. In addition to length, these reports typically contain complex, detailed data tables and graphs. Many projects and reports are in progress simultaneously.

Current computer systems (2.1.2). Currently, the Department of Program Evaluation has three operational computer units, including two mainframe terminals and a microcomputer. An IBM AT, with 30 MB fixed disk and two 5 1/4 inch disk drives is in operation. It is equipped with a WYZE 1200 based modem to communicate with the IBM mainframe computer system at the University of South Florida. A large number of software packages are available for the IBM AT, including dBase III, Lotus 123, Wordstar 2000 Plus, SPSS-PC, and PC-Talk. The AT is connected to a Hewlett-Packard LaserJet and IBM ColorJet printer; these printers can produce letter quality documents and high resolution color graphics.

A Honeywell mainframe terminal provides the department with a capability to access and manipulate a county-wide database that includes student census and assessment data. The IBM mainframe terminal serves the same function as the Honeywell system; however, the Honeywell is supplemented by updated editing capability, color display, and high resolution graphics. None of the units interface with any other unit; therefore, each operates independently.

Personnel concerns (2.1.3). The department is unable to complete

their assigned work and produce the required reports within given time constraints. In fact, there is currently a two-year backlog in completing work assigned. In an effort to produce the required work, new management procedures for standardizing requests for work, project management, data collection, and data management were developed. Streamlining these tasks, while helping, did not sufficiently increase the department's productivity.

Two main problems appear to block efficient operation. The first is the interface between the department and the separate word processing, data entry, and data processing units. The workload carried by each of these units negates their providing better service for the Department of Program Evaluation. While relations between the department and these units are mostly cordial, they are strained when the department's time pressures are great. A potential solution to the external support problem would be the conduct of all required tasks within the department, and all personnel support this solution.

An autonomous office, however, gives rise to the second problem. The department does not currently have the software or computer systems capability to become autonomous. Perceiving that developing these capabilities was the only reasonable solution for their productivity problems, all staff members agreed to study the additional capabilities required and to undertake the training necessary to use any new systems or software.

Needs Analysis Desired Computer Capabilities (2.2). This phase of the model concerned the utility and application of additional computer capabilities. Specifically, this phase of the model is to identify computer needs perceived by staff members.

Computer software evaluation (2.2.1). The software survey was administered to all staff members. Results obtained from the Assistant Superintendent, the Directors of Testing and Research, and the Evaluation Specialists were weighted to recognize their cognizance of future software needs. A difference score between what they believed they could accomplish and what they can presently accomplish was obtained. Their software needs appeared to be greatest related to word processing and univariate statistics software packages.

Computer components needs (2.2.2). A checklist was created using the networking functions staff mentioned during the status study. Staff members were asked to rank the importance of each function for completion of their jobs. A mean value was obtained for each capability, and results indicate that a laser-jet printer with graphics capability and a telephone modem were the most important needs. The need for a daisy wheel or dot matrix printer appeared to be minimal. Summarizing needs across personnel, it appeared that access to

computer systems was also a problem. More access to the mainframes, to minicomputers, and to printers appeared to be necessary.

Evaluate prototype model (2.2.3). A prototype computer systems model was developed based on the needs assessment in 2.2.2. Each staff member evaluated each component of the model using a rating scale that included: 0=not applicable, 1=excellent, 2=satisfactory, and 3=unsatisfactory. These ratings were tallied and used to refine the model to best suit the overall needs of the department members.

Allocate computer capabilities (2.2.4). Upon inspection of personnel duties and needs defined by each staff member, five units were created to allocate computer capabilities including: (1) Assistant Superintendent, (2-3) Directors, (4) Evaluation Specialists, and (5) Support Personnel. The results of the needs analysis were used to obtain the data for Table 1. Five units need mainframe access, while 4 units need microcomputers. Shared and non-shared capabilities were allocated for each unit.

Table 1 Capability Allocation

Unit	Mainframe Capability	Microcomputer	Status
Assistant Super	1	1	Not Shared
Directors	2	1	Not Shared
Evaluation Specialists	1	1	Shared
Support Personnel	1	1	Shared
Total	5	4	

Problem Inspection(3.0)

This phase of the model involves interaction between the evaluators and department personnel. The desired systems capabilities were compared with the present capabilities to determine whether the desired capabilities could be achieved with the present system by acquiring additional software, requiring staff training, or rescheduling

access to the computers.

After deliberation, it appeared that software, training and scheduling solutions were inadequate due to insufficient systems compatibilities; thus, ways to upgrade the current system were studied. Desired capabilities from the computer needs section included five mainframe access routes, four microcomputers, and three printers. Based on the shared/not-shared status prescribed by staff members and the current systems capabilities, a new systems model was developed.

Proposed Model (4.0)

The network model based on required needs and negotiations with staff members is presented in Figure 3. The model was designed to have the number of desired components and to allocate four microcomputers, three printers, and five mainframe accessing capabilities. The model incorporates the department's current systems, highlighted using bold boxes in Figure 3, as well as new components that would need to be acquired.

The mainframe terminal controller is a necessary component of the model because it allows more than one mainframe terminal to access and read the signal from the mainframe. Without the controller, expensive and awkward telephone cables would be required to allow additional terminals to access the mainframe. However, with the introduction of the controller, up to 20 terminals can access the mainframe. Thus the controller would allow additional terminals to be added as they are needed.

Three types of independent microcomputers comprise this model: the IBM AT (30 MB fixed disk), IBM System 2 Model 30 (20 MB fixed disk), and the IBM System 2 Model 60 (70 MB fixed disk). All three microcomputers are connected via a modem and smart switch to the IBM mainframe. One microcomputer can be used as a mainframe terminal at any one time. The printing capabilities include letter-quality document printing, high-resolution graphics, and medium-resolution color graphics. There are no sharing capabilities because each computer has sufficient memory capacity to store all requisite software. The IBM System 2 Model 60 has the capability of being a mother machine, another useful feature if there is a need for future networking capabilities.

The model supplements currently available capabilities with an additional mainframe terminal that does not require extensive personnel training for its use. This mainframe capability is independent of the microcomputer networking system; therefore, it should provide sufficient reliability to enhance mainframe computer utility. The

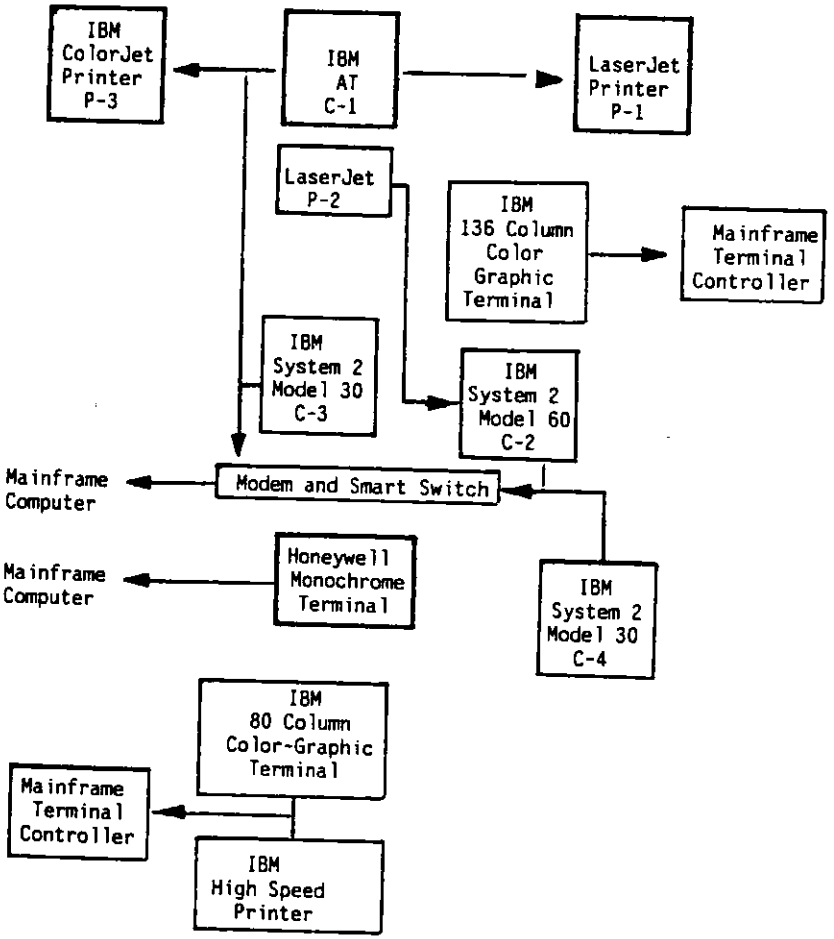

Figure 3 Network System Model

proposed model should effectively address needs identified through the needs analysis.

Strengths. There are several strengths of the proposed model. First, it is cost effective because it builds on the department's current computer capabilities. Total current costs for all new component acquisitions is $14,002. Second, the model provides all the systems capabilities identified by personnel during the needs assessment study. Third, the model, if implemented, will require a minimum of staff training since networking training is unnecessary. Finally, a dysfunction in one

component of the system will not affect the rest of the system.

Weaknesses. The model has one main weakness: it does not provide a multi-user mode which enables simultaneous access to the mainframe. Providing this capability would be costly, and the need for it should be determined after experience with the new system.

Conclusions

The systems-based needs assessment model was effective for studying the current and needed computer capabilities of the Pinellas County School District Department of Program Evaluation. While the tasks performed by the department, the needs identified, and the network model generated were unique to this department, the general needs assessment model used to guide the Pinellas County study was entirely adequate for conducting the study and developing an appropriate, cost-effective solution. One important feature of the needs assessment model was the involvement of staff members at each stage of the study. By the time the final proposal was made, staff members could clearly see that it addressed their needs.

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