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Machine Data Processing for Educational Administrators: Problems and Solutions

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To the Graduate Council:

I am submitting herewith a thesis written by James Floyd Cunningham Jr. entitled "Machine Data Processing for Educational Administrators: Problems and Solutions." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Educational Administration.

Elbert Henson, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

May 24, 1961

To the Graduate Council:

I am submitting herewith a thesis written by James Floyd Cunningham, Jr., entitled "Machine Data Processing for Educational Administrators: Problems and Solutions." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Educational Administration and Supervision.

Elbert C. Henson
Major Professor

We have read this thesis and recommend its acceptance:

Orin B. Graff
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Accepted for the Council:

Herman E. Spivey
Dean of the Graduate School

MACHINE DATA PROCESSING FOR EDUCATIONAL ADMINISTRATORS: PROBLEMS AND SOLUTIONS

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

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by

James Floyd Cunningham, Jr.

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CHAPTER I

INTRODUCTION

A. GENERAL BACKGROUND

Cumbersome procedures of manually tabulating the U. S. Census reports of the late 1800's led Dr. Herman Hollerith to develop the technique which evolved into the present punched card systems. His method consisted of transferring census data, through the medium of punched holes, onto paper strips. The transferred figures from the census reports were fed into an electromagnetic device which automatically tabulated the data. Thus, punched card data processing was born.

The first statistical tabulation was tested in New York City in 1886 and the first significant application of punched card machines was for the United States Census of 1890.[1] Other early users of Hollerith's equipment for vital statistics were Baltimore, New York City, and New Jersey.[2] Before his retirement in 1914, Hollerith developed the basic form of a numerical punch keyboard, a new sorter, a level-set gang punch, and an accumulation tabulator. James Powers, an engineer engaged by the Census Bureau to develop new machines, devised completely mechanical machines with many desirable features.[3] Although extensive developments

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[1]D. A. Talucci, The Punched Card (Detroit: The Punched Card Publishing Company, 1952), p. 8.

[2]Robert H. Gregory and Richard L. Van Horn, Automatic Data Processing Systems--Principles and Procedures (San Francisco: Wadsworth Publishing Company, 1960), p. 628.

[3]*Ibid*.

and improvements were made in punched card equipment before 1930, many functional deficiencies still existed. The tabulator could not subtract, multiply, or divide. Since 1930 customer demands have stimulated the manufacturers to correct these deficiencies as well as produce new, almost phenomenal, equipment. In fact, the customer is now trying to keep pace with the manufacturer.

Some of the early business applications were for payrolls, cost accounting, inventory control, sales tabulations, and consumer research. The reaction of accountants during the early period was characteristic of what educators are faced with today in attempting to utilize punched card equipment for the processing of educational data. They were skeptical of the new procedure because it departed from the methods they could exercise confidently. Even though technological advances demand human changes, there prevails an almost inherent resistance to change. This resistance is not restricted to the accounting profession, nor is it lacking in the teaching profession. Resistance to change is an incessant problem with which educational administrators must cope.

Increased enrollments, additional reports, need for updated information, and more complex school organizations created a growing concern among public school administrators for a more efficient system of record maintenance and control. The success of data processing in industry led educators to examine data processing systems for possible utilization in educational records. One basic problem which led administrators to seek more efficient methods of record keeping was the vast number of clerical personnel necessary to keep pace with burgeoning record demands by expanding

enrollments. Even with a large clerical staff, retrieval and analysis of educational data through the manual process is slow, cumbersome, and forbiddingly difficult.

Statistical data from the local school systems of the nation requires three years for federal agencies to retrieve, analyze, and transmit in published form. These data are history instead of up-to-date statistics upon which to base national appraisal of educational strengths and weaknesses. Another specific illustration of the slowness of transmission and analysis of data focuses on the state level. Teacher certification data are transmitted to the state level for analysis to determine whether the students are being taught by certified personnel. In many cases the manual processing of these data and the dictum notifying the superintendent of unqualified personnel are not completed until the end of the school year--too late to be of value. On the local school level masses of data about the student personnel are stored in files; but it is a slow, tedious task to manually tabulate in such form that permits cross comparisons and statistical analyses. These isolated examples are typical of a multitude of record-keeping problems on the local, state, and national level. The investigator does not purport them to be empirical evidence.

Punched card processing of educational data has been successful in several local school systems. Tennessee and a few other states are developing long-range plans for the transmission of punched card data from the local to the state level. Dr Charles K. Pullen, Director of Statistical Services, Tennessee Department of Education, has developed

procedures for recording teacher certification and assignment data on punched cards. These data are fed into an IBM 650 computer, analyzed, and superintendents are notified immediately of teachers working outside of their certified areas. This illustration is an indication of the potentiality of good system designs on the local level. Such latitude would permit the transmission of data to the state and national level without excessive burden on the local installation.

Over 300 school units in the United States are utilizing IBM punched card equipment in some phase of record keeping. There has been tremendous growth in this area during the last decade. The preponderance of progress took place in the last five years--after the manufacturer recognized education as a potential market.

During the brief history of punched card processing of educational data, the administrators participating have experienced many problems. The administrators were trained in education, but their knowledge of punched card operations was tenuous. Technical supervisors with punched card experience in industry could be employed but most of them were not familiar with the informational or retrieval requirements for education. Considering the commonalty of business functions, punched card applications to business office records of a school system presented few problems. However, the foremost requisite, maintenance of student records, had developed too slowly. Teachers and other educational personnel displayed a mental-set against breaking away from the manual system of recording attendance, grades, and other vital information about student personnel. Many educators in the past

and present have looked upon punched card data processing as a mechanical gadget for accountants and the old routine of manual record maintenance was not open to critical examination. The growth of data processing systems in education indicates a softening of this attitude. An undergirding purpose of this study was to add impetus to the movement.

B. STATEMENT OF THE PROBLEM

The problem of the present study was to determine the major difficulties encountered by educational administrators in initiating and administering punched card processing systems, the degree of concordance among administrators as to the relative difficulty of problems encountered, and possible solutions or circumventions of the problems.

C. HYPOTHESES

The following hypotheses were formulated:

1. There will emerge a significant degree of concordance within the parameter as to the perceived rank-order of the problems encountered by educational administrators in data processing.

2. There will emerge significant degrees of concordance within subpopulations as to the perceived rank-order of the problems encountered by such assumedly, homogeneous sub-groupings of educational administrators in data processing.

3. The degrees of concordance within the subpopulations, divided according to enrollment, will yield significance levels equal to that of the parameter, but perceived rank orders will be different.

4. The degrees of concordance within subpopulations, divided according to date of installation, will yield significance levels equal to that of the parameter, but perceived rank orders will be different.

5. The degrees of concordance within subpopulations, divided according to type of service, will yield significance levels equal to that of the parameter, but perceived rank orders will be different.

D. ASSUMPTIONS

The basic assumptions underlying the study were:

1. Punched card data processing in public school offers sufficient potential as a servant of education to warrant investigation.

2. Public school administrators are experiencing many problems in the transition from manual to machine processing of data.

3. The number and kind of records and reports demanded of public school personnel have become a cumulative onus of problems which will continue to increase in the future. Concurrently, the utility of machine data processing of educational records has greatly increased in the last five years and will continue to increase at an equal or greater rate in the future.

4. A few administrators with effective data processing systems have solved or circumvented many problems encountered by the majority of administrators.

5. The embryonic nature of machine data processing in education presents problems which can be solved, making it a more efficient servant of education.

6. The investigator can identify the basic problems encountered by educational administrators in this area through extensive examination of related literature, visitation to data processing installations in public schools, and participation in professional meetings and workshops for the processing of educational data through punched card equipment.

7. The basic problems can be evaluated by statistical methodology pursuant to seeking solutions for them in the rank-order of their prevalence.

E. SIGNIFICANCE OF THE STUDY

Public education is the country's greatest responsibility and is one of its largest businesses. Public school enrollments reached a record 36.3 million pupils in the fall of 1960, 24.5 in elementary schools and 11.8 in secondary schools.[4] This figure is expected to double in the 1970's. "Expenditures for education were nearly $20 billion ($16 billion public and $4 billion private) in the school year ending 1958--a four-fold increase since World War II."[5]

International competition in technological achievement has focused increased attention upon the product of the public schools. Everybody has hindsight and is able to point to the failures of our educational system of yesteryear. Others offer educated speculations as to present

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[4] U. S. Department of Health, Education, and Welfare, Fall 1960 Statistics on Enrollment, Teachers, and Schoolhousing, Office of Education Circular No. 634, February, 1961.

[5] U. S. Department of Health, Education, and Welfare, Trends, (Washington: U. S. Government Printing Office, 1960), p. 55.

and future ills, but the most reliable implement of investigation and prediction is scientific research. Local school units, state education departments, and the U. S. Office of Education are often delayed in assembling data to the point that it is outdated and useless by the time the job can be accomplished. To maintain accurate, up-to-date, and readily accessible data for scientific research, present manual methods of pupil accounting are not adequate. Therefore, the utilization of punched card machines in public schools appears to be worthy of investigation. It appears that this equipment could maintain a constantly up-dated inventory of educational data at the local, state, and national level for the bases of predictions and decisions.

Teachers spend years equipping themselves with the knowledges and skills to prepare their students for life in an ever-changing society. Their prime function is to instruct, counsel, and motivate the students toward preparation for life in a democratic society.

The constantly increasing burden of record keeping proportionately decreases the time available for their immediate mission of instructing students. If it is economically feasible, the utilization of punched card machines could relieve the teacher of much of their record keeping duties and free them for their primary function--instruction of students. Recent developments in punched card machines have made the purchase or lease of such equipment more economical than in the past. Therefore, this equipment may be within the economic availability of the majority of public school units.

The development of system designs and procedures for maintenance

of educational records has been sporadic. Attendance reporting may have been successfully developed in one school unit, while grade reporting was perfected in a distant unit hundreds of miles away. There has been an almost non-existent leadership in corroborating or sharing successful techniques. Almost every installation has gone through similar trial-and-error processes and laboriously developed procedures independently. Universities, manufacturers, publishers, associations, management consultants, and other potential leaders have not furnished the coordination that could have resulted in greater utility and more rapid development of punched card procedures in educational record maintenance.

It has not currently been ascertained whether or not a basic system design can be constructed for adhibition on a national scope. However, the present study is designed to determine the feasibility of an attempt. The parameter with which this study deals is of national scope. The basic concern is administrative problems. If concordance as to the relative importance of these problems and commonalties of solutions exist, coordinating leadership from a central agency will be a demand which could result in a basic design for national application.

F. LIMITATIONS

Limitations of the study were as follows:

1. This study was limited to public school systems utilizing IBM punched card equipment.

2. Physical and financial resources of the investigator limited the survey of effective systems to the eastern portion of the United States.

3. Technical or operational problems were treated only as they affected administrators.

G. DEFINITIONS

Coefficient of Concordance. An index of the divergence of the actual agreement shown in the data from the maximum possible (perfect) agreement.[6]

Collating. Interfiling two sets of cards in sequence.

Gang Punching. Duplicating data from the first card in a group to the cards behind, usually performed in a reproducer.[8]

IBM. International Business Machines, one of the major manufacturers of punched card equipment.

Interpreting. Printing on a card from data punched in it.[9]

Parameter. The population of schools from which the data were drawn.[10]

Public School Administrators. Generally thought of as educational leaders such as superintendents and principals; however, the present study refers to the educational leader responsible for the

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[6] Sidney Siegal, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, Inc., 1956), pp. 229-230.

[7] International Business Machines Corporation, An Introduction to IBM Punched Card Data Processing, (White Plains, New York: the Corporation), p. 20.

[8] Ibid.

[9] Ibid.

[10] Siegel, op. cit., p. 2

management and supervision of the entire data processing function.

Punched Card. The IBM punched card has eighty vertical columns. Each column will accommodate a hole (or holes) representing a single number or letter. Data to be processed through IBM machines must be punched in the card according to a standard arrangement. It can then be read by machines to do transcribing or other processing at high speed.[11]

Punched Card Equipment. The basic battery of equipment necessary to perform the record keeping function is generally the card punch, sorter, and tabulator. However, this may be supplemented by the verifier, summary punch, reproducer, interpreter, collator, and others.

Pupil Accounting. The process of recording, storing, and retrieving all data pertinent to pupil personnel.

Reproducing. Punching data from one set of cards into another set of cards.[12]

Sub-Population. Any homogeneous grouping of parts within the parameter.

System Design. A detailed outline and description of procedures to follow in performing a prescribed record keeping task.

Tab Room Supervisor. The person responsible for the technical operation of all equipment and functions in the data processing room.

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[11] International Business Machines, Machine Functions (New York: International Business Machines, 1957), p. 4

[12] International Business Machines, op. cit., p. 20.

H. METHODS AND PROCEDURES

In order to conduct an investigation in a relatively new field, the investigator prepared himself in the application and utilization of punched card equipment as it pertains to education. Basic punched card courses were taken at the University of Tennessee, and an extensive examination of related literature was conducted in the use of punched card equipment by public schools.

The investigator: (1) attended the Customers' Executive School for Educational Administrators in Endicott, New York, in an attempt to acquire a general knowledge of the problems encountered in this area; (2) attended a Workshop for the Punched Card Processing of Educational Data at George Peabody College, Nashville, Tennessee, to acquaint himself with the national leaders in the field and their problems; (3) attended the annual meeting of the Southern States Council on Educational Research and Statistics in Nashville, Tennessee, to acquaint himself with the problems and demands of local systems from the state level; (4) visited public school data processing systems in Tennessee; and (5) consulted the data processing instructors at the University of Tennessee as to the problems they were familiar with in the public schools.

The result of the previously described activities was a yield of 120 specific problems encountered by educational administrators in machine data processing. Fourteen overlapping and specific operative problems of technical personnel were deleted from the group. Close scrutiny of these groups gave rise to a comparison with the administrative

processes described by the Southern States Cooperative Program in Educational Administration.[13] The problems were placed into eleven related groups; the additional areas were sub-areas of the original seven administrative processes.

To insure complete coverage of problem areas, a basic instrument of the eleven problem areas was mailed to thirty members of the IBM meeting at Endicott. Respondents were asked to itemize specific problems under each area and to list any other problems or problem areas not provided for in the instrument. An analysis of the results of this instrument verified coverage of the problem areas as well as served as a basis for selecting eleven major problems to be used in the national survey.

An introductory letter was forwarded to the chief administrator of all public school systems employing IBM equipment in record maintenance. The significance of the study was explained and their cooperation solicited.

Each IBM practitioner agreeing to participate in the study was forwarded a composite of basic problems to rank according to their relative difficulty. General information also was requested in the instrument for the purpose of categorizing the parameter into subpopulations according to size, age, and type of installation. Kendall's Coefficient of Concordance: W (see ref. 14) was employed to ascertain

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[13] Southern States Cooperative Program in Educational Administration, Better Teaching in School Administration (Nashville: McQuiddy Printing Company, 1955), pp. 123-124.

[14] Siegel, *op. cit.*, p. 229.

the agreement within the population as to the relative difficulty of the problems. A formula presented by Siegel[15] which approximates a chi square distribution was employed to determine the level of significance by comparing the rank-order among subpopulations.

Treatment of subpopulations ascertained the change of rank-order importance as the enrollment size, type of service, or age of the installation varied. Guidelines for determining chronology and intensity of treatment for the respective problems resulted from the previously described procedures. Solutions to the previously defined problems were derived from commonalties of solutions or circumventions by effective systems.

A jury of national experts facilitated the determination of effective systems. Criteria for selecting the jury members were:

1. Extensive experience with punched card processing of educational data.

2. Current employment in some phase of data processing on a level of greater scope than the local school district. For example: state, national, manufacturer, or university level.

3. Recognition as a leader in data processing.

4. Familiarity with IBM installations in public schools and the quality of their operation.

An interview guide was constructed as a basis for surveying the effective systems. Complete case reports of the treatment of problems

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[15]Siegel, <u>op</u>. <u>cit</u>., p. 236.

by the systems adjudged effective are presented in Appendix C.

The preceding abstract of methods and procedures was presented to provide the reader with a brief but meaningful background of the present research. Detailed description of data gathering was logically reserved for a subsequent chapter.

I. ORGANIZATION OF THE STUDY

Chapter I includes the general background, statement of the problem, hypotheses, assumptions, significance of the study, limitations, definitions, methods and procedures, and organization of the study.

A review of related research and relevant literature is presented in Chapter II. Literature and writings depicting the development of punched card processing of educational data and assisting the investigator in the identification of problems are treated according to their significance. A summary of the chapter sought to present a synthesis of developments and research pertinent to the study.

Detailed procedures for identifying problems and the resultant instrument of investigation are presented in Chapter III. The procedures used in identifying the problems, refining them, and reducing them to eleven administrative problems are given thorough treatment. The chapter summary reviews the process for developing the instrument of investigation.

Chapter IV affords a discussion and delineation of the problems eventuating from the activities related in Chapter III. The chapter summary abstracts the findings.

Chapter V contains a tabulation of the data from educational

administrators and the statistical analyses. The degrees of concordance, levels of significance, and the rank-orders of the problems are ascertained for the parameter and subpopulations. The summary outlines the findings.

Chapter VI presents a compilation of solutions or circumventions to each problem area as described in the case reports in Appendix C. The summary abbreviates the findings.

Findings, conclusions, and recommendations presented in Chapter VII incorporate the results from literary investigation, questionnaires, statistical analyses, and interviews.

CHAPTER II

REVIEW OF RELATED LITERATURE

A. INTRODUCTION

The results of an intensive search of related literature are presented in this chapter. Literature which portrayed the development of punched card processing of educational data and assisted the investigator in the identification of problems is treated according to its significance.

The year 1960 marks the end of the second decade of machine data processing for science and industry. Prior to 1940, industrial and scientific applications had not reached a high degree of popularity. The international crises of the 1940's stimulated expansive scientific and technological development which demanded a more efficient process for the treatment of data. Acceptance of machine and electronic data processing during the ensuing twenty years resulted in voluminous literature for diverse industrial and scientific applications.

If 1940 was the beginning of the contemporary era of data processing growth in science and industry, 1950 marks the counterpart for its significant debut into education. However, Chicago City Schools had a punched card application as early as 1928.[1] Neither the manufacturer nor school personnel looked upon machine data processing as

[1]E. E. Ahnell, Data Processing Sales Representative, International Business Machines Corp., in a talk before Public School Administrators' Class No. 6036, March 22, 1960, Endicott, New York.

offering much potentiality for educational records until about 1950. Increased use of punched card equipment in public schools reflect acceptance of its potential.

Contact with data processing administrators in public schools revealed a dissatisfaction with the rate of comprehensive development in their respective schools. Therefore, a search of the literature sought to identify the problems which were impeding development.

The nature of literature located by the investigator was aptly described by Stibal:

> Punched card methods for student reports have not been adequately related to the educational framework within which these methods operate. Practically all of the literature on punch card methods consists of some discrete aspect of student records or a description of certain records and their construction. Much of the educational literature is on statistical application of IBM machines.[2]

Literature dealing with punched card methods was limited, and literature dealing directly with problems encountered by educational administrators was meager.

The sporadic nature of literature caused the investigator endless hours of futile searching. The first concept of the investigator was that the literature was poorly indexed. Intensive search revealed that there was little information dealing directly with this study to catalog or index. Alsop _et al_.[3] offered a very promising bibliography

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[2]Willard Stibal, "A Review of the Literature Concerning Hollerith-Type Punched Cards Methods in Connection with Student Records and Reports," _College and University_, 29:414, April, 1954.

[3]Joyce Alsop, Ann D. Franklin, and Eric D. Hankam, International Business Machines Corporation, _Bibliography on the Use of IBM Machines in Science, Statistics, and Education_, (Endicott: the Corporation, 1956).

on the use of IBM machines in science, statistics, and education. Close scrutiny of the references failed to yield a single article pertaining directly to problems in processing educational data. Ample literature was available in such areas as numerical analysis, computer logic, computer engineering, scientific applications, and business applications.

Literature presented in the remainder of the chapter was from related studies, periodicals, and manufacturer publications.

B. RELATED STUDIES

Four studies were located which involved punched card procedures in education. Crum[4] attempted to develop and demonstrate a method by which selected activities of a uniform school accounting system could be interrelated and adapted for punched card accounting procedures. The study was limited to the area of child accounting in the public schools of Englewood, Colorado. Items of information needed by the school district superintendent were tabulated from the report forms currently being prepared. The items were tabulated on interrelationship charts constructed for this purpose. Two categories were used: (1) those adaptable to punched card procedures and (2) those not adaptable to punched card procedures. Abbreviated punched card procedures were designed for those items classified as adaptable. A demonstration of the procedures were favorably evaluated by a jury.

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[4]Lewis Russell Crum, "The Development of a Method of Interrelating Selected Activities of a Uniform School Accounting System Utilizing Punch Card Accounting Procedures and a Demonstration of the Method in the Area of Child Accounting," unpublished Ed.D. thesis, University of Denver, 1957.

Walker[5] studied the present status and planned utilization of machine punched card procedures in large city school systems. Emphasis was directed mainly at school systems which used punched card machines for school census. One hundred six cities with populations over 100,000 were surveyed. Forty-one school systems indicated that they were utilizing certain machine punched card procedures in record keeping. Fifty-nine school systems were not nor did not plan to use machine punched card procedures. Six school systems were not utilizing punched card procedures but planned to in the future. A more intensive study was directed at 16 of the 106 school systems which were utilizing punched card procedures for school census. A procedural design was developed for school census in large city school systems, and recommendations were made for the possible application of punched card procedures to other pupil accounting areas.

Gruman[6] attempted to determine the high school records and services facilitated by the use of punched cards. The study was of national scope, and securing an updated list of schools and districts utilizing punched cards was a problem experienced by Gruman which has not been alleviated. The techniques used to secure the list appeared to be exhaustive and thorough. Sixty-seven schools or districts were located, but only 28 provided one or more pupil personnel services. Districts

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[5]Virgil R. Walker, "The Utilization of Machine Punched Card Procedures in Large Public School Systems," unpublished Ph.D. thesis, University of Minnesota, 1957.

[6]Allen Jepson Gruman, "High School Records and Services Facilitated by the Use of Punched Cards," unpublished Ed.D. thesis, University of Southern California, 1958.

providing only financial and test scoring services were eliminated. The parameter was composed of 20 schools which returned the major instrument of investigation. Class scheduling-registration and report cards were the most frequently performed on punched cards.

Some of the problems of machine data processing, identified by Gruman, which proved beneficial to this study were:

1. Changing the habits of teachers.
2. Changing office routines of clerks.
3. Training or securing competent machine operators.
4. Designing adequate punched cards.
5. Training or securing competent administration of the program.
6. Securing the machines and supplies.[7]

Attendance accounting was inhibited by the state regulations in California which required absences to be reported in terms of 5 per cent increments of the minimum school day.

Anderson[8] conducted a study of the problems encountered in the installation and utilization of automatic accounting machines in secondary schools. Problems were identified through attendance of the manufacturer's school for educational administrators and by visitation to ". . . _all_ secondary schools _known_ to be utilizing these machines."[9]

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[7] _Ibid_., p. 141.

[8] Calvin E. Anderson, "A Study of the Problems Encountered in the Installation and Utilization of Automatic Accounting Machines in Student Record Keeping in Secondary Schools," unpublished Ed.D. thesis, Teachers College, Columbia University, 1958.

[9] _Ibid_., p. 5

However, this was reduced to four schools, three in Chicago and one in New York. One of the four schools was in semi-operation pending delivery of punched card equipment.

Thirty schools utilizing IBM equipment were located by Anderson. He acknowledged that the selection was not complete due to the failure of any agency to develop an up-to-date list of users. Four questionnaires were sent to each school. One questionnaire was directed to administrators of the schools; eight of the nineteen returns were not usable. Three different questionnaires were directed to teachers through their administrators; 10 of the 91 returns were not usable.

Much of Anderson's study, especially the summarization, was devoted to the advantages of punched card procedures in education. The most beneficial findings by Anderson relating to this study were: (1) inadequate preplanning in punched card operations, (2) lack of educational know-how by service-bureau personnel, (3) inadequate orientation program, and (4) inability to fully utilize IBM machines in all phases of student personnel accounting.

C. PERIODICALS

Related studies previously presented in this chapter were completed between 1956 and 1958. Collectively, the writers gave a comprehensive review of periodical literature prior to the dates of their respective studies. To avoid redundancy, periodical literature published prior to 1956 is not presented in this section.

Machine operators and administrators with competence in machine

data processing have not been sufficiently available to public schools. Murphy[10] indicated that similar problems prevailed in industry. He also speculated that it resulted from the failure of universities, manufacturers, associations, publishers, and management consultants to assume their respective responsibilities to the development of thorough training programs. As a possible solution, he recommended a unified effort by all responsible agencies, possibly led by the professional associations.

Jones describes more explicitly the situation in industry:

> For the past few years, managerial and/or executive positions in the data processing field have been filled predominantly with competent graduates in areas such as the sciences and engineering. Industrial employers tend to agree that business graduates with backgrounds in data processing are much more desirable. Further comment from the same source would reveal that this situation exists primarily because of the insufficient supply of business graduates with a concentration in data processing.[11]

If industry is unable to secure an adequate supply of business graduates with a concentration in data processing, public schools probably are not able to secure a supply of education graduates with a concentration in data processing.

Rose[12] described the advantages of machine data processing at Rockford (Ill.) West High School. Machine scheduling and registration enabled classes to start one hour after school convened on the first day.

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[10] Eugene F. Murphy, "Automation Education," The Punched Card Semi-Annual (Detroit: Gille Associates, Inc., 1960), pp. 10 - 11.

[11] Vincent H. Jones, "Data Processing Education at the University Level," Data Processing, 2:9-10, June, 1960.

[12] J. E. Rose, "Student Accounting by Automation," Overview, September, 1960, p. 30.

Basic punched card equipment at the school site were keypunches and a sorter. A nearby IBM service bureau was employed to do all printing. Machine accounting for absences allegedly reduced truancy to a minimum because of the speed with which absences were processed. Grade cards were mark sensed by the teacher, and report cards were printed by the service bureau. Other advantages of machine processing experienced by Rose are described in the following statement:

> The by-products of the machine are many. When the superintendent called for a list of failures in beginning Latin, he was given the information within a few minutes. In a short time, the machine will give a complete list of sophomores, for instance, or a list of students in any one class, or in any study hall. It will separate the boys from the girls, list the failures, the incompletes, or those irregular in attendance. It is used to distribute lockers and to address mail to students' homes.[13]

According to Kern,[14] data processing equipment enabled better staff utilization in the Willoughby-Eastlake City School District, Ohio, by freeing teachers of many clerical duties. Other advantages included:

1. Less clerical work for teachers.
2. Rapid access to information.
3. Rapid production of records and reports.
4. Additional research activities.
5. Increased opportunity for greater pupil-teacher contact and greater information for use in counseling situations.
6. Increased accuracy.

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[13]*Ibid*., p. 32

[14]Willis P. Kern, "Teachers Need Not Be Clerks," School Management, 4:76-80, May, 1960.

7. A more efficient operation in line with good business practices.

Some school administrators have been apprehensive about acquiring punched card equipment because of the costs involved. Costs for manually processing student records are difficult to determine in dollars and cents because of the teacher time involved. Teacher time is often not considered to be a direct cost in calculating the cost of student records, even though it is the most expensive item in terms of personnel involved. However, the penalty for denying a student a full day of instruction because of record-keeping duties imposed on the teacher cannot be measured in monetary dimensions. Speaking emphatically about tangible costs, Spencer[15] stated, "There can be no doubt but that punched card accounting will save money." To substantiate the claim, the data processing program which he administered in Jackson (Michigan) City Schools cost between $1.00 and $1.50 per student per year.

Small schools or systems often hesitate to consider punched card procedures because the minimum enrollment which can profit by the procedures has not been ascertained. The only evidence identified by the investigator were isolated cases described in periodic literature. Burles[16] described the punched card methods employed by the Marshfield Senior High School in Coos Bay, Oregon. Class scheduling and grade reporting were processed for 1300 students by a service bureau. The

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[15] Richard E. Spencer, "Do Punched-Card Methods Save Money?" School Management, 2:35-38, August, 1958.

[16] John Burles, "So You Think You're Too Small for Punch-Card Methods?," School Management, 3:46-48, June, 1959.

service bureau, located 231 miles from Coos Bay, returned grade reports two days after marked sense grade cards were received.

Russell[17] proposed a solution for school districts considered too small for data processing. Forty-seven independent school districts in Santa Clara County, California, pooled their resources and established a central data processing center. The central installation processed business office records for each of the 47 districts. The center wrote and processed 172,000 warrants worth $89 million in 1958-59.

Nyack Senior-Junior High School, Nyack, New York,[18] selected punched card equipment to process records of 1300 students. Machine rental was approximately $400 per month. One machine operator processes report cards, attendance records, permanent records, and scheduling.

Some of the literature in periodicals presented specific punched card applications. However, they were general and designed for popular consumption. Publishers generally restrict writers to three or four pages for explaining a technical punched card application. Therefore, the result is brief, general articles. An article by Rhein[19] on transportation was an exception. In only four pages, Rhein gave a detailed description of the process for transportation control in the Farmingdale

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[17] O. D. Russell, "Data Processing for Smaller Districts," School Management, 4:86-88, April, 1960.

[18] School Management, "Look How They've Simplified High School Scheduling," 1: 59-61, September, 1957.

[19] Charles Lyons Rhein, "Public School Transportation Control," The Punched Card Data Processing Annual, (Detroit: Gille Associates, Inc., 1960), pp. 218-220.

(New York) Public Schools. A surveyor was employed to establish a mileage line to every home in the district from every school in the district. The lines divided the district into circular, target-like zones. The zones were coded from 0 to 9 according to distance from the school. Student census cards were sorted geographically and the zone codes were gang punched into the cards. From these data, the entire transportation program was machine processed, which included bus rider eligibility, transportation passes, rider lists, walker lists, bus assignment, and accuracy control.

Hamhila[20] delineated the punched card scheduling of the Carl Hayden High School, Phoenix, Arizona. Class cards are punched for the maximum number in each class offered. Class cards are placed in a pigeon-hole box arranged similarly to the master schedule. Student enrollment cards serve as a reference to pull class cards for each student. The student enrollment card is filed with one class card for each period of the day. Student schedules and teacher class lists are printed from these cards.

D. MANUFACTURER PUBLICATIONS

International Business Machines Corporation has published many bulletins in an effort to supply their customers with information necessary for maximum utilization of IBM equipment. The bulletins are highly specialized, relatively technical, and diverse in applications. School administrators have complained about being unable to understand the

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[20] Matt O. Hamhila, "Punch Card Scheduling," <u>Overview</u>, June, 1960, p. 18.

manufacturer publications. A portion of the lack of comprehension probably resulted from lack of training in data processing. The sequence of manufacturer publications presented in the remainder of the section are arranged from the simple to the complex. If read according to sequence, the educational administrator, untrained in data processing, should find the bulletins more comprehensible.

An Introduction to IBM Punched Card Data Processing[21] presents a simplified overview of fundamental processes. The bulletin is designed for general use, not specifically for education, but basic fundamentals are the same for both education and industry. Some of the items covered in the bulletin are: fundamentals of the punched card, simple coding, punching, sorting, printing, and prepunching. Machine Functions[22] is an excellent supplement to the introductory bulletin. Pictures of data processing equipment are depicted along with their functions.

After covering the two previous bulletins, Public Education Student Records[23] was more comprehensible to the investigator. The bulletin is divided into five major categories: (1) census records, (2) attendance records, (3) registration, (4) grade reporting, and (5) program evaluation. Each category contains sample forms, cards, and flow charts for each procedure.

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[21]International Business Machines Corporation, An Introduction to IBM Punched Card Data Processing, (White Plains, New York: the Corporation).

[22]International Business Machines Corporation, Machine Functions, (New York: the Corporation, 1957).

[23]International Business Machines Corporation, Public Education Student Records, (New York: the Corporation).

In planning the activities of a data processing department, it is important for the administrator to develop the fastest, most accurate, and most economical procedures. Procedure Development[24] covered objectives, source documents, and actual construction of procedures. The bulletin was developed primarily for industrial application but underlying principles of a good procedure do not vary between industry and education.

In order to determine time factors for assigning and evaluating all operations, the administrator must be familiar with the productive capacity of the equipment. In addition to machine speeds, Work Loads[25] treated factors which might enhance or impede production.

Code construction requires a full awareness of all variables in the area to be processed. Classification of data (coding) must be in terms of retrieval requirements. Modern Coding Methods[26] presented guidelines for developing codes as well as some specific methods of coding.

E. SUMMARY

An exhaustive search produced a limited amount of literature pertaining specifically to problems encountered by administrators of data processing installations in public schools. Four research studies

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[24] International Business Machines Corporation, Procedure Development, (New York: the Corporation, 1956).

[25] International Business Machines Corporation, Work Loads, (New York: the Corporation, 1955).

[26] International Business Machines Corporation, Modern Coding Methods, (New York: the Corporation).

were located which dealt generally with the area of data processing in public schools.

Articles in professional periodicals pertaining to machine processing of educational records were relatively plentiful. Many of the articles were general in nature and referred largely to the benefits reaped from the machine process. Other articles dealt with a specific application but often were brief due to space limitations by the publisher. Few problems were identified in periodicals.

Manufacturer publications were plentiful but specific in nature. As might have been anticipated, manufacturer publications did not deal with problems encountered in the process. However, if the publications had been read, understood, and followed by educational administrators, a study of problems might not be justified.

The disappointing yield of problems from the literature necessitated more intensive procedures. Procedures deemed necessary to satisfactorily identify the problems encountered by administrators of data processing installations in public schools are delineated in Chapter III.

CHAPTER III

PROBLEM IDENTIFICATION AND DATA COLLECTION

A. INTRODUCTION

The effort to identify problems encountered by educational administrators in the administration of data processing units in public schools was not intended to reflect negatively on the potential of the procedure. As indicated in Chapter I, data processing was perceived to be worthy of investigation from the standpoint of its potential utility to education.

One of the roles of the administrator is that of the problem solver. The diversity of subjects and fields represented in education makes it impossible for the administrative leader to possess detailed technical knowledge of every field under his direction. Administrative functions entail similar characteristics whether in education, industry, or government. Successful transition of administrators from the military to government to industry offers some evidence of the kindredship of administration in different fields. The military and industry have two entirely different missions, yet administrators have been transferred from one to the other without apparent effect upon their performance. In many cases, the administrator possessed technical know-how of the mission from which he was transferred but was technically unprepared for the mission of his new employ; yet, he performed successfully in the new field. Absence of technical knowledge does not predict administrative failure, nor does infinite technical knowledge in a field ensure administrative success.

Consideration of the components of administration offers enlightenment

on the successful transition of administrators from one field to another. Administration, whether in education, industry, or government, refers to a human activity that involves a minimum of four components:

1. The Task
2. The Formal Organization
3. The Work Group (or Work Groups)
4. The Leader (or Leaders)[1]

Inference that technical know-how is irrelevant to the success of the mission of an organization is not intended. Technical know-how is a desirable quality of the administrator, but it is an essential ingredient among the work groups and the subgroup leaders. This is an advantage that the previously mentioned administrators have had in industry and government; work groups and subgroup leaders of reasonable technical competence were inherited. The mission of the organization did not change as a result of the transferred administrator, but certain operations and activities were modified to enable a more efficient accomplishment of the task.

Educational administrators apparently have not enjoyed an advantage similar to industry in the transition from manual to punched card record keeping procedures. Teachers, supervisors, principals, superintendents, and most clerical employees were not trained in the use of punched card equipment--a tool developed primarily for industrial and scientific application. However, decisions have been made by school

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[1] Roald F. Campbill and Russell T. Gregg (Eds.), Administrative Behavior in Education (New York: Harper and Brothers, 1957), p. 161.

administrators to innovate the system of data collection, storage, retrieval, and dissemination through the implementation of punched card equipment. Such daring innovations were destined to produce many problems. An attempt was made in this study to identify these problems and seek possible solutions. The following sections in this chapter are devoted to the procedure for identifying, verifying, and determining the relative difficulty of these problems.

B. IDENTIFICATION OF PROBLEMS

Literature

At the outset of this study, it was assumed that most of the problems encountered by administrators in this area could be identified through an extensive search of the literature. Chapter II revealed the scarcity of pertinent literature. However, the literature did serve to strengthen the knowledge of the investigator and increase his competence to conduct a study in the area. Related studies by Anderson,[2] Gruman,[3] and Walker[4] were the most beneficial sources of problems. The periodic literature dealt more with application procedures and their respective

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[2]Calvin E. Anderson, "A Study of the Problems Encountered in the Installation and Utilization of Automatic Accounting Machines in Student Record Keeping in Secondary Schools," unpublished Ed.D. thesis, Teachers College, Columbia University, 1958.

[3]Allen Jepson Gruman, "High School Records and Services Facilitated by the Use of Punched Cards," unpublished Ed.D. thesis, University of Southern California, 1958.

[4]Virgil R. Walker, "The Utilization of Machine Punched Card Procedures in Large Public School Systems," unpublished Ph.D. thesis, University of Minnesota, 1957.

successes. Successes were more readily revealed by individuals than were their failures. Therefore, few problems were obtained from a search of periodic literature. The disappointing yield of problems from literature forced the investigator to alter the point of concentration and rely more heavily upon personal contact with practitioners in the field of data processing.

Manufacturer's School

International Business Machines Corporation sponsored a Customer Executives' School for Educational Administrators at Endicott, New York, in March, 1960. The investigator, a teaching assistant at the University of Tennessee, attended the school under the auspices of the University. The school was of five-day duration and was attended by forty-seven representatives from school systems and colleges throughout the nation. Most of the representatives were charged with the responsibility of the data processing installation in their respective systems. However, several of these people were new in data processing and had no previous experience with punched card equipment. Others represented systems of sophisticated development that were from five to ten years old.

The general pattern of instruction was lecture, demonstration, and group discussion of educational applications of punched card procedures. Group discussions were generally led by the more experienced class members. The educational applications were dominated by business office accounting. Numerous periods spent on payroll and encumbrance accounting appeared unjustifiable when considering the numerous applications of student accounting.

All problems presented in discussions with the representatives and the lectures of instructors in the school were recorded. Many of the problems presented were of a mechanical or technical nature. Indirectly, they could be classified as administrative in that they dealt largely with factors which could be included in a training program for operative personnel.

Data Processing Workshop

George Peabody College for Teachers, Nashville, Tennessee, sponsored a Workshop for the Punched Card Processing of Educational Data in July, 1960. Approximately 100 people were in attendance for one week. Membership consisted of public school administrators, state department of education personnel, and advanced graduate students.

Lectures, machine demonstrations, and group-discussion sessions were conducted by manufacturer representatives and experienced administrators in the field of educational data processing. Activities of the workshop were directed by a U. S. Office of Education specialist, a public school business manager, two superintendents, and a state director of statistical services--all of whom had varied experiences in their respective systems with the installation and administration of punched card equipment. The specialist in data processing from the U. S. Office of Education was the major contributor to the list of administrative problems. His experience entailed work with most of the schools in the nation with data processing installations. The investigator secured a two-hour interview with this specialist and obtained additional problems not covered during the regular sessions.

All problems identified at this meeting were recorded. After being checked for possible duplication, the problems were added to the previously compiled list.

Annual Meeting of State Directors of Educational Research and Statistics

Several state departments of educational research and statistics have furnished leadership to local school systems in the development of their data processing procedures. Consequently, their experiences appeared significant to this study. The annual meeting of the Southern States Council on Educational Research and Statistics at Nashville, Tennessee, August 16-17, 1960, was attended by the investigator. Although it appears essential for the operation of a state school system, much of the data on the local level would not be collected were it not for demands of state departments. Two primary concerns of these directors were improving the vehicle through which statistical data flows to the state department and furnishing assistance to the local systems in installing punched card equipment. Problems on the state level supplemented the previously collected list as well as giving the investigator new insights to problems on the local level. For example, local systems have encountered difficulty in adapting state report forms to punched card processing. The state department has been unable to change the procedures in several instances. The chief reason is that the record-keeping demands were legislated, and the state educational department was helpless in changing regulations without a legislative enactment.

In a representative form of government, legislation theoretically reflects local demands. Therefore, the state departments have been

accused of creating difficulties that could only be resolved by legislation which must be initiated by legislative representatives from local systems.

Other Sources of Problem Information

Additional problems were identified through intermittent contacts with manufacturer representatives during the previously described procedures. Two public school systems with data processing installations were visited during the same period. The equipment had only been installed for two weeks in one system. At this point, the limitation of experience inhibited a clear identification of problems. The other systems was a quasi-service-bureau operation. Their equipment was limited to a key-punch and a sorter, and most of their processing was done by a nearby industrial or university punched card installation. Census cards were the only punched card application in this system.

Information collected from these sources consisted mostly of previously defined problems.

C. VERIFICATION OF PROBLEMS

A compilation of the problems identified through the previously described activities revealed 111 questions or statements about difficulties encountered in the installation and administration of punched card data processing installations. Some of the problems were partially overlapping, closely related, or actually subproblems of major problems. In an attempt to secure verification of the problem list, they were categorized according to kindredship into ten problem areas. More detailed description of the problems and the resulting categorization are

presented in Chapter IV.

An instrument was developed containing the ten problem areas (see Appendix A). It was mailed to thirty members attending the manufacturer's school in March, 1960, who were directly connected with public schools. The remaining seventeen representatives of the class were connected with colleges and private schools. Therefore, they were eliminated because the central focus of the study was on public schools. The instrument listed the previously identified problem areas and asked the participants to itemize any difficulty they had experienced in each area. They were further requested to list additional problems or problem areas which were not provided for by the ten areas listed.

The members attending the manufacturer's school were selected as participants in this phase of the study for the following reasons: (1) they were practitioners in the field of educational data processing and represented a wide geographical range; (2) the data processing installations represented by this group ranged from an individual high school with an enrollment of 600 to a large metropolitan system with an enrollment of over 100,000; (3) the age of their data processing installations ranged from less than one year to over ten years; and (4) the instrument required considerable time to complete, and the investigator relied upon previous, personal acquaintance to elicit an adequate response.

Twenty-two of the thirty members responded to the cover letter (see Appendix A). One respondent failed to complete the questionnaire because of the time involved. Another respondent felt his experience was insufficient to validly complete the questionnaire; punched card

equipment had been purchased for his system but had not been delivered. Another respondent stated that the system had decided against purchasing punched card equipment after his attendance at the manufacturer's school. Nineteen questionnaires were used to substantiate as well as supplement the previously collected list of problems. Each of the 11 previously identified problems were compared with the questionnaires to determine whether the respondents had experienced similar problems. Eighty-nine of the problems were listed on at least one questionnaire. In addition, a new problem area and twenty-three new problems were identified, bringing their respective totals to 11 and 134. Fourteen overlapping and specific operative problems were eliminated, leaving a net total of 120 problems.

D. RANKING OF DATA PROCESSING PROBLEMS

After the completion of problem-identification procedures, a population was selected to establish the relative difficulty of the problems. Procedures for selecting the population and a description of the instrument of investigation are presented in the following section.

Population

Method of Securing Names and Addresses. The desired population for this phase of the study consisted of all public schools and school systems employing IBM data processing equipment for the maintenance of business office and/or student records. Although forewarned by Gruman,[5]

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[5]Gruman, *op. cit.*, p. 9

securing an up-to-date list of schools utilizing punched card equipment presented more difficulty than had been anticipated. An up-to-date list of IBM customers in public schools was not available. The most recent list had been compiled by the manufacturer in 1959. The 1959 customer list was combined with a previous one from 1957. The consolidation of the two was supplemented by the names of twenty-seven schools furnished by IBM sales representatives. Obviously, this list was incomplete because the investigator knew of several schools with IBM equipment which the manufacturer sources failed to yield. An intensive campaign among personal contacts with practitioners in the field yielded fifteen additional names. California was the only state department contacted which responded with an up-to-date list of schools with data processing installations. Final compilation produced 294 schools or school systems which seemingly were utilizing IBM equipment to some extent.

Securing addresses of these schools was difficult because the only reference to most of their locations was the state in which the school was located. A directory from the U. S. Office of Education[6] proved most beneficial in securing the name and address of the chief school administrator for each of the 294 schools. Several of the 294 schools on the list were suspected of not qualifying for participation in the study. Strong possibility existed that some schools only utilized IBM test scoring equipment or had discontinued punched card procedures.

Method of Eliciting Response. In order to determine the status

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[6] U. S. Office of Education, Education Directory: Counties and Cities 1959 - 1960, Part 2 (Washington: Government Printing Office, 1959).

of the schools in regard to data processing and elicit cooperation in this study, correspondence was mailed to each of the 294 schools (see Appendix A). A multilithed postal card asked for the name and address of the administrator within the system charged with the responsibility of directing the data processing program (see Appendix A).

Of the 181 replies from the previously described correspondence, only 155 were eligible for participation in the study. Table I presents the reasons for eliminating those offering to participate in the study. Most of the persons eliminated were aware that the study was limited to IBM installations; but they offered their cooperation and requested a copy of the results of this study.

Instrument of Investigation

A two-page instrument was developed that would record general information as well as provide an opportunity to rank eleven frequently encountered problems (see Appendix A).

General Information. The first part of the questionnaire, Data Processing Problems of Public Schools, sought to establish a profile of the educational personnel charged with the responsibility of administering the data processing system. The second part of the questionnaire, was designed to provide information necessary to categorize the participating systems according to enrollment, type of service, and age of installation. Categorization of the rankings according to enrollment, type of service, and age of installation was expected to afford an opportunity to ascertain the agreement of difficulty within each category.

TABLE I

REASONS FOR ELIMINATING SYSTEMS AGREEING
TO PARTICIPATE IN THE STUDY

Reasons for Elimination	Number Eliminated
IBM service discontinued	3
Remington-Rand punched card equipment	1
National Cash Register equipment	1
Used IBM punched card equipment for instruction only	2
IBM test scoring only	7
No IBM equipment	12
Total	26

Problem Ranking. Each of the eleven problems on the second page of the questionnaire are representative condensations of the subproblems encountered by the investigator in each area. A synthesis of each problem was printed in bold type along with a more complete explanation in finer type. The purpose of this design was to emphasize the area if the respondent would not take time to read the entire statement. The bold-type synthesis also permitted the problems to be considered in "capsule form" while being ranked according to difficulty.

Adjacent to each problem were two columns of squares in which the problems could be assigned ordinal ranks according to their difficulty. The five most difficult problems were ranked from one to five in the first column, one being the most difficult. The five easiest problems were ranked from one to five in the second column, one representing the easiest in the entire group. If directions were followed correctly, the squares adjacent one problem were blank. To establish a continuous ordinal rank from one to eleven, the ranking of the first column, one to five, remained as marked. The unmarked problem was ranked six, and the order of the second column was reversed: five ranked seven, four ranked eight, . . . , and one ranked eleven.

The procedure for ranking permitted rank difference to be determined from a base of five considerations instead of eleven.

Participating Schools or Systems. Each of the 155 schools qualifying for participation in the study was compared with the 294 schools on the original list. The investigator recognized 21 schools utilizing punched card equipment on the original list which had not responded to

previous correspondence. The previously described, two-page questionnaire was mailed to the 155 cooperating schools along with a cover letter (see Appendix A). The 21 additional schools, known to have punched card equipment, were forwarded the same questionnaire with a different cover letter (see Appendix A). The total possible population for this phase of the study was 176 schools or school systems. Discussion and analyses of the data secured from this instrument are presented in Chapter V.

E. SOLUTIONS OR CIRCUMVENTIONS OF PROBLEMS

Solutions or possible circumventions of the previously defined problems were sought from commonalities of treatment by effective data processing installations in public schools.

Effective Data Processing Installations

Three persons, meeting the criteria stated in Chapter I, agreed to serve as the jury to select the schools in the East with effective data processing installations. The criteria for selecting the schools were:

1. The data processing installation must be evaluated as outstanding by the jury.

2. The installation must be utilizing punched card equipment in at least two phases of pupil accounting.

3. A minimum of one phase of pupil accounting must be outstanding by the concensus of the jury.

Six schools which met the criteria were selected by the jury for visitation by the investigator. A personal interview was scheduled by

telephone with the administrators of the data processing installations in each of the six schools.

Interview Guide. To insure complete coverage of the 120 subproblems of the eleven problem areas, an instrument was designed to guide the interviews (see Appendix A). Case reports of the six systems are presented in Appendix C. Commonality of solutions or circumventions to the problems are presented in Chapter VI.

Visitation. Four of the six schools were located in the North and were visited by means of automobile; the remaining two were in the South and were visited by way of commercial airlines. Total travel required for the visitations was approximately 5,000 miles. Approximately three weeks were required for all visitations.

F. SUMMARY

Adaptation by school administrators of punched card procedures to the maintenance of educational records was a daring innovation. Success of this vehicle in supplying industrial administrators with vital data upon which to base decisions sparked the movement in public schools. Absence of technical or other resources produced many problems.

The investigator's attempt to identify the problems, through a search of the literature, proved futile. Extensive personal contacts with administrators of data processing installations in public schools was imperative for the identification of problems. A manufacturer's school, a data processing workshop, a meeting of state research and statistical directors, and visitation of data processing installations

in public schools provided the personal contact with the practitioners in the field of data processing. One hundred twenty subproblems grouped under eleven areas are presented in Chapter IV with descriptive analysis provided

A questionnaire was developed which afforded a ranking of eleven problems representative of those encountered by this investigator. Accompanied by a cover letter, this instrument was forwarded to 176 schools or school systems utilizing punched card equipment for maintenance of student or business office records. Analyses of these data are presented in Chapter V.

Solutions or possible circumventions of the problems were sought from schools with data processing installations which were evaluated as effective by a national jury of experts. An interview guide was constructed to insure full coverage of the subproblems within each area. Case reports of each interview are presented in Appendix C. Congruous solutions or circumventions are presented in Chapter VI.

CHAPTER IV

PROBLEM DELINEATION

A. INTRODUCTION

Specific problems resulting from the procedures described in the previous chapter were assembled according to similarity into eleven groups. The eleven groups or problem areas are delineated in this chapter.

Two instruments of investigation were developed from the data presented in this chapter--problem ranking and interview guide (see Appendix A). The 120 specific problems (raw data) were analyzed and categorized before the remainder of the data could be collected.

B. PROBLEM AREAS

Problem areas presented in this section are: inadequate planning, selection of equipment, insufficient orientation of personnel, insufficient supply of operative personnel, undesirable organization, inadequate coding, unsuitable report forms, inflexible government reports, unavailability of technical information and assistance, inability to fully utilize machine processing of student records, and inability to fully utilize machine processing of business records. Each area is introduced by a broad statement of the problem in order to give the reader an overview of the problem. A delineation of the problem describes the specific facets of difficulty within each area. Each problem area is synthesized into the major points to give the underlying causes of difficulty.

Inadequate Planning

Problem. Inadequate planning prior to and after the installation of equipment was a deterent to the development of some installations.

Delineation. The administrative process--planning--is directly related to many facets of the succeeding problem areas. As an administrative process, it pervades practically every administrative function. However, the isolation of planning into a separate problem area provided independent treatment of difficulties encountered during the early stages of development.

Dissatisfaction was expressed with the amount of time allotted for initial planning after the administration decided to utilize punched card procedures. Delayed delivery of equipment extended the initially allotted period to the point that the personnel directly involved in planning lost some of their enthusiasm. However, a more generally expressed perplexity was the conern over insufficient time allocated for planning.

Manufacturer representatives were generally the sole source of technical assistance. In some cases they were relied upon to the point that the staff felt the representatives were solely responsible for the success of the operation. Others felt that the manufacturer representatives did not spend sufficient time with their installation. The most frequently encountered difficulty was their limited knowledge of the demands of education. The staff knew educational demands, the salesmen knew technical ramifications; but there appeared to be a hindrant to the pooling of resources.

Another complicating factor during preplanning was the inability to identify factors to be considered when changing from manual to a machine procedure. The educational personnel involved did not have sufficient knowledge or experience of the new process to perceive future needs.

Some of the questions of data processing administrators were: How are adequate housing facilities predetermined for the equipment? How are the most suitable applications determined? How many new applications can be started simultaneously?

Most of the problems encountered in this area are indicative of insufficient technical knowledge of the new application. However, educational administrators are required to direct planning in many areas of which their specific knowledge is meager or nil.

Synthesis. Problems directly related to planning center around four questions: (1) How much time should be allowed for preplanning? (2) Who should be involved and to what extent should the staff be utilized? (3) What are the best sources of technical assistance? (4) What factors and decisions should be deliberated during initial planning?

Selection of Equipment

Problem. The basic selection of equipment was not accurately ascertained in some cases and resulted in additional purchases, delayed delivery, and/or slower procedure development.

Delineation. Decision about the selection of equipment probably should be resolved during the preplanning period. However, it is an area highly dependent upon technical knowledge. The chief source of

technical advice for the selection of equipment was from sales personnel of the manufacturer. Several administrators expressed misgivings about recommendations from sales personnel because of the profit motives. Instances were found where equipment was purchased or rented but not needed in the operation for several months. Other schools were forced to purchase additional or faster equipment shortly after installation. In fact, one system rented a Series 50 battery and was forced to completely replace it with faster equipment in less than three months. When encountered by the school superintendent for an explanation of the immediate obsolescence, the salesman stated that he sold the system "all that the market would stand." Much of the technical aspects of equipment will have to be secured from the manufacturer, but several administrators expressed a desire for a source of technical assistance, independent of the manufacturer.

Although not a problem, several administrators speculated the feasibility of utilizing a service bureau until the system was qualified to ascertain their own equipment needs.

Some dissatisfactions expressed with the functional aspects of the equipment were excessive downtime on interspersed gang punch attachment to the 026 keypunch, too many verifiers in relation to keypunches, insufficient number of counters on tabulator, first sorter too slow, and marked sense feature of reproducer fails to pick up marks.

Synthesis. Problems identified in the area of machine selection are depicted in the following questions: (1) How can machine needs be accurately ascertained? (2) Is there a preferred delivery sequence? (3) What are the basic essentials to start a punched card operation

without absolute reliance upon manufacturer representatives?

Insufficient Orientation of Personnel

Problem. The citizens of the community, the school board, and the educational staff in some instances have not given sufficient support to the data processing movement to insure maximum development.

Delineation. Although it is not directly dependent upon technical knowledge, emphasis from every source of inquiry reflected this to be one of the most difficult problems of the entire group. A typical remark about orientation was "Orientation of educational staff is one of the most serious problems and demands as much attention as any other phase of the operation."

Orientation of personnel is definitely dependent upon the administrative process--communication. Innovation of a new procedure requires open lines of communication with all personnel concerned--public, school board, educational staff, and students.

The decision to initiate punched card processing was reached in some cases but financial support was not afforded by the public and school board to permit a full complement of equipment. The public and school administration occasionally conceived the operation to simply entail pushing a button and the machine does the rest. Full staff requirements were not recognized because of this concept.

Perhaps, the mental-set of the educational staff against examination of new techniques was the biggest problem enccuntered in the area.

Innovations made possible through technological development are impressive, but the most important element of a function is the human

one. Many problems encountered in this area resulted from situations similar to the following statement of one participant in a workshop: "The educational staff is an important key to the success of the operation. We became engrossed with the technical aspects and forgot about the human element. Serious morale problems arose."

Teacher personnel disliked changing their procedures of record keeping. The disinterest or lack of confidence in performing an old task a different way created unnecessary errors when the teacher had to supply the source information. Office personnel often feared replacement.

In most cases the regular office personnel were not trained in punched card operations; thus, the advent of the new procedures created a threat to their position. Concern over the future of their job lowered morale and performance comparable degrees, and endangered the success of the entire operation. In substantiation of this, Dr. Charles K. Pullen stated, "One dissatisfied person, whether teacher or secretary, through devious means can prevent the success of any punched card operation."

Synthesis. Problems described in this area might be allayed if the following questions were answered: (1) What information should be communicated to the public, school board, educational staff, office personnel, and pupil personnel? (2) What precautions should be considered when dealing with these people? (3) What are the most efficient channels of communication with the different groups?

Insufficient Supply of Operative Personnel

Problem. Inability to employ personnel with a dual understanding of both data processing and education restricted the adaptation of punched

card equipment to educational uses.

<u>Delineation</u>. A staff of competent personnel is always a concern of administrators, whether engaged in a technical or professional endeavor. The initial consideration for a source of operative personnel was generally from among the ranks of the clerical staff. If the clerical staff were utilized, it would necessitate retraining. If outside personnel were employed, many of the clerical staff would have to be reassigned or released. Administrators displayed mixed emotions about employing or not employing outside personnel.

Outside personnel were accused of not knowing the operation and the policies governing it, thereby causing excessive errors during transition from manual to machine operations. Selection of outside personnel also created an attitude of indifference among former personnel. Other administrators contended that the desired level of operative competence and special knowledge of punched card equipment could only be secured from outside personnel.

Agreement was rather general that the tab room supervisor must possess a level of specific knowledge about punched card equipment that will counter the lack of specific knowledge generally found among educational administrators. However, incidents were cited where tab supervisors failed in personnel relations and the ability to coordinate efforts of the staff. A shortage of competent tab room supervisors created a tendency to hire machine operators as supervisors. Success or failure appeared dependent upon personal qualities as well as technical knowledge.

Training of operative personnel was both locally sponsored and

supplied by the manufacturer. There were mixed reactions to their respective merits. Individually sponsored training programs allegedly add unnecessary complexities to the entire operation. Others contended that training their own personnel was less expensive and at the same time they were taught educational applications.

Resistance to change often stems from the threat it presents to the individual's position. The word, automation, is conceived by many to reflect replacement of personnel and resultant unemployment. Therefore, transition from manual to machine processes requires utmost caution or the entire organization will suffer extreme morale impairment.

Synthesis. Most of the problems in this area seem to peripherate the following: (1) What qualities should be sought when employing supervisory and operative personnel? (2) What part does the former clerical personnel play in the new organization? (3) Should operative personnel be trained by the system or manufacturer? (4) What qualities are most desirable in operative personnel?

Undesirable Organization

Problem. The internal organizational structure of the data processing department and its relationship to other departments were not satisfactory in promoting smooth functional relationships with all departments of the entire school organization.

Delineation. Data processing is a service function. Consequently, the association of data processing staff members with members from other departments was known to create friction. Feelings sometimes prevailed that the data processing personnel were trying to usurp line authority

when securing source data from various departments. Whether data processing should be an independent division or under a previously established division of the system was a question of concern. Jealousy has arisen between departments because the department under which data processing was placed allegedly utilized the equipment more for their own purposes than for other departments. All departments with record-keeping demands should be served impartially according to their needs, but the problem was in making the necessary organizational change without creating inter-departmental rift.

Intra-department procedural organization was also a source of contention. Duties and responsibilities within the department were not clear-cut. Many of the procedural weaknesses were traceable to a failure to document flow charts, chronological schedules of processing, and general procedures of operation. One system was almost wrecked when their tab room supervisor resigned; there were no written records of card fields, coding, nor procedures.

Intra-departmental reorganization of the clerical staff was often difficult in systems with tenure laws. In some cases, employees with tenure status could not be reassigned to other departments, and the administrator was forced to retain all employees regardless whether they were suited or interested in learning a new process.

Synthesis. Organization is one of the administrative processes, but its effectiveness may become encumbered if some of the pitfalls are not anticipated. Questions representing the pitfalls identified in the area of organization were: (1) What is the perspective of the data

processing department in relation to other departments? (2) How can all departments be served unbiasedly? (3) How can procedural weaknesses be strengthened?

Inadequate Coding

Problem. Essential data for completing periodic reports were often not available on punched cards because of inadequate coding or failure to foresee the future needs at the time the data were collected.

Delineation. Systems often rushed into data processing without giving adequate consideration to coding. Codes were assigned without fields; straight numeric codes were assigned to students, teachers, and vendors; and code lists were not recorded. Tab room supervisors accused the educational administrator of not supplying him with complete retrieval requirements, and the administrator lamented that the supervisor did not understand educational operations.

Interrelationship of information on different reports were not considered; thus, separate codes were designed for each report. Identification numbers for students and teachers failed to yield an alphabetical sequence as well as a distinction between highly similar names. Alphameric code lists were used but the numbers in the sequence left blank for specific names proved insufficient; codes for additional names were assigned elsewhere, breaking the alpha sequence.

Coding appears to be purely a technical problem which would concern only the tab room supervisor, but closer scrutiny refutes the apparent. The administrator and educational staff must supply the technician with the retrieval objectives of the data, as well as its

interrelationship with other data. Coding is dependent upon technical knowledge as well as educational knowledge.

Synthesis. Coding problems described in this section are in the following categories: (1) How can adequate consideration be given to retrieval requirements, end products, and possible by-products. (2) How can personnel be coordinated to provide complete data to be coded? (3) What is an adequate formula for producing a student identification number? (4) Who should assume the leadership in code development?

Unsuitable Report Forms

Problem. Standard form designs produced by manufacturers have not been entirely adequate for specific local needs. The cost, time required, and suitability of special forms restricted the operation.

Delineation. Some administrators had the erroneous conception that standard forms, suitable for all needs, could be purchased from form suppliers. When special forms were designed for specific applications, operations were often delayed because the time involved was underestimated. The resulting rush of the first printing of special forms caused errors which resulted in redesign and excessive costs.

General purchasing practices of forms and supplies led to excessive expenditures. Bid basis for forms purchase was often not considered. National forms suppliers were assumed to be the most economical, but this proved erroneous in one isolated case. Generally, the sizes of forms were not given consideration which resulted in excessive machine cycles that cost time and money.

One system made three attempts at form designs before satisfactory

ones were produced. The third attempt was directed by a systems consultant. Practically every administrator assisting in the identification of problems stated that they underestimated the time involved in the selection, preparation, and purchase of forms.

Synthesis. The major considerations in this area are: (1) What are the sources of assistance in forms design? (2) When should forms be considered for a new application? (3) What practices will ensure economy when designing and purchasing forms?

Inflexible Government Reports

Problem. Inflexible reports and report-keeping regulations of government agencies have made the utilization of punched card equipment difficult in some areas of pupil accounting.

Delineation. Several systems initiated data processing without consultation with their state departments of education. Possible assistance from the state was overlooked as well as the possibility of violating a state regulation with the new procedure. Restriction from the state level is generally concerned with the originating or verifying document such as the teacher's register to verify attendance. One large state in the East has restricted punched card accounting for attendance by ruling that attendance can be accounted for in any manner as long as the attendance register is maintained. The imposition of the register causes a duplication of effort for punched card installations which defeats the facility of speed.

Independently, administrators are restricted in their effort to alter state reporting regulations because they are generally governed

by legislative enactment. Changes in state reporting regulations require considerable political activity.

Machine reports supplying data for the federal government did not appear to present any problems. Machine processed reports were accepted rather warily from an individual high school within a district which had no other data processing in the district.

Synthesis. The major difficulty in this area was with the state government. Several state governments have not altered their record-keeping regulations to permit machine processing of attendance records.

Unavailability of Technical Information and Assistance

Problem. Technical information and assistance in solving problems and developing new procedures were not available to a satisfactory degree.

Delineation. Limited technical information and assistance has created many unnecessary problems in the transition from manual to machine processing of educational data. An abundance of information is available for industrial or business applications, but such information is less prevalent for educational applications.

Manufacturer representatives consisted of salesmen and engineers. Preference between the two cannot be determined at this point, but there was some dissatisfaction with salesmen as resource people. Engineers were claimed by a few to be more expert for consultation. Other systems relied on system specialists, whose assistance was excellent in business office records but limited in student personnel accounting. One respondent said, "Our experience with systems people is that they seem totally incapable of understanding school functions and requirements."

One system was rather unique in having a school board member with punched card equipment in his factory. He gave free consultory service to the school installation. According to the staff, he soon developed a domineering attitude and "ran" the entire school program.

Literature resources were largely limited to manufacturer publications. They were thought to be too brief and technical for school personnel to sufficiently comprehend. Practically every administrator contacted by the investigator expressed a dissatisfaction with technical literature. Most of the administrators contacted during the identification of problems expressed a desire for a comprehensive publication directed at all phases of punched card applications in public schools.

Synthesis. Technical assistance of all types appears to be inadequate. Possible sources of technical information or assistance are literature, system specialists, manufacturer representatives, state or federal government specialists, and other school systems with data processing installations. Each of the sources displayed weaknesses and limitations. Individually, few of them have supplied the assistance which the administrators felt was necessary for satisfactory development of the data processing program.

Inability to Fully Utilize Machine Processing of Student Records

Problem. Full utilization of punched card procedures in all areas of student accounting has been restrained by many problems.

Delineation. Leadership in the development of student accounting appears weak. Several administrators speculated that there was a desirable sequence for developing specific areas but were uncertain as to which

application to initiate first.

Physical enumeration of the school population to provide basic data for establishing a student master deck proved expensive. Some schools used an in-school census. Regardless of the procedure employed in collecting source data for school census, updating necessary to maintain an accurate record was meticulously time consuming.

Registration and scheduling involves more personnel on different levels than any other student accounting function. The development of a system by which data would flow from one division to another was difficult. Less technically trained personnel expressed difficulty in understanding the procedures describing their function in the process. Numerous schedule changes from the time of pre-registration to the beginning of school compounded the difficulties.

In some cases, attendance accounting by machine processing was prohibited by state regulations. One respondent stated, "Maintenance of attendance records are not practical because the process ties up the machines for too long a period to justify the outcome." Source data for attendance was most often recorded on marked sense cards. Twenty-seven marked sense positions often would not accommodate the attendance data required by the state.

Good procedures for grade reporting and attendance enabled the posting of permanent records with relatively little effort. Year-to-date grade and attendance cards are generally summary punched while monthly reports are being processed. Therefore, posting permanent records is largely a matter of printing.

Synthesis. Most problems pertaining to student records seem to be: (1) What is the most practical student accounting application to develop first? (2) Is there a preferred sequence of developing the remaining applications? (3) How can an accurate student census be established and maintained? (4) What is a good procedural design for implementing registration and scheduling, grade reporting, attendance, testing, and permanent record applications?

Inability to Fully Utilize Machine Processing of Business Records

Problem. Full utilization of punched card procedures in all areas of business office records presented difficulty in some schools.

Delineation. Fewer specific problems were identified in business records than any other area. The problems delineated in this section represent isolated cases.

One business manager felt that the margin of error with punched card equipment was too high with inexperienced personnel. Consequently, he recommended the processing of student accounting, where mistakes were less crucial, until the personnel became proficient.

Complete information about employees was difficult to get on personnel master cards. Several cards for each employee were generally required for payroll processing. The payroll was often processed before wages were earned which resulted in voiding and rewriting checks for absentees of the last few days of the pay period. Pay dates were difficult to change because precedent had been established that employees would be paid on a certain date.

Synthesis. If the number of specific problems encountered with

business records is indicative of the relative difficulty, business records have been processed by school installations with relatively few difficulties. Most of the problems pertained to payroll processing and specifically dealt with pay dates and recording employee information on punched cards.

C. SUMMARY

One hundred twenty specific problems were grouped according to similarity into eleven areas. The eleven problem areas were:

1. Inadequate planning.
2. Selection of equipment.
3. Insufficient orientation of personnel.
4. Insufficient supply of operative personnel.
5. Undesirable organization.
6. Inadequate coding.
7. Unsuitable report forms.
8. Inflexible government reports.
9. Unavailability of technical information and assistance.
10. Inability to fully utilize machine processing of student records.
11. Inability to fully utilize machine processing of business records.

Each of the eleven problem areas dealt directly with administrative processes or technical knowledge. Specific problems within each area appeared to result from weak leadership, lack of technical knowledge, or both. For example, planning is an administrative process

common to all types of leadership. However, most of the specific problems identified in planning arose from deficient technical knowledge necessary to give the proper direction to the function. Problems solely arising from weak leadership pertained to human relations, largely, the underestimation by the administrator of the importance of the human element to the success of data processing.

CHAPTER V

STATISTICAL ANALYSES

Results from the major instrument of investigation described in Chapter III were coded, keypunched into cards, and tabulated on IBM punched card equipment. Analyses of these data are presented in this chapter in six sections: (1) data processing installations participating in the study, (2) profile of data processing administrators, (3) profile of data processing installations, (4) records maintained on punched card equipment according to subpopulations, (5) problem area ranking, and (6) summary.

A. DATA PROCESSING INSTALLATIONS PARTICIPATING IN THE STUDY

Schools Qualifying. Questionnaires were mailed to 176 public schools in 33 states with data processing installations (see Table II). One hundred forty-five schools or systems responded to the request, representing an 82 per cent return of questionnaires mailed. The greatest concentrations of data processing installations were in California, Illinois, Michigan, and New York. The degree of participation by the entire population is highly commendable, especially from the larger states.

Commendations. Special commendation is extended to R. E. Simpson, Superintendent, California Department of Public Instruction, Sacramento, California, for the cooperation of the state department and the administrators of individual schools within the state. California is recognized

TABLE II

LOCATION OF DATA PROCESSING INSTALLATIONS IN PUBLIC SCHOOLS INVITED TO PARTICIPATE IN THE STUDY

Location of Installation	Questionnaires Mailed	Questionnaires Returned
1. Alabama	1	0
2. Arizona	2	2
3. California	49	44
4. Colorado	3	1
5. Connecticut	3	2
6. Delaware	1	0
7. Florida	8	6
8. Illinois	12	11
9. Indiana	5	4
10. Kansas	4	3
11. Kentucky	2	2
12. Louisiana	1	1
13. Maryland	4	2
14. Massachusetts	5	5
15. Michigan	12	10
16. Minnesota	4	3
17. Missouri	2	1
18. Nebraska	1	1
19. Nevada	1	1
20. New Jersey	2	2
21. New Mexico	1	1
22. New York	22	15
23. North Carolina	1	1
24. Ohio	8	6
25. Pennsylvania	5	5
26. South Carolina	2	2
27. South Dakota	1	1
28. Tennessee	2	2
29. Texas	2	2
30. Utah	1	1
31. Virginia	3	2
32. Washington	3	3
33. Wisconsin	3	3
Total	176	145

as possibly the most advanced state in the development of machine data processing in public schools. One might assume that the advanced state of development and geographical distance from the site of this study might reduce interest in the study. Such an assumption would have been erroneous. In addition to a 90 per cent California response from the questionnaire, many data processing administrators in the individual schools forwarded complete descriptions of their system designs and procedures. Such cooperation for the professional growth of fellow educators in other states reflected prodigious professional interest which deserves special recognition.

Many states with a smaller concentration of data processing installations responded 100 per cent. They were Arizona, Kentucky, Louisiana, Massachusetts, Nebraska, Nevada, New Mexico, North Carolina, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Washington, and Wisconsin. Although fewer in number, the participation of these states was of utmost value to the study; and the degree of participation is highly commendable.

Schools Eliminated. Twenty-eight of the 145 questionnaires were not usable in this study (see Table III). Although exhaustive measures were taken to identify the schools utilizing punched card equipment to process school records, four respondents indicated they only utilized IBM test scoring machines, while two respondents did not have any type of punched card equipment. The total of 294 schools on manufacturer lists included customers with only test scoring machines. Consequently, the initial invitation to participate in the study included a postal

TABLE III

QUESTIONNAIRES ELIMINATED FROM TOTAL RETURNED

Reason for Elimination	Number
Processing restricted to test scoring	4
Processing totally on service bureau basis	11
No punched card equipment	2
Incomplete ranking of problem areas	4
Incorrect ranking of problem areas	3
Punched card equipment used for instruction only	2
Refused to rank problem areas	2
Total	28

card for the respondents to indicate the type of punched card equipment installed in their schools. Respondents indicating only test scoring utility were eliminated (see Table I). However, the six respondents indicated on the postal cards that they possessed punched card equipment.

The questionnaire did not represent the problems encountered by schools operating solely on a service-bureau basis. Of the eleven respondents using only a service bureau, two completed the ranking of problem areas. The remaining nine were partially ranked. Many of the eleven respondents commented on the failure of the instrument to adequately depict their problems. Some of the comments of these respondents were:

> This does not truly apply where a district contracts for services elsewhere.

> Not applicable to service-bureau schools.

> These (problem areas) do not seem to apply too well for service bureau situations.

> We have no installation. (Service bureau only) Our only significant problem has been getting delivery of cards and forms as promised by printers.

> The problems listed do not apply to our application of data processing.

The majority of the respondents, utilizing only a service bureau for processing data, expressed dissatisfaction with the instrument. Therefore, the investigator eliminated the eleven respondents from the study.

Four respondents indicated that they had not experienced all of the problems listed and did not assign them an ordinal rank. Consequently, they were eliminated from the study.

Three respondents failed to rank the problems according to instructions, two of which used check marks instead of ordinal ranks. They

were eliminated from the study.

Two respondents returned the questionnaire but refused to rank the problem areas. One respondent stated,

> I have given considerable thought to the second page of your questionnaire and have decided not to rank these major problems. I object to the negative way in which they are stated. Our major, and in fact only real, problem was changing our schedule of dates on which reports would be issued.

The other respondent in declining to rank the problem areas stated,

> With regard to your questionnaire concerning the use of electronic data processing equipment, we are actually not in a position to provide much detailed information since we are just going into a meager installation.

Of the 28 respondents eliminated, 26 completed the categorical information on the first page. However, the investigator did not include any portion of the information in the study because of possible contamination of the data. The remaining 117 respondents, ranking all problem areas according to instructions, composed the population of the study.

B. PROFILE OF DATA PROCESSING ADMINISTRATORS

Departmental Designation. The diversity of title designation depicted in Table IV may be due to the heterogeneity of local school organization. Another consideration might be the chronological novelty or age of data processing in public schools with the prevailing attitude that new innovations must be assigned as an appendage of a previously established division within the organizational structure.

According to title designation, the most popular department was the business office. Twenty-six per cent of the administrators were designated as business officers. The popular placement of data processing

TABLE IV

PROFESSIONAL PROFILES OF DATA PROCESSING ADMINISTRATORS

Title Designation	College Degree				
	Doctorate	Masters	Bachelors	No Degree	Total
Superintendent, Principal, or Assistant	7	10	1	3	21
Coordinator of Data Processing	0	2	6	20	28
Business Officer	5	6	16	4	31[a]
Director of Pupil Services	3	7			10[b]
Coordinator of Secondary Education		3			3
Director of Research	7	7			14
Other				2	2[c]
Did not indicate title	2	5	1		8
Total	24	40	24	29	117

[a]Includes business managers, auditors, directors of finance, comptrollers, and accounting officer.

[b]Includes directors of attendance, guidance, and testing.

[c]Personnel assistant and secretary.

within the business office might be due to the original application of data processing in industry, and the resultant availability of business officers from industry with data processing experience. The manufacturers of data processing equipment have also emphasized business office utility in their sales presentation. Financial justification is more tangibly evidenced with business office records than pupil accounting.

Twenty-four per cent of the administrators were entitled coordinators of data processing. A possibility exists that the majority of administrators entitled coordinators of data processing are directly under the line authority of the chief school administrator, independent of other divisions.

Eighteen per cent of the administrators were indicated to be the chief school officer by the entitlement of superintendent, principal, or assistant. Fifteen of the twenty-one indicated were in schools of five thousand or fewer enrollment. In many cases, the chief school officer in schools of this size administers and coordinates the data processing program with the assistance of one or more machine operators.

College Degrees. The depiction of college degrees held by data processing administrators does not purport to reflect competence or qualification. If a college degree accurately reflected competence and qualifications, education would not have the numerous problems which currently exist.

Seventy-five per cent of the administrators held at least one college degree, while fifty-five per cent of these held an advanced degree. State certification requirements generally demand at least one

degree as a standard to obtain any of the positions designated in Table IV, except business officer or coordinator of data processing. Formal training necessary to qualify as business officer generally leads to a college degree.

Seventy-one per cent of the coordinators of data processing not having a degree might be accounted for by contemporary advent and expanding popularity of the process. Most degree conferring institutions have not assumed the responsibility of offering college programs in data processing. Consequently, the manufacturer and private business schools have offered training programs in an attempt to satisfy employment demands.

Training Sources. The most frequent source of knowledge about data processing prior to present position as data processing administrator was acquired through independent study (see Table V). Second in popularity was experience in industry. Since several of the administrators indicated multiple sources of knowledge, percentages would not be a suitable medium for comparative purposes. However, the popularity of independent study and experience in industry compared with the sparseness of formal courses in colleges and private business schools are indicative of the failure of educational institutions to assume the responsibility and leadership in data processing training programs.

Practically one third, 32 per cent, of the administrators in the study did not indicate a knowledge of data processing prior to the acquisition of their present position.

The listing of experience in schools as a source of training after employment in present position is redundant. One could not possibly assume the position of data processing administrator without gaining some

TABLE V

TRAINING SOURCES OF DATA PROCESSING ADMINISTRATORS*

Source	Prior to Present Position	After Employment in Present Position
Manufacturer's School	28	59
College or University Courses	16	7
Private Business School Courses	6	2
High School Courses	1	0
Workshops or Seminars	23	46
Experience in Industry	38	9
Experience in Schools	18	117
Independent Study	47	76
Did not indicate a source	38	-

*Multiple training sources of several individuals cause the total of both columns to exceed 117.

knowledge of the process. However, independent study was more intensive and interest rapidly increased in workshops and seminars. Workshops and seminars were probably the most available sources of knowledge. Evidently, the manufacturer's interest also doubled after ascension to their present position since 28 indicated the manufacturer's school as a source prior to present position and 59 indicated the same after employment in present position.

Experience. As might be anticipated, coordinators of data processing indicated the most experience in industry prior to employment in or promotion to their present position (see Table VI). Since 71 per cent of the coordinators did not have a college degree, it might be assumed that much of their training was on-the-job variety.

Eighty of the administrators indicated no experience in industry prior to their present position. Many were people professionally trained in education with little opportunity for previous experience in industry.

Although different respondents, 80 administrators also indicated an absence of experience with data processing equipment in schools prior to their present position. Singularly, the same number of administrators had experience in schools as in industry; but the average amount of experience per individual in industry greatly exceeded experience in schools. The infancy of the process in public schools is probably explainable for the differential.

C. PROFILE OF DATA PROCESSING INSTALLATIONS

The categorical examination of data processing installations are

TABLE VI

TYPE OF EXPERIENCE WITH PUNCHED CARD EQUIPMENT PRIOR TO EMPLOYMENT IN/OR PROMOTION TO PRESENT POSITION

	Years Experience in Industry												Years Experience in Schools											
Title of Administrators	0	1	2	3	4	5	6	7	8	9	10+	Total	0	1	2	3	4	5	6	7	8	9	10+	Total
Superintendent, Principal, or Assistant	18			1	1				1			21	17			2				1			1	21
Coordinator of Data Processing	6				1	1	1	7	1	1	10	28	15	4	2	1	1	1	1	2			1	28
Business Officer	22		1	1		2		2			3	31	23	2	1	1			1	2			1	31
Director of Pupil Services	10											10	7	1	2									10
Coordinator of Secondary Education	3											3	2					1						3
Director of Research	13		1									14	9	1		2		2						14
Other	1	1										2	2											2
Did not indicate title	7		1									8	5	1	1		1							8
Total	80	1	3	2	2	3	1	9	2	1	13	117	80	9	6	6	2	4	2	5	0	0	3	117

according to three dimensions: pupil enrollment, date of installation, and type of service. The divisions are congruent to the subpopulations employed later in the chapter to produce a more finite focus of problem areas.

Pupil Enrollment. Contrary to popular belief, data processing installations were not most frequently utilized in the largest school systems. The frequencies of Table VII resemble the normal curve. The heaviest concentration of data processing installations were in schools with enrollment size from 5,000 to 80,000.

Date of Installation. Figure 1, a cumulative frequency polygon, presents a graphic picture of the dates of installation and spiraling growth in recent years.

Expansive growth of data processing in recent years has attracted the attention of many educators for the first time. Consequently, the educators felt that data processing in public schools had only existed for a few years. Contrary to the conception, Detroit City Schools employed punched card equipment in 1918 to process payroll records. Growth since 1918 gradually increased until 1950. If the sharp increase since 1950 is indicative of future growth, machine data processing in public schools will gain wide popularity within the next decade.

Type of Service. Table VIII reveals that 62 per cent of the systems are central office installations serving the data processing needs of several schools within the district or area. Of this type, the most common example was city or county school systems with one central machine installation which served the schools within the system. The

TABLE VII

DATA PROCESSING INSTALLATIONS BY PUPIL ENROLLMENT

Pupil Enrollment	Number of Systems
1 - 1000	2
1001 - 2000	2
2001 - 3000	8
3001 - 5000	11
5001 - 10,000	15
10,001 - 20,000	19
20,001 - 40,000	18
40,001 - 80,000	11
80,001 - 100,000	3
Over 100,000	7
Did not indicate size	21
Total	117

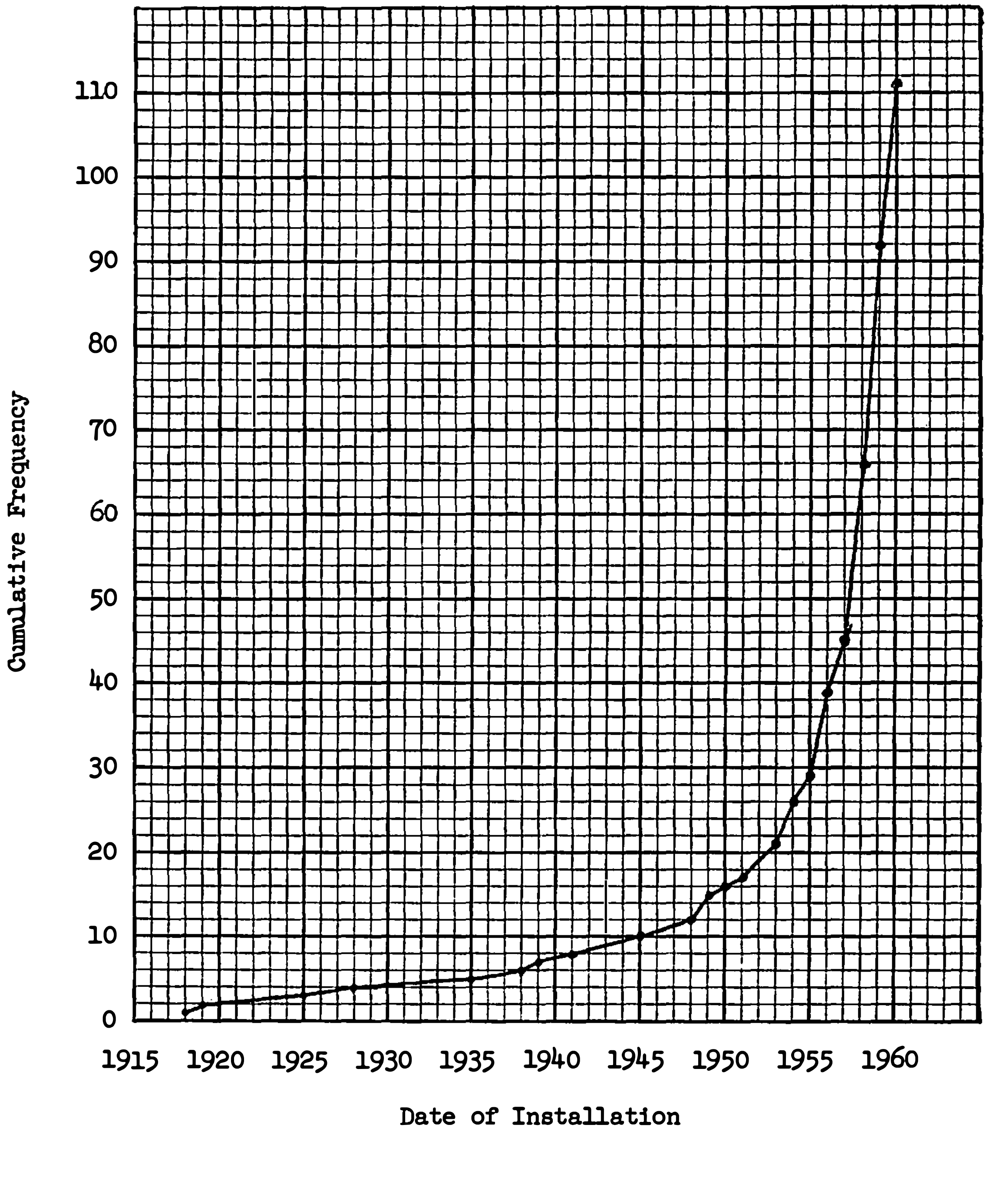

Figure 1. Cumulative Frequency Polygon (Ogive) of Punched Card Installations in Public Schools

TABLE VIII

DATA PROCESSING INSTALLATIONS ACCORDING TO TYPE OF SERVICE

Type of Service	Number of Systems
Single school serving only itself	19
Installation serving only central office	25
Central office installation serving several schools within district or area	73
Total	117

balance of the category was exemplified by several independent school systems collectively acquiring one machines battery which served them jointly. The school systems were small. Individually, they were presumed to be too small for data processing, but collectively they were not. The joint use of a single installation by several independent school systems was most frequently encountered in California.

Twenty-one per cent of the data processing installations served only the central, school-system office. Processing in such cases was largely restricted to maintenance of business office records.

The least frequently encountered installation according to type of service was single schools serving only their individual, record-keeping needs. Only 16 per cent of the parameter comprised this category.

D. RECORDS MAINTAINED ON PUNCHED CARD EQUIPMENT ACCORDING TO SUBPOPULATIONS

Records maintained on punched card equipment were analyzed according to title of administrator, enrollment size, date of installation, and type of service. The records were divided into two major divisions, student records and business office records. Although unequal in number, the specific records under each division represent the major applications. Therefore, the degree of utility of punched card equipment for each division is in terms of percentages based on the total of the particular subpopulation.

Title of Administrator. The first three titles, superintendent, coordinator, and business officer, in Table IX lend themselves to visual comparison due to the closeness of their respective frequencies. Frequencies

TABLE IX

RECORDS MAINTAINED ON PUNCHED CARD EQUIPMENT ACCORDING TO TITLE OF ADMINISTRATOR

Records	Title of Administrator								
	Superintendent, Principal, or Assistant	Coordinator of Data Processing	Business Officer	Director of Pupil Services	Coordinator of Secondary Education	Director of Research	Other	Did Not Indicate Title	Total
SCHOOLS OR SYSTEMS	21	28	31	10	3	14	2	8	117
STUDENT RECORDS									
Census	9	15	9	5	2	4	0	6	50
Grade reporting	18	19	8	6	2	10	0	5	68
Cumulative records	10	15	5	4	1	6	0	2	43
Scheduling and registration	19	20	8	6	1	11	0	6	71
Test records	10	17	14	7	2	11	0	4	65
Attendance	16	17	9	4	3	5	0	5	59
Transportation	2	4	3	0	0	1	1	1	12
Class, honor, and eligibility lists	11	13	6	3	1	7	0	4	45
Program evaluation	3	3	3	1	2	2	0	3	17
BUSINESS OFFICE									
Payroll	10	21	29	3	3	8	1	5	80
Cost accounting	4	11	14	1	1	4	0	2	37
Appropriation accounting	5	12	16	3	2	3	0	1	42
Property accounting	2	9	9	0	1	4	0	1	26
Personnel records	6	17	12	4	1	5	1	4	50
Cafeteria accounting	3	11	13	0	1	4	0	3	35
Supply requisitioning and inventory	3	13	11	1	2	4	0	2	36

in Table IX inferred that chief school officers, superintendents and principals, were more interested in the maintenance of student records than business office records. Record maintenance by business officers was opposite to school officers; greater emphasis was placed on business office records than student records.

The coordinators of data processing indicated the greatest utilization of punched card equipment for both student and business office records. Utility was evenly balanced between student and business office records; whereas the chief school and business officers tended to skew emphasis in the direction of their respective professions.

The two student records most commonly maintained on punched card equipment were (1) scheduling and registration and (2) grade reporting. Transportation records were maintained by twelve schools and were the least popular student record.

Payroll and personnel records were the two most frequently maintained business office records, while property accounting was listed least frequently. Payroll and personnel records are closely allied; each compliments the other. Deductions and other personnel data are necessary for payroll records. Therefore, the popularity of one would promote the other. Payroll is also easier to maintain on punched cards, affects more personnel, and produces more dramatic results than property accounting.

Enrollment Size. The parameter was divided into three subpopulations according to enrollment size. It was anticipated that an examination of records maintained according to the enrollment size might yield

information pertinent to the solution of problems.

According to Table X, schools with an enrollment of 5,000 or fewer were processing more student records than either of the other two divisions. However, the mean percentage of student records processed by the second division, 5,001 to 40,000 enrollment, was practically equal to the first division--a ratio of 47 to 50. The mean percentage of student records processed in schools with enrollment size over 40,000 dropped to 34 per cent. It might be concluded from these data that the development of data processing for the maintenance of student records has been most successful in schools with an enrollment size between 5,001 and 40,000.

According to Table X few schools with enrollments of 5,000 or fewer maintained business office records on punched card equipment. The second division, 5,000 to 40,000 enrollment, averaged 38 per cent utility for business office records. The third division, over 40,000 enrollment, averaged 54 per cent utility for business office records, far greater than either of the other two divisions. Processing of business office records were definitely most popular among the systems with larger enrollments.

The greatest utility of both student and business office records was found among the school or systems with an enrollment between 5,001 and 40,000.

Date of Installation. The division into three subpopulations according to date of installation was for the purpose of attempting to identify whether or not emphasis of concentration in student or business office records had shifted during the chronological development of data

TABLE X

RECORDS MAINTAINED ON PUNCHED CARD EQUIPMENT ACCORDING TO ENROLLMENT

	Student Enrollment					
	1 - 5000		5001 - 40,000		40,001 - (up)	
Records	23 Installations		52 Installations		21 Installations	
STUDENT	Number	Per Cent	Number	Per Cent	Number	Per Cent
Census records	7	30	27	52	11	52
Grade reporting	20	87	33	63	9	43
Cumulative records	13	57	21	40	4	19
Scheduling and registration	21	91	39	75	7	33
Test records	8	35	37	71	14	67
Attendance	18	77	24	46	11	52
Transportation	1	4	8	15	2	10
Class, honor, eligiblity, and other miscellaneous lists	14	61	24	46	3	14
Program evaluation	2	9	10	19	4	19
BUSINESS OFFICE						
Payroll	7	30	36	69	18	86
Cost accounting	3	13	13	25	10	48
Appropriation accounting	2	9	19	37	11	52
Property accounting	1	4	12	23	8	38
Personnel records	1	4	26	50	11	52
Cafeteria accounting	2	9	15	29	11	52
Supply requisitioning and inventory	2	9	17	33	11	52

processing (see Table XI). Since the major emphasis in the area of student records appeared to increase during the 1950's, all installations established prior to 1951 were placed in the first division. The second division, 1951 to 1957, has had a minimum of four years to develop data processing; and the respective subpopulation should indicate the area trend of development. The third group, established since 1957, should give the trend of development by the most recent entrants into the field.

Installations established from 1918 to 1950 had the most extensive processing of business office records and the least for student records. Installations established between 1951 and 1957 were leaders in the utility of data processing for student records. The second group also collectively utilized the process for both student and business office records to a greater degree than the other groups. The average utility of punched card equipment for the second group was the same for student and business office records, inferring a balance between the two areas of processing. The youngest installations, established between 1958 and 1960, utilized the process for student records to a greater degree than the oldest installations in the first group.

Type of Service. Installations were grouped into subpopulations according to the type of service in an effort to determine what type of system afforded the greatest utility in both student and business office accounting (see Table XII).

The first group, single schools serving only individual needs, had the greatest utility for student records and the least utility for business office records of either of the other two groups. Of course, major

TABLE XI

RECORDS MAINTAINED ON PUNCHED CARD EQUIPMENT ACCORDING TO DATE OF INSTALLATION

Records	Date of Installation					
	1918 - 50 16 Installations		1951 - 57 29 Installations		1958 - 60 66 Installations	
STUDENT	Number	Per Cent	Number	Per Cent	Number	Per Cent
Census records	4	25	12	41	31	47
Grade reporting	7	44	20	69	38	58
Cumulative records	6	38	12	41	23	35
Scheduling and registration	6	38	20	69	42	64
Test records	8	50	21	72	34	52
Attendance	9	56	18	62	29	44
Transportation	0	0	6	21	5	8
Class, honor, eligibility, and other miscellaneous lists	3	19	15	52	25	38
Program evaluation	3	19	9	31	5	8
BUSINESS OFFICE						
Payroll	12	75	23	79	43	65
Cost accounting	10	62	13	45	13	20
Appropriation accounting	8	50	16	55	17	26
Property accounting	4	25	10	34	11	17
Personnel records	10	62	16	55	22	33
Cafeteria accounting	7	44	13	45	14	21
Supply requisitioning and inventory	9	56	12	43	14	21

TABLE XII

RECORDS MAINTAINED ON PUNCHED CARD EQUIPMENT ACCORDING TO THE TYPE OF SERVICE

Records	Single School Serving Only Itself 19 Installations		Installation Serving Only Central Office 25 Installations		Central Office Installation Serving Several Schools 73 Installations	
STUDENT	Number	Per Cent	Number	Per Cent	Number	Per Cent
Census records	6	32	5	20	39	53
Grade reporting	17	89	2	8	49	67
Cumulative records	12	63			32	44
Scheduling and registration	19	100	1	4	51	70
Test records	8	42	8	32	49	67
Attendance	14	74	3	12	42	58
Transportation			2	8	10	14
Class, honor, eligibility, and other miscellaneous lists	11	58			34	47
Program evaluation	3	16			14	19
BUSINESS OFFICE						
Payroll	3	16	19	76	58	79
Cost accounting	1	5	9	36	27	37
Appropriation accounting	1	5	8	32	33	45
Property accounting			5	20	21	29
Personnel records	4	21	13	52	33	45
Cafeteria accounting			7	28	28	38
Supply requisitioning and inventory	1	5	6	24	29	40

financial records are generally the responsibility of the central office, while the mission of individual schools pertains basically to the instructional process which demands student records for evaluation.

The second group, installation serving only central office, would naturally be more interested in business office records with student-record responsibility being delegated to individual schools. Therefore, the group ranked second with business office records and last with student records.

The third group, central office installation serving several schools within the district or area, indicated the greatest utility with business office records and second with student records. Percentages of both student and business office records indicated a more comprehensive development by the third group than either of the other two groups.

Data Processing Equipment. The most popular combination of equipment was keypunch, sorter, and tabulator (see Table XIII). Every installation had a keypunch and sorter. The eight installations without a tabulator employed a service bureau or central office installation for printing.

Eighty-eight of the installations did not possess a calculator. Calculator rental or purchase was expensive, and the function was performed on a desk calculator in many cases.

Fifty-seven of the installations did not possess a verifier. Verification can be performed through means other than a verifier. For example, two decks can be punched from the same source document and then compared on the reproducer.

TABLE XIII

TYPE AND NUMBER OF MACHINES PER INSTALLATATION

Type of Machine	Number of Machines per Installation										
	0	1	2	3	4	5	6	7	8	9	Total
Keypunches		53	39	12	6	2	1	2	0	2	117
Verifiers	57	47	8	3	1					1	117
Sorters		86	22	4	1	3		1			117
Interpreters	43	68	5	1							117
Collators	39	59	15	3	1						117
Reproducers	32	69	12	2	1	1					117
Accounting or tab machines	8*	84	20	1	2		1		1		117
Calculators	88	26	2	1							117
Ramacs	115	2									117

*Four schools employed data processing service bureaus to print reports. Printing for the remaining 4 schools was performed by a central office installation serving several schools or districts within the area.

Two IBM 305 RAMACS were the only computers listed by the 117 installations.

E. PROBLEM AREA RANKING

The recent entry of machine data processing in public schools has not permitted time for intensive study or investigation which could yield a relevant external criterion for ranking the difficulty of problem areas. Therefore, the problem areas were ranked by the administrators according to their perceived difficulty. The rank order, resulting from composite ranking of each problem area, produced a "consensual" ordering of problem areas. The investigator acknowledges that "objective" rankings and "consensual" rankings are not synonymous. A high or significant value derived from statistical formulae does not mean that the rank order is "correct." Significance may be interpreted as meaning that the administrators applied essentially the same standard in ranking the problem areas according to their perceived difficulty. Consensual rankings of the study may provide a basis for the future development of a criterion through which more objective rankings may be derived. In the absence of a relevant criterion, the investigator felt that the rankings as perceived by the administrators were the most valid standard available for examining the problems. Raw-score ranks of the parameter and subsequent subpopulations are listed in Appendix B.

Methodology

In an effort to measure the relation among the problem area rankings by the data processing administrators, the Kendall Coefficient of Concordance

W (ref. 1) was employed.

Spearman rho measured the correlation between two sets of rankings of N objects or individuals, whereas, Kendall W measures the relation among several rankings of N objects or individuals. With k sets of rankings the association among them was determined by Kendall W. Whereas rho expresses the degree of association between two variables, W expresses the degree of association among k such variables. The coefficient produced by rho ranges from -1 to +1, and should not be confused with W which produces a range from 0 (lack of agreement) to +1 (perfect agreement). The coefficient of W is an index of the divergence of the agreement shown in the data from the maximum possible (perfect) agreement.

Downie and Heath[2] synthesized and expanded tables of coefficients for determining the level of significance for Kendall W. As the number of k judges increase, W tends to decrease, yet still yields significance. For example, 20 judges ranking 10 items would require a W coefficient of .11 to be significant at .01; for 30 judges ranking the same 10 items would require a W of only .08 to be equally significant. The simplified chi square formula as provided by Siegel accommodates diminishing W coefficients by providing an increasing integer quantity to "refit" the curve.

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[1]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, Inc., 1956), pp. 229-239.

[2]N. M. Downie and R. W. Heath, Basic Statistical Methods (New York: Harper and Bros., Publishers, 1959), pp. 282 - 283.

Edwards[3] employed Kendall W in measuring the attitudes of high school students. The span of coefficients were for the most part small but many yielded results of a significant level.

Raw-score rankings used to compute W are presented in Appendix B. The sums of ranks, R_j, for each problem area were divided by N to obtain the mean value of R_j. The sums of squares of deviations, s, were derived from these data, and the value of W were computed:

$$W = \frac{s}{\frac{1}{12} k^2(N^3 - N)}$$

where

s = sum of squares of the observed deviations from the mean of R_j,

k = number of sets of rankings, e.g., the number of administrators;

N = number of problem areas ranked,

$\frac{1}{12} k^2(N^3 - N)$ = maximum possible sum of the squared deviations, i.e., the sum which would occur with perfect agreement among k rankings.

Siegel[4] presented the formula employed to test the significance of

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[3]T. Bentley Edwards, "Attitudes of High School Students as Related to Success in School (Advanced Report)" (Berkeley: University of California, 1958); also cited in U. S. Department of Health, Education, and Welfare, Projects Initiated Under the Cooperative Research Branch (Washington: Government Printing Office, 1960), p. 11.

[4]Siegel, op. cit., pp. 236-237.

the observed value of W. The formula approximates a chi square distribution with

$$df = N - 1$$

$$\chi^2 = \frac{s}{\frac{1}{12} kN(N + 1)}$$

Observe that

$$\frac{s}{\frac{1}{12} kN(N + 1)} = k(N - 1)W$$

Therefore,

$$\chi^2 = k(N - 1)W$$

Thus, the latter formula, which is computationally simpler, with df = N - 1, was used to determine the probability associated with the occurrence under H_0 of any value as large as an observed W.

If the value of χ^2 as computed by the formula equals or exceeds that shown in Table C (ref. 5) for a particular level of significance and a particular value of df = N - 1, then the hypothesis that the k rankings are related is accepted at that level of significance.

Parameter

One hundred seventeen administrators of data processing who ranked the problem areas according to instruction composed the parameter of the study. The eleven problem areas were assigned ordinal

[5] *Ibid*., p. 249.

ranks according to their perceived difficulty. For convenient reference, Table XIV lists the problem areas, and Table XV lists the problem areas according to the perceived rank of the parameter.

According to the data presented in Table XVI, planning and orientation of personnel were the two most difficult problem areas encountered by data processing administrators. The least difficult problem area, equipment, might be accounted for by the financial motivation of the manufacturer. The ranking of the equipment area might also be interpreted as reflective of satisfied customers.

The significance check of the observed value of <u>W</u> produced a chi square of 140.40. Table C (ref. 6) revealed the coefficient to be greater than .001 level of significance. A scattergram of raw-score ranks by the parameter in Figure 2 presents a more graphic picture of agreement. Therefore, the hypothesis was accepted that a significant degree of concordance existed within the parameter as to the perceived rank-order of the problems encountered by educational administrators in data processing.

Subpopulations

<u>Enrollment</u>. The parameter was divided into three groups according to enrollment size (see Table XVI). The major purpose of the division was to determine whether or not the degree of concordance as to the relative difficulty of problems differed between various sized schools. Table XVII presents the problem areas according to the

[6] <u>Ibid</u>.

TABLE XIV

PROBLEM AREAS ENCOUNTERED BY DATA PROCESSING ADMINISTRATORS

Identification Number	Problem Area
I	Planning
II	Equipment
III	Orientation of Personnel
IV	Operative Personnel
V	Organization
VI	Coding
VII	Forms and Supplies
VIII	Governmental Report Regulations
IX	Technical Information and Assistance
X	Student Records
XI	Business Office Records

TABLE XV

PERCEIVED RANK ORDER OF PROBLEM AREAS: THE PARAMETER

Problem Area	Rank Order
Planning	1
Orientation of Personnel	2
Operative Personnel	3
Student Records	4
Organization	5
Governmental Report Regulations	6
Technical Information and Assistance	7
Coding	8
Business Office Records	9
Forms and Supplies	10
Equipment	11

TABLE XVI

PERCEIVED RANKINGS OF PROBLEM AREAS IN SYSTEMS ACCORDING TO ENROLLMENT

		Rank of Problem Areas													Level of Significance		
Systems' Size	Number of Systems	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	W	χ^2	.05	.01	.001
1 - 5,000	23	3	11	2	1	9	7	10	6	5	4	8	.09	20.70	x		
5001 - 40,000	52	2	11	1	3	5	8	10	6	9	4	7	.13	67.60			x
40,001 - (up)	21	2.5	11	2.5	7	5.5	4	10	5.5	9	1	8	.11	23.10		x	
Total group indicating enrollment	96*	2	11	1	4	6	7	10	5	9	3	8	.10	96.00			x
Total population	117	1	11	2	3	5	8	10	6	7	4	9	.12	140.40			x

*Twenty-one respondents ranked problem areas but did not indicate enrollment served by the installation.

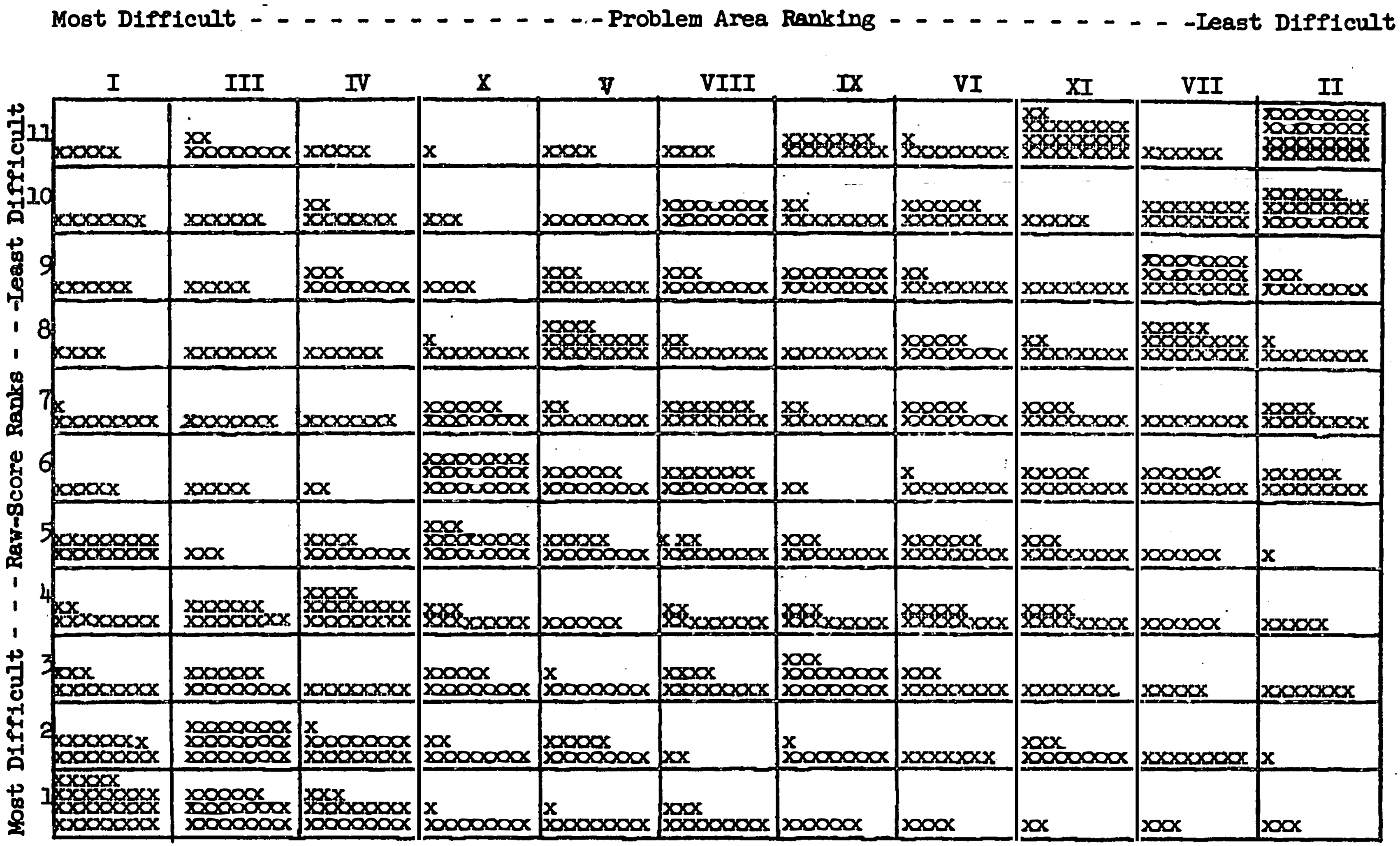

Figure 2. Raw-Score Ranks of 11 Problem Areas as Perceived by 117 Data Processing Administrators: Total Population (Scattergram)

TABLE XVII

PERCEIVED RANK ORDER OF PROBLEM AREAS: ENROLLMENT

	Rank Order According to Enrollment		
	1 - 5,000	5,001 - 40,000	40,001 - (up)
1.	Operative Personnel	Orientation of Personnel	Student Records
2.	Orientation of Personnel	Planning	Planning[a]
3.	Planning	Operative Personnel	Orientation of Personnel[a]
4.	Student Records	Student Records	Coding
5.	Technical Information and Assistance	Organization	Organization[b]
6.	Governmental Report Regulations	Governmental Report Regulations	Governmental Report Regulations[b]
7.	Coding	Business Office Records	Operative Personnel
8.	Business Office Records	Coding	Business Office Records
9.	Organization	Technical Information and Assistance	Technical Information and Assistance
10.	Forms and Supplies	Forms and Supplies	Forms and Supplies
11.	Equipment	Equipment	Equipment

[a]Tied ranks--2.5.

[b]Tied ranks--5.5.

perceived rank of enrollment subpopulations.

Twenty-one respondents of the parameter ranked the problem areas but did not indicate enrollment size of the installation. To prevent possible contamination of the data, the problem ranking and statistical analysis were determined separately for the total group indicating enrollment size. The observed rank order for the 96 respondents comprising the group differed slightly from the parameter. The .001 level of significance for the observed value of W was the same as the level of significance for the parameter.

Student enrollment of schools up to 5,000 composed the first group. The terminal number of 5,000 was selected because most of the schools within the range were individual schools which maintained data processing installations independent of the total school system. The investigator felt that problems experienced by the group might differ from those experienced by larger, centralized installations serving an entire school district.

The first group, enrollment size 1 - 5000, indicated the most difficult problem to be in the area of operative personnel. Restrictive budgetary allocations may have prohibited small, individual schools from competing for highly skilled, operative personnel. The size of the school might be indicative of the size of the community; and an abundant supply of skilled, operative personnel may not have been available in small communities. The second most difficult problem indicated by the group was orientation of personnel. It might be speculated that the orientation of personnel would present few problems

in a small school. However, the data indicated otherwise. The .05 level of significance for the observed value of W was the least level of significance produced for any subpopulation in the study. A scattergram presented in Figure 3 depicts a graphic picture of the raw-score ranks by the first enrollment group.

The range of 5,001 to 40,000 student enrollment was selected for the second group because it included smaller, central installations as well as many medium sized installations. The system size which affords optimum efficiency for punched card data processing has not been determined. Therefore, it was possible for the division according to enrollment size to yield implications for intensive investigation in the future.

The second group, enrollment size 5,001 to 40,000, indicated the most difficult problem to the the orientation of personnel. Long lines of communication necessary to inform personnel in large school systems are vulnerable to breakage and difficult to maintain. The second most difficult problem indicated by the group was planning. Planning increases in complexity with the size of the organization; however, larger installations should be able to afford a greater supply of resource personnel to assist in planning than the smaller schools. The observed value of W for the group was at the .001 level of significance.

The range of student enrollment over 40,000 was selected for the third group because the problems identified in the earlier stages of the study were divergent of those procured from systems with under 40,000 students. The third group indicated the most difficult problem

Most Difficult - - - - - - - - - - - - Problem Area Ranking - - - - - - - - - - - Least Difficult

Most Difficult - - Problem Area Ranking - - Least Difficult	IV	III	I	X	IX	VIII	VI	XI	V	VII	II
11	xx		xxx		xxxx		xx	xxxx		xxx	xxxxx
10	xx	xx	xx	x		xxxxx	xxx	xx	xx	x	xxx
9		xx	x		xx	xx	x	x	xxxx	xxxxxxx	xxx
8		x	x	xx	xxx	xx	xxxxx	x	xxxxx	xx	x
7	x	xxx	x	xxxx	x	xx	x	xxxx	x	xx	xxx
6	x	x	x	xxx	xx	xxxx	xx	xx	xxxx		xxx
5	x	x	xx	xxxxx	x	x	xxxx	xx	xxxx	xx	
4	xxxxxxx	xx	x	xx	xx	xxx		xxx	x	x	x
3	xx	xxxx		xxxx	xxxxx	x	xx	xx		xx	x
2	xxxx	xxx	xxxxxx		xx		xx	xx	x	xx	x
1	xxx	xxxx	xxxxx	xx	x	xxx	x		x	x	xx

Figure 3. Raw-Score Ranks of 11 Problem Areas as Perceived by 23 Data Processing Administrators: Enrollment 1-5000 (Scattergram)

to be the area of student records. Table X substantiates the ranking in that the third group maintained fewer student records than either of the other two groups. The second most difficult ranking was tied between orientation of personnel and planning. One might conclude that orientation of personnel and planning are equally difficult in schools or systems with enrollment size located within the range of size found in either group two or three. The observed value of W for the group yielded .01 level of significance.

An over-all comparison of the rankings by the three groups in Table XVI reveals notable divergence within five of the problem areas. Problems with operative personnel appeared to diminish with the size of the installation. More specifically, these problems dealt largely with the availability of trained personnel. The receding difficulty with increased enrollment possibly is because the larger systems sponsor their own training program, whereas smaller schools are dependent upon the open labor market for their operative personnel.

Organization was perceived to be more difficult with the second and third groups than with the first group. An interpretation might be that the complexity of organization decreases with the size of the installation.

Coding appeared to be less difficult in the smaller systems than in the largest ones. Groups one and two ranked coding several points less difficult than group three. The nature of coding would naturally present greater difficulty for 100,000 students than for 25,000 students.

Availability of technical information and assistance presented less difficulty for group two and three than for group one. Staff resources and availability of funds to procure technical assistance probably were more available in the larger systems than the smaller ones. Another consideration for the differential might be that the larger systems could afford a department of data processing with more skilled personnel. Many smaller installations have developed procedures with untrained personnel on a trial-and-error basis. In satisfying the profit motive, manufacturer representatives might have also made their services more available to the larger installations where the sales potential was greater.

The tied ranking of four by the first and second groups indicated that the implementation of student records was relatively difficult. Group three, the largest systems, perceived student records to be the most difficult of the entire problem areas. Difficulty encountered by large installations in the implementation of student records is presented more thoroughly in Chapter VI.

Although significant at the .05 and .01 levels, the perceived rankings of the smallest and largest schools, respectively, had a lower level of significance than the parameter. Therefore, the hypothesis was rejected that the level of significance for the subpopulations according to enrollment size was as high as the degree for the parameter. However, the rank order of problems differed between the individual groups and were different from the parameter.

Date of Installation. The parameter was divided into three groups according to date of installation (see Table XVIII). The

TABLE XVIII

PERCEIVED RANKINGS OF PROBLEM AREAS IN SYSTEMS ACCORDING TO DATE OF INSTALLATION

Date of Installation	Number of Systems	Rank of Problem Areas											W	χ^2	Level of Significance		
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI			.05	.01	.001
1958 - 1960	66	1	11	2	3	5	9	8	7	6	4	10	.10	66.40			x
1951 - 1957	29	3	11	1	2	5	7	10	6	9	4	8	.14	40.60			x
1918 - 1950	16	1	11	3	2	6	7	9	8	5	4	10	.29	46.40			x
Total group indicating date	111*	1	11	2	3	5	8	10	6	7	4	9	.12	133.20			x
Total population	117	1	11	2	3	5	8	10	6	7	4	9	.12	140.40			x

*Six respondents ranked problem areas but did not indicate the date of installation.

purpose of the division was to determine whether or not the degree of concordance as to the relative difficulty of problems differed with the age of the installation. Table XIX lists the problem areas as perceived by subpopulations divided according to date of installation.

Six respondents ranked problem areas but did not indicate the date of installation. To prevent contamination of the data, the problem ranking and statistical analysis were determined separately for the total group indicating the date. The observed rank order perceived by the 111 respondents comprising the subpopulation did not differ from the parameter. The .001 level of significance for the observed value of W was the same as the level of significance for the parameter.

Schools installing punched card equipment from 1958 to 1960 composed the first group. The age range was selected because of possible increased intensity of problems arising during the initial development period of three years.

The first group, consisting of installations up to three years of age, indicated planning to be the most difficult problem area (see Table XVIII). Orientation of personnel was observed to be the second most difficult problem. Planning is more intense during the early stages of development and evidently presented great difficulty. The second ranked problem, orientation of personnel, dealt with communicating plans to personnel and is logically allied with planning. The .001 level of significance for the observed value of W was the same throughout each group of the subpopulation, but the rank order of problem areas differed between specific groups. A scattergram of

TABLE XIX

PERCEIVED RANK ORDER OF PROBLEM AREAS: DATE OF INSTALLATION

	Rank Order According to Date of Installation		
	1958 - 1960	1951 - 1957	1918 - 1950
1.	Planning	Orientation of Personnel	Planning
2.	Orientation of Personnel	Operative Personnel	Operative Personnel
3.	Operative Personnel	Planning	Orientation of Personnel
4.	Student Records	Student Records	Student Records
5.	Organization	Organization	Technical Information and Assistance
6.	Technical Information and Assistance	Governmental Report Regulations	Organization
7.	Governmental Report Regulations	Coding	Coding
8.	Forms and Supplies	Business Office Records	Governmental Report Regulations
9.	Coding	Technical Information and Assistance	Forms and Supplies
10.	Business Office Records	Forms and Supplies	Business Office Records
11.	Equipment	Equipment	Equipment

raw-score ranks by the first group is presented in Figure 4.

Data processing in public schools was largely extended into the pupil accounting area after 1950. Some schools acquired the equipment for the primary purpose of processing student records. Installations established from 1951 to 1957 have had time to achieve a sophisticated state of development; therefore, they were selected to comprise the second group.

The second group, consisting of installations established from 1951 to 1957, ranked orientation of personnel as the most difficult problem area. The ranking implies that orientation of personnel remains a major problem even after the development of procedures. The ranking as second discloses that the supply of competent operative personnel does not necessarily decrease with the age of the installation. The observed value of $\underline{W}$ was at the .001 level of significance.

The major use of punched card equipment in public schools prior to 1951 was for the maintenance of business office records. The third group includes all schools which established data processing installations prior to 1951. The administrators in group three represent the pioneers of data processing in public schools. The division affords an opportunity to determine whether pupil accounting has been developed as extensively as business office records. Also, problems encountered in the oldest data processing installations might differ from the younger installations.

The third group, consisting of installation established from

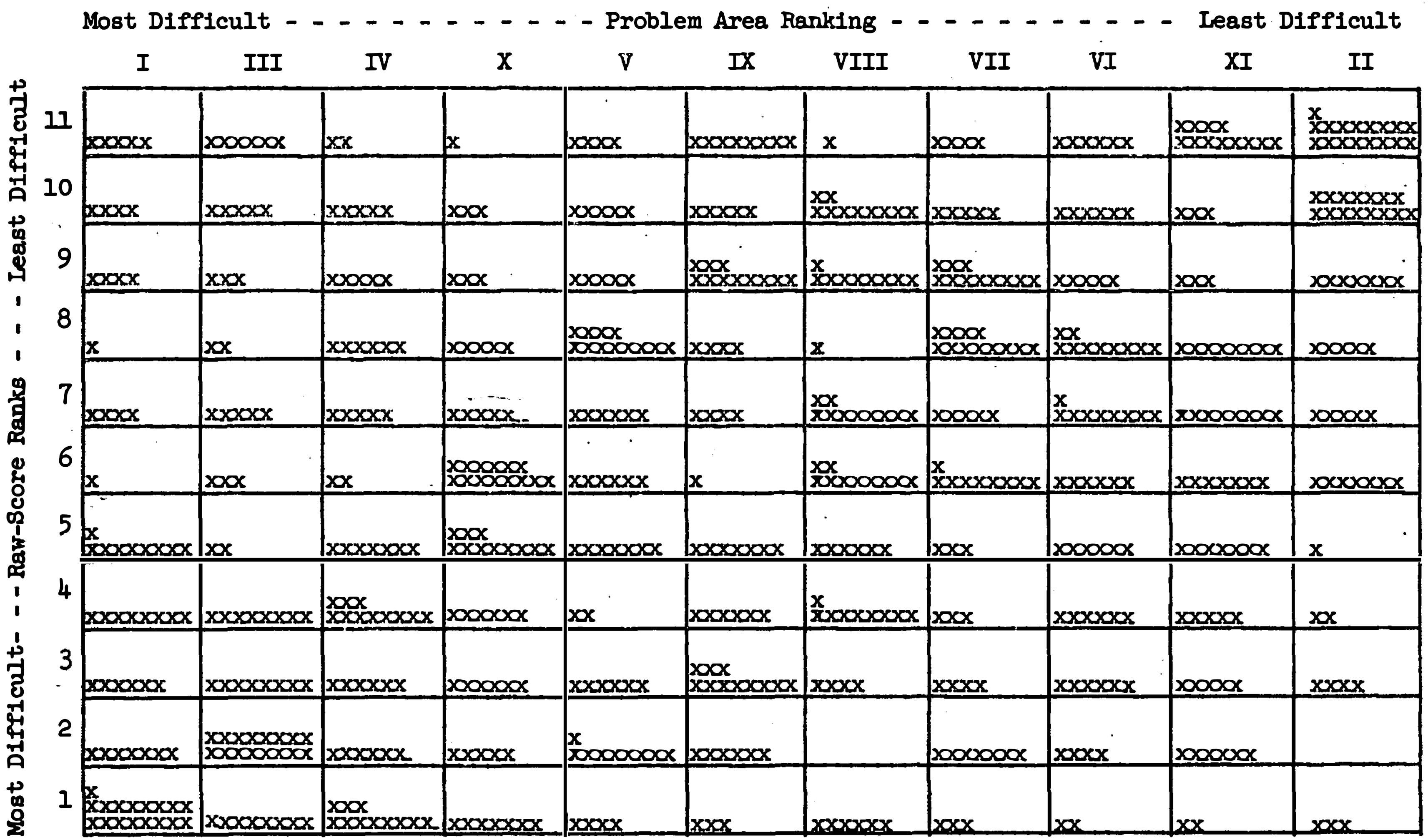

Figure 4. Raw-Score Ranks of 11 Problem Areas as Perceived by 66 Data Processing Administrators: Date of Installation 1958-60 (Scattergram)

1918 to 1950, indicated that planning was the most difficult problem area. Operative personnel problems were ranked second. The observed value of W was at the .001 level of significance.

A comparison of the rankings between the three groups shown in Table XVI discloses some variations. Planning was ranked more difficult by groups one and three than by group two. Coding was ranked less difficult by group one than either of the other two groups. Ranking of technical information and assistance by group two indicated less difficulty; therefore, it might be concluded that technical assistance was more available to group two than the others.

The observed value of W for each of the three groups was at the .001 level of significance. Therefore, the hypothesis was accepted that the level of significance for subpopulations, divided according to age of installation, will be as high as the degree for the parameter, but the rank order within the subpopulation will differ from that of the parameter.

Type of Service. The parameter was divided into three groups according to type of service (see Table XX). Single school installations were anticipated to experience problems different from central office installations. The central office installations were divided into two groups: (1) installations serving only the central office and (2) central office installation serving several schools within the district or area. Since all respondents indicated the type of service of their respective installations, the sum of the three groups equaled the parameter. Table XXI lists the problem

TABLE XX

PERCEIVED RANKINGS OF PROBLEM AREAS IN SYSTEMS ACCORDING TO TYPE OF SERVICE

Type of Installation	Number of Systems	Rank of Problem Areas											W	χ^2	Level of Significance		
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI			.05	.01	.001
Single school serving only itself	19	3	11	4	1	7	9	10	6	5	2	8	.21	39.90			x
Installation serving only central office	25	1	11	3	4	6	7	9	8	2	5	10	.22	55.00			x
Central office installation serving several schools within district or area	73	2	11	1	3	5	7	9	6	10	4	8	.12	87.60			x
Total population	117	1	11	2	3	5	8	10	6	7	4	9	.12	140.40			x

TABLE XXI

PERCEIVED RANK ORDER OF PROBLEM AREAS: TYPE OF SERVICE

	Single School Serving Only Itself	Installation Serving Only Central Office	Central Office Installation Serving Several Schools
1.	Operative Personnel	Planning	Orientation of Personnel
2.	Student Records	Technical Information and Assistance	Planning
3.	Planning	Orientation of Personnel	Operative Personnel
4.	Orientation of Personnel	Operative Personnel	Student Records
5.	Technical Information and Assistance	Student Records	Organization
6.	Governmental Report Regulations	Organization	Governmental Report Regulations
7.	Organization	Coding	Coding
8.	Business Office Records	Governmental Report Regulations	Business Office Records
9.	Coding	Forms and Supplies	Forms and Supplies
10.	Forms and Supplies	Business Office Records	Technical Information and Assistance
11.	Equipment	Equipment	Equipment

areas according to perceived difficulty by subpopulations divided according to type of service.

Group one, single schools, ranked operative personnel problems the most difficult; where student records were ranked second. Single school installations were smaller than central office installations and are less able to offer a training program to insure an adequate supply of operative personnel. Student records are generally of more concern to single schools than central office installations. Table XII also showed single schools with more extensive applications of student records than the central installations. The observed value of W was at the .001 level of significance. A scattergram presented in Figure 5 depicts a graphic picture of the raw-score ranks by group one.

The second group, installations serving only the central office, ranked planning as the most difficult problem area. An inadequate supply of technical information and assistance was ranked second. The observed value of W was at the .001 level of significance.

The third group, central office installations serving several schools within the district or area, ranked orientation of personnel the most difficult problem. Planning was ranked second. Orientation of personnel and planning are closely allied. Group two maintained mostly business office records on punched card equipment, whereas group three in maintaining student records for several schools were involved with more personnel in their orientation programs.

Comparison of ranks within the three groups showed the greatest range in the area of technical information and assistance. The

Most Difficult - - - - - - - - - - - - - Problem Area Ranking - - - - - - - - - - - - - - Least Difficult

Most Difficult - - Raw-Score Ranks - - - Least Difficult	IV	X	I	III	IX	VIII	V	XI	VI	VII	II
11	x		xx	x	x			xxxx	x	x	xxxxxxxx
10	xx		xx	xx	x	xxx	x	xx	xxxx	xx	
9				xx	xx	x	xxx	x	xx	xxxxx	xxx
8	x	x	x	x	xx	xxx	xx		xxxx	xxxx	
7		xxxx	x	x	x	x	xx	xxx		xx	xxxx
6		xxxx	x	xx		xxx	xxx	xx	x		xxx
5	x	xx	x	x	xxx		xxx	x	xxxxx	xx	
4	xxxxxxx	xx	xxx			xx	xx	xxx			
3	x	xxx		xx	xxxxxxx	xx	x	x	x	x	
2	xxx	x	xxxx	xxx	x		x	xx	x	xx	x
1	xxx	xx	xxxx	xxxx	x	xxxx	x				

Figure 5. Raw-Score Ranks of 11 Problem Areas as Perceived by 19 Data Processing Administrators: Individual School Serving Only Itself (Scattergram)

area was ranked five by group one, two by group two, and ten by group three. The availability could be due to greater assistance from the personnel within the many schools served. The installations composing group three were located in metropolitan centers where technical assistance was more available.

The observed value of W was at the .001 level of significance for each of the groups divided according to type of service. Therefore, the hypothesis was accepted that the level of significance for subpopulations, divided according to type of service, will be as high as the degree for the parameter, but the perceived rank order within the subpopulations will differ from that of the parameter.

F. SUMMARY

The instrument of investigation for determining the perceived difficulty of problem areas identified in Chapter IV was mailed to 176 administrators of data processing installations in 33 states. Twenty-eight of the 145 questionnaires returned were not usable. The remaining 117 composed the parameter.

According to title designation of data processing administrators, the most popular placement of the data processing installation within the organizational structure was within the business office. Twenty-four per cent of the data processing installations were administered by coordinators of data processing, indicating that the department was a separate entity within the total organizational structure.

Seventy-five per cent of the data processing administrators held

at least one college degree. Seventy-one per cent of the administrators designated as coordinators of data processing did not indicate a college degree.

Independent study was the most frequently listed source of data processing knowledge. Thirty-two per cent of the administrators did not indicate a source of knowledge prior to present position.

The heaviest concentration of data processing installations were found in systems with student enrollment between 5,000 and 80,000. According to the data, more data processing installations have been added in public schools during the last four years than in the previous thirty-eight years. Sixty-two per cent of the systems are central office installations serving several schools within the district or area.

Data processing administrators emphasized the applications related to their title. For example, installations administered by business officers maintained more business records than other installations; installations administered by superintendents or principals maintained more student accounting records than other installations.

Installations with small student enrollment processed more student records than schools with larger enrollments. The larger the system the fewer student records processed. Schools with student enrollment between 5,001 and 40,000 maintained the highest percentage of both student and business records combined. Data processing installations established between 1951 and 1957 maintained more student records than either of the other two groups established before and

after that date. Single schools maintained more student records than either of the two groups with central office installations.

Practically every installation had at least a keypunch, sorter, and tabulator. Only 26 installations had calculators and 47 had verifiers.

Kendall (W) was employed to determine the degree of concordance among the parameter and subpopulations as to the perceived difficulty of the problem areas. Subpopulations were divided into three groups each according to enrollment size, age of installation, and type of service.

A significant degree of concordance existed within the parameter as to the perceived rank-order of the problems. The degree of concordance among the subpopulations was significant to a degree equal the parameter, except two groups within the subpopulation divided according to enrollment size. They were installations with enrollment sizes of 1-5,000 and 40,000-(up).

The rank-order within subpopulations differed from the parameter. According to data presented in this chapter, it might be concluded that data processing installations experienced relatively the same difficulties; but under certain conditions such as size, age, and type of service, the problem difficulty fluctuates.

CHAPTER VI

SOLUTIONS OR CIRCUMVENTIONS

A. INTRODUCTION

Six data processing installations in public schools were adjudged by the national jury as having met the previously established criteria. Solutions or successful treatment of the problems delineated in Chapter IV were sought by visiting the six installations judged effective. Detailed treatment of each problem area by each installation is presented in Case Reports A - F, Appendix C.

Solutions, circumventions, or successful treatment of problems by the effective system are presented in the subsequent pages of this chapter. The investigator does not present these solutions as a panacea to all problems. The reported solutions are merely <u>successful</u> treatments of the problems under circumstances peculiar to the system interviewed. Many of the recommendations pertaining to specific problem areas are guidelines for effective administration of data processing installations. Administrators anticipating the installation of punched card equipment may be able to adapt the treatment of problems presented in this chapter to their own installation, thereby circumventing many problems.

B. PROBLEM AREAS

All points presented in this section for consideration in solving or circumventing the previously identified problems were derived from

personal interviews with the administrators in six data processing installations. Case reports in Appendix C afford individual treatment of each problem by the six administrators interviewed. The following problem areas are presented in the rank order of their perceived difficulty by the parameter.

Planning

Time Allotted for Preplanning. The length of the preplanning period is dependent upon such factors as the size of the system, availability of competent personnel, strength of leadership, and support from the administrative head of the school. However, a minimum of six months was proposed by three administrators.

Personnel. Although two administrators interviewed did not involve all levels of personnel in preplanning, the unanimous consensus was that all levels of personnel should be represented--public, school board, teachers, secretaries, administrators, and students. Wide representation on planning committees affords better channels of communication to all levels of personnel. The planning committee can help prevent or allay fears which might arise as a result of machine processing. The power of a committee should be limited to recommendations, and the final responsibility of decision should rest with the chief administrator.

Sources of Technical Assistance. The sources of technical assistance were system specialists, manufacturer representatives, federal government specialists, data processing supervisors, and other school systems with data processing installations. The administrators

did not agree on a best source of technical assistance. A source considered best by one administrator was considered weak by another. However, they agreed that a highly trained data processing supervisor was necessary for satisfactory development of the installation; and he could serve satisfactorily as a resource person for the planning and procedural development committees.

Factors to be Considered During Preplanning. One of the first factors to consider is whether or not punched card processing will meet the needs of the individual system. A survey is necessary to determine whether the manual process is satisfactory. If it is not, representatives of the various types of punched card equipment will assist in conducting another survey to determine the suitability of machine processing for the system.

If the decision is reached to install punched card equipment, it must be decided which area will be implemented first--student records or business office records. Next, a data processing supervisor must be employed. The supervisor can serve as a technical resource person for the selection of equipment and planning procedural developments. A six-month preplanning period will also give the supervisor time to thoroughly orient himself with the manual procedures to be converted as well as becoming acquainted with the personnel in the school system.

Housing facilities should be determined after the selection of equipment. Five of the six installations visited have been forced to move the equipment site two or three times each because of inadequate space. Space for housing equipment should be based on long-range plans

instead of immediate needs. In addition to ample space, the location of the installation must be convenient for the divisions to be served. If a new building is constructed for the installation or a building is being converted, wiring for both 110 and 220 volts were recommended. Thermal control is another factor. Electronic computers demand thermal and humidity control. Punched card equipment generates considerable heat; therefore, air conditioning is desirable. Even the administrators in the North where the climate is cooler recommended air conditioning.

After the area of initial development, business records or student records, is ascertained, the first application must be determined. The most important consideration in the area of student records seemed to be which application will save the most teacher time. Both the initial application and long-range sequence of developing the area were recommended. If student records are maintained first, it might be desirable to process payroll records while applications are being developed, since payroll is relatively easy to initiate.

The administrator and technical personnel will develop procedures for the first application, during which time cards and forms will be designed. Form suppliers readily offer free assistance in designing cards and forms.

Orientation of Personnel

Public and School Board. The school board represents the public in matters pertaining to public schools. The administrators interviewed expressed that the school board generally reflects the opinion of the

majority of citizens within a community. Therefore, they were both placed in one group.

Three of the interviewees had not experienced any problems with the public or school board. The remaining three experienced few problems, and they were limited to the cost of the equipment. Problems were circumvented in this area by a well informed public. Every system exhausted available news media to communicate school affairs to the public. One system organized a group of administrators and teachers to give talks to civic organizations on any aspect of the school system. The public enables a school system to have data processing. Afterwards, the success or failure of the operation is the responsibility of the school staff.

Educational Staff. Communication must flow both upward and downward in a school organization. Principals caused few problems as a result of insufficient orientation. Those resisting the transition to machine processing were generally those who resist all innovations. Teacher personnel were stated by three administrators to be the most important key to the success of the operation since most source data originates at that level. People tend to resist that which they do not understand, and special emphasis should be given to the orientation of teacher personnel since their cooperation is vital to the success of the operation. Administrators experiencing the fewest problems with teacher personnel had presented the advantages of machine processing to them and consulted them about future applications. The general procedure for orienting the educational staff was:

1. Machine processing and the resultant advantages were explained in non-technical terms.

2. Supervisor developed procedures for new applications and consulted the principals about their practicality.

3. Principals were thoroughly oriented about new applications.

4. New applications were explained generally in terms of advantages.

5. Written and oral procedures were used to explain the teachers' function in the new application.

6. Teachers were given a simulated problem of their function in the new application. The teachers marked the cards. The cards were processed, and the teachers were shown the results of the problem. Errors in problems emphasized the importance of accuracy by the persons supplying source data.

Teachers in large systems were generally informed of new applications in individual school groups. The success of the first application is important. If it is a success, the majority of the educational staff will give full support to future machine applications.

Office Personnel. Fear of replacement by machine was more prevalent among office personnel than any other group. During the transition to machine processing, office personnel should be informed that they will not be discharged as a result of the process. They should understand that they will be reassigned to a comparable position. Those showing aptitude and interest in learning machine operation can be successfully utilized within the new department. The contribution of

office personnel to the success of the new operation should not be underestimated.

Student Personnel. Students presented no problems in failing to accept the new operation. They followed the leadership of the teachers. If the teacher was satisfied with the new process, so were her students.

Parents. Parents should be informed that grade reports will be machined processed. Grade reports were generally mailed to parents. A letter was forwarded to parents at the beginning of the school year informing them of the dates they could expect the reports.

Operative Personnel

An ample supply of operative personnel was available in three of the six systems. The three systems with an ample supply trained their own personnel and/or paid salaries comparable to those received by machine operators in industry.

During the transition period, clerical personnel interested in the machine processing were sent to the manufacturer's school for machine operators. Those not interested were generally reassigned to comparable positions in other departments. If surplus personnel resulted, the turnover rate generally provided for staff reduction without discharging anyone.

Three administrators felt their systems were training grounds for industry because of their inability to compete with industry salary-wise. Systems training their own personnel generally hired competent typists as keypunch and machine operators. The aptitude tests were also used successfully as a screening device in selecting new employees.

Systems with a highly trained machine room supervisor usually trained personnel without sending them to the manufacturer's school.

Only one installation had a data processing administrator with training in both data processing and education. Four of the larger installations were administered cooperatively by an educational administrator and a data processing supervisor. All interviewees agreed that intelligence, initiative, and keen interest in data processing were essential qualifications for all operative and supervisory personnel.

The interviewees expressed a desire to employ part-time personnel during peak work periods. However, part-time personnel were only available in one installation.

Student Records

The three smaller installations were maintaining more student records than the three larger installations. With punched card equipment, it was too time consuming to centrally process records for 75,000 or more students. One installation solved the problem by placing keypunches and sorters in the high schools, and performing other machine functions in the central installation.

Five of the six installations had preceded student record applications with a pilot project. However, the installation with an administrator trained in both data processing and education stated that a pilot project was unnecessary if the person directing the project was competent.

Establishing an accurate student master deck was agreed to be the

first step in student records. An in-school census was more satisfactory and less expensive in supplying the source data for the student master deck.

One installation had attempted three student record applications simultaneously, but the administrator did not recommend the practice to other installations. Registration and scheduling were recommended as the second application. Basic data for grade reporting and attendance could be obtained from registration procedures. Since attendance reporting starts on the first day of school, it was recommended that it be implemented third and grade reporting fourth. Test records can be applied at any stage after the student master deck is established; therefore, it was not assigned a sequential rank. Cumulative records cannot be posted until the previously described applications are implemented.

The installations interviewed were not able to reasonably estimate population increases, but increases have presented considerable complications. A standard procedure must be established to correct and update all student records. A detailed account of student record procedures is presented for each of the six installations in Appendix C, accompanied by respective card and form designs.

Organization

Inter-Organizational Structure. The placement of the data processing department within the total school organization varied between systems. Three data processing departments were placed in the business

office divisions; two departments were placed in the research division; and one department was placed in the personnel division. Four administrators expressed satisfaction with the placement of the data processing division within their respective organizations. The four installations were the smaller of the six. The administrators representing the two largest installations were dissatisfied with the placement of data processing as an appendage of another division. They felt the division within which they were placed dominated operations and did not serve all departments equally. The placement of the data processing department within the total organizational structure would depend on the size of the installations and records to be maintained. Data processing equipment can only be justified if fully utilized. Therefore, the data processing department should serve all departments with data-collection or record-keeping needs.

Intra-Organizational Structure. Administrators interviewed by the investigator coordinated the entire data processing program with all departments which were served. Responsibility for machine processing was usually delegated to a machines room supervisor. Machine operators were assigned major and minor responsibilities for specific processing jobs. Major assignments were primary responsibilities, and minor assignments were processed after major assignments were completed. The minor assignments were less important applications which were processed collectively during slack periods. Such an arrangement clearly defined the responsibilities of machine operators during both peak and slack periods.

The six administrators agreed that flow charts and procedures for regular applications should be documented. However, only one installation had regular applications completely documented.

Speed of processing is one of the advantages of machine data processing. Therefore, it is important to deliver reports on schedule; or personnel less familiar with the operation might lose confidence in machine processing. Any member within the department which schedules jobs should be liberal in time estimates for processing. One administrator recommended a three to one ratio. If a job takes one day, estimate it for three days; and the recipient will never be disappointed.

Governmental Report Regulations

Local report regulations are generally governed by the same authorities who make the decisions to install data processing equipment. Therefore, the decision to acquire data processing equipment is generally accompanied by an adjustment of any record-keeping regulations which might inhibit the process.

Several states have record-keeping regulations which prohibit machine processing of reports. In states where such regulations exist, the administrators are confronted with an almost insurmountable problem.

One of the six installations visited was confronted with such a problem. The state would not accept attendance reports maintained on machines unless the source data were supported by a teacher register. Therefore, attendance accounting was not considered practical.

The administrators unanimously recommended that officials of new data processing installations check with the state department of

education before student records were processed. Not only could it be determined if restrictive regulations existed, but the state agency might be able to offer assistance in the development of the data processing program.

Technical Information and Assistance

The two most frequent sources of technical information and assistance were from the manufacturer representative and other schools with data processing installations. The manufacturer representative assisted in the development of procedures in five of the six installations. The remaining installation was developed free of outside assistance. The administrator was trained in both education and data processing and stated that the dual combination negated the necessity to elicit outside assistance.

Manufacturer representatives gave excellent assistance in the development of business office records, but their assistance with student records was limited. Most schools strengthened the lack of assistance by employing a technically trained data processing supervisor to assist an educational administrator; the system was then developed on a trial-and-error basis through the combined efforts of the two.

The divergence of experience with technical assistance indicated a lack of strong leadership from agencies capable of offering assistance. The dissatisfaction of the administrators with sources of technical information and assistance prevented a best source from emerging in the interviews.

Coding

Retrieval requirements for all data should be determined before codes are assigned. Once the retrieval requirements were determined, the data processing supervisor generally assigned identification codes. Non-technical personnel were only involved to determine retrieval requirements.

Name fields for students and teachers ranged from 22 to 25 spaces. Five installations divided the name fields into three parts--first name, middle initial, and last name. All systems used a modification of the recommendations from Suggested Codes for Machine Processing.[1]

Each of the systems had a different method of assigning student identification numbers. The yield from student identification numbers differed with each system. Some examples of the informational yield were numeric identification, alphabetical sequence, birth date, sex, and residence. Name codes were printed on the tabulator in both alphabetic and numeric sequence. More detailed information of the coding systems is presented under the coding section of each case report in Appendix C.

Business Office Records

Business office records were maintained by five of the six installations. The installation not processing business office records was a single school installation, and the central school office maintained

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[1] Office of Education, U. S. Department of Health, Education, and Welfare, Suggested Codes for Machine Processing (Washington: U. S. Government Printing Office, 1960).

business office records by manual procedures. Four installations processing business office records had not experienced any problems in the area. The administrators stated that the manufacturer representatives had given excellent assistance in developing the area. The remaining installation was designed by private system specialists, and the procedures had to be completely revised before they were functional. This is an isolated case and should not be interpreted to mean that system specialists cannot design effective business office procedures.

Forms and Supplies

Most of the cards used by the six installations were of special design. Plates for the initial printing cost from $35 to $60 each. Delivery time ranged from two to eight weeks. Representatives of form suppliers gave excellent assistance in designing cards for special applications.

Cards and forms for new applications should be designed concurrently with the development of the applications. Orders should be placed with printers several weeks in advance of the date the application is to begin.

Purchasing on a bid basis is recommended as a good practice. However, installations purchasing on a bid basis had reservations about the practice because of the red tape involved in the procedure. If an installation is a regular customer, the form suppliers will more readily extend special courtesies for rush orders and other favors.

Color coding is another important consideration when purchasing cards. Color codes enable quick visual identification. The special

card and form designs used by each of the six installations are listed with each case report in Appendix C.

Equipment

Every installation interviewed had exchanged some of its original equipment for faster models. Since the equipment was rented, the installations did not suffer a financial loss. However, only freight-in is paid on the original equipment, whereas both freight-in and freight-out must be paid on exchanged equipment.

Five installations rented all equipment. The other installation purchased an IBM 305 RAMAC and rented all supporting equipment. Purchase price plus maintenance costs of the RAMAC will be absorbed by rental costs in five years. The five installations renting equipment indicated that funds had not been available to consider the purchase of equipment.

Service bureaus were contracted for processing by three installations. The three administrators involved were not satisfied with their services nor their charges for processing.

Both immediate and long-range machine needs should be considered before the original equipment is selected. First, the original selection should be capable of performing the job without becoming obsolete as procedures expand. Second, the original selection should be compatible with machines to be added later. If the original selection is not adequate, the school board may refuse additional funds until the process has proved itself.

C. SUMMARY

All problem areas presented in this study had been encountered by at least one of the six administrators. All problems were resolved or circumvented except one--government report regulations. Only one administrator was prevented from processing attendance records because of state regulations. At the time of the interview, he had not been able to resolve the problem.

A degree of commonalty of problem treatment existed in all areas except coding. Each system had a different method for assigning student and teacher identification codes. The methods varied from straight numerical assignment to generating the number on a computer.

CHAPTER VII

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

A. INTRODUCTION

The purpose of this study was to determine the major difficulties encountered by educational administrators in initiating and administering punched card processing installations in public schools, the degree of concordance among administrators as to the relative difficulty of the problems, and possible solutions or circumventions to them.

Pursuant to the identification of problems encountered by educationad administrators, the investigator: (1) conducted an extensive examination of the literature, (2) attended the IBM school for educational administrators, (3) attended a workshop for the punched card processing of educational data, (4) attended an annual meeting of state directors of research and statistics, (5) visited public school data processing installations in Tennessee, and (6) consulted the instructors of data processing at the University of Tennessee. Eleven problem areas emerged from the activities.

An instrument was developed to establish the rank-order difficulty of the eleven problem areas. One hundred seventeen administrators of data processing installations assigned ordinal ranks to the eleven problem areas. Kendall W was employed to determine the degree of concordance as to the perceived rank order by the parameter. A chi square check was used to determine the levels of significance for the parameter

and subpopulations.

Solutions or circumventions of the problem areas were sought from public school systems in the East with effective data processing installations. A national jury identified six installations which met the criteria for effectiveness. Commonalty of treatment of problems in the six effective installations produced the solutions or circumventions.

B. FINDINGS

The findings as related to the stated hypotheses are as follows:

1. There will emerge a significant degree of concordance within the parameter as to the perceived rank order of the problems encountered by educational administrators in data processing.

A chi square check of the observed value of W for the parameter was significant at the .001 level. Therefore, the hypothesis was accepted at the .001 level of significance.

2. There will emerge significant degrees of concordance within subpopulations as to the perceived rank order of the problems encountered by such assumedly, homogeneous sub-groupings of educational administrators in data processing.

A chi square check of the observed values of W for total subpopulations indicating enrollment size and date of installation was significant at the .001 level. Therefore, the hypothesis was accepted at the .001 level of significance.

3. The degrees of concordance within the subpopulations, divided according to enrollment, will yield significance levels equal to that

of the parameter, but perceived rank orders will be different. A chi square check of the observed value of W for group one, small schools, was significant at the .05 level. A chi square check of group two, medium-size schools, was significant at the .001 level. A chi square check for group three, large installations, was significant at the .01 level. The levels of significance for groups one and two were not equal to the .001 level of the parameter. Therefore, the hypothesis was rejected.

4. The degress of concordance within subpopulations divided according to date of installation, will yield significance levels equal to that of the parameter, but perceived rank orders will be different.

A chi square check of the observed values of W was significant at the .001 level. The perceived rank order of problems by each group differed from the parameter. Therefore, the hypothesis was accepted.

5. The degrees of concordance within subpopulations, divided according to type of service, will yield significance levels equal to that of the parameter, but perceived rank orders will be different.

A chi square check of the observed values of W for the three sub-groups divided according to type of service was significant at the .001 level. The perceived rank order of problems in each group differed from the parameter. Therefore, the hypothesis was accepted.

C. CONCLUSIONS

Conclusions derived from the results of this study are as follows:

1. The eleven problem areas identified in this study encompassed the major problems encountered by administrators of data processing installations in public schools. However, the problems encountered in schools operating on a service-bureau basis were not adequately covered.

2. A significant degree of concordance existed among the administrators of data processing installations as to the relative difficulty of problems.

3. Administrators of data processing installations serving less than 5,000 students displayed less agreement than the parameter as to the relative difficulty of problems. It might be concluded that their experiences were different from the majority of administrators. Service bureaus were used by some of the smaller schools to supplement a partial battery of equipment, while other small systems possessed a battery complete enough to satisfy all processing needs. Budget limitations often prevented smaller schools from employing the personnel needed to operate the data processing program. Another consideration might be that the smaller schools did not experience as many problems as larger schools.

4. A significant degree of concordance existed among administrators divided according to the date of machine installation, but the rank order differed between groups. Problem difficulty varied with the age of the installation.

5. A significant degree of concordance existed among administrators divided according to type of service, but the perceived rank

order differed between groups. Problems experienced by administrators of single school installations varied in difficulty from those experienced in central office installations.

6. The organizational placement of the data processing department was most frequently within the business office.

7. The majority of administrators did not have work experience in data processing prior to their present position.

8. The number of data processing installations in public schools have doubled between 1957 and 1960.

9. Data processing installations in public schools have been developed on a trial-and-error basis with limited outside technical assistance. Therefore, creativity in using punched card processing for program evaluation has been hindered because of excessive effort necessary to develop basic applications.

10. Technical literature for the punched card processing of educational data is inadequate.

11. The manufacturer of punched card equipment furnishes the majority of technical assistance for educational administrators in developing their data processing installations. The manufacturer's school was also the most frequent source of training for data processing administrators, excluding independent study. Assistance from the manufacturer representatives have been more limited in student record applications than business office applications.

12. The human element is the most important factor in the success or failure of a data processing installation. Three of the

five most difficult problems emerged largely because the administrators became engrossed in technical aspects and failed to give proper consideration to the human element.

13. Resistance to data processing in public schools has arisen because of insufficient understanding of the process.

14. Previously organized departments within which the data processing installation is placed tends to dominate processing for their own needs, thereby, failing to serve all departments equally. Organizational problems also increase with the size of the installation.

15. Smaller schools or systems place greater emphasis on the processing of student records, while larger systems placed more emphasis on business office records.

16. Installations recently established are placing greater emphasis on the processing of student records than business office records.

17. Larger installations are proportionately making fewer applications of data processing to student records than smaller installations. The larger installations indicated the implementation of student records to be more difficult than the smaller installations.

18. Smaller schools or systems experienced more difficulty with securing an adequate supply of operative personnel than larger systems.

19. Technical assistance was more available to larger systems than to smaller ones.

20. Orientation of personnel and planning are the two most difficult problem areas encountered during the first three years of

operation. The difficulty is more intense within central office installations than in other types of installations.

21. Data processing installations were more prevalent among schools or systems with student enrollments between 5,000 and 40,000. They maintained a greater variety of student and business office applications than larger or smaller systems.

22. Data processing installations in larger schools or systems are generally administered cooperatively by an educational administrator and a data processing supervisor.

23. The significant degree of agreement among administrators as to the relative difficulty of problems and commonalty of solutions in effective systems indicates that a basic data processing system could be designed for adhibition on a national scope.

24. Problems encountered by educational administrators in machine data processing were caused by two factors (1) weak leadership and/or (2) lack of technical knowledge.

C. RECOMMENDATIONS

The successful and expedient development of data processing as a prevalently employed tool of education is dependent upon the effort and cooperation of many groups and agencies. Therefore, recommendations will be directed to specific groups.

U. S. Office of Education

It is recommended that the U. S. Office of Education:

1. Request funds from the federal budget to be made available

on a matching basis to local schools for the purchase or rental of punched card equipment.

2. Expand their staff of data processing consultants in order to provide more assistance to state and local school systems.

3. Collect and disseminate more information about machine data processing in public schools. For example, a detailed account of the different procedures for assigning student and teacher identification numbers would be a valuable resource for new installations.

4. Compile a directory of public schools using punched card equipment and make it available to local schools so that problems may be cooperatively solved.

5. Conduct or sponsor research for development of a basic systems design which could be adapted to any school in the nation.

State Departments of Education

It is recommended that the state departments of education:

1. Install data processing equipment, if they have not already done so.

2. Exercise more leadership in assisting local schools with the initiation of punched card procedures.

3. Employ full-time consultants to assist with the development of data processing installations in local schools and to coordinate the development with federal agencies and other states.

4. Develop a basic systems design which can be adapted to all schools.

Colleges and Universities

It is recommended that colleges and universities:

1. Develop courses in the punched card processing of student records for educational administrators.

2. Offer seminars and workshops in data processing with the central focus on stimulating creativity which will enable education to reap "full" results from machine data processing.

3. Encourage, promote, and conduct intensive research on the expansion, improvement, and utility of data processing in public schools.

4. Offer more courses in punched card operations on the operative level to help alleviate the shortage in both industry and education.

Manufacturers

It is recommended that manufacturers of punched card equipment:

1. Continue their strong leadership in assisting local schools with the development of data processing installations.

2. Increase their staff of educational consultants and offer a quality of assistance in the development of student record applications equal to the assistance given to educational administrators in the development of business office records.

Publishers

It is recommended that publishers produce a publication which gives a comprehensive coverage of systems and detailed procedures for

punched card processing of educational data.

Educational Administrators

It is recommended that educational administrators:

1. Critically examine machine data processing for possible use in their schools.

2. Read this study to gain further insights into problems which may be encountered.

3. Realize the importance of the human element to the success of any operation--mechanical or otherwise.

4. Examine the feasibility of offering instruction on the basic punched card equipment in the high school business education departments.

Future Research

It is recommended that:

1. Future graduate students interested in data processing research use this study as a basis for identifying their problems.

2. Intensive research be conducted in specific applications of student records such as census, attendance reporting, grade reporting, and testing.

3. Intensive research be conducted to determine all of the factors which are impeding creativity. Many schools with extensive student accounting applications are not going beyond the record-keeping stage.

4. An intensive cost study be conducted to determine actual per pupil cost for extensive machine applications in different

geographical locations of the nation.

5. A study be conducted to determine the advantages and disadvantages of punched card data processing in very small schools and very large systems.

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APPENDICES

APPENDIX A

COVER LETTERS AND ACCOMPANYING INSTRUMENTS OF INVESTIGATION

THE UNIVERSITY OF TENNESSEE
Knoxville

College of Business Administration

U.T. Box 8794
September 6, 1960

Mr. John Brown
Assistant Principal
Jonestown Board of Education
Jonestown, Ohio

Dear Mr. Brown:

As you may recall, I was also a member of the IBM School for Educational Administrators at Endicott, N. Y., last March. At that time I asked most of you for future assistance with a study I was planning in IBM data processing systems. Educational administrators, such as you, are definitely pioneers in this new application; and your participation will be invaluable to my research project. Therefore, will you please aid me in the preliminary stage of developing an instrument for investigation.

Please list on the enclosed form any problems you have encountered in the installation, administration, and supervision of your IBM data processing system. A brief statement that will permit the recognition of the problem will be sufficient.

This letter is only being sent to the members of our IBM class; consequently, your personal help is of utmost importance.

Thanks for your cooperation, and I am looking forward to another pleasant association with you such as the one in Endicott.

Sincerely yours,

J. Floyd Cunningham, Jr.
Teaching Assistant

IDENTIFICATION OF DATA PROCESSING PROBLEMS IN PUBLIC SCHOOL ADMINISTRATION

The topics listed on this guide sheet are considered to be general problem areas. Please list any problems which you have encountered in these areas in the installation, administration, and supervision of your data processing system. If space provided is not sufficient, use the back of each sheet.

Pre-planning problems--(Prior to selection of equipment and staff)

Selection and maintenance of equipment-

Selection and training of operative personnel-

Orientation of educational staff-

Coding of data for convenient retrieval-

Selection, preparation, and purchase of forms-

Adaptation of system to existing local, state, and federal reports-

Consultory services from manufacturing representatives-

Utilizing data processing in the maintenance of student records--(If equipment is not being utilized in any of the following areas, please list why.)

Census

Attendance records

High school registration

Grade reporting

Posting permanent records

Testing and test analysis

<u>Utilizing data processing in maintenance of business office records</u>

Payroll

Personnel records

Appropriation accounting

Property accounting

Supply requisitioning and inventory

Cost accounting

Please list any other problems or problem areas which have not been covered by the major topics.

Return to: J. Floyd Cunningham, University of Tennessee, P. O. Box 8794, Knoxville, Tennessee

THE UNIVERSITY OF TENNESSEE
Knoxville

College of Business Administration

November 21, 1960

Superintendent
North Point School District
North Point, California

Dear Sir:

The University of Tennessee is attempting to develop a program to increase the competency of school administrators in machine data processing. A study of problems encountered in the installation and administration of IBM data processing systems is one of the underlying bases for this program. Experienced administrators will lend great impetus to the effectiveness of the program. Regardless of the age of the installation and limitations of experience, it is important that all levels of experience be represented. Therefore, you are invited to participate in this study.

Please list on the enclosed card the name, title, and address of the person in charge of data processing in your school unit to whom I should address my request for information. Do not list machine operators or tab room supervisors; instead, list the person charged with the ultimate responsibility for the entire data processing program. In some instances this person may be a principal or superintendent. A checklist of a short-answer design will be used to reduce to a minimum the amount of time required of participants.

This study is nationwide, and a compilation of the results will be mailed to all participants.

Very truly yours,

J. Floyd Cunningham, Jr.
Teaching Assistant

Name of Administrator

Title

Name of School or System

Address

IBM machines used for data processing are:

☐ owned by school or system
☐ rented by school or system
☐ from a service bureau

THE UNIVERSITY OF TENNESSEE
Knoxville

College of Business Administration

January 21, 1961

Mr. John Doe
North Point High School
North Point, California

Dear Mr. Doe:

The administrative head of your school system has recently agreed to cooperate in a study of data processing problems in public schools. You were recommended as the most qualified person to supply information about your IBM installation and your experience with it.

The enclosed form is of short-answer design and will require a minimum amount of time to complete. The first page asks for such information as the enrollment, size of installation, and degree of utility; while the second page asks for a ranking of problems in data processing.

A compilation of the results of the study will be mailed to all participants. Participation of experienced administrators such as you will be of utmost value to this study. The deadline for collection of this data is February 5, and your cooperation will be greatly appreciated.

Very truly yours,

J. Floyd Cunningham, Jr.
Teaching Assistant

DATA PROCESSING PROBLEMS OF PUBLIC SCHOOLS
QUESTIONNAIRE

Person Completing Questionnaire:

1. Title of person completing questionnaire ____________

2. Check highest college degree.

No degree______ Bachelor______ Master______ Doctorate______

3. Check each source from which knowledge of data processing was gained.

Prior to present position	After employment in present position
____Manufacturer school	____Manufacturer school
____College or university courses	____College or university
____Private business school courses	____Private business school courses
____High school courses	____High school courses
____Workshops or seminars	____Workshops or seminars
____Experience in industry	____Experience in industry
____Experience in schools	____Experience in schools
____Independent study	____Independent study

4. List years of experience with punched card equipment prior to employment in or promotion to present position.

____years experience in industry ____years experience in schools

School or System:

1. The IBM installation represented in this study is in: (check one)

____an individual high school.
____elementary school.
____both elementary and high school.
____the central office of a school system, serving only the central office.
____the central office of a school system, serving several schools within the system.
____other. (If other, please list ____________

2. Student enrollment served by the IBM installation represented in this questionnaire. ____________

3. Check the records which are currently maintained on punched card equipment

____Census records	____Transportation	____Appropriation accounting
____Grade reporting	____Class, honor, eligibility & other miscellaneous lists	____Property accounting
____Cumulative records		____Personnel records
____Scheduling and registration	____Program evaluation	____Cafeteria accounting
____Test records	____Payroll	____Supply requisitioning & Inventory
____Attendance	____Cost accounting	

____Other (please list)____________

4. Please list any functions, activities, records, or reports which have been made possible as a result of machine data processing that were not available with the manual system.____________

5. List year punched card equipment was installed or first utilized. ____________

6. Indicate the number of IBM machines of each type in your installation.

____None. Use service bureau only.	____Accounting or tab machines
____Key punches	____Other (please list)
____Verifiers	____________
____Sorters	____________
____Interpreters	____________
____Collators	____________
____Reproducing punches	____________

RANKING OF DATA PROCESSING PROBLEMS IN PUBLIC SCHOOLS

Eleven problems are listed below that are commonly encountered by administrators in the development and operation of punched card installations. In the first column, identify by ranking the 5 most difficult problems from 1 (most difficult) to 5 (least difficult). In the second column, identify by ranking the 5 simplest problems, 1 representing the easiest or simplest of the entire group. If the directions have been followed correctly, one statement will be blank.

Rank Difficult	Rank Easy	
☐	☐	**INADEQUATE PLANNING** Inadequate planning prior to and after the installation of equipment has been a deterent to swift development of the installation.
☐	☐	**IMPROPER SELECTION OF EQUIPMENT** The basic selection of equipment was not accurately ascertained and resulted in additional purchases, delayed delivery, and slower procedure development.
☐	☐	**INSUFFICIENT ORIENTATION OF PERSONNEL** The citizens of the community, the school board, and the educational staff have not given sufficient support to the data processing movement to insure maximum development.
☐	☐	**INSUFFICIENT SUPPLY OF COMPETENT OPERATIVE PERSONNEL** Inability to employ personnel with a dual understanding of both data processing and education has restricted the adaptation of this equipment to educational uses.
☐	☐	**UNDESIRABLE STAFF ORGANIZATION** The internal organizational structure of the data processing department and its relationship to other departments has not been suitable in promoting smooth functional relationships with all departments of the entire school organization.
☐	☐	**INADEQUATE CODING** Essential data for completing periodic reports were often not available on punched cards because of inadequate coding or failure to foresee the future needs at the time the data were collected.
☐	☐	**UNSUITABLE REPORT FORMS** Standard form designs produced by manufacturers have not been entirely adequate for specific local needs. The cost, time required, and suitability of special forms restricted the operation.
☐	☐	**DEMANDS OF INFLEXIBLE GOVERNMENT REPORTS** Inflexible reports and report-keeping regulations of government agencies have made the utilization of punched card equipment impossible in some areas of pupil accounting.
☐	☐	**UNAVAILABILITY OF TECHNICAL INFORMATION AND ASSISTANCE** Technical information and assistance in solving problems and developing new procedures were not available to a satisfactory degree.
☐	☐	**INABILITY TO FULLY UTILIZE MACHINE PROCESSING OF STUDENT RECORDS** Full utilization of punched card procedures in all areas of student accounting has been difficult.
☐	☐	**INABILITY TO FULLY UTILIZE MACHINE PROCESSING OF BUSINESS RECORDS** Full utilization of punched card procedures in all areas of business office records has been difficult.

Return to: J. Floyd Cunningham, Jr.
University of Tennessee
Box 8794
Knoxville, Tennessee

INTERVIEW GUIDE

I. General Information

Name of School ______________________________

Location ______________________________

Enrollment Served ______________ Number Full-time DP Employees ____

Location of Machines ______________ Number Part-time DP Employees ____

Machines:

____ Key punches	____ Accounting or tab machines
____ Verifiers	____ Calculators
____ Sorters	____ Others
____ Interpreters	______________________________
____ Collators	______________________________
____ Reproducing	______________________________
	______________________________
	______________________________
	______________________________

Records Maintained:

____ Census records	____ Appropriation accounting
____ Grade reporting	____ Property accounting
____ Cumulative records	____ Personnel records
____ Scheduling & registration	____ Cafeteria accounting
____ Test records	____ Supply requisitioning & inventory
____ Attendance	____ Others
____ Transportation	______________________________
____ Class, honor, eligibility, & other misc. lists	______________________________
____ Program evaluation	______________________________
____ Payroll	______________________________
____ Cost accounting	______________________________

II. Problem Areas

A. Planning

1. What were some of the factors which led to the decision to install punched card equipment?

2. What were some of the problems which arose during the preplanning period?

3. How were the problems resolved?

4. How much time was spent for preplanning prior to delivery of equipment? __ months. Was it sufficient? __ yes __ no. How much time would be desirable? __ months.

5. Were the principals involved in preplanning? __ yes __ no.

6. Did the public or school board raise any objections to the cost of the machine procedure? __ yes __ no. If yes, explain.

7. To what extent was the educational staff such as teachers involved in preplanning?

8. Was a systems specialist employed in the planning stage to supplement the staff and manufacturer representative? __ yes __ no. Would this be advisable? __ yes __ no.

9. What were the most beneficial sources of assistance during preplanning?

10. Who determines what future applications will be attempted?

11. Should as many future applications as possible be determined during the preplanning stage? __ yes __ no __ doesn't matter.

12. How many new applications did you attempt simultaneously in the beginning? __. Was this satisfactory? __ yes __ no. What would you recommend?

13. Have you experienced any unusual increase in work load as a result of increased births, annexation, population transition, or additional report demands? __ yes __ no. Is it possible to anticipate this? __ yes __ no.

14. What factors should be considered in regard to housing prior to purchase of equipment? (location, space, climate)

15. Do you have any other recommendations, principles, or guidelines on how to insure adequate planning?

B. Equipment

1. Have you encountered any problems with the selection or maintenance of equipment? __ yes __ no. What were they?

2. As your data processing installation developed, was it necessary to purchase or rent higher speeded equipment? __ yes __ no. What were they?

3. Should only essential machine needs be acquired prior to installation or should the selection be made in regard to long-range requirements? __ immediate __ long-range.

4. What are the basic essentials to start an IBM operation?

5. Is there a preferred sequence for delivery of equipment? __ yes __ no.

6. Is machine rental or purchase more suitable for your system? __ rental __ purchase. If capital outlay were available, would it be more econimical to purchase equipment? __ yes __ no.

7. Has machine maintenance been satisfactory? __ yes __ no.

8. Have you had any experience with a Series 50 battery? __ yes __ no. __ desirable __ undesirable __ qualified.

9. Have you had any experience with a service bureau? __ yes __ no. Have you ever utilized its services during peak periods? __ yes __ no. Was it satisfactory? __ yes __ no. Would you recommend that school or system start machine data processing with a service bureau to determine whether it is desirable for them? __ yes __ no. Could they determine their needs more economically and realistically by having started with a service bureau? __ yes __ no.

C. Orientation of Personnel

1. What problems did you encounter in communicating with the following groups about data processing?

   public

   school board

   office personnel

   educational staff

   pupil personnel

2. What are some of the precautions to consider when communicating with or orienting the above groups about data processing?

3. Did you encounter particular groups with strong mind-sets against change in procedure? __ yes __ no. How were they dealt with?

4. What were some of the fears which different groups experienced in the change-over from manual to machine data processing?

   public

   school board

   office personnel

   educational staff

   pupil personnel

5. What method proved best in orienting teacher personnel?
   __ small groups __ written __ oral __ through principal __ other.

6. Did the cost of equipment present a problem with __ public
   __ schoolboard __ chief administrator?

7. Are there any other factors to be considered when communicating, orienting, or informing persons about data processing?

D. Operative Personnel

1. How were clerical personnel affected by the change-over to machine procedures? __ retrained __ re-assigned __ released.

2. What were their reactions to the new process?

3. Have you had an adequate supply of operative personnel? __ yes __ no.

4. Does your machine personnel receive higher pay than comparable clerical workers? __ yes __ no. Does this create any jealousy?

5. In a new installation, what is the most desirable source of supervisory personnel such as tab room supervisors? __ train person from within system __ outside person with experience in industry __ outside person with experience in schools.

6. In a new installation, what is the most desirable source of subordinate personnel? __ from within __ from without.

7. Do you employ part-time personnel during peak periods? __ yes __ no.

8. What are some of the desirable qualities to look for when employing a tab room supervisor?

   machine operator

   keypunch operator

9. Do you maintain a training program for operative personnel? __ yes __ no. Is or would this be desirable? __ yes __ no.

E. Organization

1. Under which division is your data processing department placed?

2. What is the organizational structure within your data processing division?

3. Has the general organization of your data processing department been satisfactory? __ yes __ no.

4. Do certain departments have priority in the use of the data processing equipment? __ yes __ no. Which? Why?

5. Do all departments appear to be served equally by the DP installation? __ yes __ no. How was this arranged?

6. Has tenure or other employment regulations hindered the reorganization of the record-keeping division from manual to machine? __ yes __ no.

7. Do annual or one-time reports upset your routine or cause unusual difficulty? __ yes __ no. Why?

8. Are flow charts and procedures documented for all applications and reports? __ yes __ no. Is it difficult to accomplish? __ yes __ no. Why?

F. Coding

1. What were some of the problems you have experienced in regard to coding?

2. How is a new code derived? Who is involved?

3. Does one person have final authority in assigning a new code? __ yes __ no.

4. How many spaces are allotted for the name field of students __ teachers __ ?

5. How are student identification numbers derived? Does the number produce any data other than identification?

6. How are teacher identification numbers derived? Does the number produce any data other than identification?

7. Is your code book printed or duplicated? __ yes __ no.

8. What are some of the most important considerations when developing an adequate coding system?

G. Forms and Supplies

1. Have you experienced any difficulty in securing cards or forms? __ yes __ no.

2. Are most of your cards and forms of special or stock design? __ special __ stock.

3. What are the factors to consider when designing special forms? (size, information, personnel, assistance)

4. How far in advance of an anticipated application should forms be designed and ordered?

5. Initially, should forms be purchased before delivery of equipment? __ yes __ no.

6. What is your procedure for purchasing forms and supplies?

H. Governmental Report Regulations

1. Have governmental record-keeping regulations restricted your operation? __ yes __ no. __ local __ state __ federal.

2. If restricted, what have you done or what could be done to amend the restricting regulations?

I. Technical Information and Assistance

1. Has the availability of technical information and assistance been satisfactory? __ yes __ no.

2. What were your sources of technical assistance? __ manufacturer representative __ private systems specialist __ state department personnel __ federal officer personnel __ other schools or systems. Do you still receive assistance from any of these sources? __ yes __ no. Which of these sources have been most valuable?

3. Has the technical literature in the field been satisfactory? __ yes __ no. If no, what effect has the lack of technical assistance had on the development of your program?

4. Do you foresee a need for school-trained people with administrative experience in education as consultants? __ yes __ no.

5. Would most of your other problems have been alleviated had a sufficient supply of technical assistance been available? __ yes __ no.

J. Student Records

1. What are the major problems you have experienced in developing the area of student records?

__ census

__ grade reporting

__ attendance

__ cumulative records

__ scheduling and registration

__ test records

In what sequence would you recommend that the above be developed?

2. Do any of the above require too much machine time to be practical? __ yes __ no.

3. Can you start more than one new application simultaneously? __ yes __ no.

4. Does a highly transient population cause any trouble? __ yes __ no.

5. What are some of the problems in updating student records?

6. Do business office functions restrict machine time available for student accounting? __ yes __ no. How is time allotted?

7. Explain procedures for each pupil accounting function.

K. Business Office Records

1. Has business office accounting on punched card equipment presented any problems? __ yes __ no.

2. If <u>yes</u>, what are some of them and how have they been resolved?

3. If <u>no</u>, to what do you attribute this?

APPENDIX B

RAW-SCORE RANKS OF PROBLEM AREAS

Raw-Score Ranks of 11 Problem Areas as Perceived by 117 Data

Processing Administrators: Total Population

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
3	6	11	10	2	3	7	9	1	8	4	5
4	1	11	7	5	6	4	10	3	9	8	2
7	2	10	1	5	6	3	4	7	11	8	9
8	1	7	8	11	6	2	9	3	10	5	4
9	1	6	2	7	9	4	10	5	11	8	3
10	3	8	4	9	6	5	2	1	10	7	11
12	3	10	7	4	5	9	8	6	11	2	1
13	2	11	1	4	6	7	8	9	3	5	10
14	9	10	4	5	8	11	2	6	3	1	7
15	9	1	11	2	5	10	6	7	8	3	4
16	4	5	3	2	11	1	8	7	10	9	6
17	2	1	3	4	6	8	9	7	11	10	5
18	8	9	1	10	2	6	4	11	3	7	5
19	11	10	4	6	5	7	1	9	2	8	3
20	9	10	1	11	8	4	5	3	7	2	6
21	5	6	1	2	9	3	11	10	4	7	8
25	1	9	2	4	8	11	7	6	3	5	10
26	3	11	10	2	8	9	7	6	1	4	5
27	5	10	3	7	1	2	6	4	9	8	11
28	1	7	2	3	5	8	9	10	4	6	11
29	1	3	6	5	4	11	10	7	2	9	8
30	6	3	4	1	8	5	7	2	11	9	10
31	3	8	4	2	1	5	10	9	7	6	11
32	1	3	4	2	5	9	10	11	8	7	6
34	5	11	8	9	10	4	6	1	7	2	3
35	1	3	6	2	9	8	7	10	4	5	11

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
36	9	10	11	4	6	8	3	5	1	2	7
37	5	9	2	1	3	6	8	10	11	4	7
40	11	10	1	9	2	8	6	4	7	5	3
41	7	3	2	8	1	11	6	4	10	9	5
42	5	11	1	2	7	4	10	3	9	6	8
43	4	8	3	1	2	5	7	10	9	6	11
44	2	11	1	10	8	3	9	4	5	7	6
45	11	10	2	1	9	6	3	4	8	7	5
47	5	11	4	1	10	2	9	8	7	3	6
48	10	11	3	1	6	2	5	7	9	8	4
52	3	7	11	8	10	6	2	9	1	5	4
54	7	6	1	2	4	9	10	8	5	3	11
56	1	10	2	9	5	8	6	7	4	3	11
57	5	11	2	7	1	10	9	6	3	4	8
58	10	11	1	2	9	5	8	6	7	3	4
59	8	6	9	2	10	5	11	3	1	7	4
60	6	3	11	4	10	7	2	1	9	5	8
61	3	11	8	1	7	9	5	2	10	6	4
62	1	11	3	4	6	5	8	9	2	7	10
63	5	9	10	11	7	6	2	1	8	4	3
64	11	9	10	1	2	8	3	4	5	7	6
65	2	11	7	3	1	9	10	6	8	4	5
68	2	7	1	4	5	10	9	8	3	6	11
69	2	7	1	4	5	8	9	10	3	6	11
70	2	8	4	3	5	1	11	10	9	6	7
71	5	4	3	10	8	1	9	7	11	6	2
73	4	11	2	5	8	7	3	10	9	1	6
76	5	4	6	11	2	10	8	7	3	1	9
77	11	6	2	10	9	8	5	4	3	1	7
78	1	11	4	10	7	5	6	8	9	2	3
80	7	8	1	10	4	6	9	3	11	5	2
82	1	7	11	2	5	10	6	4	3	8	9

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
83	5	6	4	3	2	7	8	9	1	10	11
86	6	2	5	1	4	10	9	8	11	3	7
88	7	3	11	5	1	10	9	8	4	6	2
89	1	7	11	5	4	9	8	10	3	6	2
90	10	11	4	1	3	6	7	5	8	2	9
92	2	8	1	5	7	3	9	10	4	6	11
93	1	11	7	3	8	4	10	9	2	6	5
96	4	11	6	10	7	8	9	3	5	1	2
97	10	8	5	1	3	2	9	4	11	6	7
98	6	11	2	7	8	10	9	5	3	1	4
99	1	7	3	4	8	2	9	10	6	5	11
100	7	6	8	1	9	10	5	3	2	4	11
102	4	11	6	2	8	5	10	1	9	3	7
103	5	11	3	1	2	8	10	7	4	6	9
105	3	11	4	5	8	7	2	6	10	1	9
106	7	11	8	4	6	10	2	1	3	5	9
107	1	11	2	9	3	4	10	6	5	8	7
110	1	10	3	9	6	4	8	5	2	7	11
111	1	11	2	3	8	10	5	7	9	4	6
113	4	10	9	7	8	11	3	5	6	1	2
115	2	4	3	9	1	11	10	8	5	7	6
116	1	10	2	5	9	7	6	8	3	4	11
117	5	9	11	10	4	3	8	7	1	6	2
118	5	10	9	8	3	7	4	1	11	2	6
119	1	11	2	3	6	4	8	9	7	5	10
120	1	7	2	3	6	10	8	9	4	5	11
121	4	10	8	1	3	7	11	5	9	6	2
123	10	6	7	9	11	5	8	1	2	3	4
124	7	10	4	1	2	6	9	5	11	3	8
125	1	9	2	8	3	11	6	5	10	4	7
127	5	11	10	6	7	9	8	3	4	1	2
128	2	11	3	4	8	1	10	6	9	5	7

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
130	8	10	1	9	2	7	11	6	4	5	3
131	1	6	5	4	11	10	9	7	2	3	8
132	2	11	9	4	3	5	8	1	10	7	6
134	3	7	8	2	1	9	4	10	5	6	11
135	7	11	1	10	2	3	8	6	9	5	4
136	4	10	1	7	11	8	9	6	3	2	5
138	10	9	1	2	8	5	7	6	11	3	4
140	3	6	2	1	7	8	11	5	9	10	4
143	4	6	1	8	9	3	7	10	5	2	11
145	2	10	1	4	8	3	6	9	5	7	11
146	4	8	3	1	7	11	10	9	2	5	6
148	1	10	2	9	6	3	8	11	7	4	5
150	3	6	4	1	2	11	10	8	5	7	9
151	1	7	2	4	5	10	9	8	3	6	11
152	7	11	1	5	2	3	4	10	9	6	8
153	8	9	2	4	1	7	6	3	10	5	11
154	1	4	10	2	9	3	8	7	5	6	11
155	10	9	3	1	2	4	6	5	7	11	8
158	2	6	9	4	10	7	1	11	3	5	8
161	3	6	1	4	9	5	8	10	7	2	11
162	5	9	2	8	10	4	1	7	3	6	11
164	1	4	2	11	10	5	9	6	8	3	7
167	9	10	7	5	8	6	4	1	11	3	2
171	2	1	7	10	8	3	9	4	11	5	6
174	1	10	11	9	7	2	6	3	4	8	5
175	1	7	2	4	5	9	8	10	3	6	11
176	9	8	11	7	5	4	2	3	10	6	1
R_j	516	962	533	580	688	750	838	724	735	598	798
$R_j - \frac{\Sigma R_j}{N}$*	-186	260	-169	-122	-14	48	136	22	33	-104	96
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	34596	67600	28561	14884	196	2304	18496	484	1089	10816	9216

*$\frac{\Sigma R_j}{N}$ = 702 (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 96 Data Processing

Administrators: Total Population Indicating Enrollment Size

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
3	6	11	10	2	3	7	9	1	8	4	5
4	1	11	7	5	6	4	10	3	9	8	2
8	1	7	8	11	6	2	9	3	10	5	4
9	1	6	2	7	9	4	10	5	11	8	3
10	3	8	4	9	6	5	2	1	10	7	11
12	3	10	7	4	5	9	8	6	11	2	1
13	2	11	1	4	6	7	8	9	3	5	10
14	9	10	4	5	8	11	2	6	3	1	7
15	9	1	11	2	5	10	6	7	8	3	4
16	4	5	3	2	11	1	8	7	10	9	6
17	2	1	3	4	6	8	9	7	11	10	5
18	8	9	1	10	2	6	4	11	3	7	5
19	11	10	4	6	5	7	1	9	2	8	3
20	9	10	1	11	8	4	5	3	7	2	6
21	5	6	1	2	9	3	11	10	4	7	8
25	1	9	2	4	8	11	7	6	3	5	10
26	3	11	10	2	8	9	7	6	1	4	5
27	5	10	3	7	1	2	6	4	9	8	11
28	1	7	2	3	5	8	9	10	4	6	11
30	6	3	4	1	8	5	7	2	11	9	10
31	3	8	4	2	1	5	10	9	7	6	11
32	1	3	4	2	5	9	10	11	8	7	6
34	5	11	8	9	10	4	6	1	7	2	3
35	1	3	6	2	9	8	7	10	4	5	11
36	9	10	11	4	6	8	3	5	1	2	7
37	5	9	2	1	3	6	8	10	11	4	7
40	11	10	1	9	2	8	6	4	7	5	3

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
41	7	3	2	8	1	11	6	4	10	9	5
42	5	11	1	2	7	4	10	3	9	6	8
43	4	8	3	1	2	5	7	10	9	6	11
44	2	11	1	10	8	3	9	4	5	7	6
45	11	10	2	1	9	6	3	4	8	7	5
47	5	11	4	1	10	2	9	8	7	3	6
48	10	11	3	1	6	2	5	7	9	8	4
54	7	6	1	2	4	9	10	8	5	3	11
58	10	11	1	2	9	5	8	6	7	3	4
59	8	6	9	2	10	5	11	3	1	7	4
60	6	3	11	4	10	7	2	1	9	5	8
62	1	11	3	4	6	5	8	9	2	7	10
63	5	9	10	11	7	6	2	1	8	4	3
64	11	9	10	1	2	8	3	4	5	7	6
65	2	11	7	3	1	9	10	6	8	4	5
68	2	7	1	4	5	10	9	8	3	6	11
69	2	7	1	4	5	8	9	10	3	6	11
70	2	8	4	3	5	1	11	10	9	6	7
71	5	4	3	10	8	1	9	7	11	6	2
73	4	11	2	5	8	7	3	10	9	1	6
76	5	4	6	11	2	10	8	7	3	1	9
77	11	6	2	10	9	8	5	4	3	1	7
78	1	11	4	10	7	5	6	8	9	2	3
80	7	8	1	10	4	6	9	3	11	5	2
82	1	7	11	2	5	10	6	4	3	8	9
83	5	6	4	3	2	7	8	9	1	10	11
86	6	2	5	1	4	10	9	8	11	3	7
88	7	3	11	5	1	10	9	8	4	6	2
89	1	7	11	5	4	9	8	10	3	6	2
90	10	11	4	1	3	6	7	5	8	2	9
93	1	11	7	3	8	4	10	9	2	6	5
96	4	11	6	10	7	8	9	3	5	1	2
97	10	8	5	1	3	2	9	4	11	6	7

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
98	6	11	2	7	8	10	9	5	3	1	4
99	1	7	3	4	8	2	9	10	6	5	11
100	7	6	8	1	9	10	5	3	2	4	11
102	4	11	6	2	8	5	10	1	9	3	7
105	3	11	4	5	8	7	2	6	10	1	9
106	7	11	8	4	6	10	2	1	3	5	9
110	1	10	3	9	6	4	8	5	2	7	11
111	1	11	2	3	8	10	5	7	9	4	6
113	4	10	9	7	8	11	3	5	6	1	2
115	2	4	3	9	1	11	10	8	5	7	6
117	5	9	11	10	4	3	8	7	1	6	2
118	5	10	9	8	3	7	4	1	11	2	6
121	4	10	8	1	3	7	11	5	9	6	2
123	10	6	7	9	11	5	8	1	2	3	4
124	7	10	4	1	2	6	9	5	11	3	8
125	1	9	2	8	3	11	6	5	10	4	7
128	2	11	3	4	8	1	10	6	9	5	7
130	8	10	1	9	2	7	11	6	4	5	3
131	1	6	5	4	11	10	9	7	2	3	8
135	7	11	1	10	2	3	8	6	9	5	4
136	4	10	1	7	11	8	9	6	3	2	5
138	10	9	1	2	8	5	7	6	11	3	4
140	3	6	2	1	7	8	11	5	9	10	4
143	4	6	1	8	9	3	7	10	5	2	11
145	2	10	1	4	8	3	6	9	5	7	11
148	1	10	2	9	6	3	8	11	7	4	5
151	1	7	2	4	5	10	9	8	3	6	11
153	8	9	2	4	1	7	6	3	10	5	11
155	10	9	3	1	2	4	6	5	7	11	8
158	2	6	9	4	10	7	1	11	3	5	8
162	5	9	2	8	10	4	1	7	3	6	11

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
164	1	4	2	11	10	5	9	6	8	3	7
167	9	10	7	5	8	6	4	1	11	3	2
171	2	1	7	10	8	3	9	4	11	5	6
174	1	10	11	9	7	2	6	3	4	8	5
176	9	8	11	7	5	4	2	3	10	6	1
R_j	461	781	443	490	577	602	683	569	627	483	620
$R_j - \frac{\Sigma R_j}{N}$*	-115	205	-133	-86	1	26	107	-7	51	-93	44
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	13225	42025	17689	7396	1	676	11449	49	2601	8649	1936

* $\frac{\Sigma R_j}{N} = 576$ (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 23 Data

Processing Administrators: Enrollment 1-5000

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	IX
17	2	1	3	4	6	8	9	7	11	10	5
19	11	10	4	6	5	7	1	9	2	8	3
21	5	6	1	2	9	3	11	10	4	7	8
25	1	9	2	4	8	11	7	6	3	5	10
35	1	3	6	2	9	8	7	10	4	5	11
48	10	11	3	1	6	2	5	7	9	8	4
58	10	11	1	2	9	5	8	6	7	3	4
59	8	6	9	2	10	5	11	3	1	7	4
62	1	11	3	4	6	5	8	9	2	7	10
63	5	9	10	11	7	6	2	1	8	4	3
64	11	9	10	1	2	8	3	4	5	7	6
65	2	11	7	3	1	9	10	6	8	4	5
68	2	7	1	4	5	10	9	8	3	6	11
69	2	7	1	4	5	8	9	10	3	6	11
70	2	8	4	3	5	1	11	10	9	6	7
77	11	6	2	10	9	8	5	4	3	1	7
86	6	2	5	1	4	10	9	8	11	3	7
99	1	7	3	4	8	2	9	10	6	5	11
106	7	11	8	4	6	10	2	1	3	5	9
113	4	10	9	7	8	11	3	5	6	1	2
164	1	4	2	11	10	5	9	6	8	3	7
167	9	10	7	5	8	6	4	1	11	3	2
171	2	1	7	10	8	3	9	4	11	5	6
R_j	114	170	108	105	154	151	161	145	138	119	153
$R_j - \frac{\Sigma R_j}{N}$*	-24	32	-30	-33	16	13	23	7	0	-19	15
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	576	1024	900	1089	256	169	529	49	0	361	225

*$\frac{\Sigma R_j}{N}$ = 138 (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 52 Data Processing

Administrators: Enrollment 5001-40,000

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
3	6	11	10	2	3	7	9	1	8	4	5
4	1	11	7	5	6	4	10	3	9	8	2
8	1	7	8	11	6	2	9	3	10	5	4
9	1	6	2	7	9	4	10	5	11	8	3
10	3	8	4	9	6	5	2	1	10	7	11
12	3	10	7	4	5	9	8	6	11	2	1
13	2	11	1	4	6	7	8	9	3	5	10
14	9	10	4	5	8	11	2	6	3	1	7
16	4	5	3	2	11	1	8	7	10	9	6
18	8	9	1	10	2	6	4	11	3	7	5
26	3	11	10	2	8	9	7	6	1	4	5
27	5	10	3	7	1	2	6	4	9	8	11
28	1	7	2	3	5	8	9	10	4	6	11
30	6	3	4	1	8	5	7	2	11	9	10
31	3	8	4	2	1	5	10	9	7	6	11
32	1	3	4	2	5	9	10	11	8	7	6
36	9	10	11	4	6	8	3	5	1	2	7
37	5	9	2	1	3	6	8	10	11	4	7
40	11	10	1	9	2	8	6	4	7	5	3
41	7	3	2	8	1	11	6	4	10	9	5
44	2	11	1	10	8	3	9	4	5	7	6
45	11	10	2	1	9	6	3	4	8	7	5
47	5	11	4	1	10	2	9	8	7	3	6
54	7	6	1	2	4	9	10	8	5	3	11
60	6	3	11	4	10	7	2	1	9	5	8
73	4	11	2	5	8	7	3	10	9	1	6
78	1	11	4	10	7	5	6	8	9	2	3

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
83	5	6	4	3	2	7	8	9	1	10	11
88	7	3	11	5	1	10	9	8	4	6	2
89	1	7	11	5	4	9	8	10	3	6	2
90	10	11	4	1	3	6	7	5	8	2	9
96	4	11	6	10	7	8	9	3	5	1	2
97	10	8	5	1	3	2	9	4	11	6	7
98	6	11	2	7	8	10	9	5	3	1	4
102	4	11	6	2	8	5	10	1	9	3	7
105	3	11	4	5	8	7	2	6	10	1	9
111	1	11	2	3	8	10	5	7	9	4	6
115	2	4	3	9	1	11	10	8	5	7	6
118	5	10	9	8	3	7	4	1	11	2	6
123	10	6	7	9	11	5	8	1	2	3	4
125	1	9	2	8	3	11	6	5	10	4	7
130	8	10	1	9	2	7	11	6	4	5	3
131	1	6	5	4	11	10	9	7	2	3	8
136	4	10	1	7	11	8	9	6	3	2	5
138	10	9	1	2	8	5	7	6	11	3	4
140	3	6	2	1	7	8	11	5	9	10	4
143	4	6	1	8	9	3	7	10	5	2	11
145	2	10	1	4	8	3	6	9	5	7	11
151	1	7	2	4	5	10	9	8	3	6	11
155	10	9	3	1	2	4	6	5	7	11	8
158	2	6	9	4	10	7	1	11	3	5	8
174	1	10	11	9	7	2	6	3	4	8	5
R_j	240	433	228	260	308	341	370	309	346	262	335
$R_j - \frac{\Sigma R_j}{N}$*	-72	121	-84	-52	-4	29	58	-3	34	-50	23
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	5184	14641	7056	2704	16	841	3364	9	1156	2500	529

* $\frac{\Sigma R_j}{N} = 312$ (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 21 Data Processing

Administrators: Enrollment 40,001 - (up)

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
15	9	1	11	2	5	10	6	7	8	3	4
20	9	10	1	11	8	4	5	3	7	2	6
34	5	11	8	9	10	4	6	1	7	2	3
42	5	11	1	2	7	4	10	3	9	6	8
43	4	8	3	1	2	5	7	10	9	6	11
71	5	4	3	10	8	1	9	7	11	6	2
76	5	4	6	11	2	10	8	7	3	1	9
80	7	8	1	10	4	6	9	3	11	5	2
82	1	7	11	2	5	10	6	4	3	8	9
93	1	11	7	3	8	4	10	9	2	6	5
100	7	6	8	1	9	10	5	3	2	4	11
110	1	10	3	9	6	4	8	5	2	7	11
117	5	9	11	10	4	3	8	7	1	6	2
121	4	10	8	1	3	7	11	5	9	6	2
124	7	10	4	1	2	6	9	5	11	3	8
128	2	11	3	4	8	1	10	6	9	5	7
135	7	11	1	10	2	3	8	6	9	5	4
148	1	10	2	9	6	3	8	11	7	4	5
153	8	9	2	4	1	7	6	3	10	5	11
162	5	9	2	8	10	4	1	7	3	6	11
176	9	8	11	7	5	4	2	3	10	6	1
R_j	107	178	107	125	115	110	152	115	143	102	132
$R_j - \frac{\Sigma R_j}{N}$*	-19	52	-19	-1	-11	-16	26	-11	17	-24	6
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	361	2704	361	1	121	256	676	121	289	576	36

*$\frac{\Sigma R_j}{N}$ = 126 (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 111 Data Processing Administrators:

Total Population Indicating Date of Installation

System Code	Problem Areas and Assigned Ranks: I	II	III	IV	V	VI	VII	VIII	IX	X	XI
3	6	11	10	2	3	7	9	1	8	4	5
4	1	11	7	5	6	4	10	3	9	8	2
7	2	10	1	5	6	3	4	7	11	8	9
8	1	7	8	11	6	2	9	3	10	5	4
10	3	8	4	9	6	5	2	1	10	7	11
12	3	10	7	4	5	9	8	6	11	2	1
13	2	11	1	4	6	7	8	9	3	5	10
14	9	10	4	5	8	11	2	6	3	1	7
15	9	1	11	2	5	10	6	7	8	3	4
16	4	5	3	2	11	1	8	7	10	9	6
17	2	1	3	4	6	8	9	7	11	10	5
18	8	9	1	10	2	6	4	11	3	7	5
19	11	10	4	6	5	7	1	9	2	8	3
21	5	6	1	2	9	3	11	10	4	7	8
25	1	9	2	4	8	11	7	6	3	5	10
26	3	11	10	2	8	9	7	6	1	4	5
27	5	10	3	7	1	2	6	4	9	8	11
28	1	7	2	3	5	8	9	10	4	6	11
29	1	3	6	5	4	11	10	7	2	9	8
30	6	3	4	1	8	5	7	2	11	9	10
31	3	8	4	2	1	5	10	9	7	6	11
32	1	3	4	2	5	9	10	11	8	7	6
34	5	11	8	9	10	4	6	1	7	2	3
35	1	3	6	2	9	8	7	10	4	5	11
36	9	10	11	4	6	8	3	5	1	2	7
37	5	9	2	1	3	6	8	10	11	4	7

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
40	11	10	1	9	2	8	6	4	7	5	3
41	7	3	2	8	1	11	6	4	10	9	5
42	5	11	1	2	7	4	10	3	9	6	8
43	4	8	3	1	2	5	7	10	9	6	11
44	2	11	1	10	8	3	9	4	5	7	6
45	11	10	2	1	9	6	3	4	8	7	5
47	5	11	4	1	10	2	9	8	7	3	6
48	10	11	3	1	6	2	5	7	9	8	4
52	3	7	11	8	10	6	2	9	1	5	4
54	7	6	1	2	4	9	10	8	5	3	11
56	1	10	2	9	5	8	6	7	4	3	11
57	5	11	2	7	1	10	9	6	3	4	8
58	10	11	1	2	9	5	8	6	7	3	4
59	8	6	9	2	10	5	11	3	1	7	4
60	6	3	11	4	10	7	2	1	9	5	8
61	3	11	8	1	7	9	5	2	10	6	4
62	1	11	3	4	6	5	8	9	2	7	10
63	5	9	10	11	7	6	2	1	8	4	3
64	11	9	10	1	2	8	3	4	5	7	6
65	2	11	7	3	1	9	10	6	8	4	5
68	2	7	1	4	5	10	9	8	3	6	11
69	2	7	1	4	5	8	9	10	3	6	11
70	2	8	4	3	5	1	11	10	9	6	7
71	5	4	3	10	8	1	9	7	11	6	2
73	4	11	2	5	8	7	3	10	9	1	6
76	5	4	6	11	2	10	8	7	3	1	9
77	11	6	2	10	9	8	5	4	3	1	7
78	1	11	4	10	7	5	6	8	9	2	3
80	7	8	1	10	4	6	9	3	11	5	2
82	1	7	11	2	5	10	6	4	3	8	9
83	5	6	4	3	2	7	8	9	1	10	11

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
88	7	3	11	5	1	10	9	8	4	6	2
89	1	7	11	5	4	9	8	10	3	6	2
90	10	11	4	1	3	6	7	5	8	2	9
92	2	8	1	5	7	3	9	10	4	6	11
93	1	11	7	3	8	4	10	9	2	6	5
96	4	11	6	10	7	8	9	3	5	1	2
97	10	8	5	1	3	2	9	4	11	6	7
100	7	6	8	1	9	10	5	3	2	4	11
102	4	11	6	2	8	5	10	1	9	3	7
103	5	11	3	1	2	8	10	7	4	6	9
105	3	11	4	5	8	7	2	6	10	1	9
106	7	11	8	4	6	10	2	1	3	5	9
107	1	11	2	9	3	4	10	6	5	8	7
110	1	10	3	9	6	4	8	5	2	7	11
111	1	11	2	3	8	10	5	7	9	4	6
113	4	10	9	7	8	11	3	5	6	1	2
115	2	4	3	9	1	11	10	8	5	7	6
116	1	10	2	5	9	7	6	8	3	4	11
117	5	9	11	10	4	3	8	7	1	6	2
118	5	10	9	8	3	7	4	1	11	2	6
119	1	11	2	3	6	4	8	9	7	5	10
120	1	7	2	3	6	10	8	9	4	5	11
121	4	10	8	1	3	7	11	5	9	6	2
123	10	6	7	9	11	5	8	1	2	3	4
124	7	10	4	1	2	6	9	5	11	3	8
125	1	9	2	8	3	11	6	5	10	4	7
127	5	11	10	6	7	9	8	3	4	1	2
128	2	11	3	4	8	1	10	6	9	5	7
130	8	10	1	9	2	7	11	6	4	5	3
131	1	6	5	4	11	10	9	7	2	3	8
132	2	11	9	4	3	5	8	1	10	7	6
134	3	7	8	2	1	9	4	10	5	6	11

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
135	7	11	1	10	2	3	8	6	9	5	4
138	10	9	1	2	8	5	7	6	11	3	4
140	3	6	2	1	7	8	11	5	9	10	4
145	2	10	1	4	8	3	6	9	5	7	11
148	1	10	2	9	6	3	8	11	7	4	5
150	3	6	4	1	2	11	10	8	5	7	9
153	8	9	2	4	1	7	6	3	10	5	11
155	10	9	3	1	2	4	6	5	7	11	8
158	2	6	9	4	10	7	1	11	3	5	8
161	3	6	1	4	9	5	8	10	7	2	11
162	5	9	2	8	10	4	1	7	3	6	11
164	1	4	2	11	10	5	9	6	8	3	7
167	9	10	7	5	8	6	4	1	11	3	2
171	2	1	7	10	8	3	9	4	11	5	6
174	1	10	11	9	7	2	6	3	4	8	5
176	9	8	11	7	5	4	2	3	10	6	1
R_j	335	593	317	376	418	438	514	438	524	386	479
$R_j - \frac{\Sigma R_j}{N}$*	-103	155	-121	-62	-20	0	76	0	86	-52	41
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	10609	24025	14641	3844	400	0	5776	0	7396	2704	1681

* $\frac{\Sigma R_j}{N}$ = 438 (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 66 Data

Processing Administrators: Date of Installation 1958 - 60

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
12	3	10	7	4	5	9	8	6	11	2	1
14	9	10	4	5	8	11	2	6	3	1	7
15	9	1	11	2	5	10	6	7	8	3	4
16	4	5	3	2	11	1	8	7	10	9	6
17	2	1	3	4	6	8	9	7	11	10	5
19	11	10	4	6	5	7	1	9	2	8	3
25	1	9	2	4	8	11	7	6	3	5	10
26	3	11	10	2	8	9	7	6	1	4	5
27	5	10	3	7	1	2	6	4	9	8	11
29	1	3	6	5	4	11	10	7	2	9	8
31	3	8	4	2	1	5	10	9	7	6	11
35	1	3	6	2	9	8	7	10	4	5	11
37	5	9	2	1	3	6	8	10	11	4	7
40	11	10	1	9	2	8	6	4	7	5	3
41	7	3	2	8	1	11	6	4	10	9	5
43	4	8	3	1	2	5	7	10	9	6	11
44	2	11	1	10	8	3	9	4	5	7	6
45	11	10	2	1	9	6	3	4	8	7	5
48	10	11	3	1	6	2	5	7	9	8	4
52	3	7	11	8	10	6	2	9	1	5	4
57	5	11	2	7	1	10	9	6	3	4	8
60	6	3	11	4	10	7	2	1	9	5	8
62	1	11	3	4	6	5	8	9	2	7	10
63	5	9	10	11	7	6	2	1	8	4	3
64	11	9	10	1	2	8	3	4	5	7	6
69	2	7	1	4	5	8	9	10	3	6	11

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
70	2	8	4	3	5	1	11	10	9	6	7
73	4	11	2	5	8	7	3	10	9	1	6
77	11	6	2	10	9	8	5	4	3	1	7
78	1	11	4	10	7	5	6	8	9	2	3
83	5	6	4	3	2	7	8	9	1	10	11
89	1	7	11	5	4	9	8	10	3	6	2
93	1	11	7	3	8	4	10	9	2	6	5
96	4	11	6	10	7	8	9	3	5	1	2
97	10	8	5	1	3	2	9	4	11	6	7
103	5	11	3	1	2	8	10	7	4	6	9
105	3	11	4	5	8	7	2	6	10	1	9
106	7	11	8	4	6	10	2	1	3	5	9
107	1	11	2	9	3	4	10	6	5	8	7
111	1	11	2	3	8	10	5	7	9	4	6
113	4	10	9	7	8	11	3	5	6	1	2
118	5	10	9	8	3	7	4	1	11	2	6
119	1	11	2	3	6	4	8	9	7	5	10
120	1	7	2	3	6	10	8	9	4	5	11
121	4	10	8	1	3	7	11	5	9	6	2
123	10	6	7	9	11	5	8	1	2	3	4
124	7	10	4	1	2	6	9	5	11	3	8
125	1	9	2	8	3	11	6	5	10	4	7
127	5	11	10	6	7	9	8	3	4	1	2
130	8	10	1	9	2	7	11	6	4	5	3
131	1	6	5	4	11	10	9	7	2	3	8
136	4	10	1	7	11	8	9	6	3	2	5
140	3	6	2	1	7	8	11	5	9	10	4
143	4	6	1	8	9	3	7	10	5	2	11
145	2	10	1	4	8	3	6	9	5	7	11

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
152	7	11	1	5	2	3	4	10	9	6	8
154	1	4	10	2	9	3	8	7	5	6	11
155	10	9	3	1	2	4	6	5	7	11	8
158	2	6	9	4	10	7	1	11	3	5	8
162	5	9	2	8	10	4	1	7	3	6	11
164	1	4	2	11	10	5	9	6	8	3	7
167	9	10	7	5	8	6	4	1	11	3	2
171	2	1	7	10	8	3	9	4	11	5	6
174	1	10	11	9	7	2	6	3	4	8	5
175	1	7	2	4	5	9	8	10	3	6	11
176	9	8	11	7	5	4	2	3	10	6	1
R_j	299	545	318	332	396	432	434	414	410	341	435
$R_j - \frac{\Sigma R_j}{N}$*	-97	149	-77	-64	0	36	38	18	14	-55	39
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	9409	22201	5929	4096	0	1296	1444	324	196	3025	1521

* $\frac{\Sigma R_j}{N}$ = 396 (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 29 Data

Processing Administrators: Date of Installation 1951 - 57

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
3	6	11	10	2	3	7	9	1	8	4	5
4	1	11	7	5	6	4	10	3	9	8	2
7	2	10	1	5	6	3	4	7	11	8	9
10	3	8	4	9	6	5	2	1	10	7	11
13	2	11	1	4	6	7	8	9	3	5	10
18	8	9	1	10	2	6	4	11	3	7	5
30	6	3	4	1	8	5	7	2	11	9	10
32	1	3	4	2	5	9	10	11	8	7	6
34	5	11	8	9	10	4	6	1	7	2	3
36	9	10	11	4	6	8	3	5	1	2	7
42	5	11	1	2	7	4	10	3	9	6	8
54	7	6	1	2	4	9	10	8	5	3	11
58	10	11	1	2	9	5	8	6	7	3	4
59	8	6	9	2	10	5	11	3	1	7	4
68	2	7	1	4	5	10	9	8	3	6	11
71	5	4	3	10	8	1	9	7	11	6	2
76	5	4	6	11	2	10	8	7	3	1	9
80	7	8	1	10	4	6	9	3	11	5	2
82	1	7	11	2	5	10	6	4	3	8	9
88	7	3	11	5	1	10	9	8	4	6	2
90	10	11	4	1	3	6	7	5	8	2	9
102	4	11	6	2	8	5	10	1	9	3	7
115	2	4	3	9	1	11	10	8	5	7	6
128	2	11	3	4	8	1	10	6	9	5	7
135	7	11	1	10	2	3	8	6	9	5	4
138	10	9	1	2	8	5	7	6	11	3	4

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
146	4	8	3	1	7	11	10	9	2	5	6
148	1	10	2	9	6	3	8	11	7	4	5
153	8	9	2	4	1	7	6	3	10	5	11
R_j	148	238	121	143	157	180	228	163	198	149	189
$R_j - \frac{\Sigma R_j}{N}$*	-26	64	-53	-31	-17	6	54	-11	24	-25	15
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	676	4096	2809	961	289	36	2916	121	576	625	225

*$\frac{\Sigma R_j}{N} = 174$ (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 16 Data

Processing Administrators: Date of Installation 1918 - 50

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
8	1	7	8	11	6	2	9	3	10	5	4
21	5	6	1	2	9	3	11	10	4	7	8
28	1	7	2	3	5	8	9	10	4	6	11
47	5	11	4	1	10	2	9	8	7	3	6
56	1	10	2	9	5	8	6	7	4	3	11
61	3	11	8	1	7	9	5	2	10	6	4
65	2	11	7	3	1	9	10	6	8	4	5
92	2	8	1	5	7	3	9	10	4	6	11
100	7	6	8	1	9	10	5	3	2	4	11
110	1	10	3	9	6	4	8	5	2	7	11
116	1	10	2	5	9	7	6	8	3	4	11
117	5	9	11	10	4	3	8	7	1	6	2
132	2	11	9	4	3	5	8	1	10	7	6
134	3	7	8	2	1	9	4	10	5	6	11
151	1	7	2	4	5	10	9	8	3	6	11
161	3	6	1	4	9	5	8	10	7	2	11
R_j	43	137	77	74	96	97	124	108	84	82	134
$R_j - \frac{\Sigma R_j}{N}$*	-53	41	-19	-22	0	1	28	12	-12	-14	38
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	2809	1681	361	484	0	1	784	144	144	196	1444

* $\frac{\Sigma R_j}{N}$ = 96 (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 19 Data

Processing Administrators: Single School Serving only Itself

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
25	1	9	2	4	8	11	7	6	3	5	10
48	10	11	3	1	6	2	5	7	9	8	4
58	10	11	1	2	9	5	8	6	7	3	4
59	8	6	9	2	10	5	11	3	1	7	4
62	1	11	3	4	6	5	8	9	2	7	10
63	5	9	10	11	7	6	2	1	8	4	3
64	11	9	10	1	2	8	3	4	5	7	6
65	2	11	7	3	1	9	10	6	8	4	5
68	2	7	1	4	5	10	9	8	3	6	11
69	2	7	1	4	5	8	9	10	3	6	11
77	11	6	2	10	9	8	5	4	3	1	7
86	6	2	5	1	4	10	9	8	11	3	7
89	1	7	11	5	4	9	8	10	3	6	2
96	4	11	6	10	7	8	9	3	5	1	2
102	4	11	6	2	8	5	10	1	9	3	7
106	7	11	8	4	6	10	2	1	3	5	9
132	2	11	9	4	3	5	8	1	10	7	6
143	4	6	1	8	9	3	7	10	5	2	11
151	1	7	2	4	5	10	9	8	3	6	11
R_j	92	163	97	84	114	137	139	106	101	91	130
$R_j - \frac{\Sigma R_j}{N}$*	-22	49	-17	-30	0	23	25	-8	-13	-23	16
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	484	2401	289	900	0	529	625	64	169	529	256

*$\frac{\Sigma R_j}{N} = 114$ (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 25 Data Processing

Administrators: Installation Serving only Central Office

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
15	9	1	11	2	5	10	6	7	8	3	4
43	4	8	3	1	2	5	7	10	9	6	11
44	2	11	1	10	8	3	9	4	5	7	6
56	1	10	2	9	5	8	6	7	4	3	11
57	5	11	2	7	1	10	9	6	3	4	8
52	3	7	11	8	10	6	2	9	1	5	4
61	3	11	8	1	7	9	5	2	10	6	4
80	7	8	1	10	4	6	9	3	11	5	2
83	5	6	4	3	2	7	8	9	1	10	11
92	2	8	1	5	7	3	9	10	4	6	11
93	1	11	7	3	8	4	10	9	2	6	5
98	6	11	2	7	8	10	9	5	3	1	4
99	1	7	3	4	8	2	9	10	6	5	11
100	7	6	8	1	9	10	5	3	2	4	11
116	1	10	2	5	9	7	6	8	3	4	11
117	5	9	11	10	4	3	8	7	1	6	2
120	1	7	2	3	6	10	8	9	4	5	11
127	5	11	10	6	7	9	8	3	4	1	2
131	1	6	5	4	11	10	9	7	2	3	8
134	3	7	8	2	1	9	4	10	5	6	11
136	4	10	1	7	11	8	9	6	3	2	5
146	4	8	3	1	7	11	10	9	2	5	6
152	7	11	1	5	2	3	4	10	9	6	8
154	1	4	10	2	9	3	8	7	5	6	11
175	1	7	2	4	5	9	8	10	3	6	11
R_j	89	206	119	120	156	175	185	180	110	121	189
$R_j - \frac{\Sigma R_j}{N}$*	-61	56	-31	-30	6	25	35	30	-40	-29	39
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	3721	3136	961	900	36	625	1225	900	1600	841	1521

$^*\frac{\Sigma R_j}{N} = 150$ (Composite mean)

Raw-Score Ranks of 11 Problem Areas as Perceived by 73 Data Processing Administrators:

Central Office Installation Serving Several Schools Within District or Area

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
3	6	11	10	2	3	7	9	1	8	4	5
4	1	11	7	5	6	4	10	3	9	8	2
7	2	10	1	5	6	3	4	7	11	8	9
8	1	7	8	11	6	2	9	3	10	5	4
9	1	6	2	7	9	4	10	5	11	8	3
10	3	8	4	9	6	5	2	1	10	7	11
12	3	10	7	4	5	9	8	6	11	2	1
13	2	11	1	4	6	7	8	9	3	5	10
14	9	10	4	5	8	11	2	6	3	1	7
16	4	5	3	2	11	1	8	7	10	9	6
17	2	1	3	4	6	8	9	7	11	10	5
18	8	9	1	10	2	6	4	11	3	7	5
19	11	10	4	6	5	7	1	9	2	8	3
20	9	10	1	11	8	4	5	3	7	2	6
21	5	6	1	2	9	3	11	10	4	7	8
26	3	11	10	2	8	9	7	6	1	4	5
27	5	10	3	7	1	2	6	4	9	8	11
28	1	7	2	3	5	8	9	10	4	6	11
29	1	3	6	5	4	11	10	7	2	9	8
30	6	3	4	1	8	5	7	2	11	9	10
31	3	8	4	2	1	5	10	9	7	6	11
32	1	3	4	2	5	9	10	11	8	7	6
34	5	11	8	9	10	4	6	1	7	2	3
35	1	3	6	2	9	8	7	10	4	5	11
36	9	10	11	4	6	8	3	5	1	2	7
37	5	9	2	1	3	6	8	10	11	4	7

System Code	Problem Areas and Assigned Ranks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	IX
40	11	10	1	9	2	8	6	4	7	5	3
41	7	3	2	8	1	11	6	4	10	9	5
42	5	11	1	2	7	4	10	3	9	6	8
45	11	10	2	1	9	6	3	4	8	7	5
47	5	11	4	1	10	2	9	8	7	3	6
54	7	6	1	2	4	9	10	8	5	3	11
60	6	3	11	4	10	7	2	1	9	5	8
70	2	8	4	3	5	1	11	10	9	6	7
71	5	4	3	10	8	1	9	7	11	6	2
73	4	11	2	5	8	7	3	10	9	1	6
76	5	4	6	11	2	10	8	7	3	1	9
78	1	11	4	10	7	5	6	8	9	2	3
82	1	7	11	2	5	10	6	4	3	8	9
88	7	3	11	5	1	10	9	8	4	6	2
90	10	11	4	1	3	6	7	5	8	2	9
97	10	8	5	1	3	2	9	4	11	6	7
103	5	11	3	1	2	8	10	7	4	6	9
105	3	11	4	5	8	7	2	6	10	1	9
107	1	11	2	9	3	4	10	6	5	8	7
110	1	10	3	9	6	4	8	5	2	7	11
111	1	11	2	3	8	10	5	7	9	4	6
113	4	10	9	7	8	11	3	5	6	1	2
115	2	4	3	9	1	11	10	8	5	7	6
118	5	10	9	8	3	7	4	1	11	2	6
119	1	11	2	3	6	4	8	9	7	5	10
121	4	10	8	1	3	7	11	5	9	6	2
123	10	6	7	9	11	5	8	1	2	3	4
124	7	10	4	1	2	6	9	5	11	3	8
125	1	9	2	8	3	11	6	5	10	4	7
128	2	11	3	4	8	1	10	6	9	5	7
130	8	10	1	9	2	7	11	6	4	5	3

	Problem Areas and Assigned Ranks										
System Code	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
135	7	11	1	10	2	3	8	6	9	5	4
136	4	10	1	7	11	8	9	6	3	2	5
138	10	9	1	2	8	5	7	6	11	3	4
140	3	6	2	1	7	8	11	5	9	10	4
143	4	6	1	8	9	3	7	10	5	2	11
145	2	10	1	4	8	3	6	9	5	7	11
146	4	8	3	1	7	11	10	9	2	5	6
148	1	10	2	9	6	3	8	11	7	4	5
151	1	7	2	4	5	10	9	8	3	6	11
152	7	11	1	5	2	3	4	10	9	6	8
153	8	9	2	4	1	7	6	3	10	5	11
154	1	4	10	2	9	3	8	7	5	6	11
155	10	9	3	1	2	4	6	5	7	11	8
158	2	6	9	4	10	7	1	11	3	5	8
161	3	6	1	4	9	5	8	10	7	2	11
162	5	9	2	8	10	4	1	7	3	6	11
164	1	4	2	11	10	5	9	6	8	3	7
167	9	10	7	5	8	6	4	1	11	3	2
171	2	1	7	10	8	3	9	4	11	5	6
174	1	10	11	9	7	2	6	3	4	8	5
175	1	7	2	4	5	9	8	10	3	6	11
176	9	8	11	7	5	4	2	3	10	6	1
R_j	490	920	516	549	649	709	786	685	692	572	758
$R_j - \frac{\Sigma R_j}{N}$*	-176	254	-150	-117	-17	43	120	19	26	-94	92
$\left(R_j - \frac{\Sigma R_j}{N}\right)^2$	30976	64516	22500	13689	289	1849	14400	361	676	8836	8464

* $\frac{\Sigma R_j}{N}$ = 666 (Composite mean)

APPENDIX C

CASE REPORTS OF EFFECTIVE DATA PROCESSING INSTALLATIONS

LIST OF FIGURES IN APPENDIX C

Note: Case reports delineated in Appendix C, pursuant to solutions or circumventions of previously identified problems, were conducted with the aid of an interview guide (Appendix A). The case reports consist of a brief history of the installation; problems, their solutions or circumventions; and a description of pupil accounting procedures. All statements are results of a personal interview with the administrator of data processing in each school or system.

CASE REPORT OF SYSTEM A

System A is one of twenty-six county school districts within the state. The mushroom-type growth of a nearby metropolitan area has spread into the County in which System A is located. Student population has grown from 20 to 80 thousand in the last ten years--representing an increase of 5 or 6 thousand students each year. Fifteen to twenty million dollars a year have been spent during this time on capital outlay for additional buildings, but approximately one thousand students still attend school in shifts. The annual operating budget is approximately 35 million dollars.

The population, most of whom are employed in the nearby city, is unique by several standards. Most of them are professional or highly trained persons with education, abilities, and incomes well above the national average. The median IQ score on the California Mental Maturity Test (Short Form) for the student population was 114 in 1960.

Student enrollment in System A expanded to the point that manual processing of data was not satisfactory and a search was begun for a more efficient process. School board members from this professionally dominated population demanded facts and figures upon which to base decisions, but the information was not available. The embarrassing failure to supply statistical demands lent impetus to the movement to secure more efficient methods of processing data.

A basic punched card battery consisting of a keypunch, sorter, and tabulator was acquired in 1950. IBM representatives were commercially oriented, and the transition to business office records was accomplished

easily.

The first and most readily adaptable application at that time was the payroll. Manufacturer representatives displayed no concept of handling anything other than the financial aspects of the school system. Consequently, the focus for the next four years was upon refining procedures for maintaining business office records.

In 1954 the Director of Research acquired information from The California Test Bureau that punched card equipment was being used for processing standard test results. After the initial break-through with test results, pupil inventories and surveys were processed on the machines. Since 1954, emphasis had been on the development of the pupil accounting area. The machine battery has more than doubled but still does not have the capacity needed.

An IBM 1401 computer is on order and will be delivered to the system in 18 months. The Assistant Treasurer has been released from his business office duties to direct the planning and integration of electronic data processing with emphasis upon its potentiality for the development of pupil accounting.

A. PLANNING

The data processing administrator indicated that a desire must prevail among the staff to make facts available upon which proper decisions can be based. One of the problems in planning was the inability to get the personnel involved to take a long-range look at their area of responsibility. If they can be stimulated or oriented

to take this step, half the battle is won.

A minimum of six months was recommended for pre planning prior to the delivery of equipment. During this time, it may be determined whether the financial or pupil accounting approach will be initiated. Even if pupil accounting is deemed most important, the payroll readily lends itself to this type processing and is a means of justifying the equipment while pupil accounting is being developed. The size of the system would definitely be a determinant in the amount of time reserved for preplanning.

When a new application is being considered, representative personnel directly affected should be included in the planning. They not only can insure reasonable ramification of facets to be considered but will serve as leaders to communicate the new process to their peers.

Technical assistance during development was restricted to the manufacturer representative. System specialists were not employed; however, additional assistance would have been valuable. Other school systems with data processing installations are often valuable sources of assistance, but their procedures generally have to be modified to fit individual system requirements.

An eminent needs exists for adminstrators charged with the top responsibility of the data processing program to have reasonably accurate concepts as to the potential of the equipment. If not, a $14,000 idea might be sat on by a $7,000 machine supervisor.

Starting several applications simultaneously should be given careful consideration. In business records, payroll and accounts payable

may be started simultaneously. The complexity and number of personnel upon which the system is dependent for source data discourages starting several pupil accounting procedures simultaneously.

Housing requirements determined prior to arrival of equipment were based only upon the space required to house the equipment. Consequently, after a few months expansion was necessary and the space demands increased proportionately with new procedures. Administrators of new installations should be liberal in the estimation of space needed to house equipment.

New applications should be considered according to their economic feasibility, and economy should be measured in terms of teacher time. For example, attendance accounting should be given priority over class scheduling because of the time involved. In other words, is it more important to save the principal a few hours or to save every teacher in the entire system many hours?

B. EQUIPMENT

The selection of equipment was satisfactory. The assistance of manufacturer representatives proved most beneficial. All equipment is rented. Since the initial selection, it has been necessary to acquire additional as well as faster equipment. This sequence appears to be a natural one. Early stages of development generally do not require an extensive battery of equipment. Therefore, by selecting only essential machine needs of reasonable speed, a considerable saving may be realized in rental costs.

Long-range machine requirements should be a consideration

accompanying long-range planning. Ascertaining machine needs should be in two classifications--immediate and long range. Determine the immediate applications and select the machines to perform that application. Make long-range plans for extensive, integrated applications, a part of which would be the determination of equipment necessary to perform the tasks. An important consideration between the two is that equipment for both should be compatible. Immediate machine needs are generally basic punched card batteries, and long-range needs are generally in terms of electronic computers. Long-range machine selections should not render the basic battery obsolete or vice versa.

Maintenance has been excellent. Many maintenance problems have been avoided through preventative maintenance--run a good shop and have operators take proper care of the equipment.

A keypunch, a sorter, and a tabulator are the basic essentials for an independent operation. The keypunch might be delivered first, but the sorter and tabulator would have to follow shortly before any appreciable progress could be made. The verifier is a desirable piece of equipment; however, it is possible to prove accuracy of punching with collator, etc. Most operations will need a verifier, even though a collator and other peripheral equipment are available.

All equipment in System A is rented. However, if capital funds were available, it would be more economical to purchase. Serious consideration is being given to the purchase of keypunches to replace the present ones which are rented. The opinion of the administrator was that most systems could purchase keypunches more economically than

they could rent them. This is especially true where a system maintains a typewriter repair service. The manufacturer offers free schooling on keypunch maintenance to customers' typewriter repairmen. Since cost of maintenance is the prime objection to purchasing equipment, the keypunch phase of the problem could be alleviated.

The administrator of System A has not had experience with a Series 50 battery. On a few occasions, a service bureau was utilized during peak periods. However, that practice has been discontinued. The processing cost of the service bureau was prohibitive. It takes very few service-bureau contracts to compensate for additional rental of equipment necessary to perform the task independently of service bureaus.

A serious study of data processing should be undertaken before beginning an operation on a service-bureau basis. The experience of the administrator was that the excessive costs of service bureaus counteracted the first year's rental on the basic equipment necessary to perform the job. Even routine operations were not recommended.

C. ORIENTATION OF PERSONNEL

The administrator experienced no trouble communicating with personnel outside the school about the data processing installation. The school board, in its demand for factual information upon which to base decision, reflected the wishes of the public, who had no objections to the cost. The equipment offered a solution for the deficiency of data maintenance, and the public was willing to pay for it.

Slight resistance against data processing was evident among a

few teachers and principals. Resistance to change will always appear in varying degrees among groups affected by the change. The degree to which it appears can be magnified or reduced by administrative control. The key is that people fear that which they do not understand; therefore, the clue is to exhaust all resources to insure full understanding.

Orientation of educational staff involved three factors: (1) explaining the need of a new system, (2) explaining the advantages of the new system to all concerned, especially to the teaching staff, and (3) a detailed, circumstantial procedure was demonstrated to show their part in supplying source data. Figures 1a, 1b, and 1c are illustrations of the detail necessary to insure satisfactory collection of source data. The principals were given detailed instruction on the procedure; then, it was their responsibility to convey this instruction to their staff. When the source data was collected from the teaching staff, the principals were oriented on the new procedure and held responsible for a smooth, accurate function on that level.

New procedures were explained through both oral and written explanations to groups of functional size, generally individual school groups. The explanation included a demonstration, and the group was given a facsimile problem situation to perform. Problems should be repeated until everyone has a clear concept of the new procedure.

D. OPERATIVE PERSONNEL

Initially, the better typists expressing interest were retrained

as keypunch operators. They were trained at a manufacturer's school. Outside personnel were employed when this source was exhausted. Most of the latter group were typists who were also sent to the keypunch school. The manufacturer's aptitude test was used satisfactorily as a screening device. Experienced keypunch operators could not be employed because of salary competition from industry. Therefore, it was necessary to train their own personnel.

The turnover among operative personnel has been high. Industry lures trained operators away from the system with higher wages. Most operators are married females; therefore, pregnancy and transferred husbands take a toll of employees.

Although limited in number, the most desirable source of subordinate personnel was from within the organization. A training or transition period is necessary for any person in a new position; therefore, personnel from within the organization understand the over-all operation which results in an easier, more efficient transition.

Machine personnel receive wages comparable to regular clerical workers. In competing with industry, the wages would have to be higher. Employment of part-time personnel during peak periods was considered desirable, but they have not been available in the area.

The administrator considered the most desirable source of supervisory personnel to be from within the organization. The administrator of the entire data processing division is the Assistant Director of Finance, a licensed Certified Public Accountant. Without previous experience in machine data processing, he has merged his systems

experience in accounting with the technical knowledge of the machine room supervisor to produce a successful operation.

E. ORGANIZATION

The data processing division is under the administration of the Finance Division. The Assistant Director of Finance coordinates the operation with the Research and other divisions. Although finance is more sophisticatedly developed, the Director of Research expressed satisfaction with the organizational structure.

Business office records are generally processed from the first to the fifteenth of the month. The latter part of the month is devoted to test record processing and to other pupil accounting functions. However, rush jobs from either division can be intermittently executed during the other half of the month not designated for them. The half-month schedule for each of the two divisions appear to be working to the satisfaction of both divisions.

The administrator acknowledged that flow charts and detailed procedures of operations should be documented. However, it is most difficult to accomplish because of the time involved.

F. CODING

Manufacturers, state, and federal agencies can furnish assistance in coding. Attempts are being made to standardize coding procedures in the state in which System A is located.

Suggested Codes for Machine Processing,[1] a publication resulting from the combined efforts of local, state, and federal authorities, has been an excellent resource in this area.

A new installation should contact the state department of education before coding is attempted. All personnel directly concerned with the data to be coded should be involved in the determination of a new code. Leadership, coordination, and final authority for coding should rest with the data processing administrator.

Permanent code numbers for students have been delayed because the state is attempting to design a state-wide coding regulation. Coding regulations have not been printed in System A, but the administrator stated that they should be printed and copies distributed to personnel concerned.

G. FORMS AND SUPPLIES

Card and form designing is a time-consuming procedure. Card and form suppliers have given excellent assistance. In some cases, the states have designed cards and forms which can be utilized by the local installations. In this case, stock designs are available; otherwise, special cards and forms must be designed.

When planning a new application, the supplies necessary to perform the job should be designed and purchased. The plate for a new

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[1]U. S. Department of Health, Education and Welfare, Suggested Codes for Machine Processing, (Washington: Government Printing Office, 1960).

card design costs about $60. After the initial purchase, the form is of stock design and can be purchased more economically. Purchasing specially designed cards or forms was difficult on a bid basis.

H. GOVERNMENTAL REPORT REGULATIONS

Machine processing of student records was acceptable with the state department. The only difficulty experienced in this area was state regulations governing the coding of absences and accounting for tardies. Marked sense cards are limited to 27 positions. Accounting for absences, reasons for absences, and tardies was practically impossible with 27 positions for a 20-day attendance period.

I. TECHNICAL INFORMATION AND ASSISTANCE

Technical information and assistance has been satisfactory. The manufacturer representative was available during early stages of development but his availability decreased with the age of the installation. His assistance in business office accounting was excellent but less effective with pupil accounting.

Other schools with data processing installations were an excellent source of technical information and assistance. All schools visited were unanimously cooperative.

Technical literature in pupil accounting was difficult to adapt to local conditions. The problem may always prevail due to unique differentials of locally controlled schools.

J. STUDENT RECORDS

Attempts to maintain a census have been abandoned because of the transient nature of the community.

Attendance. A pilot program was attempted last year in one of the high schools. Next year, it will be implemented in all of the high schools. An elementary program for attendance has not been developed at this time but is in the planning stage.

Grade Reporting. Grade reporting was also attempted on a trial basis last year. However, it was not accepted and will not be implemented next year.

Cumulative Records. Cumulative records are not processed on machines. It will be necessary to perfect attendance and grade reporting before permanent records can be maintained on machines.

Scheduling and Registration. Registration for a junior college within the district is being executed by the data processing department. Pilot attempts also have been made in the high schools, but the transiency of the population interfered with a finite development of the procedure.

Test Records. Test records are the most complete pupil accounting function in the system. It is the one termed outstanding by the jury.

The California Mental Maturity Test (Short Form) is administered to approximately 30,000 students in the grades 3, 5, 6, and 8.

1. The tests are administered in the schools. Each of the 4 answer sheets i arranged alphabetically by section and forwarded to the central office.

2. The central office staff machine scores and collates the four tests, without disturbing the alphabetical arrangement.

3. Student number, name, and other information through card column 35 is reproduced from a master card into Card A (Figure 2) for each student.

4. Raw scores for each test are keypunched into Card A for each student. Each card is verified.

5. Student data and raw scores are reproduced into Card B (Figure 3). Cards are run through the calculator, and the raw scores are converted into derived scores needed for Total Mental Factors.

6. Card C (Figure 4) is reproduced from Card A raw scores. Achievement factors are derived from the raw scores through the use of the calculator. Achievement factors are based on two norms, local and national, which give a broader basis for more complete analysis of each student.

K. BUSINESS OFFICE RECORDS

Procedures for processing business office records have been satisfactorily developed in System A. The data processing administrator is a Certified Public Accountant, highly trained in business office systems. In addition, the manufacturer representatives extended excellent assistance in developing the area.

Business office records currently maintained on punched card equipment are: payroll, cost accounting, appropriation accounting, property accounting, personnel, cafeteria accounting, supply requisitioning and inventory, and monthly financial reports.

Form 61C1

Use a number 2 pencil only. Do not fold, bend, staple, or mutilate card.
Return completed card to your principal.

INSTRUCTIONS FOR COMPLETING THE ELEMENTARY SCHOOL STUDY CARD
([redacted] State Department of Education Form DPD-956)

The new elementary school study card is an IBM "mark-sense" card developed by a committee of superintendents, supervisors, principals, and members of the State Department of Education in co-operation with the State Data Processing Division to provide important information about staffing and teacher load in our elementary schools. In order to give accurate data the cards must be marked correctly. The questions and answers below give specific instructions.

WHO SHOULD MARK A CARD

Each of the following should mark a separate card for each school to which he is assigned:
Regular grade teachers
Special Education personnel
Special Subject personnel
Administrative personnel
Professional and clerical, nonteaching and nonadministrative personnel

The list on the back of the card gives a breakdown of each of the above groups.

HOW IS THE CARD MARKED

1. Use a regular lead (graphite) #2 pencil only.
   Do not use colored pencils, wax crayons, or a ball point pen since the IBM machine will recognize only graphite marks.

2. Make a firm stroke in the space provided for the mark. ⊂6⊃
   A dense, black, solid line is desired.

3. Stay within the marking area. A mark that is too high, too low, too long, or too short may be improperly punched.

NOTE: If you have never filled out a mark-sense card, you may wish to refer to the example on the reverse side of this sheet before proceeding further.

WHAT SHOULD BE MARKED

<u>Name</u>	Print your last name, first name, and initial in the space indicated.
<u>Sex</u>	Mark appropriate space in this column.
<u>Experience</u>	The instructions are on the card. A mark must be placed in each column in order to register correctly. For example, if a teacher has taught 8 years <u>excluding</u> the present school year, mark⊂0⊃in the first column and⊂8⊃in the second column. A teacher with no previous teaching experience should mark⊂0⊃⊂0⊃.
<u>Certification</u> ([redacted] Counties)	This area is in 3 parts. Place <u>one</u> mark in this area in the appropriate part. Educational personnel in [redacted] counties who have been issued certificates should mark "Regular," "P[redacted]al," "Emergency," or "Substitute." County personnel whose certificate[redacted]t yet been issued should mark "Unknown." Personnel not requiring cert[redacted]n, such as doctors, nurses, and secretaries, should mark "Not Applicable."
<u>Major Assignment</u>	Use the code on the reverse side of the card to mark this area. Place one mark in <u>each</u> column. For example, a regular grade teacher should mark⊂0⊃⊂0⊃; a music teacher should mark⊂4⊃in the first column and⊂1⊃in the second column; a secretary should mark⊂6⊃in the first column and⊂1⊃in the second column.
<u>Your Time in This School</u>	The school week of 5 days has been divided into 10 half-days. If you work 1 half-day per week in this school, 1/10 of the week, mark⊂1 10⊃; similarly, if you work 3 full days per week in this school, 6 half-days, mark⊂6 10⊃. If you have an irregular schedule, mark the space representing the average time in this school.

Figure 1a. Instruction Sheet for Elementary School Study

<u>Pupil Count Full Day or A.M. Session</u>	This area is to be filled out by all persons working directly with pupils except those working with P.M. pupils only. (Nonteaching administrators, secretaries, and others not working directly with pupils will not fill out this area.)
<u>Pupils Session</u>	In this column mark the length of your pupils' day regardless of the time you spend in this school. Mark only <u>one</u> space. If you work with pupils attending more than one kind of session, mark "Other."
<u>Number of Different Pupils Served</u>	The number of pupils served should be those <u>on roll as of the last regular school day in January</u>. There are 3 columns to allow for recording more than 99 children. Mark <u>each</u> column. For example, a regular teacher working with 35 pupils should mark ⊂0⊃ in the first column, ⊂3⊃ in the second column, and ⊂5⊃ in the third column; a music teacher working with 308 pupils in several classes in this school should mark ⊂3⊃ in the first column ⊂0⊃ in the second column, and ⊂8⊃ in the third column. If you work with more than 999 pupils, mark ⊂0⊃⊂0⊃⊂0⊃. (This marking will be handled mechanically to indicate "1000 or more." Note: Report only the number of pupils you serve in your major assignment. For example, a regular grade teacher who exchanges classes for special instruction should report only those pupils in her regular class.
<u>Grade</u>	Mark only <u>one</u> space. Examples: A kindergarten teacher should mark ⊂K⊃ a third-grade teacher should mark ⊂3⊃; a teacher working with a combination of second and third grades should mark ⊂mixed prim⊃. Persons working with all grades, with ungraded classes, or with combinations of primary and intermediate grades should mark "Other."
<u>Roll Report</u>	This column will provide information for counting the total number of pupils in this school. Indicate whether you keep the register for the number of pupils with whom you work directly. Mark only <u>one</u> space.
<u>Pupil Count P.M. Session Only</u>	This area is to be filled out by persons working directly with pupils attending P.M. session only. For the columns in this area, follow instructions given for pupils on full-day or A.M. session. Note: A kindergarten teacher with different groups in the A.M. and P.M. session should fill out this and the preceding area.

Example: Mary B. Jones began teaching September, 1952. She has a bachelor's degree plus 15 hours graduate credit and holds a regular certificate. She is assigned as a regular grade teacher full time to this school where she teaches pupils attending full-day session. There are 35 third-grade pupils in her class (end of January roll). She keeps a class register for school enrollment.

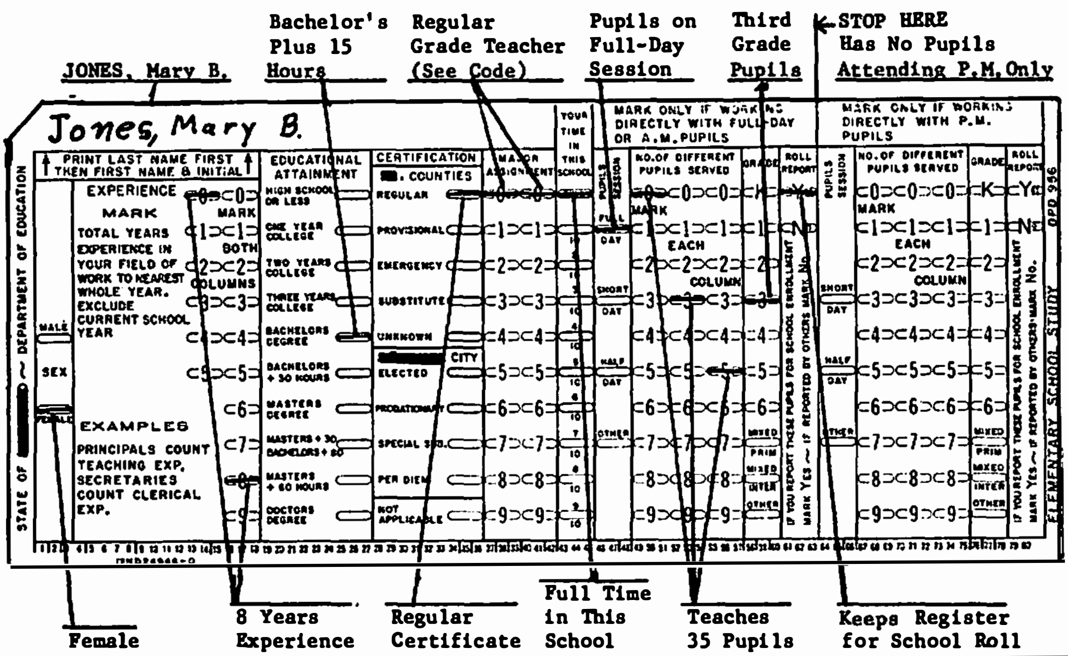


Figure 1a. ((Continued)

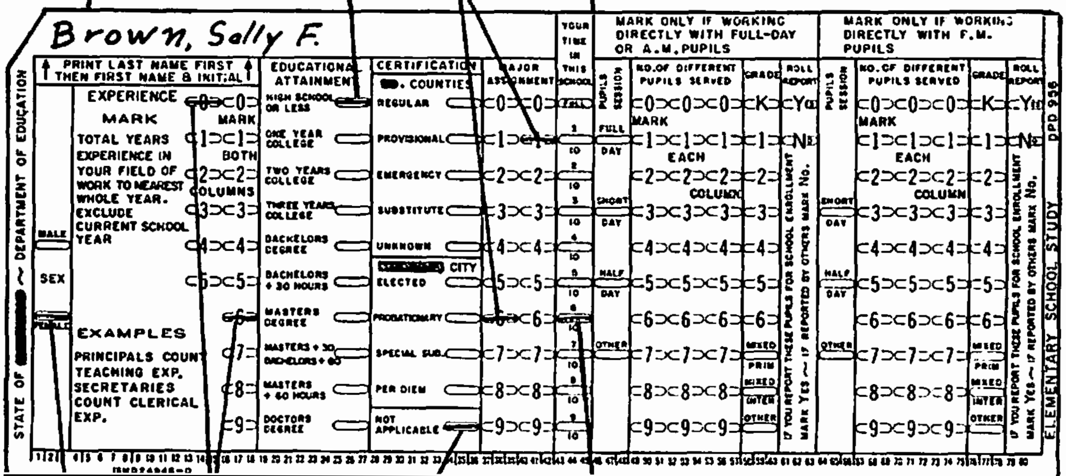
Form 61C2

Supplement To
INSTRUCTIONS FOR COMPLETING THE ELEMENTARY SCHOOL STUDY CARD
([redacted] State Department of Education Form DPD-956)

Example: School Secretary

Sally Frances Brown had 4 years clerical experience before taking her present position in September, 1958. She is a high school graduate. She is assigned as a school secretary 3 days a week in this school.

BROWN, Sally F. | High School Graduate | Secretary (See Code) | STOP HERE Does Not Work Directly With Pupils



Female | 6 Years Experience | No Certification Required | In This School 3 Days Per Week

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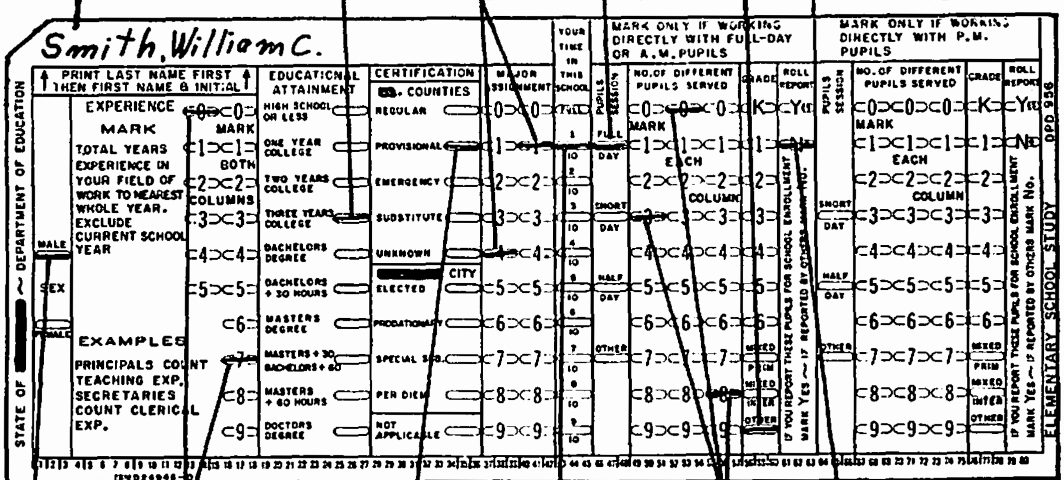
Example: Music Teacher

William C. Smith began teaching October, 1953. He needs six credits for his bachelor's degree and holds a Provisional Certificate. He is assigned to teach music every Thursday afternoon at this school where he has three classes of pupils attending full-day session. As of the end of January he has worked with 308 different pupils of various grade levels. The regular grade teachers report these pupils for school enrollment.

SMITH, William C. | Needs Six Credits for Bachelor's | Teaches Music (See Code) | Pupils Attend Full Day | Pupils in Various Grades | STOP HERE Has No Pupils Attending P.M. Only

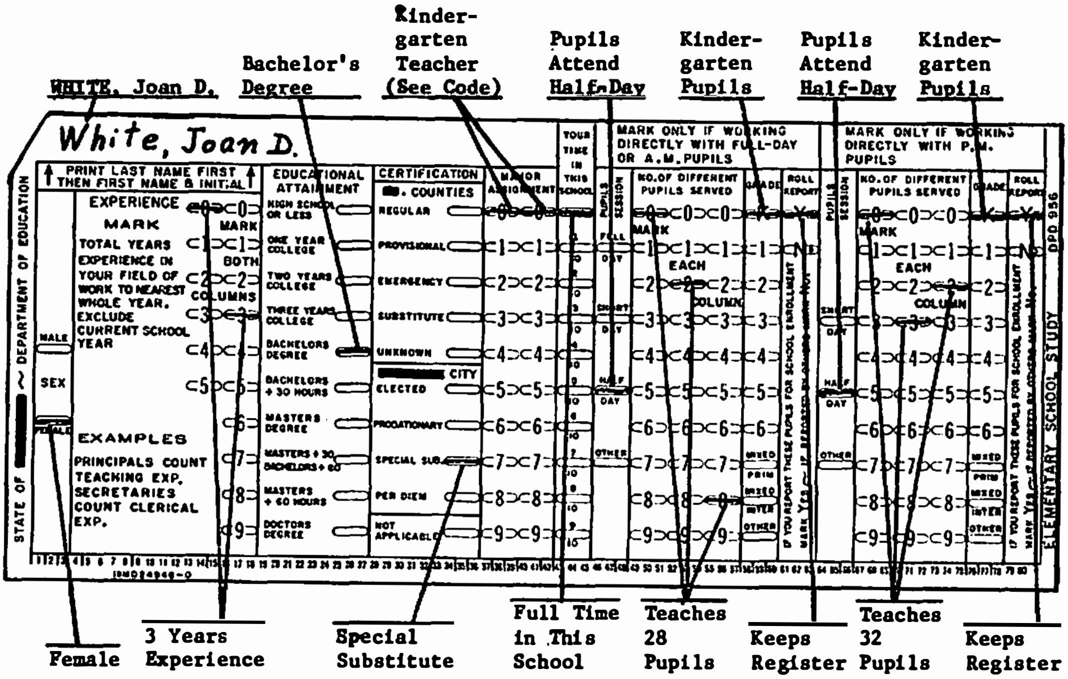


Male | 7 Years Experience | Holds Provisional Certificate | In This School One Half-Day Per Week | Teaches Total of 308 Pupils | Roll Reported by Other Teachers

Figure 1a. (Continued)

Example: Kindergarten Teacher

Joan D. White taught for two years, took maternity leave, and returned to teaching in September, 1959. She has a bachelor's degree and is a special substitute. She is assigned as a kindergarten teacher full time to this school where she teaches a morning kindergarten class of 28 pupils and an afternoon kindergarten class of 32 pupils (end of January roll). She keeps a class register for school enrollment for both groups.



Example: Principal

Margaret E. Johnson began teaching September, 1926. She has a bachelor's degree plus 45 hours graduate credit and has elected status. She is assigned to this school as a principal, teaching full time. Her pupils attend full-day session. In this school of 150 enrollment, she teaches 26 sixth-grade pupils (end of January roll). She keeps a class register for these 26 pupils for school enrollment purposes.

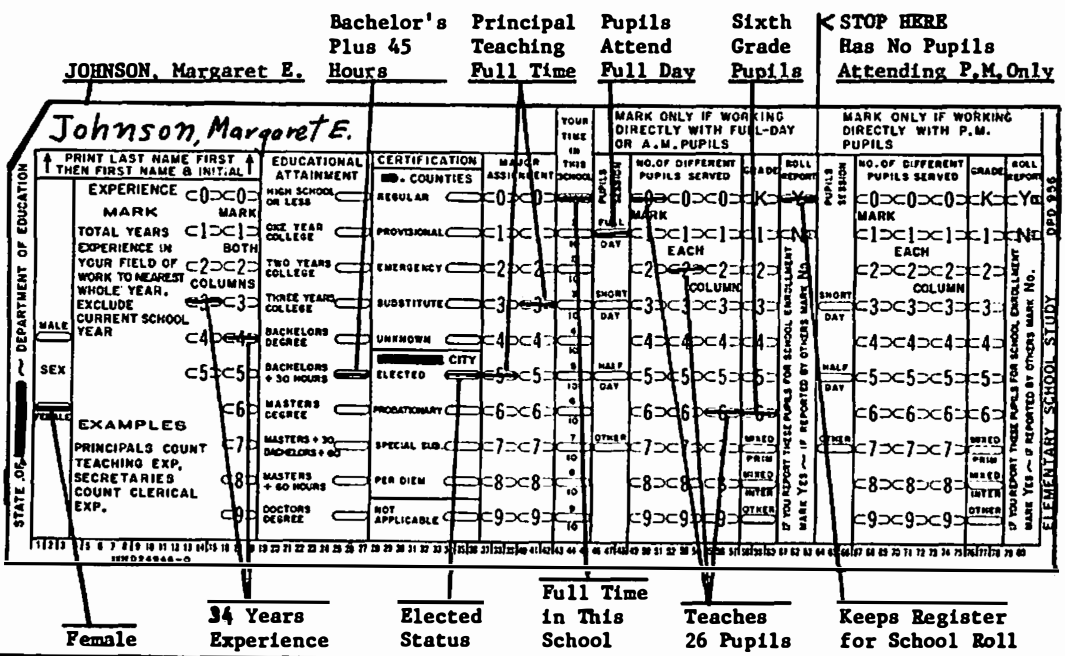


Figure 1a. (Continued)

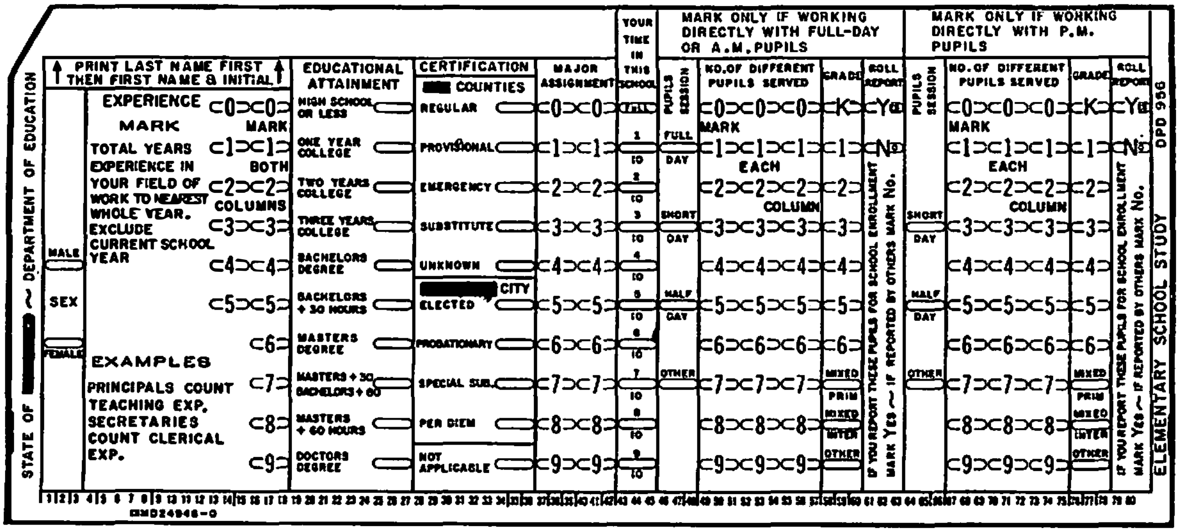


Figure 1b. Marked Sense Card for Elementary School Study (Front)

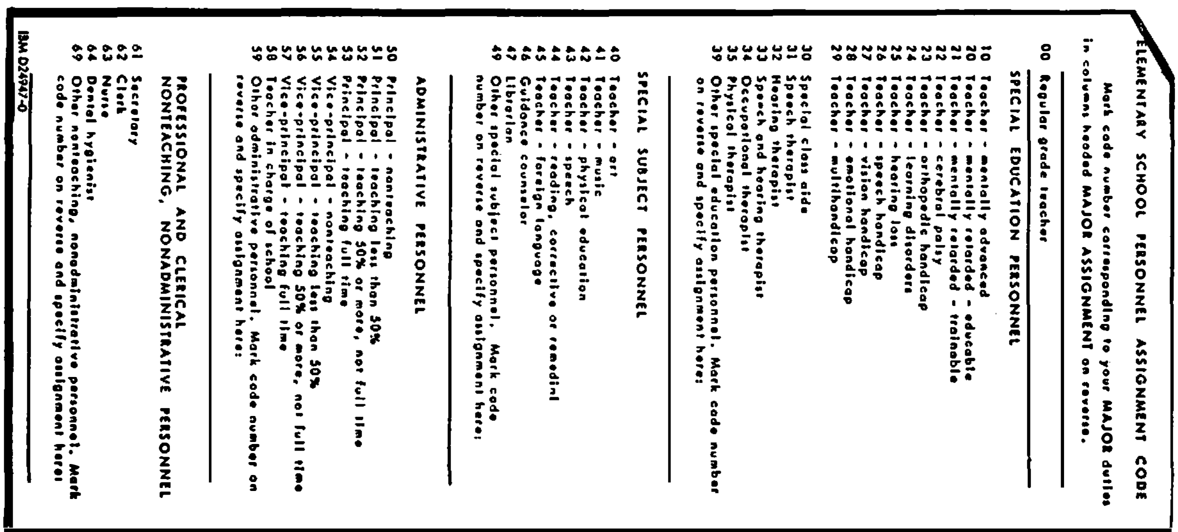


Figure 1c. Marked Sense Card for Elementary School Study (Back)

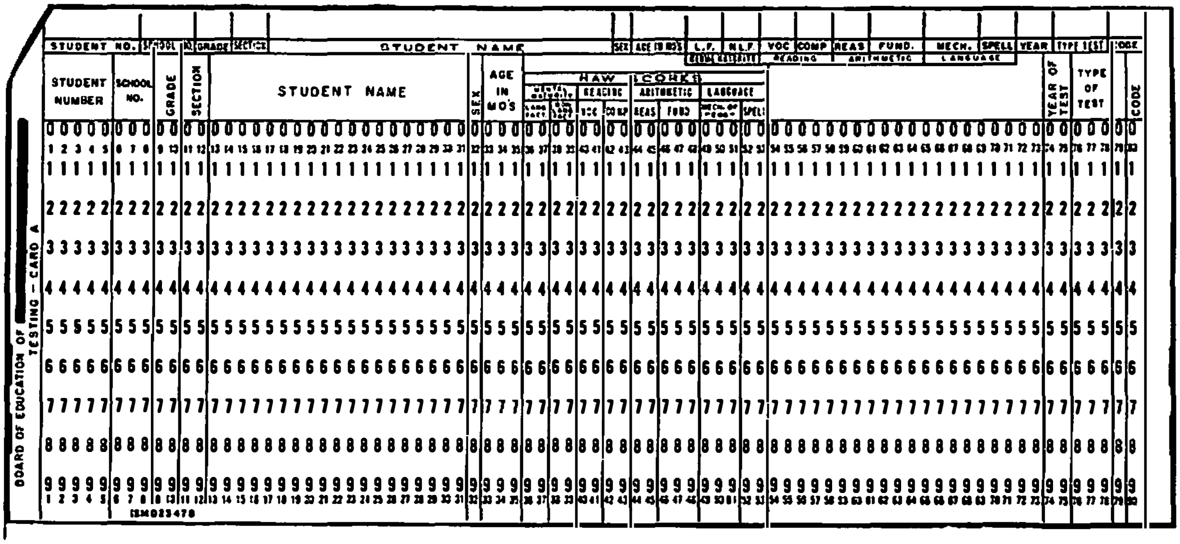


Figure 2. Testing Card A

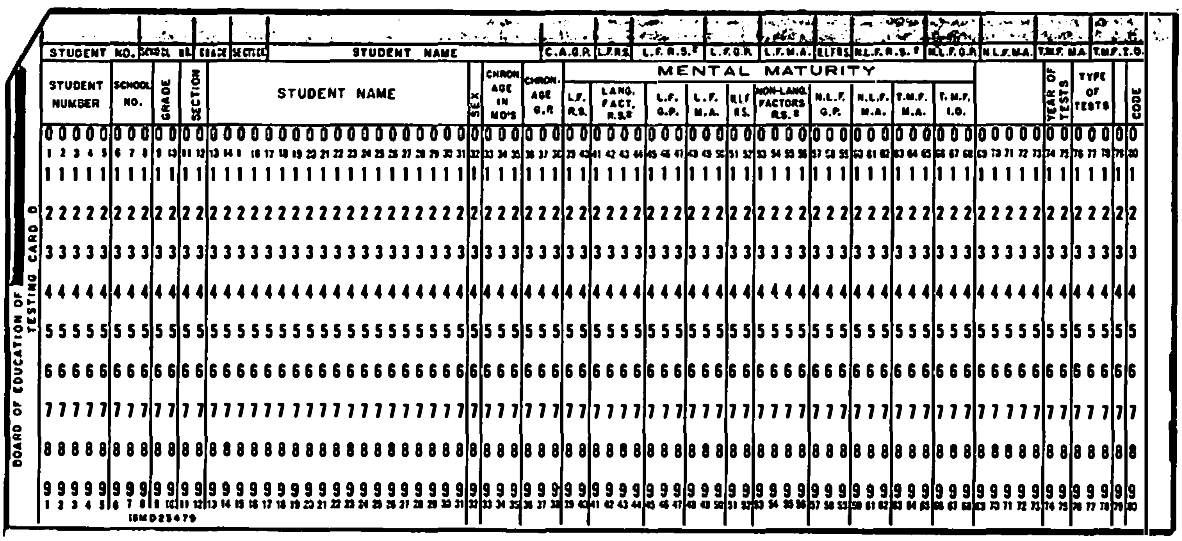


Figure 3. Testing Card B

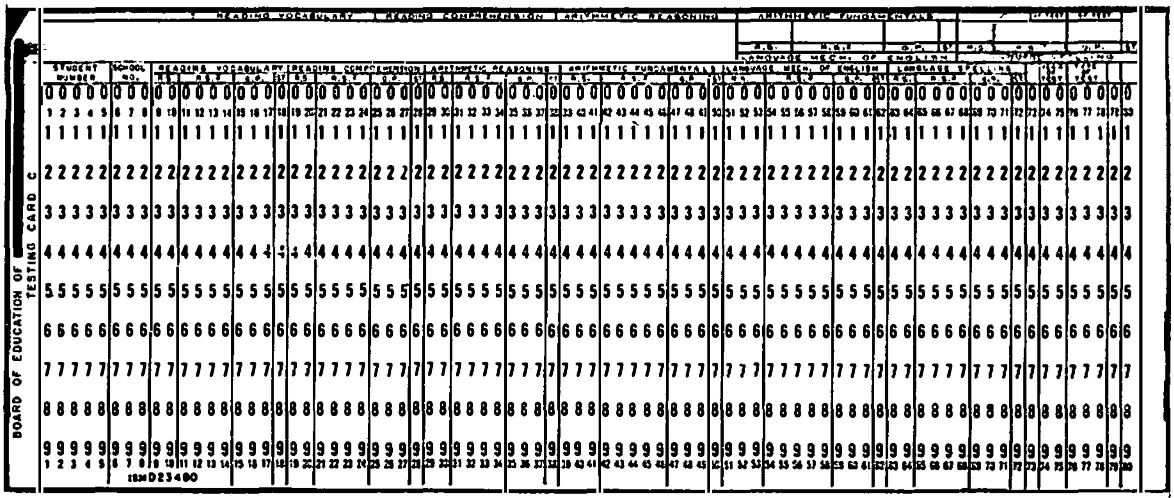


Figure 4. Testing Card C

CASE REPORT OF SCHOOL B

School B is a comprehensive high school with a student body of approximately 1,000. The city in which the school is located has a population of approximately 6,000. Seventy-five per cent of the high school enrollment take a college preparatory course, 7 per cent take a general academic course, 15 per cent take a commercial course, and the remaining 3 per cent take a vocational trades course. The high school has ability grouping with four groups in the constant subjects. There is no track system and students are scheduled individually. The testing program is broad with comprehensive achievement and aptitude testing. College Board Exams are given at the high school.

The increasing burden on teaching personnel in the preparation of student programs, class lists, attendance registers, report cards, testing records, and student permanent records stimulated School B to seek a more efficient records processing system. Punched card procedures were determined to be the most feasible.

Successful experience with the test scoring machine in the system led to the examination and later selection of punched card equipment by the same manufacturer, International Business Machines. The initial battery commenced in 1956 with a keypunch and sorter. Tabulating services were contracted from a nearby service bureau. A Series 50 tabulator was added to the basic battery of equipment at the end of the first year.

The most pressing demand for the advantages of machine data processing was in the area of pupil personnel records. The assistant

principal of the high school was responsible for pupil services and was instrumental in the initiation and development of pupil accounting procedures. Operative personnel was limited to a high school graduate, selected and trained by School B as a keypunch operator. The keypunch operator resigned at the end of a year and a half, and was replaced by a substitute business education teacher. Subsequent developments were combined efforts of the new data processing supervisor and the assistant principal. Currently, a woman with 20 years' experience in industry has been employed to relieve the former supervisor for full-time teaching duties.

A. PLANNING

Initiation of machine accounting on an individual school basis presents multi-faceted problems divergent of system-wide installations. Communication must radiate in all directions. The public, school board, administrators, and educational staff must be "brought along" together. Understanding the potential and accepting innovations such as data processing is of utmost importance.

Preplanning time will vary according to size of school system and technical resources available. Six months would be a minimum amount of time. Administrative organization of the data processing department should be formulated and the person charged with its responsibility should be selected. Generally, it is desirable to select an educational administrator several months prior to installation of equipment to administer and coordinate the services of the data processing department with all school departments and personnel. A technically trained person should

be employed as data processing supervisor to direct the actual processing of data. The supervisor can lend technical assistance during the development of applications. However, a person with a background in both educational administration and data processing would permit the consolidation of the two positions into one. Larger installations would still demand at least two persons to completely administer the entire program. Administrative personnel for data processing should definitely be employed in time to inventory and familiarize themselves with manual procedures as well as direct the preplanning.

People controlling the financial purse strings were neglected by School B; therefore, they failed to appreciate and provide adequate financial support for the data processing installation. The public, school board, school administration, and teaching staff should be represented in all phases of planning and development. The representative group should examine and decide which applications are feasible as well as their chronological sequence of implementation. Representation of all groups will promote understanding and an appreciation for the potential of the new tool. The fear of the unknown will diminish and the chief administrator's nightmare of being replaced by a machine will subside.

Technical assistance during development was limited to the manufacturer representative. Although the manufacturer extended assistance at every request, adaptation of the equipment to pupil personnel accounting was new and assistance limited. The representatives did not understand educational functions and requirements. However, the

representative learned pupil personnel accounting along with the personnel in School B. Since School B developed personnel accounting, many schools have developed sophisticated systems and afford excellent sources of information. Scores of people from practically every state and a few foreign territories have visited School B to secure information and assistance in developing their own data processing installations. In fact, the assistant principal in charge of pupil services has developed an excellent presentation of applications through the use of color slides which he personally narrates. The presentation, though graphic, lessens the amount of time required of School B personnel in presenting their data processing procedures to others.

B. EQUIPMENT

The most difficult problem encountered in regard to equipment was insufficient supply of funds to satisfy machine needs. The keypunch and sorter were the only two pieces of equipment for one and one-half years. A Series 50 tabulator was added to the two previously selected machines. Addition of a reproducer and collater would reduce processing time and permit expansion into business office records as well as enhance pupil personnel accounting applications. The school board has not provided funds for an adequate complement of equipment because the chief school administrator of the district fails to appreciate the potential of the equipment. Again, this is a situation unique to an individual school. The school system does not have machine data processing, only School B within the system; therefore, it is extremely difficult to

communicate the importance of the procedure to the system. This problem has not been solved by School B.

Although School B operated for more than a year with only a keypunch and a sorter, it recommended the addition of a tabulator as the basic essential to start a punched card operation. The sequence of delivery could be a keypunch and sorter, with a tabulator added when needed. As applications expand, a reproducer and collator are desirable.

With insufficient funds to satisfy basic machine needs, School B has not given consideration to rental versus purchase costs.

Machine maintenance in School B was excellent. The Series 50 tabulator in School B has been satisfactory, but the Series 50 sorter was entirely too slow in the absence of a collator. Many collating jobs are performed on the sorter; therefore, the sorter is used more than the normal average.

A local service bureau was engaged to process data on equipment which School B did not have. The bureau was cooperative but did not understand the problems of pupil personnel accounting. Previous experience of the service bureau had been in monetary dimensions, and statistical applications were difficult for them to fathom. Service-bureau charges were high in comparison with the processing cost of individually owned equipment. Complete utility of a service bureau in starting a data processing program was considered prohibitively expensive. However, they served an important function during peak or emergency periods.

C. ORIENTATION OF PERSONNEL

Most people tend to reject or resist that which they do not understand. Therefore, the implementation of new procedures should be fully explained to all personnel concerned. Intensive effort should be made on the part of the administrator to insure complete understanding of advantages by all those involved and their respective responsibility in contributing to the success of the new procedure. Misunderstanding breeds discontent which can result in the failure of innovations.

If the public expressed any discontent with the implementation of data processing, the administrator of School B was not aware of it. However, the public was informed through news media of the advantages of the new process.

The school board in System B failed to adequately appreciate the advantages of data processing. They supplied financial support for the bare essentials of operation but did not supply peripheral equipment necessary to increase the efficiency of processing. They did not seem to understand that the addition of a reproducer and collator would permit wider development of a more sophisticated procedure which would render more readily accessible data on all phases of the school program.

Office personnel of School B consisted of several departmental secretaries within the school. With the advent of machine data processing, a high school graduate was employed and trained to operate the equipment. Office personnel apparently accepted the new process in the beginning. However, when record-keeping tasks began shifting from various offices to the data processing center, the office personnel

displayed a degree of insecurity by objecting to various record-keeping functions being shifted from their control. Resistant attitudes of office personnel could probably be avoided by encouraging and training all office personnel to assist in the machine processing of their respective records.

Educational staff, mainly teachers, appreciate the relief from record-keeping duties. They must understand that the ultimate key to the success of the pupil personnel accounting is the teacher, since most source data must originate from them. More available data about students and the reduction of teacher time should be stressed.

The best orientation of teacher personnel was a combination of oral and written explanation, accompanied by pertinent problems for the teacher to solve. The simulated problems were repeated until the teacher could execute the function with confidence. A few teachers are always late in meeting report deadlines; therefore, responsibility should be placed upon the delinquent teachers instead of the entire staff. The time schedule for collecting data for machine processing is of paramount importance, and the teachers should understand its significance to the success of the operation.

Pupil personnel should be oriented by the teaching staff when source data originates from the student. Students are responsive to changing conditions and will readily cooperate with new procedures if they are presented in the proper attitude and manner by the teacher.

Teachers presented the strongest mind-set against changing to machine data processing. After they understood the advantages to both

themselves and the students, the unfavorable attitude almost disappeared. Resistance can be reduced, but its complete eradication is impossible. Administrative personnel not directly involved with machine data processing have displayed reactions indicative of the fear of replacement by machine. To insure adequate understanding on all levels, communication must radiate upward as well as downward.

D. OPERATIVE PERSONNEL

The supply of machine operative personnel has been stable. Only one full-time person is employed in the machines room. High school girls from the secretarial practice classes also work in the machines room on a part-time basis. High school girls displaying proficiency on the electric typewriter and an interest in machine data processing were selected. Before the acquisition of a keypunch for training in the business education department, the electric typewriter keys were masked and lettered similarly to the keypunch keyboard. Girls were taught the touch system in secretarial practice classes. Practical experience for students and a readily available supply of supplementary operators were two advantages of the practice.

The first full-time person was replaced by a substitute business education teacher who had not received training with punched card equipment. Her work was highly satisfactory, but she later chose to return to full-time teaching. A woman with 20 years' experience in industry is currently being trained to replace the former full-time employee.

It would be desirable to have a data processing supervisor with

training in both education and punched card equipment. Since this combination is practically nonexistent, a person trained with punched card equipment would be more desirable. Their lack of understanding educational functions could be supplemented by an educationally oriented person. If neither possessed technical knowledge of the equipment, there would be a sharing of ignorance. An excellent source of data processing personnel is women of near middle age, who have grown children, and are ready to return to the labor market. They are mature, stable, and will not present replacement problems common to younger female employees.

All personnel connected with data processing should be intelligent, interested in the type of work, and possess a high degree of initiative.

E. ORGANIZATION

The data processing department in School B was in the pupil personnel department under the directorship of the assistant principal. The assistant principal coordinated the program; and the machines department was managed by one full-time person, assisted by part-time high school students.

All departments appeared to be served equally and satisfactorily. Operations were restricted to pupil personnel accounting. Secretaries in the main office and other departmental offices maintained the business office records. Pupil accounting was distributed among these offices prior to the installation of punched card equipment. Office personnel status remained the same, while pupil accounting duties gradually shifted to the data processing department, as procedures were developed. Reduced

work of departmental secretaries did not bring about a reduction of staff nor an alteration of duties. The data processing personnel could have been supplemented through reorganization of departmental office staffs, but the administration felt gradual change of the organizational structure would later remedy the problem.

Administrative personnel acknowledged that flow charts and procedures should be documented, but the task was extremely difficult to accomplish. Documentation was not attempted until after a procedure was perfected. After perfection, the procedure worked smoothly, and the importance of documentation deminished. Documentation of pilot or trial procedures would only necessitate refinement; therefore, written flow charts and procedures would be more of a reality if all attempts were carefully recorded from the beginning.

F. CODING

Coding is the responsibility of the data processing department. Intensive measures were taken to ascertain the extent to which data would be used. Determination of usage and the interrelation of data between reports provided the base for establishing a code which would yield data in usable form.

Coding is a technical process of which teachers and other indirectly related personnel have little or no knowledge; therefore, they were not consulted about coding *per se*. Coding was determined by data processing personnel, and the assistant principal in charge of the entire operation made the final approval.

A six-digit identification number was assigned to each student. The entire student enrollment was sorted alphabetically, and a 6-digit identification number with intervals of 30 was assigned to each of them. For example, the first student in the alphabetical sequence was assigned 000030, the second student was assigned 000060, etc. Alphabetical placement of new enrollees are determined and placed numerically between adjacent numbers. If a new enrollee ranked alphabetically between student number one and two in the above example, he would be assigned number 000045. The student identification number remains the same until one year after graduation or transfer. The number is then eligible to be assigned to a new student. The system has worked satisfactorily thus far, but names beginning with the letter S are dominant, and numbers in that area are becoming acute.

A code book is printed on the tabulator and remains in the machines room at all times. One person is responsible for updating or making changes in the code book.

The name field for students is 25 spaces, but the components are not individualized. The data processing supervisor indicated this system was satisfactory and enabled complete printing of all student names. Deletion of vowels in last names to provide room for printing is confusing to teachers. Parents who feel that their students' names have been misspelled can become rather upset because of family pride.

G. FORMS AND SUPPLIES

In a new installation practically all forms and supplies are

specifically designed to fit unique needs. Plates for special forms cost approximately $45 each. After first printing, the rate is appreciably reduced. However, special-design costs can be reduced in many instances by preparing and printing forms on a mimeograph or multilith machine.

Color coding is an important feature to consider when selecting cards. Colors afford rapid, visual identification.

Forms and supplies should be developed prior to the beginning of a new application. They also should be given consideration during pre-planning, especially, the cost involved. If a system spends the limit on the equipment and fails to anticipate supplies costs, the equipment will probably be idle while budget increases are being sought.

H. GOVERNMENTAL REPORT REGULATIONS

The state education department of School B will not accept Regents' Exam reports nor attendance reports prepared by machines. Recently, a modified machine attendance procedure was accepted; but the regulation still required the teacher to maintain an attendance register. Of course, the duplication of effort reduced the advantages of using machines for attendance accounting.

I. TECHNICAL INFORMATION AND ASSISTANCE

Two sources of technical assistance were the manufacturer representatives and other schools with data processing. Dade County, Florida, and Cicero, Illinois, were consulted for technical assistance. Several

of their procedures were adapted to School B. However, the manufacturer representative was the main source of assistance. Through the exchange of their respective professional knowledges, the assistant principal and manufacturer representative trained each other in pupil personnel accounting. The manufacturer representatives assisted to the extent of their ability, but their lack of knowledge about statistical or pupil personnel accounting restricted their usefulness. Practically every procedure had to be developed on a trial-and-error basis.

As a result of developing the present system, the assistant principal could develop a new system more rapidly, efficiently, and thoroughly. Had training been available to the assistant principal prior to the installation in School B, most of the difficulties might never have been encountered.

J. STUDENT RECORDS

The first and most vital step in pupil personnel accounting is to establish and maintain a student master card. Initially, the necessary information can be secured from an in-school census. Accuracy of this file must be absolute before launching into other procedures.

Student Registration and Scheduling. Each year the student receives a booklet of course offerings. Together with his parents and counselor, he decides on his four-year program, which can be changed in subsequent years if necessary. The assistant principal and counselors group the students according to ability in the various subjects. All the testing information, teacher recommendations, and the most recent

grades of each student are printed in a booklet by machine record procedures so that a decision on the grouping of each student can be made. After the groupings are made, the information is transferred from the four-year program to an IBM registration card by punching a card for each student.

The first step in the above described procedure is to assign a number to each student and teacher for identification purposes (see F. Coding in this report). Then each subject is assigned a code number (Figure 1). For example, English 12A might become E12A with the code number 35-5, the number 5 being punched in card column 35. The procedure enables the operator to punch the code number in one column of the card, and later select the card, count, and print the information from it.

From the student's four-year program card (Figures 2a, 2b) each of his subjects is written by symbol and code on a registration card (Figure 3) by a clerk in the Guidance Office. The registration card had been intersperse gang punched with the student's name, number, sex, and grade from a student master card (Figure 4) which contains this information. The code for each subject is keypunched into the registration card. All registration cards are color coded by class for quick sight selection and a check as to grade.

All student registration cards are sorted in each column from 34 to 79, subject by subject, to determine the number of students requesting each subject. These data are entered by hand on tally sheets. The tally sheet is a list of courses with the total number of students

in each course. The master schedule is set up to insure the proper number of classes to handle the student load.

At this point a conflict sheet (Figure 5) is prepared. On a large sheet of paper all the subjects offered during only one or two periods are listed across the top. Down the left side of the paper, the courses are listed in the same order. The paper is ruled into small squares. The student registration cards are then sorted in the following manner: Latin III, all cards are sorted on a card column--39-6. All cards of students taking Latin III will drop into pocket 6. Cards in pocket 6 are then sorted on other card columns of one- and two-period subjects listed on the conflict sheet. The numbers are listed in the appropriate squares as indicated. The process is continued until every subject is sorted against the other on the conflict list. If a number of conflicts result for any two subjects, it is important not to schedule these subjects at the same hour, and the master schedule must be so arranged.

Individual scheduling is by course rather than by student. Therefore, a priority list is compiled, indicating the order in which subjects will be scheduled with the most inflexible first. One-section courses, courses with lab periods, and distributive education courses with part-time work experience are examples of inflexible courses.

The clerk then prepares the cards necessary for subsequent procedures.

For each class period of each subject, a teacher master card (Figure 6) is prepared, containing teacher's number, name, room number,

period of course, subject code number, and subject name. From each of these cards, detail or subject cards (Figure 7) are reproduced for each student represented in the course. For example, if there were 200 general science students and one wished to have an average of 25 students per class, he would prepare eight teacher master cards; from each of these, 30 subject cards would be prepared. The difference between 25 and 30 cards permits a degree of flexibility to compensate for conflicts.

Each class in the master schedule is arranged in the master tub file with 30 subject cards behind each teacher's master card for each subject period. The clerk schedules the students into the proper course and room.

Taking the highest priority subject, the clerk runs all the registration cards through the sorter on the card column in which the code is punched for that subject. The cards of all students registered for that subject will fall into the selected pocket. The clerk then takes from the tub file the detail cards for the subject which has just been sorted. She then gang punches each student's number, name, and grade into a seat card, thus assigning each student a seat in the class. If there is more than one section, she takes the first 25 students and assigns them to one class, the next 25 to the succeeding class and so on. A control is also punched into the student's registration card to show that a certain period in his schedule is no longer available for other classes. On the face of each card is also written in colored pencil the period this particular subject is scheduled. The written figure is for quick, visual verification later. The class size is

recorded on a large master schedule on the wall.

The clerk schedules each class, subject by subject, according to the sequence of the priority list. Eventually, she will encounter a "conflict." The conflict is set aside for a guidance counselor to resolve. The better the master schedule, of course, the fewer the conflicts, although a few are unavoidable. This method enables the clerk to schedule almost all of the classes mechanically without much assistance except in the cases of conflicts which might necessitate course changes.

Individual Daily Program. When every student has had every subject scheduled including study halls and lunch period, the cards are sorted in the machine so that each student's registration card is put together with each of his subject cards. (This could be performed faster on a collator.) Total cards for each student are visually checked to make sure that there is one card for each period in the school day. After sorting out the registration cards, address cards are sorted (collated) with the student's subject cards; individual student programs (Figure 8) are printed.

Class Lists. Subject cards are sorted alphabetically by class and collated behind the teacher master card. The cards are inserted in the tabulator, and the Class List (Figure 9) is printed.

Schedule Changes. Schedule changes after school is opened are handled in the following manner:

1. The counselor fills out a change card for the student, duplicating the present and new schedules. The original copy is filed in a tickler file to check in the event a student does not return his

sign-out card.

2. The student is given a carbon copy of the present schedule only. He takes it to his teacher during the specified class to be signed out and remains in that class for that period.

3. The guidance secretary takes the new schedule and makes out an admission slip for each new class. These slips are filed until 3 p.m. of the day the change is made.

4. The student returns the duplicate of the old schedule on the change card at 3 p.m., signed out by his teachers, and gives the card to the guidance secretary. She then gives him a copy of his new schedule (the other half of the change card).

5. The secretary places the admission slip in the new teacher's mailbox that same afternoon.

6. The new teacher picks up the admission slip from his mailbox the next morning and considers the student CUT if he is not present in class that day.

7. A completed change card (copy of old and new schedule) is sent to the machines room for processing when the admission slip is placed in the teacher's mailbox.

8. In the machines room the following operations take place:

a. A change is made in the tub file (the subject card is removed from the student's file and replaced with a new one).

b. A new schedule is printed for the student, copies going to all offices.

c. In about a week, after all changes have been made, the cards are re-sorted in class order and a new class list is printed for the teacher with all student changes thereon.

Student Report Cards. The same subject cards used to print a student's program are used to print the student report card (Figure 10).

Prior to the end of a grade reporting period, subject cards are sorted alphabetically by class and forwarded to the proper teacher. The teacher writes on the card the student's grade, citizenship mark, and any keyed remarks that might be necessary. The homeroom teacher enters times tardy and total absences on the homeroom subject card. These cards are returned to the operator who punches the information into the cards. The cards are sorted by students' names with address cards and student master cards inserted before each student's subject cards. The student report cards are printed on the tabulator with as many duplicate copies as desired. (Note: Subject cards have both provision for marked sense and keypunching information. The dual design did not increase the cost of the card; therefore, the staff was looking forward to the time when a reproducer would be available for this operation.)

Scholarship Report. The scholarship report (Figure 9) is printed on the same form as the Class List. The procedure is the same except every student's grade, number of absences, and citizenship marks are added. One copy goes to each teacher, one to the guidance office, one to the principal and assistant principal, and one to the superintendent.

Permanent Record Card. Student subject cards are used for three grade periods (one semester). New cards are prepared for the second semester. At the end of the year, the cards are sorted by semester and full-year courses to print the Permanent Record Card (Figure 11).

This card is 12" x 12" and is hand fed into the tabulator for printing or updating.

Honor Roll. The grades in School B are reported in numerical form based on percentage. IBM clerks compute students' composite averages on a desk calculator and punch the names and averages into a standard punched card. Cards are sorted into rank order; and the names, rank, and average of those qualifying for honors are printed by the tabulator on a ditto master. The master is reproduced and distributed to all personnel concerned.

Test Results. Standardized aptitude and achievement test scores are punched into student test cards (Figure 12) into which students' names and numbers have been pre-punched. They are listed on ditto masters and reproduced for each teacher. These same cards are used to print student number and test scores on pressure-sensitized labels (Figure 13) which are attached to the permanent record cards. In addition, these data are available in cards for research purposes, grouping, etc.

Attendance. A ditto master is used to reproduce on the back of an IBM card a facsimile of a page from the teacher's attendance register. Each student's name, number, grade, telephone number, and homeroom number are intersperse gang punched into an attendance card (Figure 14). Each homeroom teacher receives a card for each student. The roll is called from the card, and cards of absentees are forwarded to the machines room. From these cards the absence list is printed on a ditto master, reproduced, and distributed to teachers. Duplicate

cards of absentees are prepared each day and sent to the attendance nurse who calls the home and records the reason for absence, which is also printed on the daily absence list. The homeroom teacher puts appropriate register symbols on the reverse side of the attendance card. These data are transferred to the register. It is planned to further adapt this system so that teachers have to do no compilation of figures either at the five-week period or at the end of the school year, pending state approval.

K. BUSINESS OFFICE RECORDS

School B acknowledged that data processing equipment could be successfully utilized in the maintenance of business office records, but the administration perceived the most urgent utilization to be in the area of pupil personnel accounting. Lack of financial support has restricted the acquisition of staff and equipment necessary to broaden machine functions to include business office records.

IBM CODE SHEET

SYMBOL	SUBJECT	CODE
E9AD	English 9 Adv.	34-4
E9A	English 9A	34-5
E9B	English 9B	34-6
E9C	English 9 Career	34-7
EOD	English 10 Adv.	35-0
EOA	English 10A	35-1
EOB	English 10B	35-2
EOC	English 10 Career	35-3
E1D	English 11 Adv.	35-5
E1A	English 11A	35-6
E1B	English 11B	35-7
E1C	English 11Career	35-8
E2D	English 12 Adv.	36-1
E2A	English 12A	36-2
E2B	English 12B	36-3
E2C	English 12 Career	36-4
SS9D	Citizenship Ed. 9 Adv.	38-4
SS9A	Citizenship Ed. 9A	38-5
SS9B	Citizenship Ed. 9B	38-6
SS9C	Citizenship Ed. 9 Career	38-7
SSOD	History 10 Adv.	39-0
SSOA	History 10A	39-1
SSOB	History 10B	39-2
SSOC	History 10C	39-3
SS1D	History 11 Adv.	39-5
SS1A	History 11A	39-6
SS1B	History 11B	39-7
SS1C	History 11C	39-8
SS2D	History 12 Adv.	40-0
SS2A	History 12A	40-1
SS2B	History 12B	40-2
SS2C	History 12C	40-3
MEA	Elementary Algebra	42-4
MEA1	Intro. to El. Algebra	42-5
MGM	General Math	42-7
MPG	Geometry	43-1
MIA	Intermediate Algebra	43-4
M11	Mathematics 11	43-8
M12A	Mathematics 12A	44-2
M12B	Mathematics 12B	44-4
SCAP	Chemistry Adv.	47-0
SC	Chemistry	47-1
SCL	Chemistry Lab 1	47-2
SCL	Chemistry Lab 2	47-3
SPA	Physics	47-5
SPL	Physics Lab 1	47-6
SPL	Physics Lab 2	47-7
LS1	Spanish 1	49-0
LS2	Spanish 2	49-1
LS3	Spanish 3	49-2
LS4	Spanish 4	49-3
LF1	French 1	49-4
LF2	French 2	49-5
LF3	French 3	49-6
LF4	French 4	49-7
LL1	Latin 1	50-0
LL2	Latin 2	50-1
LL3	Latin 3	50-2
LL4	Latin 4	50-3
LG1	German 1	50-4
LG2	German 2	50-5
LG3	German 3	50-6
LG4	German 4	50-7
BIB	Intro. to Business	52-0
BCT	Commercial Typing (1 yr.)	52-2
BAT	Academic Typing (½ yr.)	52-3
BB1	Bookkeeping 1	52-5
BS1	Stenography 1	52-8
BS2	Steno 2 & Transcription	52-9
BOP1	Office Practice 1	53-1
BOP2	Office Practice 2	53-2
BSP	Secretarial Practice	53-3
BR1	Retailing 1	53-4
BR2	Retailing 2	53-5
BWED	Work Exp. (Distr. Ed.)	53-6
BWES	Work Exp. Secretarial	53-7
BWEG	Work Exp. General	53-8
IA9W	Indus. Arts 9 Wood	54-0
IA9M	Indus. Arts 9 Metal	54-1
IGMA	Gen. Metal (1st sem.)	54-3
IGMB	Gen. Metal (2nd sem.)	54-6

Figure 1. Subject Code Sheet

The student is expected to follow this program as carefully planned and initialed by parent, student and counselor for the current year.

Name: ______

Plans: College ______ Other: ______ Work [type]: ______

Course of Study: ______	Gen. Academic ______	Commercial ______	Vocational ______
Check one by X	Science Math Language Art Industrial Arts Homemaking	Secretarial Retailing General	Auto Mechanics Building Trades Electricity, Radio & TV Beauty Culture Agric.; Hort.; Floriculture Office Machines
Major Areas of Study Underline one			

Graduation Requirements:

1. Completion of all required subjects—Those printed on program.
2. Completion of 16 units of credits. Passing a subject which meets 1 period per day, 5 days per week for the school year=1 unit.
3. Completion of a 3 unit major. A major consists of passing three subjects in the same area of study.
4. Physical Education is required, but no units are given toward graduation credit.

Instructions: Student, Parents and Counselor will review this program yearly. Each will initial above "Date" when program is mutually satisfactory.
It is contemplated that no changes will be made in this program for at least the first semester of the new school year.

Signature: I have read over this program and agree that ______ be permitted to pursue the course as planned.
Name of Student

Signed ______ ______
Parent or Guardian *Date*

Figure 2a. Student Four-Year Program Card (Front)

Name: Address: Phone:

Plans:

1956-57	PF	U	1957-58	PF	U	1958-59	PF	U	1959-60	PF	U
Phys. Ed.			Phys. Ed.			Phys. Ed.			Phys. Ed.		
English 9			English 10			English 11			English 12		
Citizen Education 9			History 10			History 11			History 12		
Science						Speech / Health					
Math.											

Ex-Curr.

Counselor:

Student:

Parent:

Date: Please see other side

Figure 2b. Student Four-Year Program Card (Back)

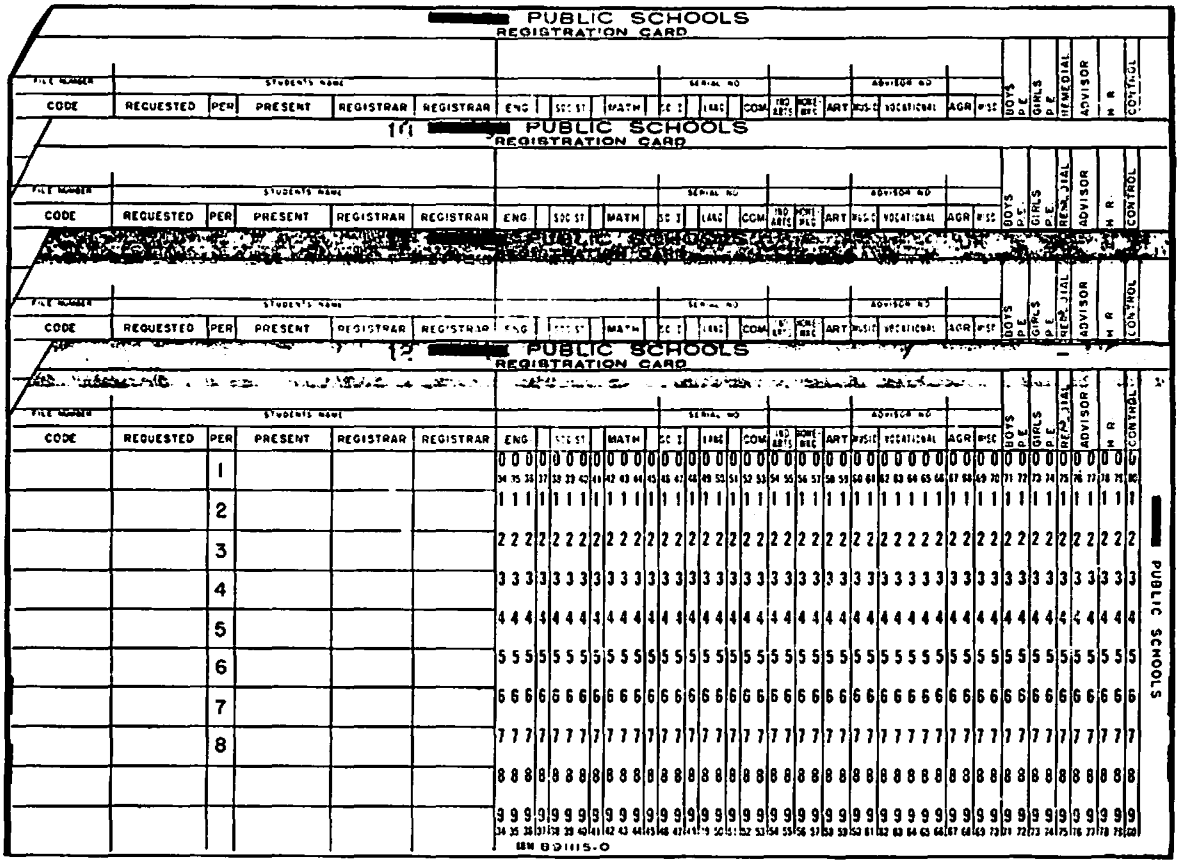


Figure 3. Registration Cards

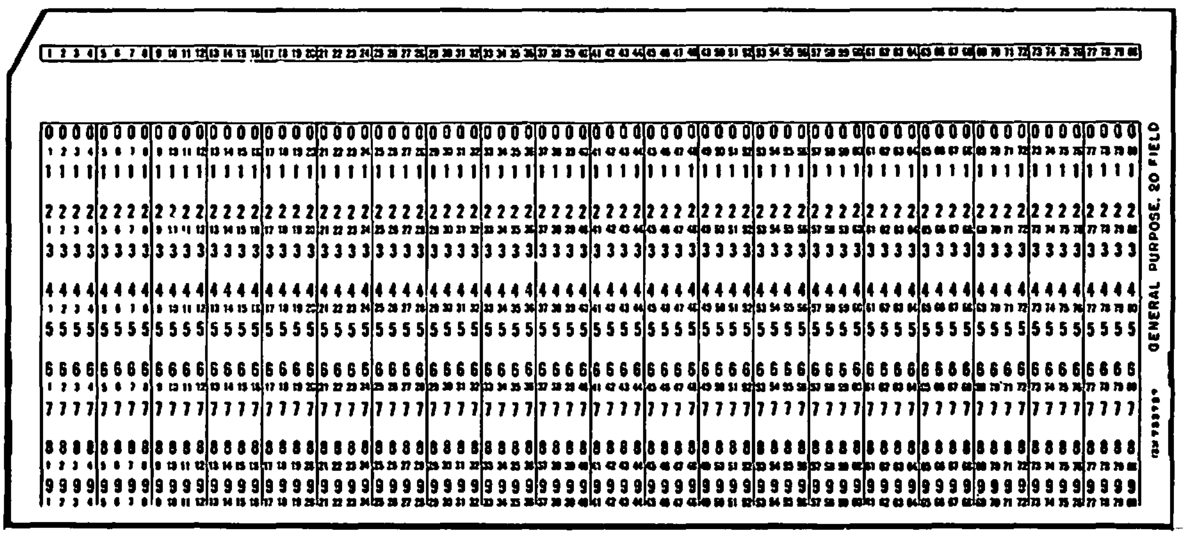


Figure 4. Student Master Card

	Latin III	English 10 Adv.	History 10 Adv.	Math 10 Adv.	Chemistry Adv.
Latin III	27	24	26	25	23
English 10 Adv.		26	25	27	22
History 10 Adv.			26	27	21
Math 10 Adv.				29	24
Chemistry Adv.					24

Figure 5. Class Conflict Sheet

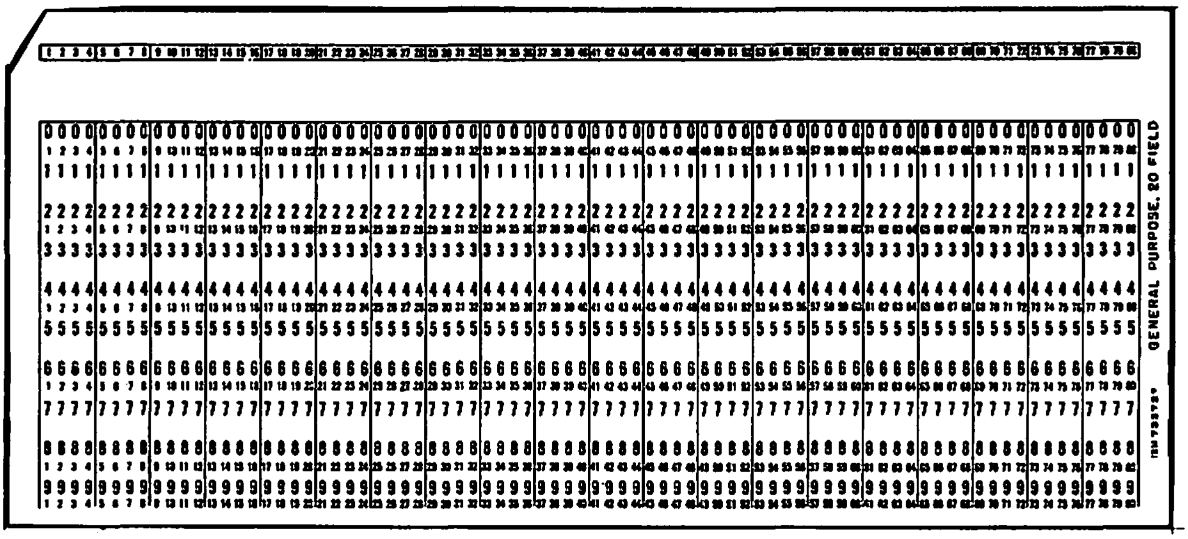


Figure 6. Teacher Master Card

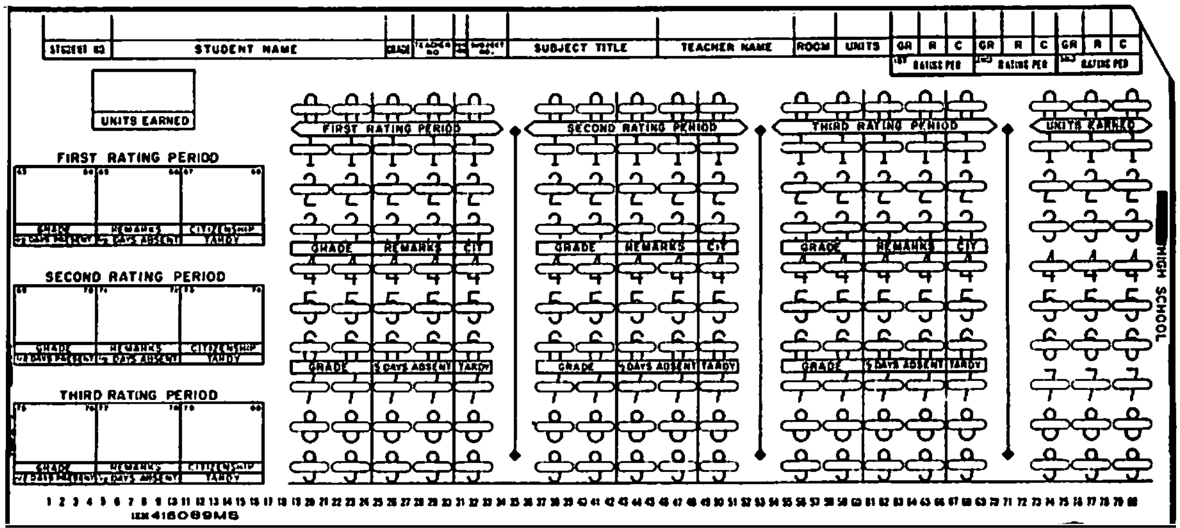


Figure 7. Detail or Subject Card

INDIVIDUAL DAILY PROGRAM

STUDENT'S NAME

PARENT'S NAME GRADE

PHONE NO. LOCKER NO.

SUBJECT TITLE	SUBJ. SYM.	ROOM NO.	PER. NO.	TEACHER

Figure 8. Individual Daily Program

[redacted] HIGH SCHOOL

CLASS LIST AND SCHOLARSHIP REPORT

TEACHER SUBJECT ROOM PERIOD

STUDENT NAME	½ DAYS PRESENT			½ DAYS ABSENT			TIMES TARDY			UNITS
	GRADES			REMARKS			CITIZENSHIP			
	1-4	2-5	3-6	1-4	2-5	3-6	1-4	2-5	3-6	

Figure 9. Class List and Scholarship Report

[redacted] HIGH SCHOOL [redacted]

STUDENT REPORT CARD

MAILED TO

REPORT OF

LAST NAME FIRST NAME STUDENT NO.

PERIOD ENDING		
MO.	DAY	YR.

SEMESTER	PERIOD

SUBJECT	TEACHER

REMARKS CONCERNING GRADES

1. Incomplete
2. Work improving
3. Does not do homework
4. Shows real effort
5. Does not pay attention
6. Does not make up back work
7. Does not do well on tests
8. Does not work up to ability level
9. Assignments poorly prepared
10. Should come in 9th period for help

CITIZENSHIP

11. Superior citizen
12. Excellent citizen
13. Good citizen
14. Fair citizen
15. Poor citizen

DENTAL HEALTH

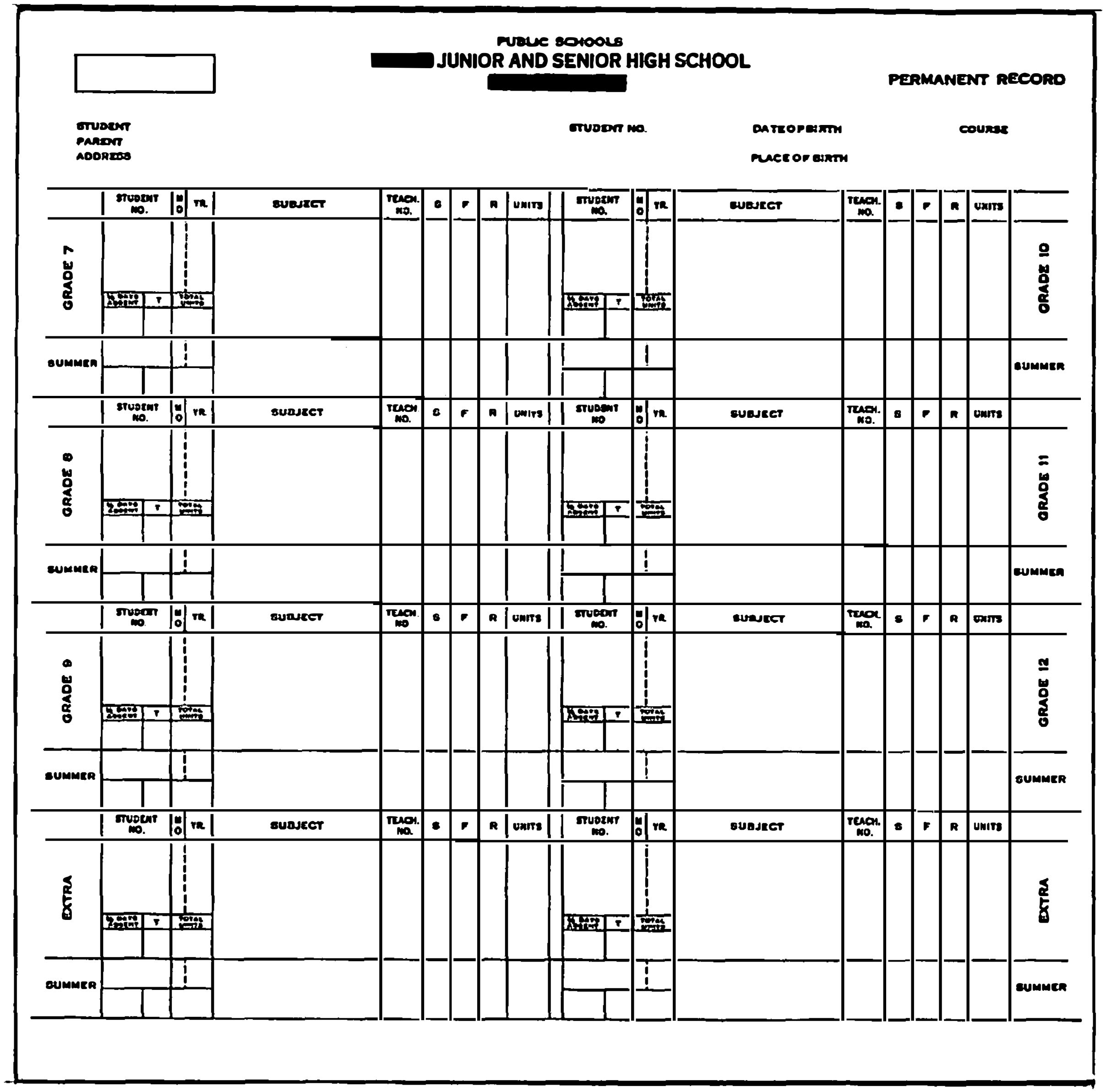
16. Satisfactory
17. Unsatisfactory

GRADES			REMARKS			CITIZENSHIP			UNITS
1	2	3	1	2	3	1	2	3	

½ DAYS PRESENT			½ DAYS ABSENT			TIMES TARDY			TOTAL UNITS TO DATE
1	2	3	1	2	3	1	2	3	

NOTE: SYSTEM OF GRADES EXPLAINED ON REVERSE SIDE

Figure 10. Student Report Card



PUBLIC SCHOOLS

[redacted] JUNIOR AND SENIOR HIGH SCHOOL

[redacted]

PERMANENT RECORD

STUDENT
PARENT
ADDRESS

STUDENT NO.
DATE OF BIRTH
PLACE OF BIRTH
COURSE

	STUDENT NO.	M O	YR.	SUBJECT	TEACH. NO.	S	F	R	UNITS	STUDENT NO.	M O	YR.	SUBJECT	TEACH. NO.	S	F	R	UNITS	
GRADE 7	½ DAYS ABSENT / T		TOTAL UNITS							½ DAYS ABSENT / T		TOTAL UNITS							GRADE 10
SUMMER																			SUMMER
GRADE 8	½ DAYS ABSENT / T		TOTAL UNITS							½ DAYS ABSENT / T		TOTAL UNITS							GRADE 11
SUMMER																			SUMMER
GRADE 9	½ DAYS ABSENT / T		TOTAL UNITS							½ DAYS ABSENT / T		TOTAL UNITS							GRADE 12
SUMMER																			SUMMER
EXTRA	½ DAYS ABSENT / T		TOTAL UNITS							½ DAYS ABSENT / T		TOTAL UNITS							EXTRA
SUMMER																			SUMMER

Figure 11. Permanent Record Card

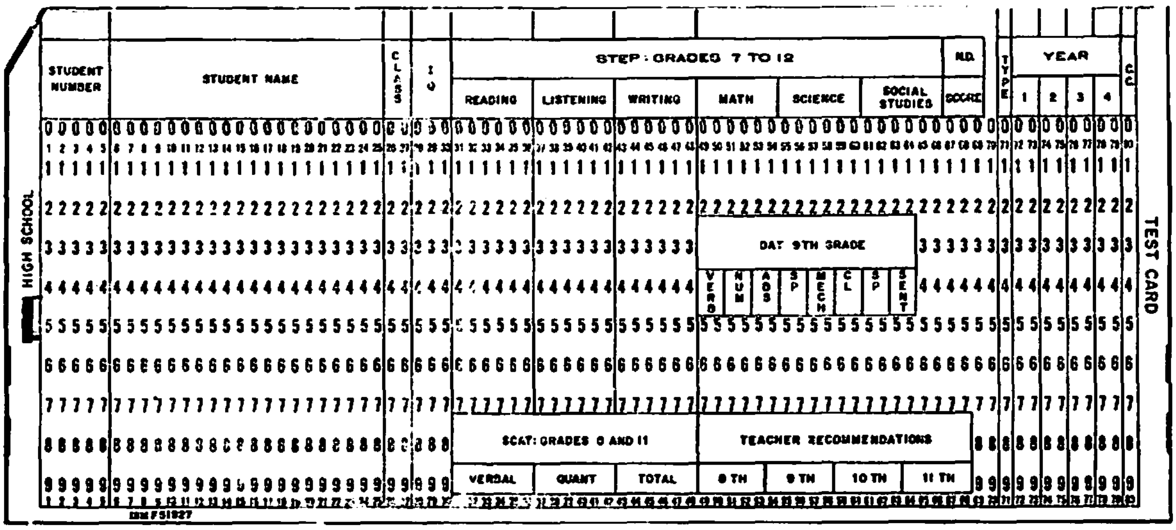


Figure 12. Student Test Card

STUDENT NUMBER	YEAR	SEQUENTIAL TESTS OF EDUCATIONAL PROGRESS				
		READING	LISTENING	WRITING	MATH.	SOC. STUD.

STUDENT NUMBER	YEAR	DIFFERENTIAL APTITUDE TESTS							
		VERB	NUM	ABS	SP	MECH	CL	SPL	SENT

Figure 13. Test Labels

NAME____________________ H.R.______

PARENTS NAME____________________

ADDRESS________________________

DATE OF BIRTH__________ DATE ENTERED__________

TEL. NO.________________________

FIRST SEMESTER

	M	T	W	TH	F	COMMENTS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

For both tardiness and absence use the same symbols as used in the register.

Figure 14. Attendance Card

CASE REPORT OF SCHOOL DISTRICT C

School District C is a city school district serving 7 small municipalities within a 31 square-mile area. The student enrollment for the district is 9,879 and is projected to reach 14 to 17 thousand by 1965. The district is classified as a "bedroom community" since most of the citizens work in a nearby metropolitan area. However, the district is considered to have a good balance of business and industry.

The system operates 10 elementary schools, 3 junior high schools, 2 senior high schools on the 6-3-3 plan. Most of these schools have been built within the past ten years. The sudden influx of enrollment transformed record-keeping and scheduling tasks from hundreds to thousands of students. Even with increased professional and clerical help, employment was extended into the summer. Most principals could not receive more than two or three weeks vacation between annual school terms, because the entire summer was needed to complete records of the previous year and prepare schedules for the next year. During the school term, teachers were required to spend an excessive amount of time performing clerical tasks.

Statistical information from testing programs and grade records provide an excellent basis for improving the instructional program. These data existed in singular form on student permanent records, but retrieval in usable form for analysis was manually impossible. Time required for manual retrieval reduced program evaluation to piecemeal projects. Broad, comprehensive evaluation of the instructional program

was impossible because of the time element involved. Some process other than manual was decided to be the answer to the statistical problems of the district.

A. PLANNING

The school administration decided that an integrated, machine data processing system offered the most promising solution to their problem. Representatives from the major manufacturers of this type of equipment were contacted. After many interviews with salesmen and visitation to their representative installations in industry, IBM punched card equipment was selected.

The director of pupil personnel, who is now assistant superintendent, was appointed to direct the data processing program. The school board was aware of deficiencies in manual processing and authorized the search for a new, record-maintenance system. Top school administrators were satisfied with the potential offered by the new process, but the school board objected to the cost. Saving of teacher time does not reflect in reduced school budgets, but the point was stressed that teachers would be released from record-keeping duties to instruct students--their prime function.

Representatives of the equipment manufacturer and form suppliers worked closely with the district throughout the development period. Forms and procedures were designed for the district by these representatives. A local industry volunteered the use of their punched card equipment for running tests to insure workability of the system. The

case, which included a demonstration of the process at the local industry, was presented to the school board. The demonstration was instrumental in the decision to acquire punched card equipment for School District C.

Keypunches were rented and placed in the high schools for instruction. The director of pupil personnel attended the manufacturer's school, after which a data processing supervisor was employed.

The rental of a keypunch, sorter, and tabulator was authorized by the school board upon the recommendation of the manufacturer representative. This action was taken and the equipment delivered before the employment of the data processing supervisor. Three pupil accounting procedures were planned for immediate implementation. The supervisor felt three simultaneous applications would not be possible without the addition of a reproducer, collator, and interpreter. When confronted with the request for additional equipment, the school board displayed mixed reactions, mostly unfavorable. However, the board approved the additional rentals with reservations. Time required for the delivery of equipment caused delays which could have been prevented had the proper technical resources been available during initial selection of equipment.

At least six months should be reserved for preplanning. A technically trained data processing supervisor should be selected as soon as the decision has been reached to adopt punched card procedures, unless the educational staff includes a person with experience or training with the equipment. The school district needs at least one person with a reasonable degree of technical knowledge about the

equipment and procedures to be employed. The services of the supervisor should be available prior to selection of equipment to prevent the problems encountered in School District C.

The data processing supervisor should acquire a thorough knowledge of the manual, record-keeping processes. Learning the old system will necessitate his personally contacting personnel on all levels. It also affords an opportunity to get acquainted and establish rapport with most of the personnel in the system. If the data processing supervisor is experienced only in industrial applications, more time should be allowed for him to learn the "language" of educational functions and procedures.

Representatives from principals, teachers, secretaries, and students should be involved in the decision and planning of new applications. Decisions in School District C were reached through such group decision. The majority of the staff expressed the desire to start applications where they would be most beneificial to the most students.

Since a highly trained data processing supervisor was employed, system specialists were not considered necessary. The manufacturer representative was eager to assist but was limited because of the nature of the new application. The data processing supervisor and the director of pupil personnel visited two schools with data processing installations to secure information which might expedite the work in School District C.

Comprehensive coverage of future applications during preplanning is necessary if an integrated data processing system is to be the end result.

Three applications were attempted simultaneously by School District C, but the practice is not recommended by their administrator.

Ample space was provided for the data processing department. Availability of space determined the location of the data processing department when the acquisition of additional property coincided with the initiation of data processing. The newly acquired buildings were spacious and structurally suited for housing the department.

A battery of punched card equipment is heavy, and the structural makeup of housing facilities must be strong. Both 110- and 220-volt currents should be available in the data processing department. Provision should be made for temperature control because of the excessive heat produced by the equipment.

B. EQUIPMENT

Selection and maintenance of equipment presented one major problem. Additional equipment was added since the original selection was inadequate. The system did not suffer a financial loss as a result of added equipment but did experience delay as well as difficulty with the school board. In some cases, money may be saved by selecting only basic needs in the beginning and expanding as demands necessitate.

A keypunch, sorter, and tabulator are basic essentials for starting a punched card operation. Reproducers, interpreters, collators, and calculators are desirable; but the operation, though restricted, can function without them.

Funds have not been available to purchase equipment; therefore,

rental versus purchase costs have not been considered.

Service bureaus have not been utilized by School District C, but a local industry loans machine time and assistance during peak periods. The industry also has an electronic computer which is available to the school at a nominal charge.

C. ORIENTATION OF PERSONNEL

Two problems have been encountered in the area of communication: (1) objection of school board to cost of data processing, and (2) resistance to change in procedure. Neither of these problems were insurmountable but occasionally proved perplexing.

The school board, though they approved the rental of equipment, complained about the high cost. School District C mistakenly offered economy as an advantage in the beginning. There was economy in machine processing of educational data, but it was relatively intangible. It was difficult to place saving of teacher time in profit-and-loss form. Greater availability of data for improvement of the instructional program is difficult to explain in dollars and cents. Therefore, the economy of data processing should not be a selling point to the public or the school board. Educational advantages should be explained in terms of quality education rather than economy.

Resistance to change is inevitable, but the degree can be reduced through the proper orientation of personnel. Resistance was not eradicated in School District C, but it was felt that the orientation approach reduced the degree appreciably.

The following steps were taken to orient all personnel including the data processing supervisor.

1. The data processing supervisor visited all offices and schools and learned very thoroughly the manual, record-keeping system.

2. Principals, teachers, secretaries, and students were consulted about applications that were possible on the new equipment. Collectively, the decision was reached to start three pupil accounting applications simultaneously.

3. Procedures were designed and written by the data processing supervisor and assistant superintendent. These procedures were taken to the principals and teachers to determine their reaction. At the same time, principals and teachers were orienting themselves by having a part in the development of procedures.

4. After procedures were refined with the assistance of the staff, forms were designed and ordered. Six to eight weeks were allowed for delivery of new forms.

5. Written instructions for personnel gathering source data were prepared. As soon as the forms were delivered, workshops were held for teachers and principals. Instructions were both written and oral. The teachers actually marked cards for a problem which simulated their part in the new application.

6. Panels were wired and tested on the equipment in a nearby industry. (Note: The previously described activities can be executed before equipment is actually delivered.)

7. The equipment was delivered and processing started with

student census. Orientation was a part of the initial planning; and since everyone was involved from the beginning, they oriented each other.

D. OPERATIVE PERSONNEL

One full-time machine operator was employed, and one high school secretary was transferred to the new department. Shortly thereafter, the former secretary asked to be re-transferred to her old job.

As applications developed, three full-time and one part-time persons were employed in the machines room. All personnel can operate all equipment in the machines room. One of the three full-time persons was machine room supervisor and was responsible for all data after it was delivered to the machines room.

An ample supply of operative personnel was available in School District C. Several persons were trained by the data processing supervisor, and others were trained operators when employed.

Machine personnel received higher pay than comparable clerical workers. Jealousy resulted among the clerical staff, but not to the point that operations were impeded. Higher pay for operators was necessary to prevent industry from luring them from School District C.

Success at any position in the machines room required above average intelligence, ambition, and a keen interest in the work. Employees possessing these qualifications were used interchangeably on machines and procedures. Every employee in the machines room operated all of the equipment. Each person was assigned a major job responsibility. Upon completion of major assignment, the operator was free to assist with

other applications.

E. ORGANIZATION

The data processing department is under the ultimate control of the Assistant Superintendent of Business Affairs. The data processing supervisor is subordinate to the assistant superintendent but joins his technical competence with the professional understandings of the assistant superintendent to coordinate the entire data processing program. A machines room supervisor is charged with all activities in the machines room. She is assisted by two full-time and one part-time machine operators.

The data processing department appears to satisfactorily serve all other departments. Test processing conflicts with attendance and grade reporting during certain periods of the year, but testing is postponed until regular monthly reports are processed.

All departments agreed that payroll processing would have priority over all other applications. Part of the procedures of School District C were documented, but the need for complete documentation was expressed.

F. CODING

Coding is a function which requires technical competence; therefore, the data processing supervisor determines all codes. Outside personnel are consulted only about the retrieval requirements of data. Job codes are printed in book form and never leave the data processing center.

Twenty-five spaces are fielded for student names: 13 for the last name, 11 for the first name, and 1 for the middle initial. If a last name is longer than 13 spaces, vowels at the end of the name are deleted until it is reduced to 13 spaces.

Student identification numbers were derived by sorting in alphabetical sequence and assigning a six-digit code number at intervals of 100. For example: The first student number was 000100, the second number was 000200, etc. The alphabetical location of a new enrollee is determined and arbitrarily placed within the one-hundred interval between the two numbers. Its alphabetical similarity determines the distance it is placed from the name most similar. The student identification number yields no information other than alphabetical sequence.

An updated student code book is of ultimate importance to the success of pupil personnel accounting.

Teacher code numbers are assigned by a procedure similar to that used for students, except a four-digit code is used with intervals of 50.

G. FORMS AND SUPPLIES

Design and procurement of forms and supplies have presented few difficulties. Representatives of forms suppliers were excellent sources of assistance.

Practically every form was of special design, but subsequent orders were more reasonably priced. School District C requests bids from at least 3 companies, and the lowest bidder is awarded the contract. However, the supervisor questioned this method with school systems. School

problems are unique. Forms salesmen must spend considerable time with school customers; therefore, when a good salesman is located that can give good service, the supervisor advises a system to remain with the same company. A dependable source of assistance with forms design is worth more than the small amount saved by purchasing on a bid basis.

When contemplating a new application, at least 6 to 8 weeks should be allowed for delivery of new forms.

H. GOVERNMENTAL REPORT REGULATIONS

School District C did not encounter any record-keeping regulations which restricted the utility of punched card equipment for maintenance of pupil personnel records. However, new applications were submitted to the state department of education for approval before they were initiated.

I. TECHNICAL INFORMATION AND ASSISTANCE

The two major sources of technical assistance were manufacturer representatives and schools with data processing installation. The need for technical assistance is directly dependent upon the technical competence of personnel within the system. School District C employed a data processing supervisor with training and experience on punched card equipment in industry. He and the assistant superintendent combined their respective competencies to produce an outstanding data processing installation.

Technical literature pertaining to pupil personnel accounting was sparce and often too brief to comprehend. A dual combination of

training both in education and data processing would be desirable, but School District C did not encounter such a combination. However, this did not prevent the district from developing an outstanding data processing department.

J. STUDENT RECORDS

School District C felt that pupil personnel accounting was the most important area to develop. Establishing and maintaining an up-to-date census of all school-age students is the prime requisite for all other pupil accounting applications.

Census. Census-registration sheets (Figure 1) were sent home with students for the parents to complete. The in-school census supplies all state required information plus other data necessary for preparing reports concerning students. Three student master cards, punched from the information sheet, contain: (1) student information (Figure 2), (2) parent information (Figure 3), and (3) residence information (Figure 4). Census information must be updated when new students enroll or when the basic information changes. A standard record change sheet is necessary to maintain control over updating.

Student master cards were sorted in strict alphabetical sequence and the 604 calculator assigned each student a six-digit code number with intervals of 100. The code number is punched in each of the three student master cards.

A code book is printed on the tabulator from the student master cards. The following information about each student is printed: student

code number, student name, school, and grade. Updating for transfers or withdrawals are recorded manually in their proper alphabetical position in the code book. The code book must be reprinted each year. Since student code numbers are permanent, a credit symbol indicates withdrawal, transfer, or graduation. In addition to supplying basic data for all student applications, the student master card affords statistical data for studies of parent employment, school boundaries, bus schedules, etc.

Pupil Information Record. Student master cards are sorted by school, grade, and teacher. The three cards are collated, and the pupil information record (Figures 5a, 5b) is printed. Copies are sent to principals, counselors, and homeroom teachers. Identifying information about each student is available to the entire district staff without clerical encumbrance. Code classifications are printed on the reverse side of the information sheet for interpretive convenience.

Pupil Locator Card (Elementary). The pupil locator card (Figure 6) for elementary students contains the same information shown in Figure 5a, except it is printed on heavier paper and space is provided at the bottom for notes about the student. This card is retained in the principal's office.

Student Registration and Scheduling. Each high school duplicates registration sheets listing the courses available in their respective school. Before the end of the school term, the counselor holds a conference with each student in the school to determine interest areas. Interests, abilities, and courses taken are analyzed; the courses to be taken next year are listed. The registration sheet is taken home by each

student for parents approval and signature.

Identifying information is reproduced from a student master card and interpreted on a subject master card (Figure 7) for each student. The subject master card has a marked sense position for each subject offered in the district. These cards are sorted by school and forwarded to the counselor of each school. The counselor mark senses the subjects of each student from the approved registration sheet.

The completed subject master card is returned to the data processing center where the marked senses are converted and the cards sorted by school and subject to determine the number of students in each course. A list of courses and number requesting them are printed on the tabulator and forwarded to each principal. From the course list, the principal can determine the courses and sections of each course to be included on the master schedule.

From the master schedule, the principal prepares a course request form which lists the following information for each section: course name, period offered, room number, instructor code, minimum enrollment, and maximum enrollment. The data processing department keypunches a header card for each section of each course from the course request form.

The minimum enrollment in each class is generally 25 and the maximum 30. Therefore, 25 white grade cards are gang punched with the class information from the header card and placed behind it. Five salmon or different colored grade cards are punched and placed behind the header card to allow enrollment overage. Cards are collated in the following order: header card for each section, 25 white grade cards,

and 5 salmon grade cards. They are interpreted and sent to their respective schools.

The principal has a pigeon-hole file arranged in order similar to the master schedule. The header card, and grade cards for each course section are loaded in the file.

The subject master cards of students taking single offering courses are pulled out by the sorter. Subject master cards for each student are sent to the school where the principal and secretaries schedule each student. The cards that have been pulled out by the sorter because of singleton courses are scheduled first to reduce the possibility of conflict. As each student is scheduled, the subject master card is placed in the file with 8 white grade cards, one for each period, behind it. Upon completion of scheduling, the file is forwarded to the data processing.

Student information from the master subject card is reproduced into the grade report cards (Figure 8). Grade cards are sorted by period by teacher and counted to get the class balance listing. The number scheduled in each course is compared with the number requesting that course.

Student Schedule. If the class balance checks with the requests, student grade cards are sorted by student; the student schedule is printed by the tabulator on plain paper. One copy of the student schedule is retained as a locator card in the principal's office, while the other copy is given to the student.

Teacher Class Lists. Grade cards are sorted by teacher and a

class list is printed. The teacher recieves a class list for all periods before school opens. To permit time for schedule changes, a revised class list is printed three weeks after the opening of school.

Pupil Locator Card (Secondary). A copy of the student schedule serves for a locator card until three weeks after school opens. All schedule changes must be completed within three weeks after the opening of school. At that time the grade cards are merged with the census cards of each student, and the pupil locator card--secondary--(Figure 9) is printed.

Grade Reporting. Student grade cards are sorted by student by teacher and remain in the data processing department until the end of the grading period. Each teacher receives a card for each student in the class. Student grades are mark sensed, and the cards returned to the data processing department where they are punched and sorted by student by homeroom. Grade cards are merged with the year-to-date attendance cards and student grade reports (Figure 10) are printed.

Student name, grade, school year, school code, absences to date, and student code are printed from the year-to-date attendance card. The course, instructor, and grade are printed from the grade card. While the grade reports are being printed, a grade storage card (Figure 11) is summary punched with the total honor points and course credits.

A letter is mailed to the parents at the beginning of the year notifying them of the dates they can expect to receive the grade reports through the mail. One copy of the grade report is mailed to the parent; one is sent to the homeroom teacher; and one copy is retained in the

principal's office. Grades are cumulative on successive grade reports for all previous grading periods.

Honor rolls and failure lists are prepared from the student grade card. Honor points are computed on the calculator from the summary punched grade card, and the class rank is established.

Attendance. A master attendance card file, by school, is prepared by gang punching information found on the student information census card. Marked sense attendance cards (Figures 12a, 12b) are reproduced from the master file and sent to each school.

Attendance is kept in base periods of 3 weeks. Either 6- or 9-week attendance reports can be maintained. At the end of 3 weeks, the absences are mark sensed for the period and returned to the data processing department.

The attendance cards are punched, placed in the collator, and zero balanced. The group that is zero balanced is reproduced into a work deck for 15 days perfect attendance. The non-zero balance group is merged with a regular 5081 card on the collator and run through the calculator which computes absences, days present, days not due, times tardy, and punches the information into the merged 5081 storage cards. The two cards for each 6-week attendance period are merged with the grade cards to enter attendance on student grade reports. A year-to-date attendance card is summary punched. The attendance register (Figure 13) is written from the attendance cards. If the attendance register is correct, the teacher signs it and files it in the principal's office where it remains for 5 years (state law).

Yearly attendance reports are prepared from the last summary, year-to-date attendance card.

Permanent Records. At the end of the school year, the attendance storage cards, grade storage cards, and test storage cards are merged to print the student permanent record (Figure 14). The information on the permanent record is cumulative in many cases. When permanent records are printed, the insert from the previous year is discarded because the up-to-date permanent record also contains the information on the discarded insert.

The permanent record for the senior year is 5 ply. This provides ample copies for transcript requests. One unique use of the record is that a copy is adhered to the student's diploma. In the event that the copy might be removed, a note is revealed on the back of the diploma stating the transcript has been removed.

K. BUSINESS OFFICE RECORDS

Development of procedures for processing business office records presented relatively few problems according to the data processing administrator. Procedures experienced by the administrator in industry were easily adaptable to the business office records of School District C.

Business office records currently maintained on punched card equipment are: payroll, personnel, and property accounting records.

[redacted] CITY SCHOOL DISTRICT
REGISTRATION

PLEASE DO NOT WRITE IN THIS SPACE

PUPIL

Name — Last First Init.

Sex — M F

Birthdate — Mo. Da. Yr.

Birthplace
1 Ohio
2 U.S.
3 Foreign
(check one)

Pupil Lives With:
1 Father
1 Mother
2 Step-father
2 Step-mother
3 Adoptive F
3 Adoptive M
0 Other (Relationship
0 Other (Relationship
(Please check)

Pupil Entered From
Home, or
Kindergarten, or
School
City State

School
Grade
Teacher
Bus. No
Entry Date
Mo. Da. Yr.
From
File

Pupil Lives With

First name of Father or person having paternal authority

First name of Mother or person having maternal authority

Authority for Birthdate
Certified by:
Date

Family's Religious Preference
Catholic
Jewish
Protestant

Language in home
English
Other

Number of Bros.&Sis.

Father Mother
Natural Parents
1 Living
2 Deceased
3 Living, Separated
4 Living, divorced
5 Living, Div. Remarried
6 Living, Widowed, (remarried

Birthplace
Father Mother
1 Ohio
2 U.S.
3 Foreign

Parents in Home Employed?
Father Mother
1 Yes
2 No

Occ. Code

Head of Family
Place of Employment Occupation

File

RESIDENCE

Number Street Telephone City

Street Code

Ordinarily the father is the legal guardian of the child.
Please check below:
Legal Guardian
Father
Other person
Relationship Name
Agency

Trans.

Signature of person giving information:

Leg. Guard

Date

File

Figure 1. Census-Registration Sheet

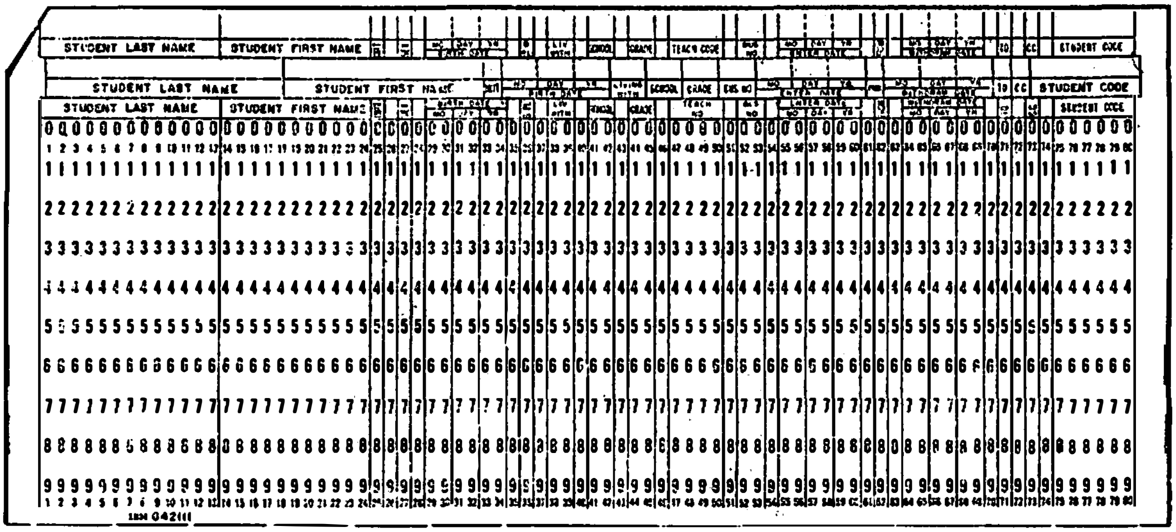


Figure 2. Student Master Card (Student Information)

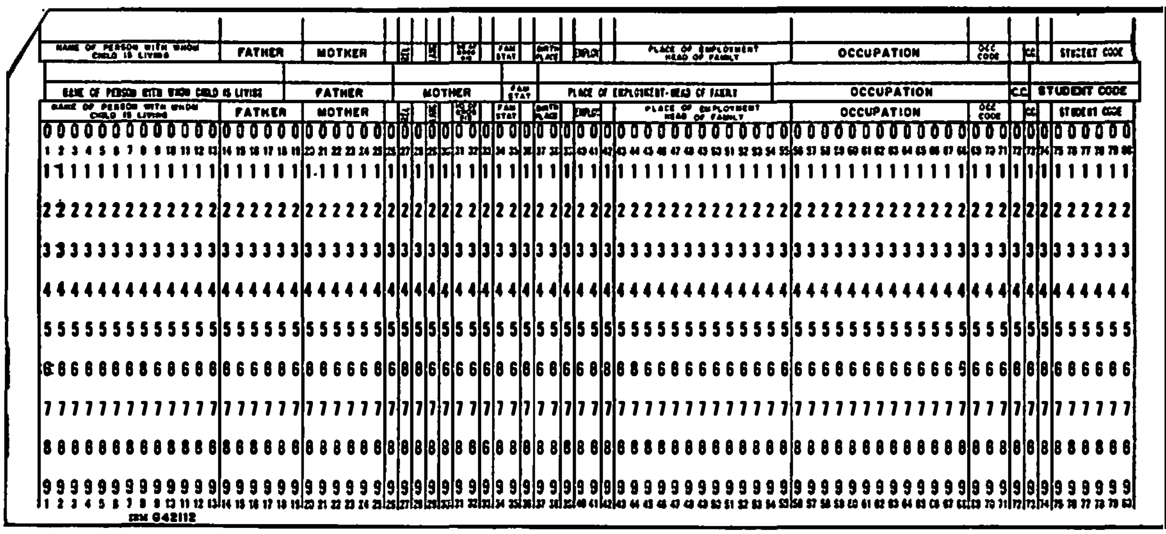


Figure 3. Student Master Card (Parent Information)

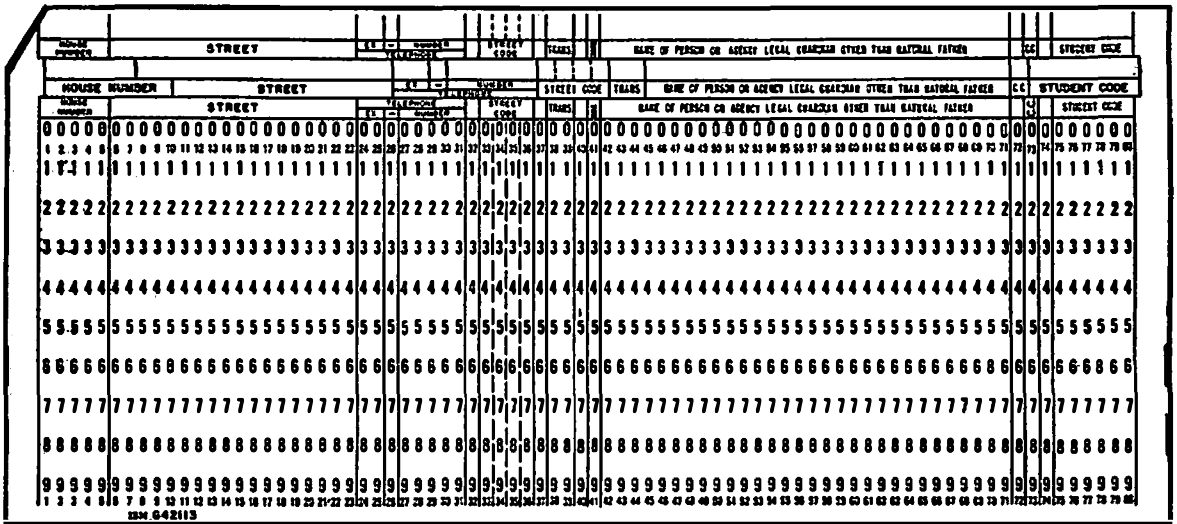


Figure 4. Student Master Card (Residence Information)

SCHOOL YEAR		
1960	TO	1961

PUPIL INFORMATION RECORD

[redacted] CITY SCHOOLS

STUDENT NAME			BIRTH DATE			1	2	3	ENTER DATE			4	5		
LAST NAME	FIRST NAME	M I	MO.	DAY	YR.	BIRTH PLACE	SEX	LIVES WITH	MO.	DAY	YR.	ENT. FROM	SCHOOL	GRADE	TEACHER

STUDENT LIVES WITH:		
LAST NAME.	FATHER	MOTHER

6 BIRTH PLACE		7 FAM. STATUS		8	9	
F	M	F	M	REL.	LANG.	NO. OF BR. & SR.

STUDENT NUMBER

STUDENT ADDRESS		TELEPHONE		10	11	12
HOUSE NO.	STREET NAME	EXCH.	NUMBER	GUARDIAN	CITY CODE	TRANS-PORTA-TION
		—				

PLACE OF EMPLOYMENT HEAD OF FAMILY	OCCUPATION

13 PARENTS IN HOME EMPL'D	
F	M

NOTE: EXPLANATION OF CODED INFORMATION. (NUMBERED BOXES ABOVE), IS ON REVERSE SIDE.

Figure 5a. Pupil Information Record (Front)

KEY TO CODES:

1. BIRTH PLACE - STUDENT

1 - [redacted]
2 - U.S.
3 - FOREIGN

2. SEX

4 - MALE
6 - FEMALE

3. LIVES WITH

1		- FATHER
	1	- MOTHER
2		- STEPFATHER
	2	- STEPMOTHER
3		- ADOPTIVE FATHER
	3	- ADOPTIVE MOTHER
4	4	- OTHER

4. ENTERED FROM

0 - HOME
1 - KINDERGARTEN
2 - SCHOOL OUT OF STATE
3 - ANOTHER OHIO SCHOOL
4 - ANOTHER WILLOUGHBY-EASTLAKE SCHOOL

5. SCHOOL

31 - BROWNING
32 - CHANDLER
33 - GARFIELD
34 - JEFFERSON
35 - LINCOLN
36 - LONGFELLOW
37 - McKINLEY
38 - ROOSEVELT
40 - ROYALVIEW
39 - SHOREGATE
11 - NORTH HIGH
12 - SOUTH HIGH
21 - [redacted] JUNIOR HIGH
22 - [redacted] JUNIOR HIGH
23 - WILLOWICK JUNIOR HIGH

6. BIRTH PLACE - PARENTS

1 - OHIO
2 - U.S.
3 - FOREIGN

7. FAMILY STATUS

1 - LIVING
2 - DECEASED
3 - LIVING SEPARATED
4 - LIVING DIVORCED
5 - LIVING, DIVORCED, REMARRIED
6 - LIVING, WIDOWED, REMARRIED

8. RELIGION

3 - CATHOLIC
1 - JEWISH
7 - PROTESTANT
6 - OTHER

9. LANGUAGE IN HOME

5 - ENGLISH
6 - OTHER

10. GUARDIAN

1 - FATHER
2 - MOTHER
3 - STEPFATHER
4 - STEPMOTHER
5 - ADOPTIVE FATHER
6 - ADOPTIVE MOTHER
7 - GRANDPARENT
8 - AUNT
9 - UNCLE
0 - OTHER
CR - AGENCY

11. CITY CODE

1 - WILLOUGHBY
2 - EASTLAKE
3 - WILLOWICK
4 - WILLOUGHBY HILLS
5 - TIMBERLAKE
6 - LAKELINE
7 - WAITE HILL
0 - ALL OTHERS

12. TRANSPORTATION

0		- DOES NOT RIDE BUS
1		- DOES RIDE BUS
	0	- LIVES LESS THAN ONE MILE FROM SCHOOL
	1	- LIVES ONE MILE OR MORE FROM SCHOOL

13. PARENTS IN HOME EMPLOYED

1 - YES
2 - NO

WITHDRAWN: ____________________
DATE

TO WHERE: ____________________

ASSIGNMENT FOR THE YEAR: 19____ 19____

GRADE: ____________

____________ DATE ____________ TEACHER

Figure 5b. Pupil Information Record (Back)

STUDENT LAST NAME	STUDENT FIRST NAME	INIT.	BIRTH DATE	BUS	GRADE	INSTR. NO.	STUDENT NO.

HOUSE NO.	STREET NAME	TELEPHONE NO.
		–

FATHER OR GUARDIAN LAST NAME	FIRST NAME

PUPIL LOCATOR CARD

ELEMENTARY

[redacted]

- CITY SCHOOLS -

Figure 6. Pupil Locator Card (Elementary)

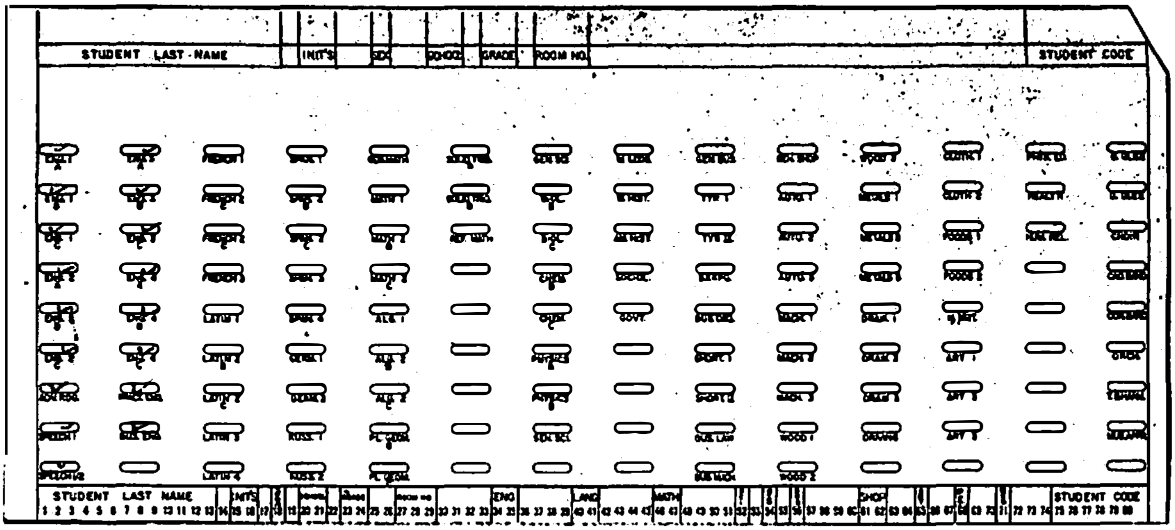


Figure 7. Subject Master Card

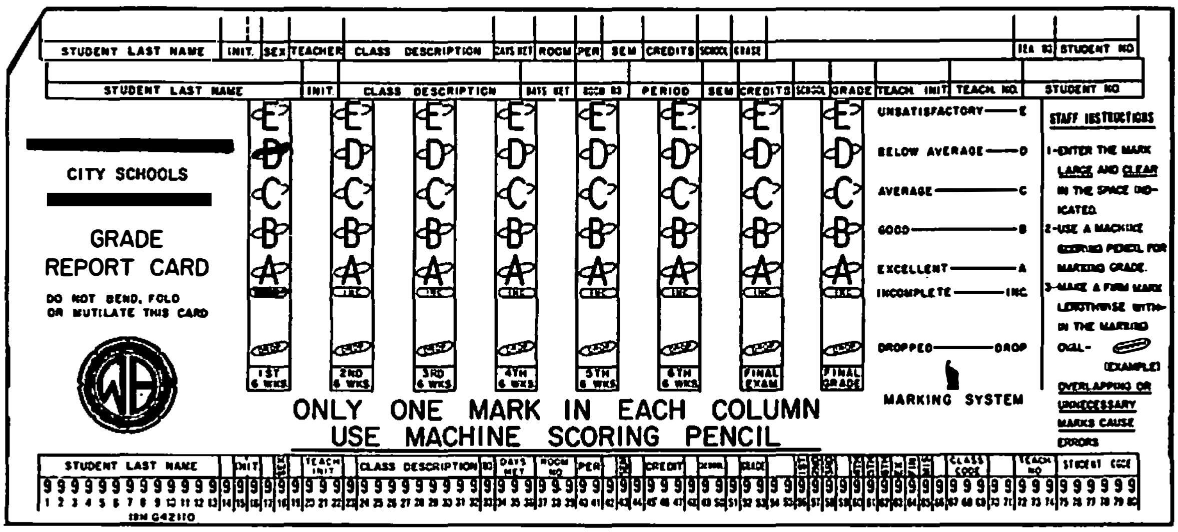


Figure 8. Grade Report Card

PUPIL LOCATOR CARD

SECONDARY

[redacted]

- CITY SCHOOLS -

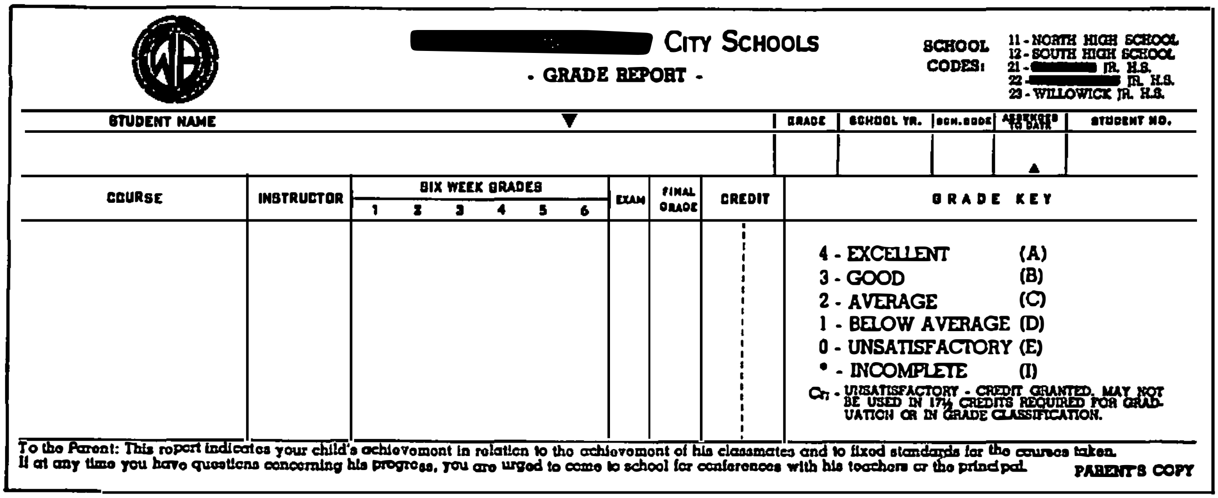
CLASS DESCRIPTION	INSTR. INIT.	DAYS MET	PERIOD	ROOM NO.	SEMESTER 1	2	3		CREDITS

PARENTS' LAST NAME	FATHER	MOTHER

HOUSE NO.	STREET NAME	TELEPHONE NO.	LOCKER NO.
		—	

STUDENT LAST NAME	STUDENT FIRST NAME	INIT.	STUDENT CODE	SEX	GRADE	BUS NO.	ROOM NO.

Figure 9. Pupil Locator Card (Secondary)



[redacted] CITY SCHOOLS

· GRADE REPORT ·

SCHOOL CODES: 11 - NORTH HIGH SCHOOL; 12 - SOUTH HIGH SCHOOL; 21 - [redacted] JR. H.S.; 22 - [redacted] JR. H.S.; 23 - WILLOWICK JR. H.S.

STUDENT NAME	GRADE	SCHOOL YR.	SCH. CODE	ABSENCES TO DATE	STUDENT NO.

COURSE	INSTRUCTOR	SIX WEEK GRADES 1	2	3	4	5	6	EXAM	FINAL GRADE	CREDIT	GRADE KEY
											4 - EXCELLENT (A) 3 - GOOD (B) 2 - AVERAGE (C) 1 - BELOW AVERAGE (D) 0 - UNSATISFACTORY (E) * - INCOMPLETE (I) Cr - UNSATISFACTORY - CREDIT GRANTED. MAY NOT BE USED IN 17¼ CREDITS REQUIRED FOR GRADUATION OR IN GRADE CLASSIFICATION.

To the Parent: This report indicates your child's achievement in relation to the achievement of his classmates and to fixed standards for the courses taken. If at any time you have questions concerning his progress, you are urged to come to school for conferences with his teachers or the principal.

PARENT'S COPY

Figure 10. Student Grade Report

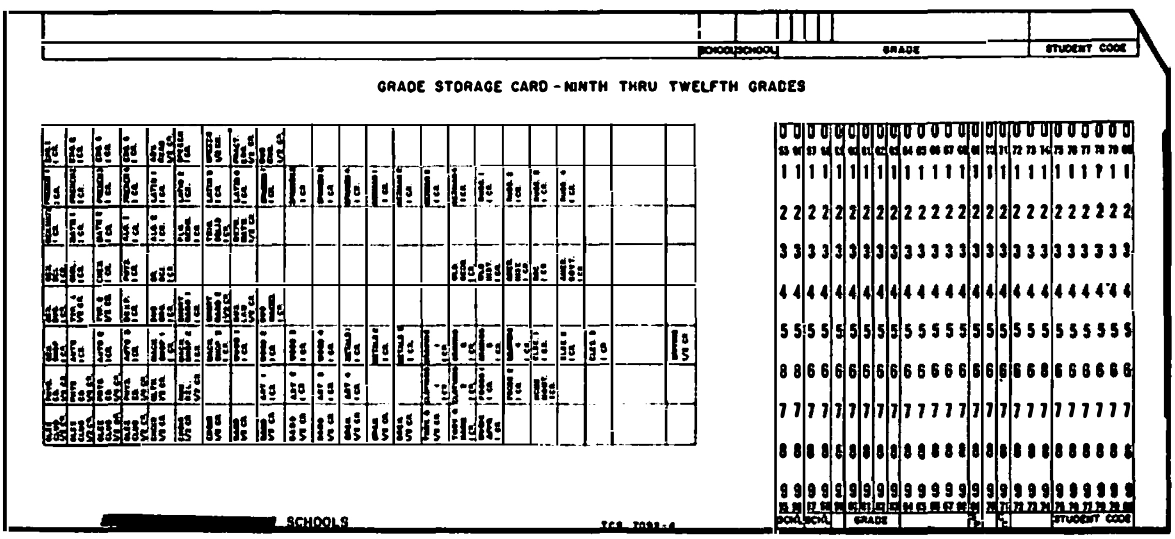


Figure 11. Grade Storage Card

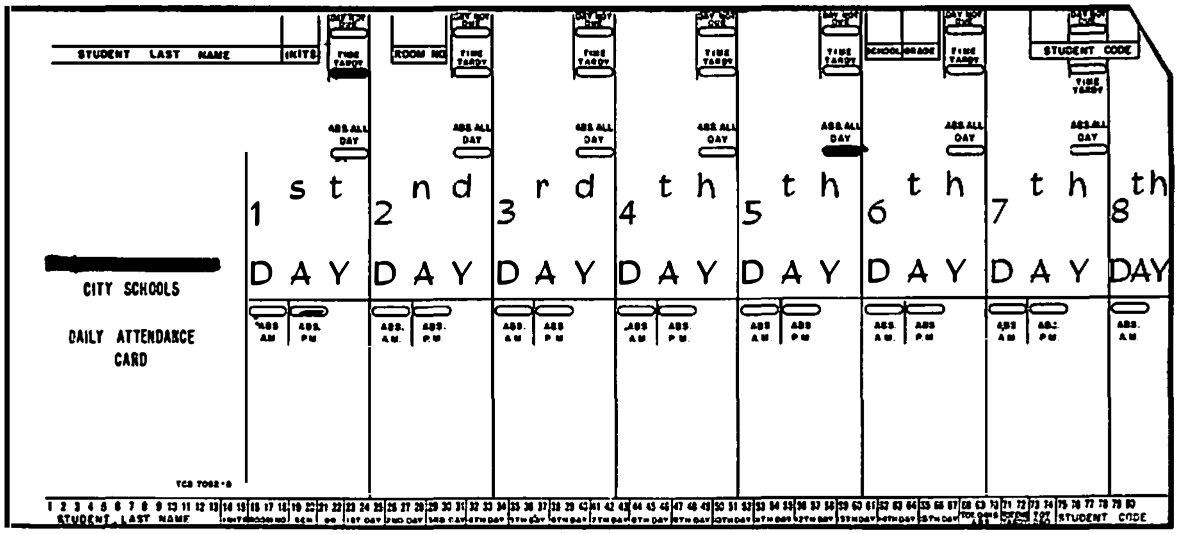


Figure 12a. Daily Attendance Card (Front)

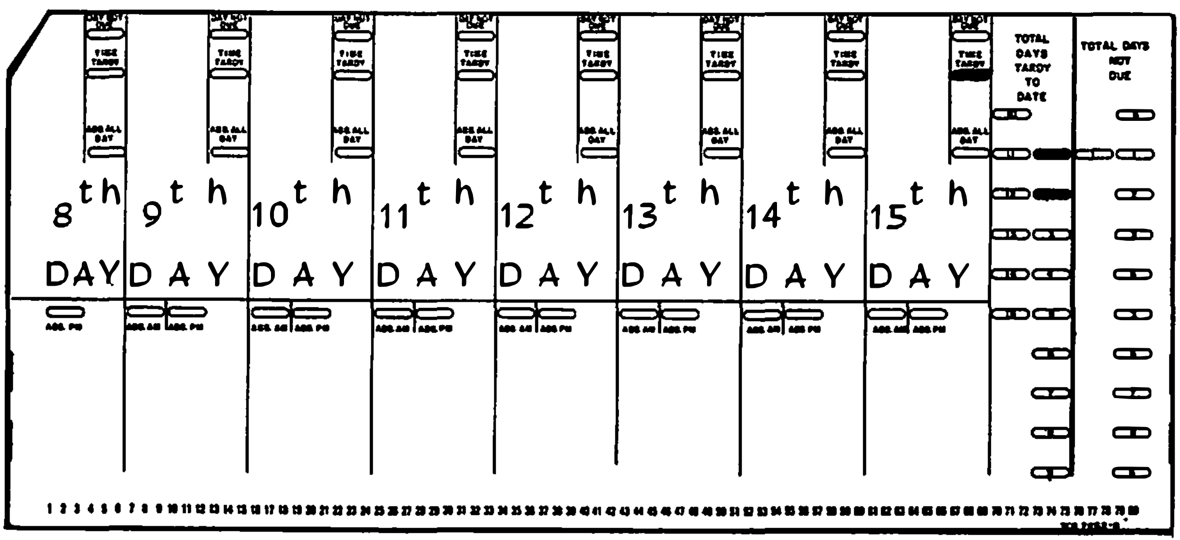


Figure 12b. Daily Attendance Card (Back)

TCH. INT.	HOME ROOM	GRADE	SCH.	ATTENDANCE PERIOD				SCH. YEAR	DAYS IN ATTEND. PERIOD
				BEGINNING		ENDING		SEPT.	
				DAY	MO.	DAY	MO.		

[redacted] CITY SCHOOLS

ATTENDANCE REGISTER

5 - ABSENT A.M.
3 - ABSENT P.M.
1 - ABSENT ALL DAY
& - DAY NOT DUE
TIME TARDY

STUDENT CODE	STUDENT		1ST WEEK					2ND WEEK					3RD WEEK					4TH WEEK					TOTALS		
	LAST NAME	INT.	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	ABSENT	TARDY	NOT DUE

TEACHER'S SIGNATURE: ____________________

ABSENT	TARDY	NOT DUE
CLASS TOTALS		

Figure 13. Attendance Register

[redacted] CITY SCHOOLS

STUDENT PERMANENT RECORD

GRADES 9-12

STUDENT

LAST NAME	FIRST NAME	MDL. INIT.		DATE OF ENTRY MO	DAY	YR	SEX	NO. IN CLASS	CLASS RANK	STUDENT CODE

ATTENDANCE

GRADE	YEAR ENDING	SCHOOL	HOMEROOM TEACHER CODE	DAYS ABSENT	TIMES TARDY		GRADE	YEAR ENDING	SCHOOL	HOMEROOM TEACHER CODE	DAYS ABSENT		TIMES TARDY

ATTENDANCE

GRADE	YEAR ENDING	SCHOOL	HOMEROOM TEACHER CODE	DAYS ABSENT	TIMES TARDY		GRADE	YEAR ENDING	SCHOOL	HOMEROOM TEACHER CODE	DAYS ABSENT		TIMES TARDY

GRADE KEY: 4 - EXCELLENT (A) 2 - AVERAGE (C) O - UNSATISFACTORY (E)
3 - GOOD (B) 1 - BELOW AVERAGE (D) D - DROPPED

ENG. 1 1 CR.	ENG. 2 1 CR.	ENG. 3 1 CR.	ENG. 4 1 CR.	ADV. READ ½ CR.	SPEECH 1 CR.	SPEECH ½ CR.	PRAC. ENG. ½ CR.	BUS. ENG. ½ CR.	ENGLISH

FR. 1 1 CR.	FR. 2 1 CR.	FR. 3 1 CR.	FR. 4 1 CR.	LAT. 1 1 CR.	LAT. 2 1 CR.	LAT. 3 1 CR.	LAT. 4 1 CR.	SPAN. 1 1 CR.	SPAN. 2 1 CR.	SPAN. 3 1 CR.	SPAN. 4 1 CR.	GER. 1 1 CR.	GER. 2 1 CR.	GER. 3 1 CR.	GER. 4 1 CR.	RUSS. 1 1 CR.	RUSS. 2 1 CR.	RUSS. 3 1 CR.	RUSS. 4 1 CR.	LANGUAGE

GEN. MATH. 1 CR.	MATH 1 1 CR.	MATH 2 1 CR.	ALG. 1 1 CR.	ALG. 2 1 CR.	PLN. GEOM. 1 CR.	TRIG. SOLID 1 CR.	REFR. MATH. ½ CR.	MATHEMATICS

GEN. SCI. 1 CR.	BIOL. 1 CR.	CHEM. 1 CR.	PHYS. 1 CR.	SR. SCI. 1 CR.	SCIENCE	WLD. GEOG. 1 CR.	WLD. HIST. 1 CR.	AMER. HIST. 1 CR.	SOC. 1 CR.	AMER. GOVT. 1 CR.	SOCIAL STUDIES

GEN. BUSN. 1 CR.	TYP. 1 ½ CR.	TYP. 2 ½ CR.	BKKP. 1 CR.	BUSN. ORG. 1 CR.	SHORT-HAND 1 1 CR.	SHORT-HAND 2 1½ CR.	BUSN. LAW ½ CR.	BUSN. MACHS. 1 CR.	BUSINESS

GEN. SHOP 1 CR.	AUTO. 1 1 CR.	AUTO. 2 1 CR.	AUTO. 3 1 CR.	MACH. SHOP 1 1 CR.	MACH. SHOP 2 1 CR.	MACH. SHOP 3 1 CR.	WOOD 1 1 CR.	WOOD 2 1 CR.	WOOD 3 1 CR.	WOOD 4 1 CR.	MET-ALS 1 1 CR.	MET-ALS 2 1 CR.	MET-ALS 3 1 CR.	DRAW-ING 1 1 CR.	DRAW-ING 2 1 CR.	DRAW-ING 3 1 CR.	DRAW-ING 4 1 CR.	ELEC. 1 1 CR.	ELEC. 2 1 CR.	ELEC. 3 1 CR.	DRIV-ING ½ CR.	INDUSTRIAL ARTS

PHYS. ED. ½ CR.	PHYS. ED. ½ CR.	PHYS. ED. ½ CR.	PHYS. ED. ½ CR.	HLTH. ½ CR.	HUM. REL. ½ CR.	HEALTH AND PHYS. ED.	ART 1 1 CR.	ART 2 1 CR.	ART 3 1 CR.	ART 4 1 CR.	ART	CLOTH-ING 1 1 CR.	CLOTH-ING 2 1 CR.	FOOD 1 1 CR.	FOOD 2 1 CR.	HOME MGMT. 1 CR.	HOME ECONOMICS

GLEE CLUB ½ CR.	GLEE CLUB ½ CR.	GLEE CLUB ½ CR.	GLEE CLUB ½ CR.	CHOIR ½ CR.	CHOIR ½ CR.	CHOIR ½ CR.	BAND ½ CR.	BAND ½ CR.	BAND ½ CR.	BAND ½ CR.	ORCH. ½ CR.	ORCH. ½ CR.	ORCH. ½ CR.	ORCH. ½ CR.	THRY. & HARM. 1 CR.	MUSIC APPR. 1 CR.	MUSIC

SCHOOL CODES:

11 - NORTH HIGH SCHOOL
12 - SOUTH HIGH SCHOOL
21 - [redacted] JUNIOR H.S.
22 [redacted] JUNIOR H.S.
23 - WILLOWICK JUNIOR H.S.

CALIFORNIA MENTAL MATURITY					CO-OP						
LANGUAGE		NON-LANGUAGE		FORM	AMER. HIST.	MECH. OF EXPRES.	EFFECT OF EXPRES.	READING COMP			FORM
M.A.	I.Q.	M.A.	I.Q.					VOC.	SPEED	LEVEL	

CALIFORNIA ACHIEVEMENT							
READING		ARITHMETIC		LANGUAGE		FORM	
VOC.	COMP.	FUND.	REAS.	MECH.	SPELLING		
							SPRING
							FALL
							GAIN

Figure 14. Student Permanent Record

CASE REPORT OF SCHOOL DISTRICT D

School District D is largely composed of one city with a population of approximately 100,000. Communities on the periphery of the city were permitted to decide through referendum whether or not to become a part of School District D. Only a limited number of the 20,000-student enrollment were from outside the city boundaries.

Based on the physical observation of the investigator, the city appeared to be economically prosperous, although there were few industrial plants in or near the city. A principal source of income was from the rich farmlands of the surrounding area.

An evaluation of the testing program in 1954 revealed many deficiencies. Few changes or improvements had been made in years. Test data were collected, but a dirth of analytical information was available to the teacher. A test scoring machine was ordered to expedite improvement in the testing program.

Difficulties presented by a series of annexation and redistricting projects in the city led to the examination of punched card procedures. Census and population research studies demanded accurate, easily retrievable data for pupil forecasting. Census data were collected by enumerators and sent to the IBM service bureau to be punched into cards and tabulated. Consequently, the first punched card application of School District D was pupil forecasting on a service-bureau basis.

Success of the first application led to a consideration of utilizing punched card procedures for processing test scores. The test

scoring machine expedited the speed and accuracy of test scoring, but availability of analytical information about the results did not improve. The need for such information combined with the success of the pupil forecasting application resulted in the decision to install punched card equipment.

The Supervisor of Testing Research who started the basic punched card procedures is no longer with School District D. The present Supervisor was employed in 1958.

A. PLANNING

Since the present administrator of the data processing system in School District D was employed in 1958, three years after installation, problems pertaining to planning prior to the installation could not be presented. Other data pertaining to planning are results of the Supervisor's experience in planning new procedures or his opinion as a result of his data processing experience. Planning will be covered as it pertains to the subsequent problem areas.

B. EQUIPMENT

The initial battery of equipment in School District D consisted of 3 keypunches (including a printing punch), a verifier, a collator, an interpreter, a reproducer with mark sense, a tabulator, 2 sorters (including a statistical sorter), and a calculator. Since employment of the current supervisor, a keypunch, a verifier, and a sorter have been deleted from the battery. Although the equipment battery was

reduced during this period, additional applications were made possible through the integration of procedures. For example: A student's name is only keypunched once with the integrated system; thereafter, it is reproduced from a master deck.

The supervisor felt that all of the equipment in School District D was necessary for data processing operations, but there was no surplus. A keypunch, sorter, and tabulator are the basic essentials for a limited data processing operation. The difference between the three essential machines and the battery of School District D is the difference between the demands for a limited operation and an extensive operation.

A keypunch, sorter, and tabulator are considered by the supervisor to be essential in beginning a punched card operation. However, a service bureau may be utilized to substitute for the absence of any part of the essential battery.

The question of rental versus purchase of machines has not been considered in School District D because of the unavailability of funds.

Machine maintenance has been satisfactory. Few occasions have arisen which demanded maintenance. When there were needs for repairs, the manufacturer servicemen were prompt; and their work was satisfactory.

The supervisor of School District D had no experience with Series 50 equipment.

The supervisor felt that use of service bureaus could only be justified in the absence of equipment. A battery as comprehensive as School District D will permit punching, sorting, collating, reproducing, interpreting, calculating, and printing. Consequently, all procedural

requirements are met. An unexpected, overload of work could be processed by addition of an extra shift or overtime with the present staff.

C. ORIENTATION OF PERSONNEL

During the tenure of the present Supervisor, few problems appear to have arisen and many have been circumvented.

The greatest concern of the public in School District D was the cost of the installation and operation of the equipment. Informing the public cannot be accidental; they must be informed through a well-organized and executed plan.

Speakers about the data processing program were always available for civic club and professional meetings. The true cost of the program was presented; but the most significant factor in the program, improvement of the quality of instruction, was emphasized. The imposition of clerical record-keeping duties on a professional, teaching staff reduces the time available for and quality of their main mission--instruction. In addition, the cost of employing professional people to perform clerical tasks demands the use of punched card equipment.

The rise of unemployment to 11 per cent in the area during the past few years has reduced revenue collected by the municipality and resulted in some objection to the cost of data processing. The dissension of a power group advocating public support of parochial schools created some objection to any expenditure for public education, including data processing. The objections have been overcome to the point that adequate financial support has been provided, but it required planned communication

to all personnel concerned with public education.

The Superintendent of School District D is progressive. He and the administrative staff have given full support to the development of a data processing system.

The teacher is the key to success of a data processing installation. Most of the source data originates with the teacher, and her importance to the success of the operation should be stressed. The supervisor felt that the recognition of the importance of the teacher in the process had prevented many problems from arising. Herein lies the need for a data processing supervisor to be a professional educator. The supervisor always presented himself to the teachers as a fellow teacher who did not know but had the potential to understand their problems. Teachers in School District D were alleged by the supervisor to be representative of their profession--conservative and independent. Therefore, every means must be exhausted to insure full cooperation.

Teachers and principals should always be consulted for their opinion of new projects. If possible, new projects should arise from the teaching staff.

Students presented no problems in School District D. The attitude of the teachers toward data processing was reflected by the students.

It was emphasized that a major responsibility of the data processing supervisor is in personnel relations. Every means should be exhausted to insure that all people concerned are informed as to the advantages, disadvantages, cost, and potential of the data processing installation.

A combination of written instructions accompanied by oral explanations proved the most satisfactory when informing the staff of their part in a new application. Before the new procedures are explained, the staff was oriented toward acceptance of their responsibility to the new application. Simulated problems of the actual function of the teacher should be included in the instruction.

D. OPERATIVE PERSONNEL

School District D currently has an adequate supply of operative personnel. In the past, many operators became proficient and sought employment in industry because of higher wages. Providing a training school for industry proved expensive, but the problem was solved.

Most of the operative personnel were young women. Marriage, pregnancy, and higher wages from industry created a rapid turnover in employment. The problem was solved by hiring older women as operators. Many women of middle age have their children reared and would like to return to the labor market. The older women employed in School District D proved stable, easy to train, and generally suited for public school work. Most of them had college degrees and were of the social status that would not permit them to work in factories, but data processing work appealed to them because its technical nature and association with education gave them a quasi-professional status. The supervisor of School District D emphatically stated that middle age women are the best potential source of operative employees.

School District D trains their own operative personnel. All

operative personnel are trained to operate every machine in the installation. Any person who can type can be easily trained in keypunch operations. Permanent boards are wired for regular operations, but the operators are taught the concepts of instructing the machines through panel wiring. The emphasis was on understanding instead of rote learning.

Each operator is assigned a processing job which is her first responsibility. After her major job assignment is complete, she is available for miscellaneous processing. For example: One woman is charged with all test scoring. When there are no tests to score, she is eligible to assist with some other processing such as attendance.

E. ORGANIZATION

The data processing division of School District D is placed in the Department of Pupil Services under the direction of the Supervisor of Testing and Research. The Supervisor coordinates and directs the entire data processing program with the assistance of three women in the machines room.

The general organization of the data processing department appears to have been satisfactory. Regular, periodic applications are scheduled and take priority over other processing. Unexpected applications not on the regular schedule are processed when time is available between scheduled applications. All departments felt they were being served adequately and impartially.

Flow charts and documented procedures were prepared for most of the regular applications. The supervisor indicated that all regular

applications should be documented.

The supervisor stressed that time estimates for processing data for other departments should be conservative. He related that the ratio should be 3 to 1. If he thought a project would take one day to process, his estimate for the job would be three days. Conservative time estimates insured that all processing would be delivered on schedule. Failure to meet deadlines on processing for other departments often creates jealousy, and the feeling may arise that the department involved is being neglected.

F. CODING

Coding and fielding of information have presented no problems in School District D. The Supervisor develops all codes.

The six-digit code number is used for student identification. The first two digits represent the year of birth; the third digit represents the sex; and the last three digits identify the student. Transfers and first-year enrollees do not exceed 999.

Two code books are printed and remain in the tab room at all times. One code book is alphabetically arranged and the other is numerically arranged. The two books provide cross references in addition to a dual means of student location. The code books are printed annually. Updating between printings is done manually.

The students' names are fielded in 22 spaces: 12 spaces for the last name, 9 spaces for the first name, and 1 space for the middle initial. The student identification number yields the date of birth, sex, and identification.

G. FORMS AND SUPPLIES

Most of the forms for School District D were designed by the former supervisor of data processing; consequently, the present supervisor was not familiar with any difficulties which might have been encountered in this area during the early stages of development.

The present supervisor has designed all forms necessary for new applications without outside technical assistance. The only difficulty encountered is the time required to design, order, print, and receive new forms. He was of the opinion that forms should be designed concurrently with procedural development of new applications.

Forms and supplies were purchased by School District D on an individual basis. Special considerations such as rush deliveries are more freely extended by manufacturers of which the system is a regular customer.

H. GOVERNMENTAL REPORT REGULATIONS

All governmental agencies requiring reports of School District D have cooperated fully with machine record processing. Attendance accounting regulations, which are a problem in many states, are very liberal because teacher allocation is not based upon attendance. Almost absolute local autonomy exists in attendance record keeping.

I. TECHNICAL INFORMATION AND ASSISTANCE

The supervisor was professionally trained in education and had an extensive background in machine data processing prior to his employment with School District D. The background in both fields has enabled him to

develop a system free of outside technical assistance.

J. STUDENT RECORDS

As previously related, the present Supervisor was not with School District D during the early stages of development. However, several new applications have been initiated since his employment with the system. New applications were thoroughly planned and tested on the machines without running a pilot project of the applications. According to the supervisor, a pilot project should not be a pre-requisite to new applications if the administrator is competent in both technical and educational aspects. If the machine test proves the workability of a new application, the only possible hindrant is the human element. If all personnel are properly prepared for the new application, the system will function adequately without a pilot project. The supervisor felt that a pilot project was for those who were not confident of their own ability.

Census. The basic step to any student accounting application is the development of a student master deck from an accurate, updated census. An accurate, updated census eliminates 90 per cent of the difficulties which could be encountered in other pupil accounting procedures.

A student master file was originally constructed from census cards (Figure 1). The master file is updated daily to maintain an accurate source of basic data. Withdrawals and additions are accounted for through a special form supplied each teacher. Pre-school age children are ascertained from information supplied by older brothers and sisters and an annual physical census.

Registration and Scheduling. Cards of students who will be attending the high school are reproduced from the master deck to the student election card (Figure 2). Although the supervisor designed all cards, the principals' names were printed on the cards for personnel-relation effect. The reverse side of the student election card is used to obtain additional data for grouping. The student election card is filled out by the student with the assistance of his counselor. Identifying code numbers for each course are listed on the card along with the name of the course. The course codes listed in each card are keypunched with a printing punch at the high school.

The student election cards are sorted by course and a report is prepared showing the number of students electing each course and a listing by name if desired. A tentative master schedule is formed by each principal from the previous year's schedule and the course list. Using the 101 statistical machine, courses are scheduled and checked for conflicts. As the classes are scheduled from the student election cards, subject cards (IBM 5081) are reproduced and interpreted.

The subject cards are placed in a pigeon-hole file arranged similarly to the master schedule, by period by subject. Cards are pulled for each course from the student's election card. The name of the student is keypunched from the student's election card at the high school. The subject cards are placed back into the pigeon-hole file by subject by period after the name is punched. In case of conflicts, student cards can be examined for possible changes.

After completion of scheduling for each student, the class cards

are sorted by homeroom to make homeroom lists; sorted by class to make class lists; and sorted by student to make student schedules (Figure 3).

Grade Reporting. Marked sense grade report cards (Figure 4) are reproduced from the student class cards which remain in the data processing department. The reproduced grade report cards are returned to the school and become the school's student master card file. The master file is maintained with cards arranged in alphabetical order within classroom for each period. The keypunch at the school is employed to maintain the file on a current basis.

At grade reporting time, the grade cards are given to the teachers who mark the grades for each student in each subject. The marks are converted to punches with the reproducer. Grade cards are sorted by student and collated with attendance cards, and student grade reports (Figure 5) are printed on the tabulator. Teacher class reports (Figure 6) are prepared by sorting the grade cards by class and printing on the tabulator. Attendance and drop-out reports may also be run from these data.

Attendance. As previously stated, attendance is largely governed by local autonomy. Principals of individual schools control daily absence reporting which does not go outside the individual school. Absences are maintained on a marking period basis instead of monthly for machine processing purposes. An attendance and citizenship card (Figure 7) is reproduced in a manner similar to the grade report card and accompanies the grade report to the individual school. At the end of the grading period, absences are mark sensed in calibrations of one-half days. The cards are returned to the data processing center with the grade report

cards, both of which are used to write the student grade report for the period.

Testing. Cards for the class or classes tested are pulled from the student master file and identification data reproduced on the test results card (Figures 8a, 8b). As the machine scores the tests, raw scores are punched or mark sensed into the test cards.

The cards are sorted into raw score sequence. The tabulator is wired to produce the data (n, f, Σx, Σy, Σxy) necessary for norming and statistical analysis.

From the normative data, master percentile cards (Figure 9) are punched and merged with the test cards. The cards are reproduced on classification and test cards (6th grade only). Test cards are made for the central office file, the students' permanent record, and in some cases for the parent. The percentile rank in each test area is punched into a schematic design on the end of the card which graphically depicts the student's profile (Figure 9).

The classification cards (Figures 10a, 10b), which are used as an aid in junior high school grouping, are sent to the sixth grade teachers who mark the estimated progress level of each student. This information is punched into the cards. The cards are then sorted and listings are prepared alphabetically by school, alphabetically by teacher, and by rank. Students are grouped and research reports are run as desired.

Permanent Records. School District D does not post nor maintain a composite permanent record by machine processing. An interpreted copy of census, grade report, attendance, test, and other informational cards

is filed with the student's permanent folder upon graduation or withdrawal. All of the cards necessary to print a copy of the student's record while in School System D are readily accessible for machine printing if the occasion demands.

K. BUSINESS OFFICE RECORDS

The data processing supervisor stated that development of business office records had presented few problems. Source information for business records is more centrally located than pupil information. Therefore, the human element involved in business records is less prevalent and does not inhibit development.

Business office records currently maintained on punched card equipment in School District D are: payroll, appropriation accounting, personnel, supply requisitioning and inventory, and property accounting.

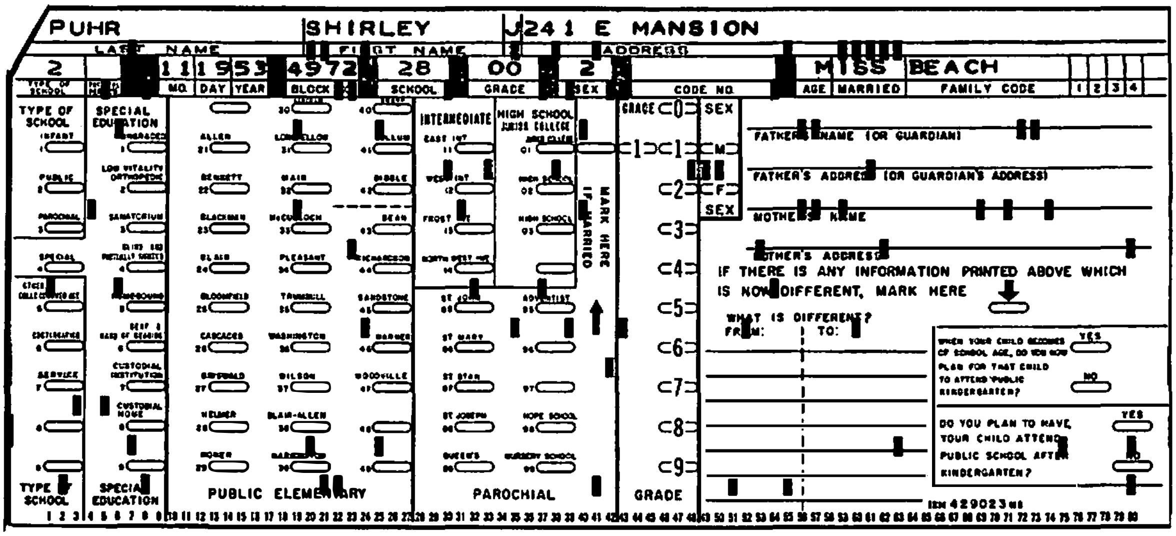


Figure 1. Census Card

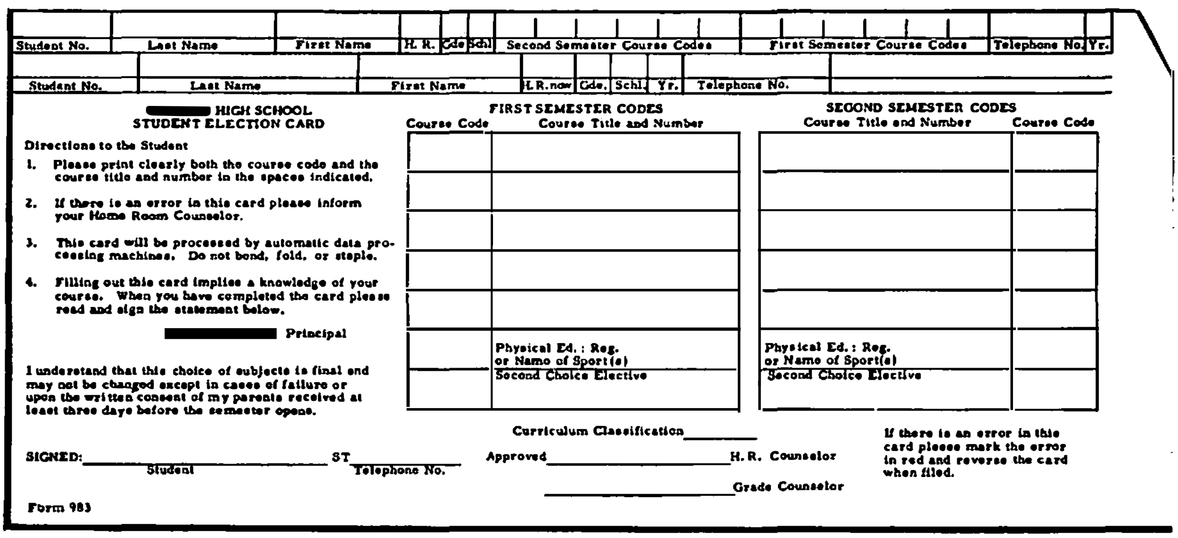


Figure 2. Student Election Card

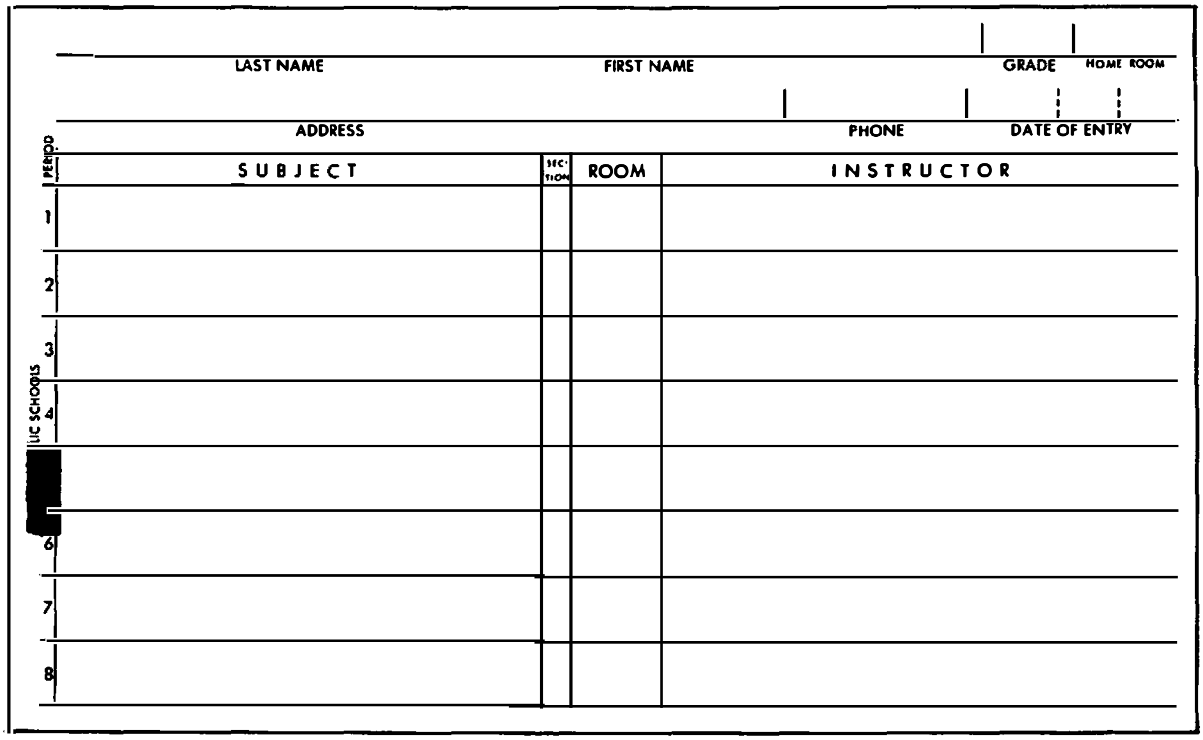


Figure 3. Student Schedule

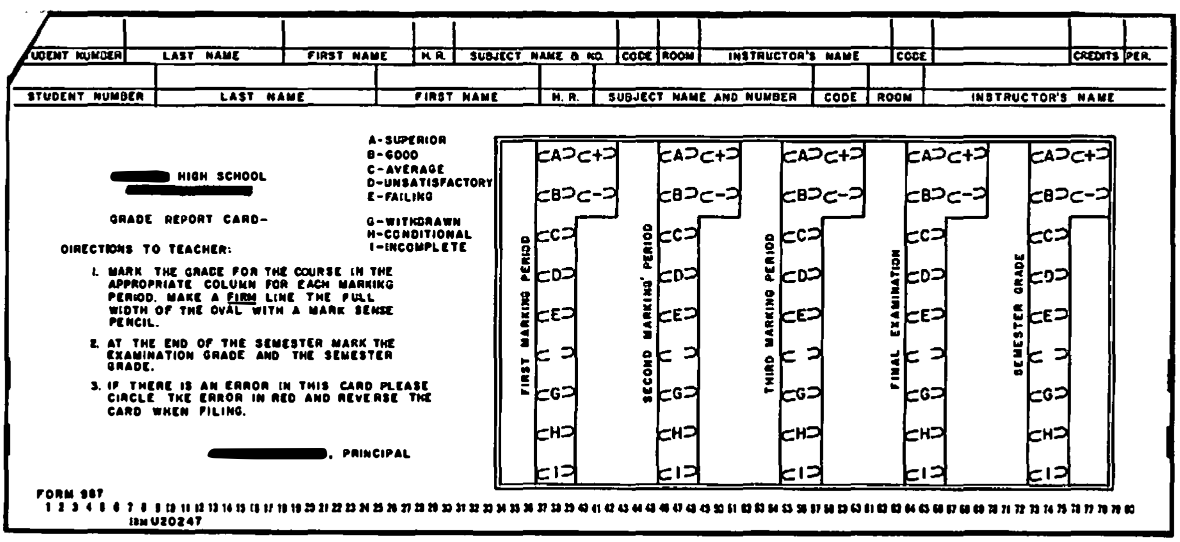


Figure 4. Grade Report Card

ACADEMIC
ATTENDANCE & CITIZENSHIP
REPORT

[redacted] **HIGH SCHOOL**
[redacted]

LAST NAME FIRST NAME DATE OF REPORT

NUMBER AND STREET HOME ROOM GRADE

[redacted]

CITY STUDENT NUMBER

	CITIZEN-SHIP	HALF DAYS ABSENT	TIMES TARDY
1			
2			
3			

COURSE TITLE & NO.	INSTRUCTOR	1	2	3	EXAM.	SEMESTER GRADE	CREDITS EARNED	HONOR POINTS

A - SUPERIOR
B - GOOD
C - AVERAGE
D - UNSATISFACTORY
E - FAILING

G - WITHDRAWN
H - CONDITIONAL
I - INCOMPLETE

COLLEGES HAVE DEFINITE REQUIREMENTS FOR ADMISSION. THE QUALITY OF WORK DONE AND THE PATTERN OF HIGH SCHOOL SUBJECTS ARE ITEMS OF IMPORTANCE. PLEASE CONSULT THE DIRECTOR OF ADMISSIONS OF THE COLLEGE(S) OF CHOICE REGARDING ADMISSION REQUIREMENTS.

SEMESTER TOTALS

Figure 5. Academic, Attendance, and Citizenship Report

TEACHERS CLASS REPORT [redacted] **HIGH SCHOOL**

TEACHER CODE SEMESTER ENDING COURSE TITLE CODE

LAST NAME	FIRST NAME	GRADE	1	2	3	EXAM	SEMESTER GRADE	NUMBER	REMARKS

	ENROLLED	WITHDRAWN	REMAINING	PASSED	CONDITIONED	FAILED	% FAILED
BOYS							
GIRLS							
TOTALS							

CODE

A — SUPERIOR
B — GOOD
C — AVERAGE
D — UNSATISFACTORY
E — FAILING
W — WITHDRAWN
H — CONDITIONAL
I — INCOMPLETE

TEACHER'S SIGNATURE

Figure 6. Teacher's Class Report

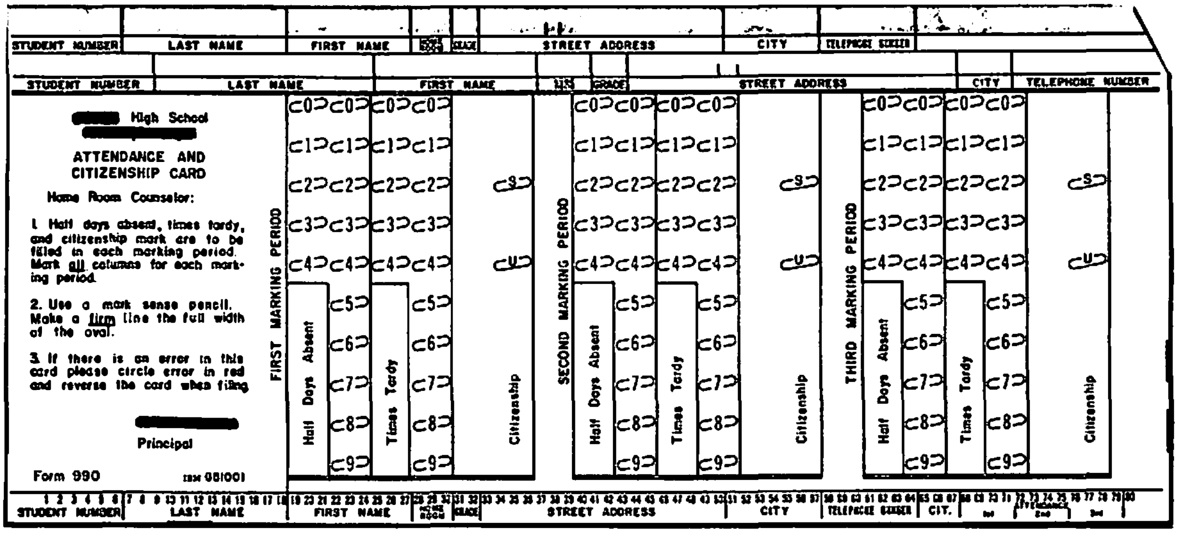


Figure 7. Attendance and Citizenship Card

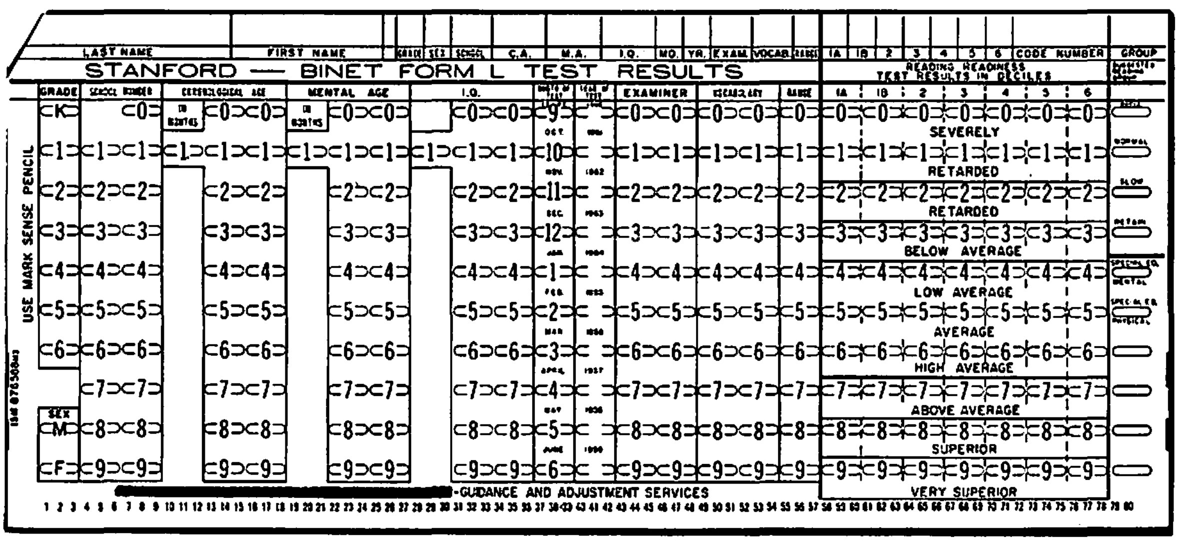


Figure 8a. Test Result Card

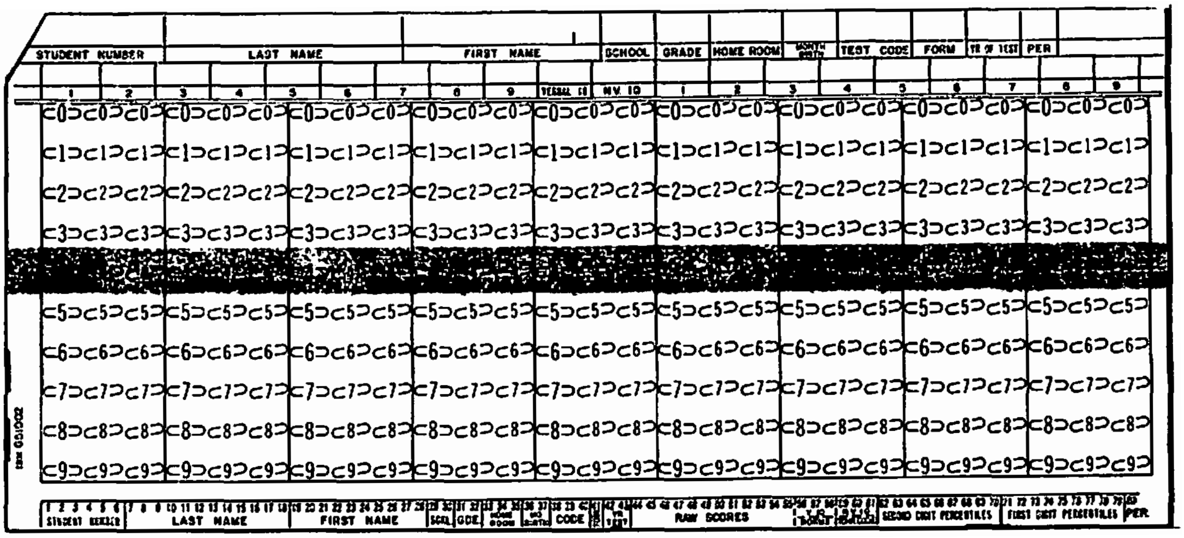


Figure 8b. Test Result Card

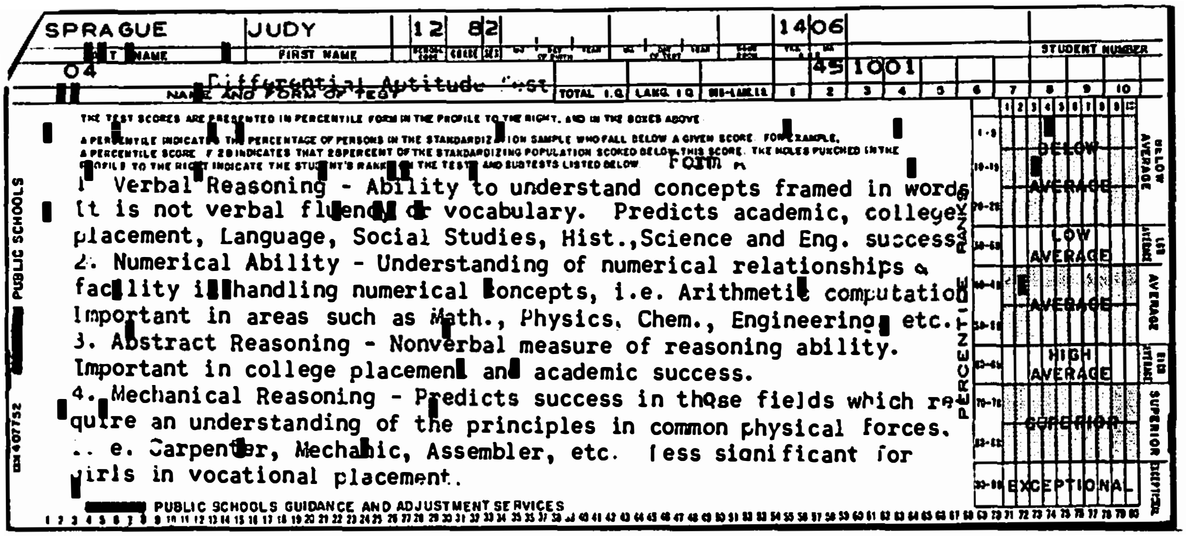


Figure 9. Master Percentile Card

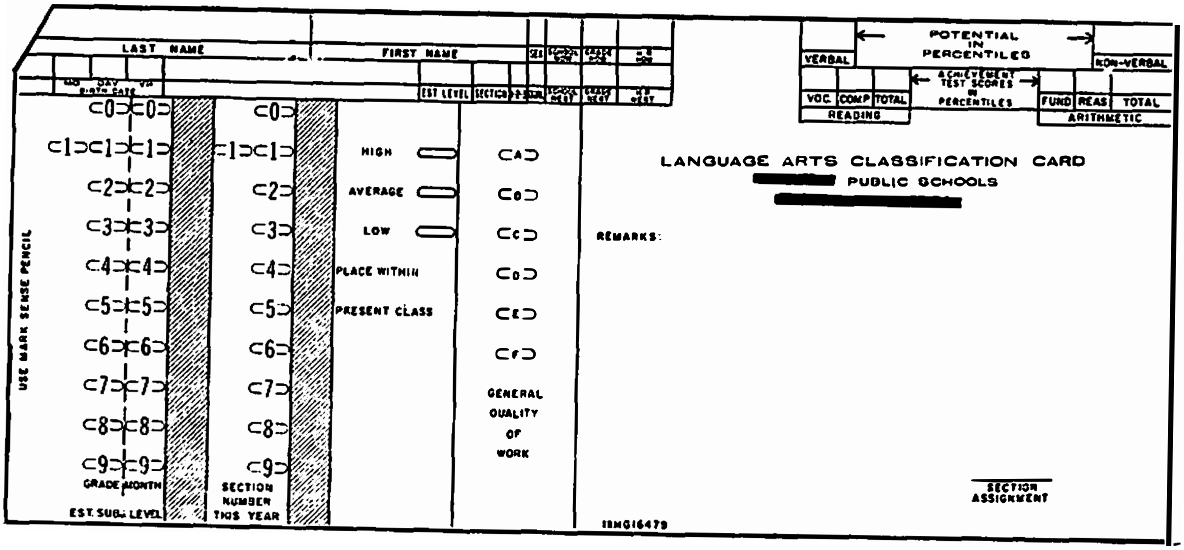


Figure 10a. Classification Card (Language Arts)

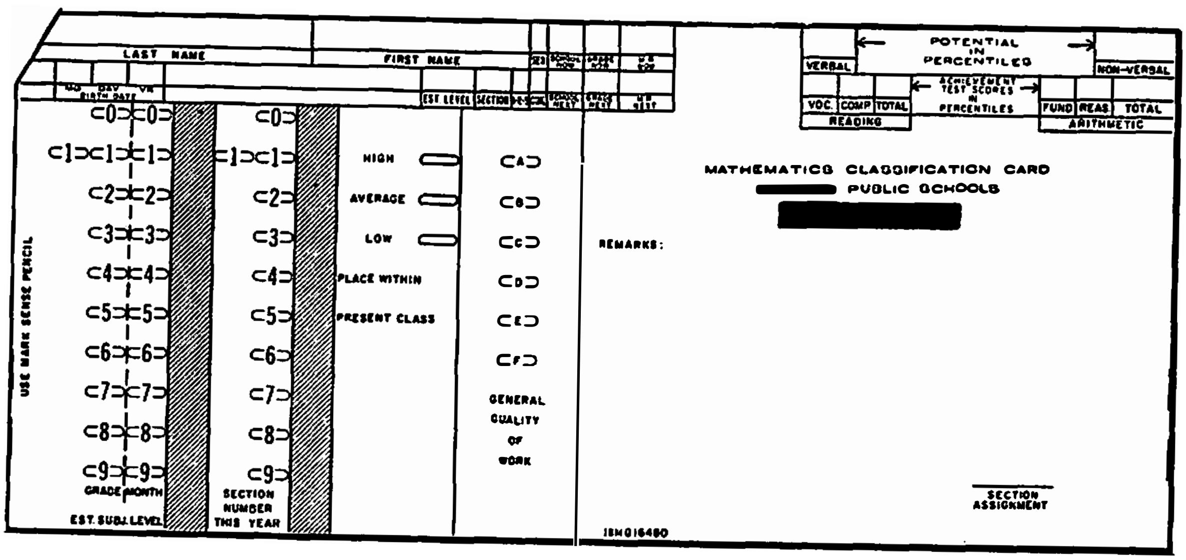


Figure 10b. Classification Card (Mathematics)

CASE REPORT OF SCHOOL DISTRICT E

School District E is a city school district serving a population of over 500,000. Marketing of agricultural products and shipping are the major sources of income. The pupil enrollment of approximately 100,000 is instructed by 3600 teachers in 115 school administrative units. Some administrative units encompass both elementary and high schools. Individually, there are 175 reporting units for attendance accounting.

In 1951 the enrollment was expanding at such a rate that adding clerical personnel to accommodate resultant record-keeping demands did not seem practical. Additional personnel could manually store data which could not be retrieved and analyzed with sufficient expedience to keep up with the growth and changing conditions. A different system was necessary to supply data that would enable more efficient management of the school system.

Tangibly, it was felt that the installation of data processing equipment could be justified on the basis of dollar savings in the business records department. Intangibly, it was felt that benefits could be derived in the area of instruction. Routine clerical work performed by teachers could be reduced, thereby, enabling them to devote more time to instruction.

Data processing equipment was originally installed in School District E in 1951. The first area for transition to machine processing was the business office records. The data processing system remained fairly static from 1951 to 1957 and was restricted to business office

applications. In 1957 a trend developed to examine the financially intangible benefits in the area of instruction. Pupil personnel accounting areas were explored, and a study of equipment needs was conducted. It was decided that a punched card battery supplemented by an IBM Ramac 305 would best meet the demands of finance, instruction, and growth of the system.

A. PLANNING

The present administrator of data processing in School District E assumed that position in 1955, 4 years after the installation of punched card equipment. Problems encountered during the first 3 years of development were not known to the present administrator. A major concern of this study was to cover problem areas encountered in the implementation of punched card procedures for pupil personnel accounting. Since pupil accounting procedures were initiated since 1955, the investigator considered the experience of the present administrator to be of value to this study.

The transition from manual to machine processing of student records presented several problems in School District E. A degree of resistance to change initially existed on practically all levels of employment. Some of the resistance was magnified because of planning errors due to inexperience. The initial machine room supervisor proved incompetent. Some planning errors were corrected by employment of a new machine room supervisor who could give better assistance in system design as well as machine processing. The resistance from the educational staff was practically eliminated through an intensive "selling

job." Remaining resistance disappeared after the first pupil accounting procedure was developed--this was tangible proof that the new system would work.

The administrator felt that the length of time allocated for preplanning prior to delivery of equipment would depend upon the size of the system, availability of competent personnel, strength of leadership, and support from the administrative head of the school system. These variables would probably cause the time to vary from 3 to 12 months.

Manufacturer representatives were available for assistance in preplanning. Key office personnel and principals receptive to the new system assisted in preplanning activities. This group decided which pupil accounting areas were most beneficial and their sequence of implementation. The technically trained personnel developed procedures and designed the necessary source documents, cards, and forms for new applications. New procedures were then discussed with the principals to determine their practicality. Necessary revisions were made and the new application was presented to the teaching staff.

The teaching staff was not involved in planning unless they had information necessary to develop the new application. They were used to evaluate the effectiveness of pilot procedures. The administrator felt that the difficulty of communicating with teacher personnel due to lack of understanding machine accounting negated the value of their utility.

A systems specialist was not employed by School District E to assist in planning and procedural development. A competent machine room supervisor and the manufacturer representative were adjudged the most beneficial sources of assistance during preplanning.

The central staff and principals were consulted about the feasibility of new applications. Their concensus was submitted to the superintendent, and he made the final decision.

School District E determined as many future applications as possible during planning periods. Broad objectives of the instructional program were developed; the procedures, personnel, and equipment necessary to attain these objectives were determined; and a written report was submitted to the school board via the superintendent.

School District E has not attempted more than one new application at a time. The size of the system was the chief reason for not simultaneously attempting multiple applications.

School District E is still a rapidly expanding school system. Although one of the larger cities in the South, the shift to suburbia has not reduced the population increase. The city has expanded its limits through annexation as the population grew and shifted to the suburban area. Many unexpected population increases have been experienced. An accurate projection of the increase had not been possible to date.

The original housing facilities for the data processing department proved inadequate as the department expanded. The department was moved to the second floor of the central school office. Additional equipment could not be added because of the structural weakness of the building. The entire battery was then moved to a one-story building. Addition of the Ramac decreased space availability for the basic punched card battery and necessitated strict thermal control. To avoid the expense of thermal control for the entire building, a separate room was

partitioned from the punched card installation to house the Ramac. The present housing facilities will not accomodate the equipment necessary for future applications. Therefore, architects have designed a new data processing building, which will be constructed in the near future.

B. EQUIPMENT

School District E selected the equipment necessary to process immediately planned applications. As applications were added, additional equipment was necessary. Addition of equipment did not result in extra costs other than extra rental for the new equipment. However, the exchange of equipment for larger or faster models resulted in an extra freight-out cost. Freight-in had to be paid on the new equipment as well as the freight-out for the equipment being replaced. Extra cost of equipment replacement can usually be circumvented by originally selecting equipment of adequate speed and capacity.

Long-range machine needs should be determined as early as possible, and a plan developed to acquire the machines as they are demanded by application expansion.

A keypunch, sorter, and tabulator were considered by the administrator to be the basic essentials to start punched card operation; but a system as large as School District E would require a larger battery.

The IBM Ramac 305 was the only data processing equipment purchased; the balance of the equipment was rented. The Ramac was selected because of its large storage capacity. The annual rental was approximately $36,000, while the cost price was $168,000. The cost price plus $3,000 annually for maintenance service could be absorbed by the rental

costs within 5 years. Another factor contributing to the decision to purchase the Ramac was the annual budget. Since the school board agreed to purchase the Ramac, the $36,000 rental will not have to be included and defended in the budget each year.

The administrator felt that keypunches and interpreters might be more economically acquired by purchasing since relatively few changes are made from year to year. Improvements on the balance of the punched card battery might render them obsolete, and direct purchase could result in excessive financial loss on exchange of equipment.

The administrator of data processing in School District E has not had experience with Series 50 equipment.

School Distrcit E utilized a service bureau during the early stages of development. The present administrator was not with the system at that time and was not familiar with their experience on that basis. Since employment of the present administrator, a service bureau has not been utilized. Peak periods of processing were accomplished by overtime of present staff and employment of part-time personnel.

C. ORIENTATION OF PERSONNEL

School District E has experienced few problems as a result of inadequate orientation of the public or school board. The general public and school board were oriented about the ramifications of machine data processing through the same media. Future proposals for data processing development were documented and justified through economic and instructional advantages. The proposals were presented to the public through the school board by every possible media. It was felt that problems in this area were circumvented by this procedure.

A relatively small degree of fear prevailed among some of the office personnel that they would be replaced by machines. The administrator felt that the system went too far in trying to alleviate this fear.

Originally, many of the educational staff resisted the transition to machine processing. They were not familiar with the process and were skeptical of its potential. Even after a pilot project in attendance accounting, many teachers did not trust machine processing. Many teachers kept duplicate sets of attendance records the first year. They felt the procedure would be a failure and that they would be called upon at the end of the year to supply data for the annual attendance report. After the first year of operation, the potential of machine processing was a reality and has enjoyed almost unanimous support since that time.

The principals were oriented as procedures for new applications were developed. A short time afterwards, the principals were assisted by a representative from the data processing department in explaining the new application to his staff. All instructional programs include simulated problems of the functions required of personnel being instructed.

Individuals on all levels within the system who resisted the new process were reputed to be the type of persons that resist all innovations. Therefore, after the initial application, the resisting element usually was identified and given "special" treatment. The strongest resistance to machine processing appeared to be among the older teachers.

Strong principals had little trouble in promoting acceptance of a new application. Weak principals experienced more trouble; but they were the ones that had trouble with all new procedures, regardless of the type. If the procedure involved mark sensing, the cards were converted, the

report printed, and the teachers were actually shown the results of their work. Display of the results of practice problems created a sense of accomplishment as well as pointing out errors made in practice.

D. OPERATIVE PERSONNEL

Until 1956 the data processing department of School District E was relatively small. Only 3 persons of the operative level were employed. In 1957 the staff was expanded to 12 persons, including the administrator. All clerical personnel in the accounting department interested in data processing were retrained by the manufacturer in machine operations. A few persons resigned and the balance were reassigned to comparable positions in other departments. Resignations and reassignees were not interested in data processing. The administrator evaluated the competence of operative personnel very low as a result of the actions. However, retraining was the expedient action because of a shortage of operative personnel in the area.

The administrator felt that employees should not be released because of the transition to machine processing. The former clerical staff should be screened for aptitude in machine accounting. Aptitude tests developed by the manufacturer have been used very satisfactorily in School District E. Personnel displaying aptitude should be retrained in machine operations, and those failing to display aptitude should be assigned to a comparable position in some other department. Employees familiar with operations can make a valuable contribution to machine processing. A nucleus of well-trained personnel should be employed to supplement the lack of experience with machine processing that is generally found in a newly trained staff.

A highly trained machine room supervisor was purported to be essential for an efficient operation. A competent supervisor can prevent most of the problems arising from operative personnel.

Part-time keypunch operators are employed during peak periods. The balance of work during peak periods is processed by the regular staff during overtime.

Outside persons with experience in schools would be the most desirable source of supervisory personnel, but the administrator indicated that the source had not been available to School District E. The most difficult problem encountered in this area was in securing a competent machine room supervisor. Three different supervisors have worked with School District E during the tenure of the present administrator. The first supervisor was inherited when the administrator joined the system; he was unsatisfactory because of a personality that did not promote a good working relationship with his staff. The second supervisor did not possess the know-how nor the drive necessary to accomplish the job. The present supervisor has the personality, technical know-how, and initiative necessary to competently execute the job.

Female operators have displayed physical limitations in handling heavy trays of cards. Therefore, male machine operators were considered more satisfactory than female.

An adequate supply of trained keypunch operators has not been available. Trained typists, displaying aptitude on the manufacturer's test, are employed and sent to the basic machine school conducted by the manufacturer.

E. ORGANIZATION

The Director of Accounts administers the data processing department under the Assistant Superintendent in Charge of Business Affairs. The Director has complete responsibility for all machine processing of business and pupil personnel records.

The Director coordinates the total program with the business and educational staff. A Data Processing Supervisor is in charge of the actual machine processing. The Supervisor is assisted by an Operating Supervisor and a Ramac Supervisor. The balance of the staff consists of 2 machine operators (407), 2 verifier operators, and 3 keypunch operators.

The Director of Accounts expressed a qualified satisfaction with the organizational structure. The internal or operational structure was highly satisfactory, but the placement of the data processing department within the Business Affairs Division did not yield the desired expedience. The organization of the data processing department as an appendage of an established division necessitates the crossing of departmental lines which has caused slower acceptance of data processing. The Director recommends that data processing be organized as an independent division directly responsible to the superintendent. The data processing department is a service department with responsibility for service to all departments which have record-keeping demands.

Flow charts and procedures were documented for all applications. However, the acquisition of a Ramac necessitated revision of procedures which has not been accomplished to date.

F. CODING

The most difficult problem with coding since acquisition of the Ramac has been developing codes to fit into the direct addressing system.

New codes are developed by the personnel in the data processing department, and the administrator has final authority for its approval.

Student names are fielded in 25 spaced--14 for last name, 10 for the first name, and 1 for the middle initial.

The first six digits of the student identification number are generated by the Ramac from the student's name. The birthdate of six digits and the first letter of the last name are also used for a total of thirteen digits in each student number. The estimated probability of duplication is one in two hundred and fifty thousand. The number yields identification, birth date, and alphabetical sequence.

Teachers have two identification numbers: the state certification number and the working number which is the address of teacher records within the Ramac.

A code book of identification numbers is currently printed but will be discontinued when conversion to the Ramac is completed.

G. FORMS AND SUPPLIES

Practically all of the card forms used by School District E were specially designed by the data processing staff. Design of forms by the staff releases the system from moral obligation to any single forms publisher and permits purchase on a bid basis when desirable.

Cards and special forms are designed concurrently with the development of new applications. Sample copies are printed by the school with an off-set printer and sent to the users of the form to insure inclusion of desired information. Specifications are then written and submitted to manufacturers. Delivery time is generally 2 to 3 weeks.

H. GOVERNMENTAL REPORT REGULATIONS

Local report regulations have not presented any problems. State agencies have been cooperative in accepting machine printed reports. However, many of the state report forms were not suited for machine printing. Machine forms similar to the state report format were printed at local expense. The state accepted the forms but has not contributed to the expense of developing such forms.

I. TECHNICAL INFORMATION AND ASSISTANCE

Technical literature which could assist in procedural development has not been available to School District E. The technical assistance of the manufacturer representatives has been excellent. The representatives have worked closely with the development of all applications.

School systems with data processing installations were visited as a possible source of technical assistance. Few of their procedural developments were adaptable to School District E because of the size differential.

J. STUDENT RECORDS

School District E has experienced difficulty in initiating a comprehensive pupil accounting program because of enrollment size. Maintaining student records on an individual basis necessitates a vast amount of machine time for prepunching and interpreting with an enrollment of 100,000. Therefore, the present machine battery has not been capable of performing the functions on a centralized basis. Plans are currently being implemented for a broad coverage of the pupil accounting area. It is felt that the addition of an IBM Computer 1401 with its fast printing feature will fill the machine demands for centralized processing of all student records. The 5,000,000-unit storage of the Ramac will also release auxiliary equipment for processing of student records.

An example of time required to interpret one card for 100,000 students is: An interpreter with a speed of 100 cards per minute would require approximately 17 hours of machine time. When considering reproducing and time required for other punched card processing, it was not feasible to attempt comprehensive pupil accounting with the conventional punched card battery.

Census. An in-school census is maintained by School District E. A student record card (Figure 1) is punched for each student and updated by grade as the student advances. A permanent student number is assigned as each student is enrolled and this number is used until the student is dropped from the file.

The student's name and number are reproduced from the student record card into the student registration card (Figure 2) and sent to

each school at the beginning of the new school period. As the students are registered, the information is checked as either correct or incorrect. If correct, the cards are returned to the data processing center for use as beginning enrollment cards for the school. If incorrect, the error is marked in the spaces provided before returning to the center. If students cannot be located, they are shown on a lost pupil list which is followed up by the attendance officers. After processing, these cards are held in the history file.

An enrollment card (Figure 3) is filled out for each new student at the beginning of the school term. It is also made out when a student transfers to another school, withdraws during a school term, re-enters after a withdrawal, or drops from the school system. The enrollment cards are returned to the data processing center where the mark senses are punched and checked. The cards are merged with the summary cards from the previous period and sorted by school. An enrollment report is written that summarizes by grade within the school, showing school code, grade, gross enrollment, net enrollment, and membership. The enrollment report is checked against the attendance summary report to balance membership. Membership totals by grade and school must be the same. The check provides an accurate control on the month's attendance. If errors are discovered, schools are notified and summary cards are corrected.

Attendance. Attendance records are maintained by the data processing department *en masse* rather than individually. Conventional punched card equipment has not proved practical in maintaining attendance records for 100,000 students on an individual basis because of the prohibitive amount of machine time involved.

The attendance cards (Figure 4) are pre-punched and end-printed with the school number, grade, and section. These cards are sent to the individual schools before the beginning of each new reporting period. The homeroom teacher prepares one card for each student by writing the student's name on the top line. Each day the teacher marks each student's card, using the cards as a class register. At the close of each period, the cards are sent to the center where they are used to compile monthly attendance statistics.

At the data processing center the mark sensed attendance cards are checked for double punches and blank columns. Any errors located are corrected while processing. The total half days present are crossfooted with the total half days absent to equal total half days belonging. The attendance report is run while the total membership by grade within each school is summary punched. One card for each school is keypunched from the attendance report, showing total half days belonging, total absent, and total present. The attendance cards for each school are crossfooted to see that the total half days present by school plus total half days absent equals half days belonging. Membership summary cards are merged with school attendance cards, and the membership report is written.

To calculate the attendance average, the attendance per day is ascertained by dividing half days present by 40. Average daily membership and absences are calculated in the same manner. The percentage of attendance is obtained by dividing average daily attendance by average daily membership.

The Superintendnet's Monthly Report is written. This report is broken down by high school, junior high, and elementary groupings for both white and colored schools.

The mark sensed attendance card has several undesignated columns at the end of the card. Those columns are used to indicate failures at the end of the year.

From the previously described data, the following reports are produced:

Weekly
- Attendance Summary by School
- Enrollment Summary by School
- Membership by School
- Membership by Grade

Monthly
- Superintendent's Monthly Report

Annually
- State Statistical Attendance Report
- Analysis of Withdrawals by Type
- Total of Failures by School
- Subject Analysis (high school and junior high)
- Total Failure Percentage by Subject Within School
- Comparative Breakdown Failure Percentage by Subject Within School
- Comparative Report Failure Percentage Between White and Colored Schools by Subject

K. BUSINESS OFFICE RECORDS

School District E had the most extensive coverage of business office records encountered by the investigator. The administrator, a highly trained accountant, did not encounter difficulty in developing the area.

The following records and reports of the business office are automatically processed by machines:

A. Payrolls

1. Computation of gross earnings
2. Computation of variable deductions
3. Computation of net pay
4. Payroll checks
5. Check register
6. Deduction register
7. Individual retirement records
8. Social security reports
9. State retirement reports
10. Bank reconciliation
11. Computation of salary increases
12. Salary exhibit for board minutes
13. Teacher contracts
14. Analyses of various types of absences
15. Labor distribution by location and work order
16. W-2 forms
17. Individual earnings records
18. S. U. N. enrollment

B. Accounts Payable and Financial Control

1. Registers
   a. Purchase order
   b. Encumbrance
   c. Check
   d. Voucher
   e. Revenue
2. Checks
3. Vouchers
4. Remittance statements
5. Expense distribution
   a. Budget account
   b. Location
   c. Work order
6. Analysis
   a. Expenditures and encumbrances by appropriation
   b. Capital outlay projects
   c. Revenue by estimate
   d. Purchases by vendor
7. Classification of capital outlay expenditure
8. School feeding profit and loss
   Monthly and year to date
   a. Individual school
   b. System wide

C. Inventories

1. Perpetual warehouse inventories
    a. School feeding
    b. Textbooks
    c. Custodial supplies
    d. First aid supplies
    e. Library supplies
    f. Athletic supplies
    g. Plumbing supplies
    h. Paint supplies
    i. Sheet metal
    j. Furniture
2. Perpetual inventory of textbooks in each school
3. Loading lists
4. Delivery lists
5. Cost allocation by location of warehouse issues
6. Invoices
7. Analyses of issues and receipts
8. Report of items below minimum stock
9. Typewriter inventory by school

D. Group insurance

1. Enrollment cards
2. Age analysis
3. Premium computations

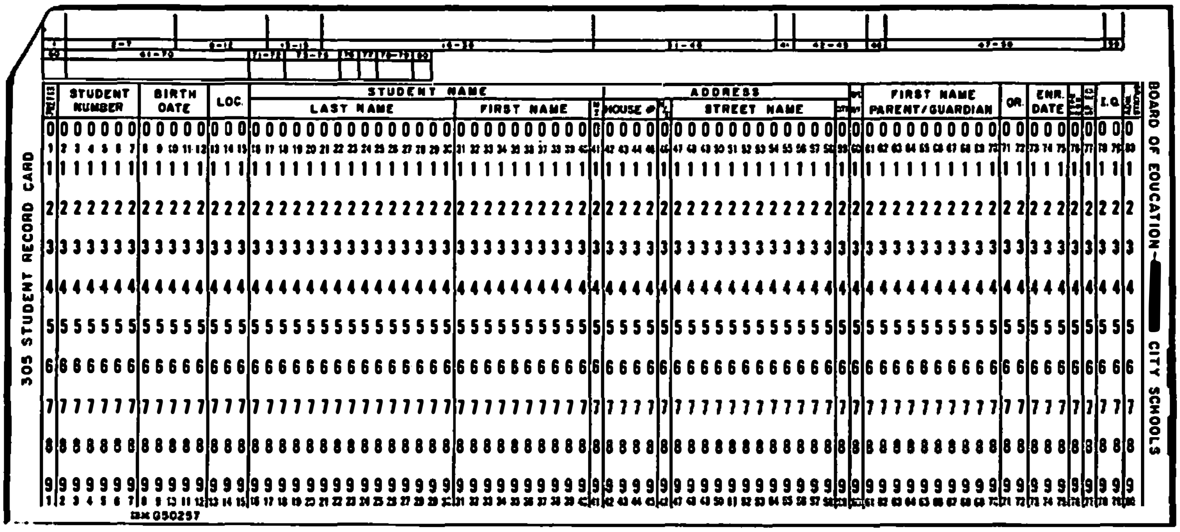


Figure 1. Student Record Card

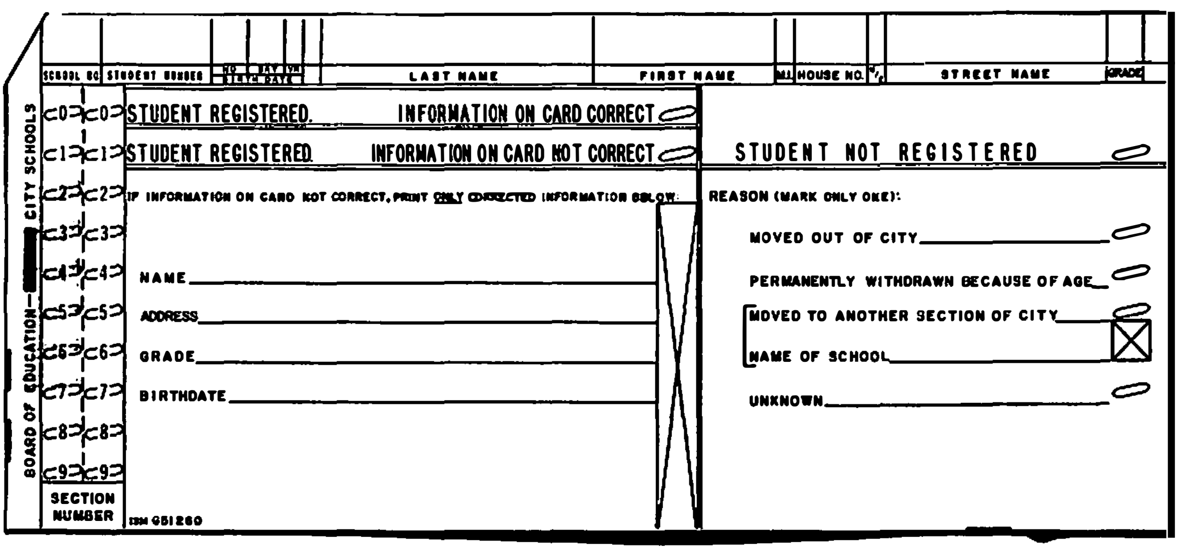


Figure 2. Student Registration Card

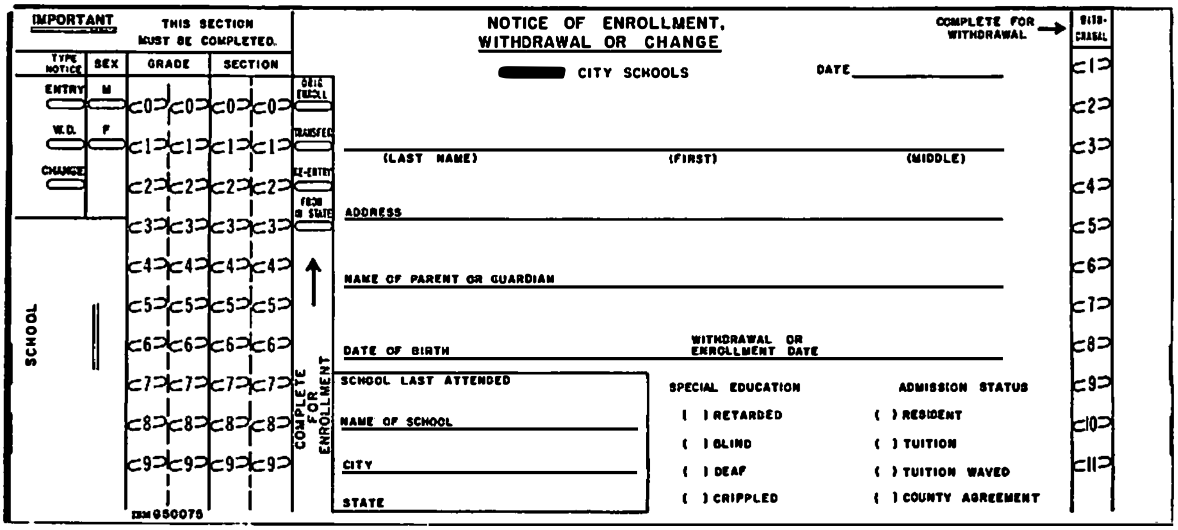


Figure 3. Enrollment Card

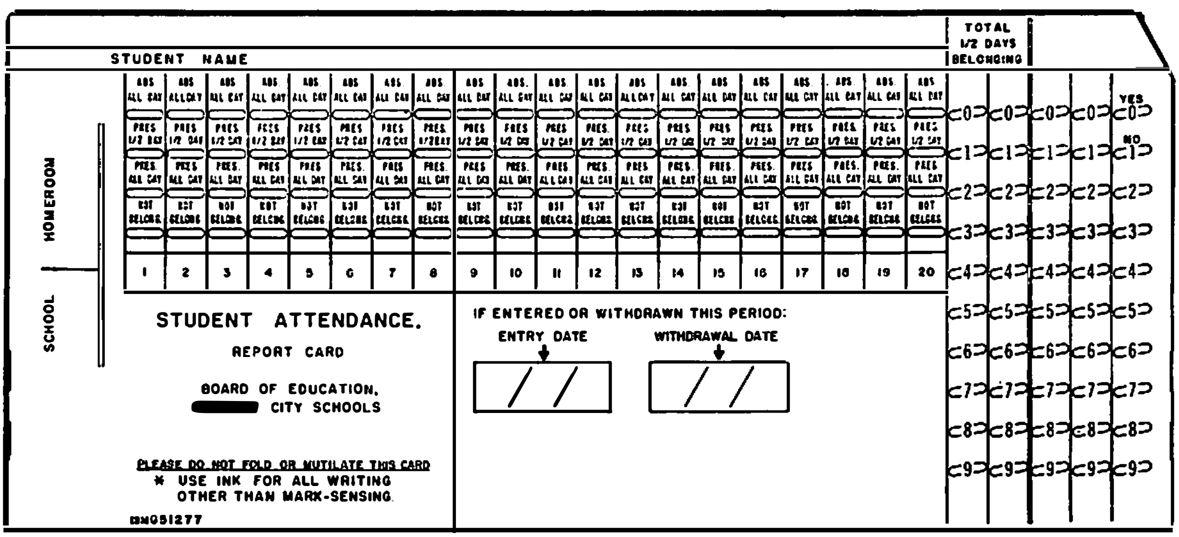


Figure 4. Student Attendance Card

CASE REPORT OF SCHOOL DISTRICT F

School District F encompasses an entire county with a land area of 2,054 square miles. The school district is heavily populated and includes several municipalities; the largest has over 500,000 population. The school building program has not met the needs of increasing student enrollment. Many schools are operating double shifts to accommodate the influx of students. In some instances, entire schools are being taught in Spanish because of the inability of new students to speak English. Cheap labor, resulting from a sudden expansion of the labor force, has also disrupted the economy of the area.

School District F employs 7,000 teachers to instruct 167,000 students in 181 school units. Five thousand administrative and service employees bring the total employment of the district to twelve thousand.

A vocational high school in the district installed punched card equipment in 1956 for instruction as well as processing school records. The success of the operation, population growth, and the potential of the equipment to meet record-keeping demands were the influencing factors which caused School District F to install punched card equipment in 1959.

A. PLANNING

A private firm of system specialists were employed by School District F to set up complete punched card procedures for personnel and payroll accounting. The installation was surveyed, procedures developed, and equipment recommended to process the job.

Five months lapsed from the time the system specialists were employed until the equipment was installed. Technical assistance during preplanning was supplied solely by the system specialists. Since payroll and personnel accounting were the only applications implemented at this stage, principals and teachers were not utilized in the planning.

Approximately 20 persons were employed in payroll and personnel accounting with a National Cash Register system. The NCR operators were trained on punched card equipment and the balance were assigned nonoperative jobs within the department. Only three persons of the original staff are currently with the system because of normal job turnover in the department.

Neither the public nor school board raised objections to the cost of original equipment. However, the equipment recommendations of the system specialists proved inadequate to process payroll and personnel records. Attempts to secure the additional equipment necessary to process payroll and personnel applications met with opposition from the school board. The consultants were paid $19,000 for their services, and it was difficult to explain to the board that equipment recommendations made by the firm were inadequate. However, after the employment of a well-trained Supervisor of Machine Records, the school board was convinced that additional equipment was necessary for present applications and future expansion.

The unanimous concensus of administrative personnel was that neither equipment nor procedures developed by the system specialists were satisfactory. All procedures were revised before they were

functional. An absolute lack of knowledge about educational procedures prevailed among the consulting staff. As a result of the experience in School District F, the administrative personnel expressed that they would not recommend system specialists to other school systems unless a comprehensive knowledge of educational records was displayed by the specialists.

Initiation of multiple applications in a system as large as School District F was not recommended by the administrator of machine records unless they were closely allied such as payroll and personnel accounting. Future applications should be determined during initial planning to insure the acquisition of equipment that would permit expansion into other applications without making an additional budget request to governing authorities.

Development of pupil accounting applications has been impeded because of the constant surge in pupil enrollment. Pupil enrollment has averaged a 12 per cent increase per year for the last five years. Personnel in School District F have not been able to accurately predict the increase in pupil enrollment.

Original housing facilities proved to be structurally incapable of accommodating the weight of the punched card battery. The current location of the punched card battery is spacially inadequate because of increased utility of the equipment. Expansion is expected to actuate the move to a larger location in the near future.

Difficulty with scheduling was originally encountered in School District F. The time estimates necessary to process applications were conservative. Resultant late reports endangered the confidence of administrative personnel in the potential of data processing.

Controls to insure the accuracy of processing were not set up by the system specialists. After the original design of applications, controls were difficult to implement without complete revision of procedures.

B. EQUIPMENT

The punched card equipment recommended by the system-specialist firm proved inadequate. The IBM 402's were replaced by 407's to increase speed and printing capacity necessary to process the 12,000-member payroll records. Resistance was encountered from the school board and the chief school administrator when confronted with the proposal to secure faster, larger capacity machines. The persons resisting indicated greater confidence in the recommendations of the specialists than the persons operating the equipment. Documented proof of machine time required to process payroll and personnel records actuated the approval for acquisition of faster equipment. The error in machine needs was largely attributed to the method employed by the specialists in calculating machine time. Machine time was calculated at the rate of gross performance, without regard for downtime or operational delays.

The keypunch, sorter, and tabulator were acknowledged as essential to basic operations. However, the size of the School District F prohibited the slightest consideration for such a meager battery. Since a company of alleged experts miscalculated machine needs, the administrator preferred rental of equipment instead of purchase during early stages of development. A data processing service bureau was not utilized in processing any of the applications in School District F.

Due to the magnitude of School District F, data processing is performed on a partially decentralized basis. A printing punch and Series 50 sorter with counter are located in each of the four high schools. Keypunching and sorting for all pupil accounting applications are performed at the individual school site. Interpreting, calculating, gang punching, and printing are performed on equipment in the central office of School District F.

The central office installation consists of three keypunches, a verifier, two sorters, an interpreter, two collators, two reproducers, and two tabulators (407).

C. ORIENTATION OF PERSONNEL

The public and school board have given support to the implementation of data processing. The only resistance from either source has been objection to the exchange of equipment recommended by the system specialists. The public and school board were informed about the problem of coping with increasing record-keeping demands of an expanding school population. Consequently, the potentiality of data processing as a solution to the problem led to acceptance.

Office personnel were familiar with machine processing of payroll and business accounts on National Cash Register equipment. The substitution of punched card equipment was accepted as a more functional process to accommodate personnel records for 12,000 employees.

The educational staff appear to have offered the greatest resistance to punched card processing of student records. One high school

was forced to discontinue punched card processing because of resistance from the instructional staff.

After experience with the high school which discontinued data processing, more emphasis was placed on the orientation of educational personnel. New applications are explained to the principals. The instructional staff of each school concerned is oriented on the advantages and functions of the new applications. Instruction of teachers is conducted at the individual schools sites. After the primary instructional session, teachers are instructed again on the final phases of the process to insure complete understanding of their function in the procedure and benefits which might be derived.

With 7,000 teachers, the administrator felt that orientation was most effective when conducted in individual school groups at the school site. Instructional techniques included both oral and written exercises.

D. OPERATIVE PERSONNEL

When School District F acquired punched card equipment, most of the clerical staff were retrained in the operation of the new machines. Clerical personnel not interested in being retrained were transferred to other departments. The administrator was not aware of resistance nor fear among the operative personnel because of the transition to a new process. Abundant job opportunities for clerical workers in the area was proposed as a possible reason for the absence of fear or resistance to the change-over.

An inadequate supply of operative personnel was given as a reason for retraining the clerical staff. An inservice training program is regularly conducted for the operative personnel to keep them abreast of new equipment and applications.

The wages of operative personnel are comparable with clerical and secretarial employees of other departments within the school system. However, the wages are less than those received by operative personnel in industry. Higher wages result in a constant shift of operative personnel from School District F to industry.

The administrator of School District F indicated that the most desirable qualification of supervisory personnel in data processing was a technically trained person with experience in schools. Inavailability of persons with such qualifications within the system necessitated the employment of a supervisor from outside the system. School policy requires promotion of personnel within the system to administrative vacancies if qualifications for the position are satisfied. The experience phase of qualification was stated to be the most difficult requirement to satisfy. Persons thoroughly trained with punched card equipment and experience with school systems are practically non-existent.

E. ORGANIZATION

The data processing department is a subsidiary of the personnel division in School District F. The Director of Personnel is responsible for all functions concerning payroll or personnel records. The Supervisor of Machine Records directs all activities within the data

processing department and is responsible for coordinating data-processing services with other divisions within the school system.

The organizational structure of the data processing department as an appendage of the Personnel Division has not functioned satisfactorily. The personnel division, under which the data processing department is located, has priority in the use of the equipment. Serving other divisions within the school system results in crossing departmental lines; therefore, more interest is focused on the record-keeping needs of the division within which the data processing department is located. A data processing department is a service organization with equal responsibility to all divisions within the school system that have demands for compilation of statistical data. In an attempt to satisfy the adjudged responsibility, the data processing department is being reorganized as a separate division, directly under the line authority of the Superintendent. Establishment of data processing as an independent division is expected to provide equal service to all divisions within School District F.

Annual or non-regular reports tend to cause excessive difficulty within the procedural organization of the data processing department. Annual reports usually require overtime of personnel. Non-regular reports are processed during slack periods and overtime. The greatest difficulty encountered with non-regular reports is time estimation for job processing. Amount of time required to process non-regular reports is generally underestimated, and persons to whom the report is due occasionally expressed dissatisfaction with machine processing.

Flow charts and procedures for processing applications were not documented. The administrator acknowledged the importance of written procedures but indicated the failure was due to the amount of time involved in developing written procedures.

F. CODING

One difficult problem in coding has been the assignment of teacher identification numbers. The state retirement number was originally used as the teacher identification number. The retirement number is assigned by the state to a new employee several months after initial employment within the state. Until the state number is assigned, it was necessary to use a temporary number. Extreme caution was necessary in the assignment and discontinuance of the temporary number. Caution failed to correct the problem. Consequently, teachers are presently assigned two numbers: a state retirement number and a permanent working number.

All codes are developed by the data processing personnel and approved by the supervisor.

Both employee and student names are fielded in 23 spaces--13 spaces for the last name, 9 spaces for the first name, and 1 space for the middle initial. If a student's name cannot be placed within the assigned spaces, vowels are dropped from the end of the name until it fits the specified field.

Student records are not kept on a centralized basis in School District F. All punching and sorting is executed at each of the four high schools. Processing demands other than punching and sorting are

performed by the central installation. However, all cards and records are kept at the individual high school. Source documents never leave the school. The individual school is responsible for assigning student identification numbers. A 4-digit number is assigned according to the alphabetic sequence of the name from an IBM coding manual. The number is red lined in the coding manual when it is assigned to a student.

Numeric identification for employees was considered by the administrator to be more practical than alpha numbers. Alpha numbers would have to be reassigned upon the marriage of a female employee, whereas numeric would remain the same.

Two code books are printed on the tabulator, one in alpha sequence and the other in numeric sequence.

G. FORMS AND SUPPLIES

The time element required of the purchasing procedure has been the most difficult problem in this area. Department heads are permitted to make purchases up to $100. Purchase requisitions amounting to between $100 and $1,000 are forwarded to the purchasing department. The purchasing department asks for quotations and selects the cheapest vendor. Purchase requisitions amounting to more than $1,000 are submitted through the purchasing department to the vendors for sealed bids. Special cards or form designs require about three weeks for delivery if the amount of the purchase is under $100 and can be submitted directly to the manufacturer. The purchasing procedure for purchases over $100 requires about six weeks.

Most of the cards and forms used by School District F are of special design. Test results cards are printed on a miltilith in the vocational division of the school system. All other cards and forms are supplied by regular forms manufacturers. Plates for special card designs cost $35.

H. GOVERNMENTAL REPORT REGULATIONS

School District F has not encountered any difficulties from the state organization which prevented machine processing in any area of application. The administrator indicated that the possibility of difficulty was greatly reduced by consulting the state agency prior to entry into punched card processing.

I. TECHNICAL INFORMATION AND ASSISTANCE

Technical information and assistance in developing punched card applications has not been satisfactory. The manufacturer representatives appeared to be more interested in selling machines than assisting with developmental problems. The administrator felt the emphasis on sales was due to the inability of the salesman to understand the problems of processing educational records. The manufacturer representative did assist in wiring control panels for the 407 tabulator on two occasions.

As previously discussed, the employment of system specialists was not satisfactory due to their inability to understand educational processing.

Technical literature for application development was alleged to be practically non-existent by the administrator. Publications by the equipment manufacturer was extremely abbreviated and highly technical.

Limited availability of technical information and assistance has necessitated independent development of applications on a trial-and-error basis. Consequently, application development was slowed to the point that the confidence in machine processing was endangered.

J. STUDENT RECORDS

Pupil accounting applications are currently restricted to four high schools within School District F. The applications are processed on a partially decentralized basis. Each of the four schools has an 026 printing punch, an 082 card sorter, and a card tub file for class detail or student grade cards. All card forms are designed to fit 402-3 or a 407 tabulator.

Punching and sorting are performed at the school site without special personnel. Clerical personnel experienced on a typewriter are trained to operate the printing punch and card sorting device. Printing, interpreting, and reproducing are performed on the equipment in the central installation.

Registration and Scheduling. The guidance counselor or other school administrative personnel assist the student in filling out the information on the student registration card (Figure 1). The student's name is written in the proper space on the front of the card. Subjects required by the student are listed under course name with course number

in the next column. Course numbers are also mark sensed in areas 1 through 6.

Marked sense positions are converted in the central office. A tally of all students intending to enroll in each course is either produced on the tabulator in the central office or obtained from the sorter at the school site.

The registrar assigns a 4-digit student identification number from an IBM manual, <u>10,000 Division Code for Proper Names</u>, and writes the number in the space provided on the card.

The student master card is identical to the student registration card except for color. The registrar or office personnel keypunch student master card information from the registration card. The master schedule is prepared by administrative personnel after the course requests are tabulated.

The keypunch operator prepares a course master card (Figure 2) for each teacher's class. The course master card is labeled as student grade card and differs only in color.

The proper number of student grade cards (Figure 2) are reproduced from the header card, course master card, at the central office. The cards are also interpreted for each student in each class. The cards are returned to individual schools where they are arranged in the tub file with the header card in front and detail cards for the maximum number in each class. The tub file is arranged similarly to the master schedule.

The student master card is the source from which grade cards are pulled from the tub file for each class which the student is registered. Grade cards for each class are pulled and placed in a file behind the student master card.

Student's assigned number, homeroom or section, name and grade level are reproduced from the student master card into grade cards at the central office. The cards are interpreted after punching.

Student Schedule. The central office prints the student schedules (Figure 3) in quadruplet from the student grade cards. Copies of student schedules are given to students, deans, counselors, and registrars.

Class Roll. Student grade cards are sorted by class, merged with the course master card, and class rolls (Figure 4) are printed in triplicate. The copies are forwarded to the schools and distributed to the teachers, instructional supervisors, and office.

Student Schedule Change. Two copies of request for schedule change and class admit (Figure 5) are completed for students requesting a change of schedule. One copy is given to the student to take to the classes from which he has withdrawn and classes into which he is to enter. The other copy is used to change the student's grade cards to agree with the new schedule. Updating of schedule changes, drop-outs, etc., are performed at the individual school site. Late registrations are handled entirely by the individual school. Necessary printing is written or typed.

Grade Reporting and Attendance. Student grade cards are sorted alphabetically by teacher by period for delivery to the teachers for

marking. Teachers mark the appropriate grade and attendance information in the proper area. Student grade cards are then sorted alphabetically by student and homeroom section. The cards are forwarded to the central office where marked senses are converted, and the progress reports (Figure 6) are printed in duplicate. Attendance data from the grade cards are tabulated and periodic attendance reports written.

The student grade cards are returned to the individual schools for use by the school registrar between grading periods. Progress reports are delivered to teachers for distribution to students who take them home for inspection and signature by the parents.

Permanent Records. Permanent records (Figures 7a and 7b) are posted on the tabulator from the student grade and attendance cards. The student grade cards with the registration card preceding each student's grade card must be in the same precise order as the permanent records since the permanent record is on individual instead of continuous forms. Records may be hand posted if they are not in convenient order for posting.

K. BUSINESS OFFICE RECORDS

Punched card procedures for payroll and personnel accounting were originally designed by a systems specialist firm. The schedule of processing was changed, and control on accuracy was added to the original system design. Property accounting is the only other business office record currently being processed on punched card equipment. Future plans include complete coverage of all business office records when equipment and personnel are available.

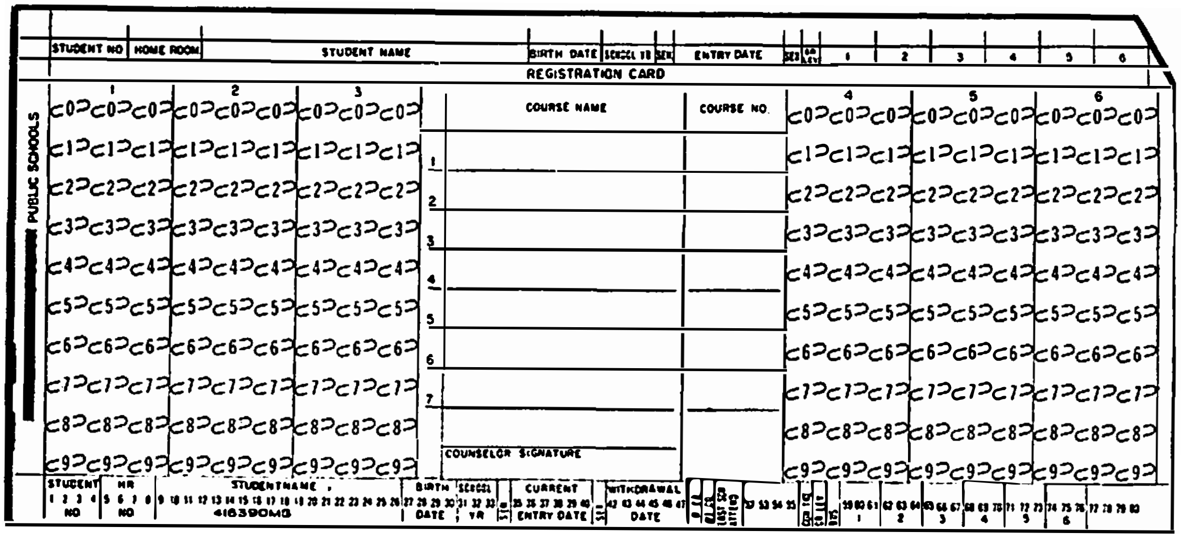


Figure 1. Student Registration Card and Student Master Card

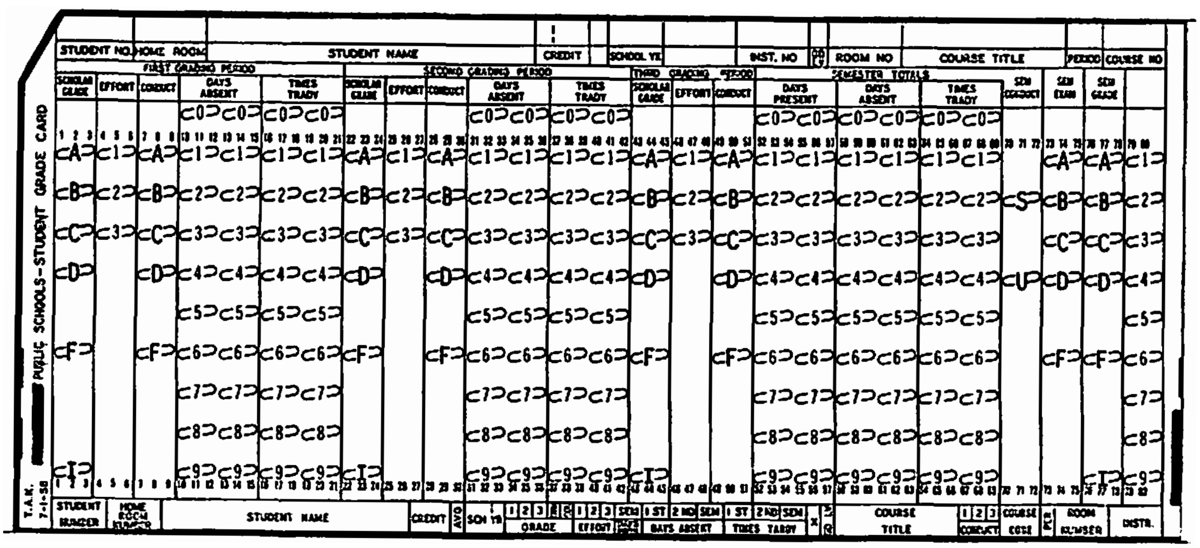
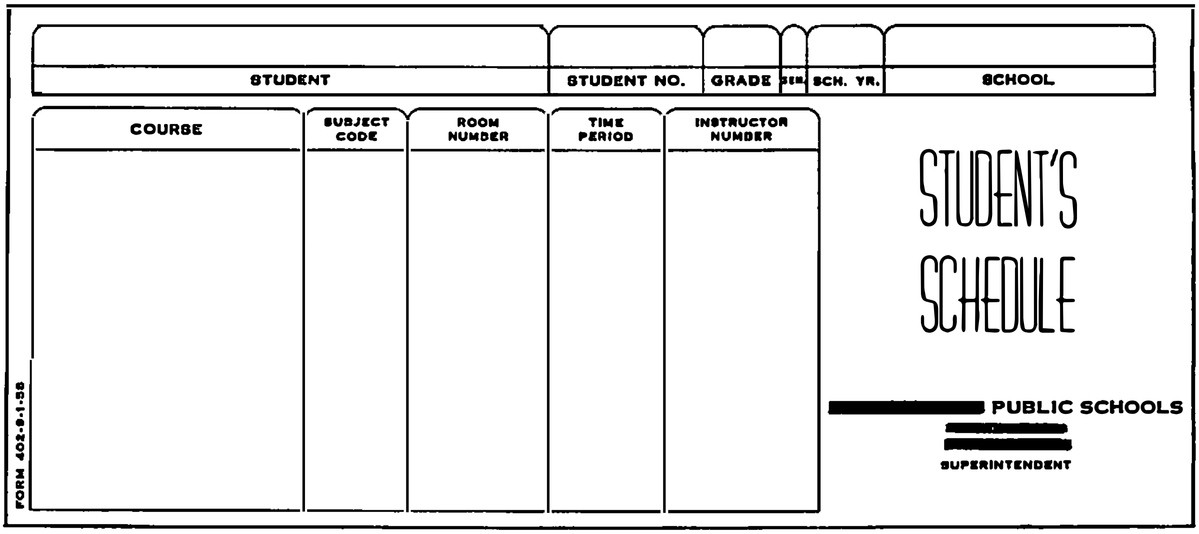


Figure 2. Course Master Card and Student Grade Card



STUDENT	STUDENT NO.	GRADE	SEM.	SCH. YR.	SCHOOL

COURSE	SUBJECT CODE	ROOM NUMBER	TIME PERIOD	INSTRUCTOR NUMBER

STUDENT'S SCHEDULE

[redacted] PUBLIC SCHOOLS

[redacted]

SUPERINTENDENT

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Figure 3. Student's Schedule

[redacted] PUBLIC SCHOOLS

[redacted]

PAGE NO.________

CLASS ROLL

INSTRUCTOR NAME

COURSE NAME	COURSE CODE	PERIOD	SCHOOL	ROOM	INSTRUCTOR NO.

STUDENT NUMBER	STUDENT	HOME ROOM		1st WEEK M	T	W	T	F	2nd WEEK M	T	W	T	F	3rd WEEK M	T	W	T	F
			1															
			2															
			3															
			4															
			5															
			6															
			7															
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			52															
			53															
			54															

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Figure 4. Class Roll

NUMBER	H ROOM	STUDENT NAME	B DATE	SCH YR	SEX	ENTRY DATE	S	L

REQUEST FOR SCHEDULE CHANGE AND CLASS ADMIT

DATE: ____________ S NUMBER: ____________ H ROOM ____________

COUNSELOR: STUDENT NAME:

[redacted] PUBLIC SCHOOLS SCHEDULE CHANGE CARD

CLASS PERIOD	PRESENT SCHEDULE	ROOM NO	SUB DROP	INSTRUCTOR INITIALS	NEW SUBJECTS SCHEDULED	ROOM NO	INSTRUCTOR INITIALS
1							
2							
3							
4							
5							
6							

IBM D10956 TAK 1-4-56 BE SURE TO WITHDRAW FROM CLASSES DROPPED BEFORE ENTERING NEW CLASSES— —INSTRUCTORS SHOULD CHECK FOR INITIALS

Figure 5. Request for Schedule Change and Class Admit

[redacted] PUBLIC SCHOOLS

PROGRESS REPORT

STUDENT	STUDENT NO	GRADE	SEM	SCH. YR.	SCHOOL	DATE ENTERED	WITHDREW

COURSE	SCHOLARSHIP GRADES					EFFORT			CONDUCT			DAYS ABSENT		TIMES TARDY		SEMESTER TOTALS			CREDITS	INSTRUCTOR NO.
	1ST.	2ND	3RD	EX.	AV	1ST.	2ND	3RD.	1ST.	2ND	3 RD.	1ST	2 ND.	1ST.	2 ND	DAYS PRESENT	DAYS ABSENT	TIMES TARDY		

SCHOLARSHIP AND CONDUCT
A - EXCELLENT 93-100
B - GOOD 85-92
C - AVERAGE 77-84
D - POOR 70-76
F - FAIL 69-BELOW
I - INCOMPLETE

EFFORT
1 - SATISFACTORY
2 - IMPROVEMENT SHOWN
3 - UNSATISFACTORY

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PARENT'S SIGNATURE

Figure 6. Progress Report

Senior High School Permanent Record Card - [redacted]

STUDENT NUMBER ____________ Name ____________

Address ____________

Place of Birth ____________ Date of Birth ____________

Parent's Name ____________

Parent's Occupation ____________

Previous School ____________

Located At ____________

Date Entered ____________ Date Withdrawn ____________

Reentered ____________ Date Graduated ____________

Grade Avg. ____________ Rank in Class ________ in ________

Grad. Requirements.
Eng. ____________ Sci. Above 10 ______
Math ____________ H. Mak. (Girls) ______
Soc. Stud. ____________ Phys. Ed. ______
Foreign Lang. ______

Student No.	Yr.—Sem.	Course	Grade	Conduct	Instructor	Attendance Days Pres.	Attendance Days Abs.	Attendance Times Late	Course Code	Credits
		Math ( )								
		English 9								
		Civics								
		Science								
		Phys. Ed. 9								
		Homeroom								

Accredited by Southern Association of Colleges and Secondary Schools

Figure 7a. Permanent Record (Front)

SENIOR HIGH SCHOOL TEST RECORDS

[redacted] STATE-WIDE
9th Grade Test Program

Pupil No.	School No.	School Ability Test-Form 3 Verbal Score	%ile	Quant. Score	%ile	SAT-Total Score	%ile	Iowa Tests of Educational Development Cor.Write. Score	%ile	Quant. Score	%ile	Soc. Studies Score	%ile	Nat. Sci. Score	%ile	Literature Score	%ile	Standard Scores Composite Score Score	%ile	DATE

TENTH GRADE
School and College
Ability Test-Form 2 ___

VERBAL Score	%ile	Range	QUANTITATIVE Score	%ile	Range	TOTAL Score	%ile	Range
		-			-			-

← CONVERTED SCORE

DATE

ELEVENTH GRADE
TESTING PROGRAM

COOPERATIVE ENGLISH READING Score	%ile	MECH. Score	%ile	EFF. Score	%ile

FORM ___

← STANDARD SCORES

CALIF. ADV. MATH. REASON Score	%ile	FUND. Score	%ile	TOTAL Score	%ile

FORM ___

← RAW SCORES

DATE

[redacted] STATE-WIDE 12th GRADE
TESTING PROGRAM

ACE-Psy. Score	%ile

← RAW SCORE STANDARD SCORE →

COOPERATIVE ACHIEVEMENT Effect. Score	%ile	Soc.Stud. Score	%ile	Nat. Sci. Score	%ile	Math. Score	%ile	Lang(F L S) Score	%ile

COMPOSITE SCORE

DATE

PERSONAL QUALITIES : DATE ___

CODE: 1. VERY GOOD 2. GOOD 3. AVERAGE 4. POOR

Personal
- PERSONAL APPEARANCE
- PHYSICAL VIGOR
- SOCIAL MATURITY

School
- WORK AND STUDY HABITS
- DEPENDABILITY
- LEADERSHIP

Home
- FINANCIAL BACKING
- HOME ENVIRONMENT

EXTRACURRICULAR ACTIVITIES AND HONORS

COMMENTS:

Student No.	Yr.—Sem.	Course	Grade	Conduct	Instructor	Attendance Days Pres.	Days Abs.	Times Late	Course Code	Credits

TRANSCRIPTS

DATE	SENT TO

NOTES:

Figure 7b. Permanent Record (Back)