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ABSTRACT

In response to the specifications of a United States Office of Education grant "Common Core of Data for the Seventies" (CCD-70), the Michigan Department of Education developed a procedure for identifying user's requirements relative to a State Education Information System. The project sought to identify users, to locate and prioritize their management concerns, to identify related linkage questions, and to relate these to the flow of information. The tools developed by the study included an interview guide and a consensus survey employing a modified Delphi Technique. Results indicated that these procedures responded to users' needs, for they generated the major questions faced by users, identified the data needed to answer these questions, and located the data which was available. It was concluded that these procedures could be adopted in other contexts since they represented a viable means for identifying user needs with respect to management information systems. (Author)

A PROCEDURE FOR IDENTIFYING USER'S REQUIREMENTS FOR A MANAGEMENT INFORMATION SYSTEM

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The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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INTRODUCTION

In a time of ever-increasing demands at federal, state, and local levels for more and better information about education, there is a need for a systematic and economical means of collecting, managing, and disseminating educational data. There are two major forces which create compelling reasons for a comprehensive information system in the Michigan Department of Education. Both of these forces are related to the broad concept of accountability. The first revolves around meeting the educational needs of children and youth in Michigan in a systematic and economical way; the second derives its impetus from the impact of planning by all State Governmental Agencies for implementation of a Program Budgeting and Evaluation System (PBES).

In order to implement a comprehensive information system, a solid data base is needed from which to address policy and management questions. In Michigan, the requirements of data users are diverse, but at the same time, they are related to pertinent and mutual issues faced by decision-makers.

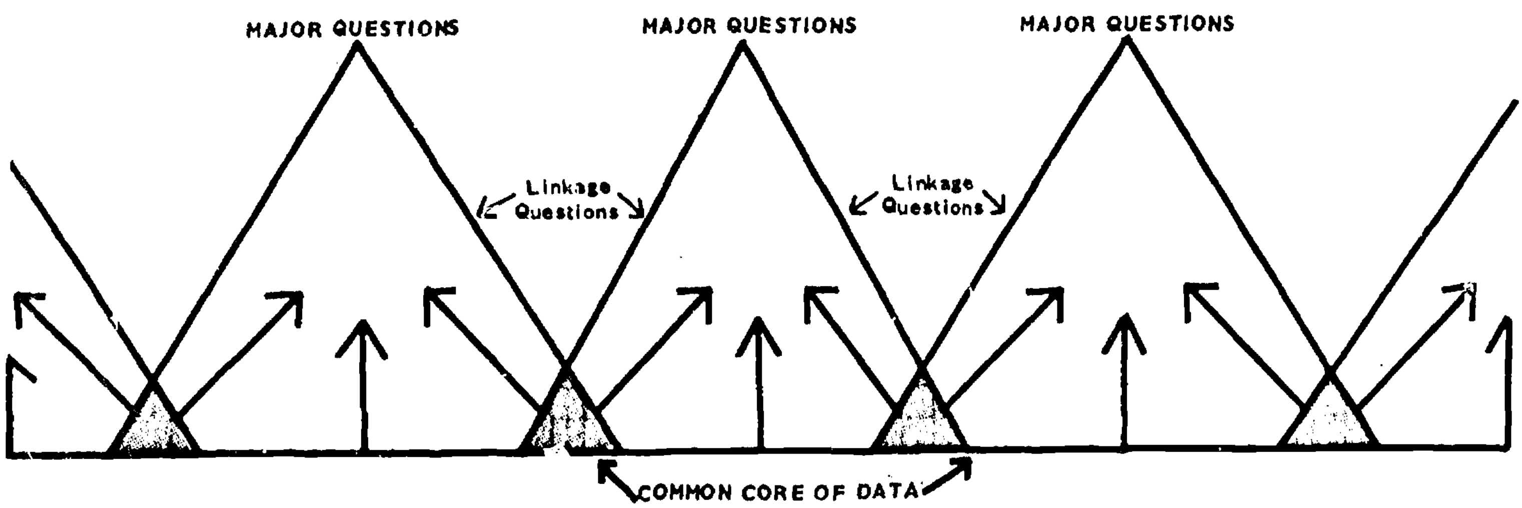
As an initial step in the development of a system-base, it is essential to identify the requirements of the users of data. It is to this task that this paper is addressed.

In response to the specifications of a United States Office of Education grant "Common Core of Data for the Seventies" (CCD-70), The Michigan Department of Education developed and tested a procedure for identifying users' requirements for the financial module of a State Education Information System. It will be the purpose of this paper to describe the procedures developed for identifying users requirements, and to briefly describe how these procedures were applied, without going into the details of the Michigan study. The methodology that was developed should be equally applicable to all modules of a management information system.

The theory behind the Michigan Department of Education's study to identify users' needs was that the identification of the questions to which the data must respond is the first step to be undertaken. If the major management and policy questions of the state's educators can be identified, it will be possible to identify their information requirements and to identify, collect, analyze, and use data needed to meet these requirements.

The specific objectives of Michigan's CCD-70 grant were to identify and prioritize major management and policy questions, identify the related linkage questions (specific, data related questions) and data base, and relate these results to the existing information flow.

It was assumed that more specific questions would demand specific data items while more general questions would require more generally applicable data items or, perhaps more likely, combinations of data items from a common data base. The relationships between the major and/or linkage questions may be shown as an interlocking series of pyramids (see Figure 1) with the shaded areas representing the common core of data to be used to answer overlapping questions.



DATA BASE

FIGURE 1: Interconnecting Relationship of Data Elements to Major and Linkage Questions. (Shaded Areas Represent Common Core of Data)

Figure 1 indicates the following: (1) some linkage questions may share no common data elements; (2) some linkage questions will share common data elements; and (3) all major questions are likely to share some common data elements. In order to identify the major management and policy questions, linkage questions and required data, a personal interview approach was used. The individual tasks required to meet these objectives were as follows:

1) Develop an interview guide
2) Test the interview guide
3) Conduct interviews
4) Analyze the interview results
5) Identify major management and policy questions
6) Identify the subset of major questions with particularly strong fiscal implications
7) Develop a method to prioritize these questions
8) Prioritize the major questions
9) Relate major questions to linkage questions and data requirements
10) Identify financial information that is presently available
11) Identify areas of greatest existing need

The completion of these tasks has resulted in "The Identification of Users' Requirements for a State Education Information System."*

The following sections of this paper present discussion on

1. The interview process
2. Construction of data sets
3. Analysis of results, and
4. Conclusion

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*The study identified users' requirements for the financial module of a State Education Information System. However, the procedures reported herein should be equally applicable to each module of an information system.

THE INTERVIEW PROCESS

The interview process involved three basic steps: (1) development of the interview guide, (2) the selection of people to be interviewed and (3) conducting of the interviews. Each of these steps required considerable time and planning in order to respond to the requirements of the specific study and at the same time to maintain the potential for broader applicability.

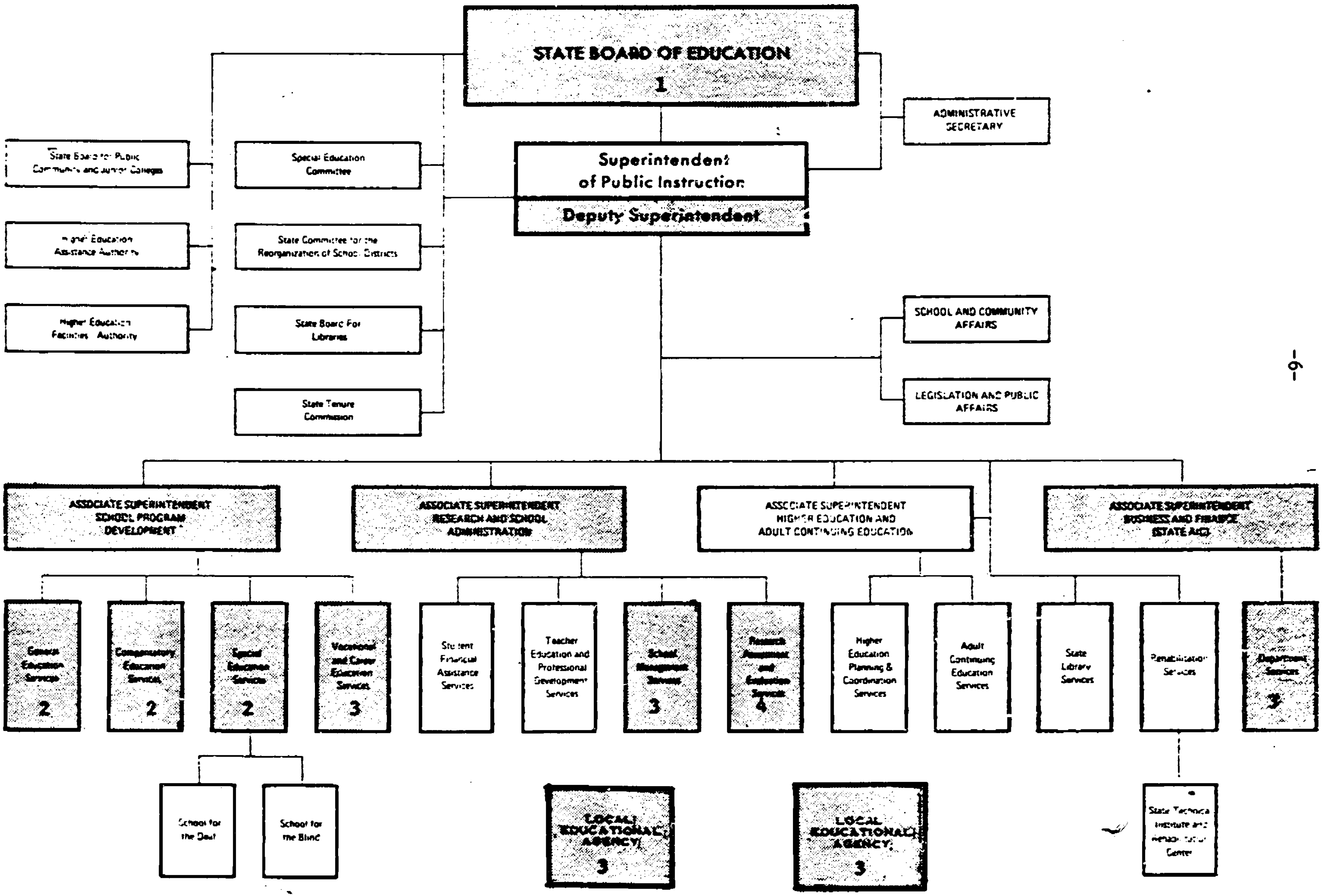
The interview guide developed for Michigan's CCD-70 project has a personal data sheet and five sections. (See Attachment A). Section I collects the major management and policy questions and linkage questions. In Section II the interviewee is asked to indicate the information that he has or would like to have in order to answer each question in Section I. Section III is designed to establish an overview of data needs. The questioning in this section is specifically directed toward the respondent's need for financial data. A matrix with funds, allocation and expenditures as variables on one axis, and federal, state and local levels on the other serves as the framework or outline for this group of questions. Section IV asks questions about what financial data the respondent uses, what he has, and what he would like to have. The final section, Section V, requests unstructured comments and recommendations from each person being interviewed.

The intent in choosing the people to be interviewed was to obtain a representative sample of management people in the K-12 sector of the State Department of Education. The final selection included: The Deputy Superintendent; three Associate Superintendents; one member of the State Board of Education; seven Service Area Directors; seven Program Administrators; five Coordinators of Federal Programs; and personnel from two Local Education Agencies (6 individuals). The following organizational chart (Diagram 1) indicates the relationship of the sample selection to the Departmental structure.

The selection of two Local Education Agencies (LEA's) can, at best, be considered only as an indicator of local data needs. It was not possible to obtain a representative sample of local systems in the time frame allowed. Instead, staff of a rather large (23,761 students) system and a fairly small (3,787 students) system were interviewed. One day was spent in each system. In each case the superintendent, business official and curriculum director were interviewed. Their inputs were considered as indicators of the simularity or diversity between their data needs and those of the State Education Agency (SEA).

The interviews followed a basic format. Each interviewee received a memo introducing the staff and indicating that he would be contacted for an appointment for the interview. The interviewer was accompanied by a stenographer who recorded the interviewee's comments. In this way, the person being interviewed could respond at a rate that was natural for him and there would be a transcript of the interview to fill in any omissions. Each interview was assigned a code number and cannot be associated with the name of the person interviewed, except by the Project Director. The interviews ranged in time from one to four hours and were essentially uninterrupted sessions. For the most part, the people interviewed were very enthusiastic about the project and eager to participate.

MICHIGAN DEPARTMENT OF EDUCATION JULY 1971



= People Interviewe

Diagram 1

CONSTRUCTION OF DATA SETS

A reasonably accurate overview of an organization's information needs can be established with four data sets:*

Data Set I	The major management and policy questions
Data Set II	A prioritized subset of major questions relating to the information module being developed (in this case financial)
Data Set III	The data required to respond to the questions in Data Set II
Data Set IV	The data presently available within the module under consideration.

The first three of these Data Sets can, for the most part, be constructed from a rigorous analysis of the interviews. Data Set II requires the application of a prioritizing process. The manner in which Data Set IV is constructed, would depend on data control procedures within the organization.

Following is a brief description of the four Data Sets from the Michigan study and how they were constructed.

Data Set I - Major Questions

The first data set resulting from careful analysis of the transcripts of the interviews consisted of 111 major questions identified in 30 interviews. In each interview, the interviewee was asked to identify the management and policy questions or concerns that were of primary importance to him. These broad scopes questions will be referred to as major questions. Each person was also asked to supply the more detailed and specific questions that would need to be answered in order to deal with the major questions; these more specific questions are referred to as linkage questions.

Data Set II - Prioritized Fiscal Questions

The large number of major questions made prioritization of all of them unmanageable. Therefore, in keeping with the objectives of the grant, the

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*The data sets are available upon request.

questions with fiscal implications were identified for prioritization. The questions with the most prominent fiscal implications were subjectively selected by the researcher. This subset of thirty major questions was chosen for prioritization, in order to identify the priority of major issues. Data Set II contained the thirty major fiscal questions with the 153 associated linkage questions, ordered according to the results of the prioritization process; and graphic representations of the results from each of the steps in the process (Attachment B) Only the State level management people were involved in the prioritization process.

The prioritization process employed a modified Delphi technique. The Delphi technique was developed by the Rand Corporation and was modified for this application, under contract, by Person-O-Metrics, Inc. The Delphi technique is a forecasting and consensus technique for anonymous contributions from expert or concerned opinion. Delphi questionnaires seek a group judgment by offering a continuum of responses, providing controlled feedback on previous group and individual judgments, and forcing the range of judgments to converge. Opinions of those not in agreement with the majority are recorded and used as feedback to the group. A statistical response of the median and interquartile range (middle 50%) is usually reported.

The consensus survey, or prioritization of the major questions, was performed in three phases. The technique used in each of the three phases is discussed in the following paragraphs. Each phase involved the sending of materials soliciting responses from each person who had been interviewed. The respondents were given a three to four day time span to return the materials. An analysis of the results was performed and the next phase prepared for distribution within a week.

The first phase of the survey was a "Q-sort" which simply involved the linear ranking of the thirty major questions. Each participant was given 30 cards with one question on each card. Instructions informed the respondents to divide the deck into three aporoximately equal piles of "very high," and "moderately high to low" priorities for the entire Michigan Department of Education. The piles were sorted again, merged, and numbered in rank order.

The Q-sort technique produced an ordinal ranking which was without the usual omissions and ties which tend to haunt many rank order exercises. The distributions of opinions on the item questions were quite wide with very few item questions able to claim statistically significant differences over the overlapping distributions of their neighboring items. The top 16 items were maintained for the second round of the survey. The second phase of the consensus survey reported back to each respondent how he rated each of the sixteen items in comparison to the middle fifty percent of respondents. The respondent was then requested to rate the item within the fifty percentile range, or give his reasons for not being willing to do so. An important variation in the usual Delphi technique was present in that the repositioning of the response was not only made in relationship to the group feedback but also in relation to the rank ordered responses to the items immediately above and below the item being repositioned. The results of the second phase were then calculated to evaluate the new interquartile range for each item.

The results of the first Delphi round (the second round of the survey) contracted the item distributions into ~~slightly~~ smaller interquartile bands. Although the distributions did not approach convergence, the contraction was sufficient to allow most of the items to claim statistical significance in their differences among the items more than one or two positions above and below. Sixty-five percent of the participants chose to state one or more reasons for not conforming to majority opinion. Each of the 16 items had at least one defender or critic arguing for a higher or lower priority. In the third and final phase, the respondent was again asked to reevaluate his response for the six highest ranking issues. However, in this round he was able to see the comments of his fellow respondents who wished to remain outside the fifty percentile range before making a final evaluation of his position. The results of this final round were accepted as the consensus of opinion on the priority of major issues.

The statistical relationship among the top six items indicate the statistically significant (i.e., not likely due to chance) greater than (>) and approximately equal (≈) comparisons between each item and the other five items.

TOTAL GROUP

BA	Long range planning
≈ CE	Equal educational opportunities
> > CB	Most effectively deliver services
> > > BB	Utilize human and financial resources
> > > ≈ AB	Best delivery system
> > ≈ > ≈ AC	Priority of programs

The data were broken down by job and role classification. One group comprised of Service Area Directors and Executive Office was compared to the other participants consisting of Program Supervisors and Coordinators. The Service Area Directors and Executive Office spread their responses widely over the six items so that only two significant item differences could be proven with this small subsample.

SERVICE AREA DIRECTOR AND EXECUTIVE OFFICE

BA	Long range planning
≈ CB	Most effectively deliver services
≈ ≈ BB	Utilize human and financial resources
≈ ≈ ≈ AC	Priority of programs
≈ ≈ ≈ ≈ CE	Equal educational opportunities
> > ≈ ≈ ≈ AB	Best delivery system

The Program Supervisors and Coordinators made up of an equally small subsample as that of the Directors and Executive Office were in greater agreement over ranking the items. The item on equal educational opportunities led the ranking with the priority of programs question at the bottom.

PROGRAM SUPERVISORS AND COORDINATORS

CE	Equal educational opportunities
≃ BA	Long range planning
> ≃ BB	Utilize human and financial resources
> ≃ ≃ CB	Most effectively deliver services
> > ≃ ≃ AB	Best delivery system
> > > ≃ > AC	Priority of programs

On an item to item comparison of the top six priorities, between the Directors and Executive Office Group and the Program Supervisors and Coordinators Group, the Directors and Executive Office showed the Priority of Programs item significantly higher in its distribution than in the Supervisors and Coordinators Group. The Program Supervisors and Coordinators Group were significantly higher in their positioning of the Equal Educational Opportunities item.

All of the statistical significance testing used the Kologorov-Smirnov two-sample, one-tailed test. This is a powerful statistical procedure for small samples where the assumptions of a normal distribution (bell-shaped curve) cannot be made.

Data Set III - Financial Data Needed

The third data set, identification of financial data needed by management people within the State Department of Education, was organized by data source. In accordance with the interview guide, each interview had four major areas that identified data needs. All data items mentioned by the interviewee in one of these areas were listed in financial and non-financial data sets. The items in the financial data sets from each interview were merged and regrouped according to data source. Data Set III represented the indicated data needs, according to data source, of the people interviewed. The data items were coded to indicate whether or not they were available. Also, a code was used to indicate to which of the major questions the data items responded.

Data Set IV - Financial Data Presently Collected

The fourth and final data set is the financial data collected from the local and intermediate school districts. The Michigan Department of Education's Research Data Program maintains up-to-date files of all collection documents that are sent out to the local and intermediate school districts. A thorough search of these files for documents requesting financial information, resulted in the information presented in Data Set IV.

Indicated with the name of each collection document was the form number, respondent, collection date, package, service area requesting the information, data processing status and comments. These pieces of information are self-explanatory, except perhaps "package." In an attempt to relieve the responding burden of the local and intermediate agencies, the Department of Education has established collection packages that group collection documents with comparable functions or collection deadlines into a single package. There are presently three collection packages: Fourth Friday (information collected the fourth Friday after Labor Day), End of School Year, and Close of Fiscal Year.

Analysis of Results

The analysis of the results of the four data sets is a very straight forward process. The major questions of the management staff, the data needed to answer those questions and the data available to answer them, have been identified; in other words, the users' requirements have been identified. The information available makes it possible to study patterns of information flow, areas with priority information needs, information availability by management level and many other aspects of information exchange. Beyond the objective of identifying users' requirements, the broad scope view made available by the four data sets provides a frame work for systems design efforts.

The purpose of the "CCD-70" was fulfilled with the identification of information that would be required in the data base for the financial module of a MIS. The type of information gathered for the study made it possible to carry out a more complete analysis that would be more specific and meaningful within the State Department of Education. The analysis of the results of the Michigan study included a discussion of information flow from each of the levels of the educational hierarchy (local, intermediate, state, and federal) to management people within the State Department of Education. Primary areas of data need were identified at each level. The data needs that were not being fulfilled at the time of the study were explored and discussed in light of existing information flow; and recommendations for improved information flow were associated with area of need.

Conclusion

The methodology described above for identifying users' requirements of a management information system was developed with a commitment to the premise that the identification of the users' questions must precede the identification of the users' data requirements. Also basic to this methodology is the belief that modular information needs can not be fully understood unless they are viewed in relation to a total information system.

It is necessary to have an awareness of how the information in the module under consideration relates to the information that would be in the other modules of the system, so that the capability for cross referencing can be anticipated and planned. Additionally, it is necessary to understand the implications of collection, storage and use of the information at each level of the system.

The application of this methodology in the "CCD-70" study, proved to be effective. Indeed, users requirements for the financial module of a management information system were identified. Also, recommendations, were made to improve information availability and flow. The potential for applying the methodology to other modules and for interrelating them and carrying them through to implementation has begun to be explored, through additional studies at the Michigan Department of Education, and the prospects for continuing success are promising.

ATTACHMENT A - Interview Guide

Section I

Section II

Section III

Section IV

Section V

INTERVIEW GUIDE

PERSONAL INFORMATION

1. NAME: ____

2. Room________Bldg.__________Phone________Service Area__________

3. ADMINISTRATIVE AREA: (Evaluation, Assessment, Title III).

   ____

4. LEVEL OF RESPONSIBILITY

   Superintendent

   Associate Superintendent

   Director

   Program Supervision

   Coordinator of Federal Program

   School District

5. LEVEL OF PROGRAM RESPONSIBILITY (express in % time spent, if necessary)

   Federal__________________

   State__________________

   Local__________________

   Other__________________

INTERVIEW NUMBER

____
INTERVIEWER

INTERVIEW GUIDE

Section I

As a normal function of your position, you must make decisions and have questions answered daily. I would like to establish a hierarchy of these questions; or to put it another way, to have a listing of these questions and the major management or policy decisions that they help you to make. (As an example, consider a classroom teacher: a major management type decision that the teacher might be concerned with is "How can I provide the best education for my students?" Having answers to the following questions would help to answer this question:

1. What are the students deficiencies?
2. Where are they showing the greatest interest and responsiveness?
3. What will be most useful to them?).

Question Sections I & II	Data Item	Source	Present Access	Freq. of Update	When Collected	Analysis

Section III

FUNDS Source	ALLOCATION Recipient	SPENDING Expenditure
Federal	State District School	State District School
State	State District School	State District School
District School		

SECTION IV

INTERVIEW GUIDE

What financial information do you presently use the most? i.e. charts, tables, data items (please list, beginning with the most used information).

What financial information would you be able to make use of if it were available? (Please list and rank as above.)

Do you have need of any up-to-date information? (Please specify the type of information and the frequency, i.e. daily, weekly, monthly, semi-annually.)

INTERVIEW GUIDE

Would your questions be answered more rapidly and more thoroughly by data that had undergone manipulations specified by you? (Calculation, reorganization, etc.)

Section V

Considering that our objectives are to supply the most needed financial data in the most useful form, can you make any further suggestions that might facilitate our efforts?

ATTACHMENT B

FIRST ROUND MEDIAN RANKINGS AND STATISTICAL DIFFERENCES AMONG ITEMS [.05 LEVEL]

MEDIAN	ITEM RELATIONSHIPS		KEY WORDS IN ITEM
4		BA	Long range planning
4	≈	CE	Equal educational opportunities
4	≈ ≈	AB	Best delivery system
5	≈ ≈ ≈	CB	Most effectively deliver services
5	≈ ≈ ≈ ≈	BB	Utilize human and financial resources
9	> > > > >	AG	Allocation of resources
9	> > > > > ≈	AH	Communication of budgetary requirements
10	> ≈ ≈ > > ≈ ≈	AC	Priority of programs
11	> > > > > ≈ ≈ ≈	CG	Funding to program quality
13	> > > > > > ≈ ≈ ≈	DF	Programming funds for specific programs
14	> > > > > > > > ≈ ≈	DB	Information requirements from LEAs
14	> > > > > > ≈ > ≈ ≈ ≈	CC	Rules for disbursement of funds
15	> > > > > > ≈ > ≈ ≈ ≈ ≈	CF	Budget and continue which programs
15	> > > > > > ≈ > > ≈ ≈ ≈ ≈	AD	Coordination among agencies
16	> > > > > > > > > ≈ ≈ ≈ ≈ ≈	DD	Assist LEA's financial management
16	> > > > > > > > > > ≈ ≈ ≈ ≈ ≈	AA	Finding sources of federal revenue
18	> > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈	CH	LEAs fulfilling lawful requirements
18	> > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈	BC	Resultant benefit of fund request
20	> > > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈	BE	Coordinate funding of internal activities
20	> > > > > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈	BG	Working within Program Budgeting (PBES)
20	> > > > > > > > > > ≈ > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈	AE	Operating within appropriations
21	> > > > > > > > > > > ≈ ≈ > ≈ ≈ ≈ ≈ ≈ ≈ ≈	DA	Costs compared to General Education
21	> > > > > > > > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈	AF	Best accounting procedure
21	> > > > > > > > > > > > ≈ > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈	DC	Best method of accounting for LEAs
22	> > > > > > > > > > > ≈ ≈ > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ <	BH	Stable funds to continue or expand
22	> > > > > > > > > > > > > > > > > > ≈ ≈ ≈ ≈ > ≈ ≈	BF	Does PBES portray what MDE does?
23	> > > > > > > > > > > ≈ ≈ > > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈	CD	Centralized disbursement of grants
23	> > > > > > > > > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈	CA	Status of accounts, biweekly
24	> > > > > > > > > > > > > > > > ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈ ≈	BD	Spending plan for federal money
29	> >	DE	Problems of collective bargaining

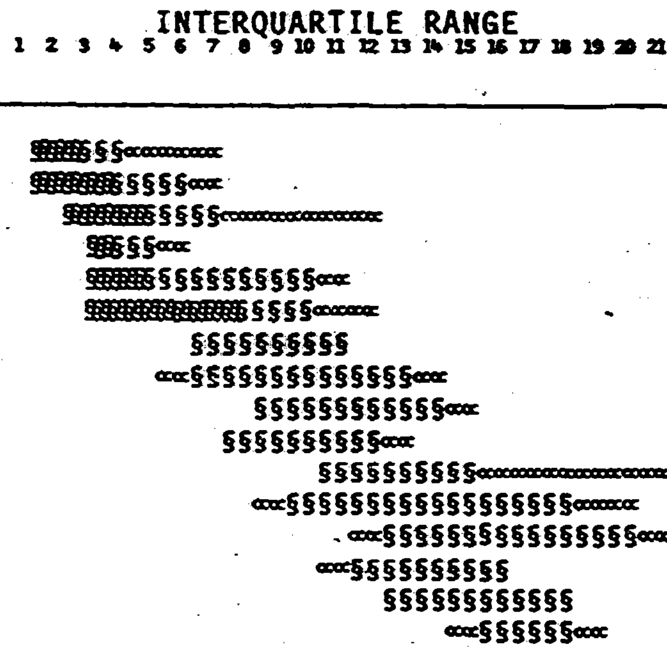
SECOND ROUND STATISTICAL DIFFERENCES OF ITEMS ARRANGED BY THEIR MEDIAN POSITION [.05 LEVEL]*

MEDIAN POSITION	ITEM RELATIONSHIPS	KEY WORDS IN ITEM
2	B_A	Long-range planning
3	{ $\approx C_E$	Equal educational opportunities
	$> > B_B$	Utilize human and financial resources
4	$> > > A_B$	Best delivery system
5	$> \approx \approx \approx C_B$	Most effectively deliver services
6	$> > > > \approx A_C$	Priority of programs
7		
8		
9	{ $> > > > > > A_G$	Allocation of resources
	$> > > > > \approx \approx A_H$	Communication of budgetary requirements
10	$> > > > > > > \approx D_F$	Programming funds for specific programs
11	{ $> > > > > \approx \approx \approx \approx C_G$	Funding to program quality
	$> > > > > > > > > > A_D$	Coordination among agencies
12		
13		
14	{ $> > > > > > > > \approx > \approx C_C$	Rules for disbursement of funds
	$> > > > > > > > > > > \approx C_F$	Budget and continue which programs?
15	$> > > > > > > > > > \approx \approx \approx D_B$	Information requirements from LEAs
16	{ $> > > > > > > > > > > \approx \approx > D_D$	Assist LEA's financial management
	$> > > > > > > > > > > > > > \approx A_A$	Finding sources of federal revenue

*Kolmogorov-Smirnov two-sample, one-tailed test of statistical significance.

DISTRIBUTION OF RANK POSITIONS SHOWN BY INTERQUARTILE RANGES [MIDDLE 50%] AFTER EACH OF THE THREE ROUNDS

FINAL RANKING BY MEDIAN		ITEM	KEY WORDS IN ITEM QUESTION
1st	(2)	BA	Long range planning
2nd	(2)	CE	Equal educational opportunities
3rd	(3)	CB	Most effectively deliver services
4th	(4)	BB	Utilize human and financial resources
5th	(5)	AB	Best delivery system
6th	(5)	AC	Priority of programs
7th	(9)	AG	Allocation of resources
8th	(9)	AH	Communication of budgetary requirements
9th	(10)	DF	Programming funds for specific programs
10th	(11)	CG	Funding to program quality
11th	(11)	AD	Coordination among agencies
12th	(14)	CC	Rules for disbursement of funds
13th	(14)	CF	Budget and continue which programs?
14th	(15)	DB	Information requirements from LEAs
15th	(16)	DD	Assist LEA's financial management
16th	(16)	AA	Finding sources of federal revenue



KEY:
- First round interquartile range
- Second round interquartile range
- Third round interquartile range (top six items only)