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Integrated data processing in offices was studied to determine implications for the development of office occupations curriculums in public secondary schools and post-high school institutions offering less than baccalaureate degrees. Interviews were held with representatives of 285 businesses, teachers in 176 public high and post-high schools in the cities in which the businesses were located, and advanced planning executives of 13 computer manufacturers. Extensive findings include (1) It appears that jobs will become more complex rather than proliferate, (2) Little change will take place in computers in the next 3 to 10 years, (3) With the relative decrease in use of punched cards as input, the proportion of key punch and verifier operators will decrease, (4) Advances in software will be extensive in the next 3 to 10 years, and (5) There will be opportunities for programmers in systems analysis. Recommendations include: (1) inauguration of new programs and updating of existing ones, (2) training of greater numbers of teachers for the data processing field, and (3) summer experience in data processing for teachers. Recommended curriculums are included. (JK)

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FINAL REPORT

PROJECT NO. BR5-0144

CONTRACT NO. OE-6-85-030

# CURRICULAR IMPLICATIONS OF AUTOMATED DATA PROCESSING FOR EDUCATIONAL INSTITUTIONS

SEPTEMBER, 1968

U. S. DEPARTMENT OF

HEALTH, EDUCATION, AND WELFARE

OFFICE OF EDUCATION

BUREAU OF RESEARCH

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# CURRICULAR IMPLICATIONS OF AUTOMATED DATA PROCESSING FOR EDUCATIONAL INSTITUTIONS

Project No. BR5-0144

Contract No. OE6-85-030

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University of Colorado

Boulder, Colorado

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## SUMMARY

The problem was to determine the implications of integrated data processing in offices for the preparation of office workers and the development of office occupations curriculums in public secondary and public post high school institutions offering less than baccalaureate degrees.

Specifically, the problem included:

1. The analysis of integrated data processing training programs in public education institutions.

2. A study of employees in the integrated data processing programs in selected business offices, as well as a study of needs as expressed by the data processing management personnel of these offices, to determine the common body of knowledge needed for entry into selected office occupations in data processing, adjustment to office occupations requiring knowledge or ability in data processing techniques, patterns of advancement in such office occupations, and job descriptions for seven major data processing job categories.

3. Determination of new and projected developments in data processing as forecasted by manufacturers and users of hardware and software and the influence of such developments on future job opportunities and training programs.

## OBJECTIVES

The purpose of the study was to provide guidance for schools in evaluating existing programs and for establishing new programs in integrated data processing. The study compiled information to form the basis for modification of existing data processing programs and for establishment of new and flexible data processing curriculums in office occupation oriented educational programs. Occupational information about the data processing field for use of counselors was also obtained.

## METHOD

The sample survey design utilizing interviews and questionnaires was used for this study. The design, using teams of trained interviewers, made possible the collection of data from schools and offices concurrently. The use of interviewers resulted in reaching nearly 100 per cent of the samples selected.

Interview schedules and questionnaires were developed and refined, tried out, and revised. The populations and samples were then selected. Since data processing equipment represents large capital investment, larger companies were the source of information for the problem. The population from which the sample of data processing equipment users was drawn was Dun and Bradstreet's 1963 Million Dollar Directory, which listed some 28,000 businesses with net worth of one million dollars or more. Use of the N.E.A. small-sample formula indicated that 285 businesses would constitute a reliable sample for a study of this kind. The study included 353 businesses.

The schools and teachers for the study were determined by the location of the businesses selected for the sample. Teachers in the public high schools in the city in which a business was located and public two-year post highs that offered programs in data processing were interviewed. A total of 176 school systems were included in the study.

A preliminary census of data processing offerings in the public educational institutions in the United States was obtained. A brief, one-page questionnaire, designed for optical scanning, was sent to all secondary and two-year post high schools in the United States. Over a 94 per cent return (10,278 questionnaires) was received. Analysis of these questionnaires resulted in a compilation of characteristics of existing data processing programs throughout the United States.

Fourteen interviewers, all business education teachers who taught at different educational levels from junior high school to four-year colleges, were selected and trained in the interviewing process. Specific training was given the interviewers on the use of the instruments designed for this study. The interviewers, working together in seven teams of two, spent three months collecting data throughout the 39 states in the sample.

Interviews were held with the advance planning executives of the computer manufacturers to determine what technological developments were being planned that would have any effect on the training of future employees in data processing.

Data collected from the interviews and questionnaires were coded and key punched into cards. Programs were written and run on the University computer. Analysis of the print-out data was made resulting in two recommended data processing curriculums, one for the high school and one for the two-year post high school institutions.

## RESULTS

Analysis of the data collected from several sources (managers of data processing departments, employees in the data processing departments, teachers of data processing, and advance planning executives of the computer manufacturers) resulted in the development of a recommended data processing curriculum and course outline for the high school and for the two-year post high school. The recommended curriculums are as follows:

### HIGH SCHOOL CURRICULUM IN DATA PROCESSING

| 9th Grade | Units |
|---|---|
| Mathematics | 1 |
| English | 1 |
| Social Science | 1 |
| Science | 1 |
| Typing | 1 |
| Physical Education | 1 |

| 10th Grade | |
|---|---|
| Mathematics | 1 |
| English | 1 |
| Social Science | 1 |
| Science | 1 |
| Introduction to Data Processing | 1/2 |
| Physical Education | 1 |
| * | |

| 11th Grade | |
|---|---|
| Advanced Algebra | 1/2 |
| English | 1 |
| Social Science | 1 |
| Computer Concepts and Systems Development | 1 |
| Bookkeeping | 1 |
| Physical Education | 1 |

*Electives:
Introduction to Business
Consumer Economics

| 12th Grade | Units |
|---|---|
| Oral Communication | 1/2 |
| Written Communication | 1/2 |
| Business Organization and Management | 1/2 |
| Human Relations | 1/2 |
| Business and Office Procedures and Data Processing Applications | 1 |
| Physical Education | 1 |
| ** | |

**Elective:
Economics

Data Processing Courses

Among the specific topics and concepts to be included in the high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (10th Grade-1/2 Unit)

1. History of records systems and manual data processing
2. Tabulating cards and equipment
   a. Card layout and design
   b. Equipment (purposes and operation, excluding panel wiring)
      (1) Key punch and verifier
      (2) Sorter
      (3) Interpreter
      (4) Reproducer
      (5) Accounting machine
      (6) Collator
3. Electronic computer logic
   a. Memory
   b. Input of data
   c. Calculation (arithmetic)
   d. Output
4. Flow charting
5. Computer operation (using a type and model of computer and a symbolic language for which the teacher and student have access)

Computer concepts and systems development (11th Grade-1 Unit)

1. Review of electronic digital computers and principles of data processing
2. Computer logic
3. Logic development through problem solving in general
4. Procedures development
5. Forms design
6. Computer languages (two languages: COBOL and one other, possibly Autocoder)
7. Computer business applications

Data processing applications (12th Grade-1/2 Unit)
(This course should be coordinated with Bookkeeping and Business and Office Procedures)

1. Systems analysis and design
2. Programming essentials
3. Report writing and analysis from computer printout
4. Gaming (simulation)
5. Laboratory (or on a co-op basis)
    a. Forms design
    b. Flow charting
    c. Writing the programs
    d. Operating computer
    e. Debugging
    f. Running of live work

POST HIGH SCHOOL CURRICULUM IN DATA PROCESSING*

FIRST YEAR

| 1st Semester: | Units |
|---|---|
| College Algebra | 4 |
| Written Communication | 3 |
| Accounting Principles | 3 |
| Introduction to Data Processing | 4 |
| Principles of Economics | 3 |
| | 17 |

*Typewriting is considered a pre-requisite to this program.

FIRST YEAR (continued)

| 2nd Semester: | Units |
|---|---|
| Data Processing Mathematics | 3 |
| Oral Communication | 3 |
| Accounting Principles | 3 |
| Business Conditions (or Contemporary Economic Problems) | 3 |
| Logic and Introduction to Systems Analysis | 5 |
| | 17 |

SECOND YEAR

| 1st Semester: | |
|---|---|
| Business Statistics | 4 |
| Psychology | 3 |
| Advanced Accounting | 3 |
| Introduction to Computer Programming | 3 |
| Data Processing Systems | 3 |
| | 16 |

| 2nd Semester: | |
|---|---|
| Principles of Management | 3 |
| Human Relations | 3 |
| Data Processing Applications and Practicum in Programming | 5 |
| Advanced Programming | 3 |
| | 14 |

Data Processing Courses

Among the topics and concepts to be included in the post high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (1st Year, 1st Semester-4 Units)

1. History of data processing
2. Principles of data processing

Introduction to data processing (continued)

3. Overview of unit records
    a. Key punch and verifier
    b. Sorter
    c. Interpreter
    d. Reproducer
    e. Accounting machine
    f. Collator
    g. Principles of panel wiring
4. Card layout and design
5. Electronic computer equipment
    a. Types
    b. Logic
6. Flow charting
7. Elements of programming
8. Laboratory in data processing equipment
9. Number systems

Logic and introduction to systems analysis (1st Year, 2nd Semester-5 Units)

1. Procedures development
2. Forms design (source document)
3. General flow charting
4. Program flow charting and block diagramming
5. Computer logic
6. Analysis of information network systems
7. Coding and condensing data

Introduction to computer programming (2nd Year, 1st Semester-3 Units)

1. Review of computer equipment
2. Principles and theory of digital computers
3. Programming essentials
4. Computer logic
5. Block diagramming
6. Coding and condensing data
7. Purposes and functions of different languages
8. Uses of symbolic languages
9. Central processing unit
10. Computer applications
11. Registers
12. Assembly programs and compilers
13. Programming systems
14. Fixed and floating points
15. Macro-generators

Business systems design and development (2nd Year, 1st Semester-
3 Units)

1. Identification of system objectives
2. Identification of system requirements
3. Methods for achieving system objectives
4. Development of operating procedures
5. Installation of system for each of the following

    a. Customer order and billing
    b. Customer accounts receivable
    c. Inventory control
    d. Sales information
    e. Payroll
    f. Purchasing and accounts payable
    g. General-ledger accounting

Data processing applications and practicum in programming
(2nd Year, 2nd Semester-5 Units)

1. Data processing applications

    a. Payroll
    b. Inventory
    c. Accounts receivable and payable
    d. Sales analysis
    e. Policyholders records
    f. Cost accounting
    g. General accounting
    h. Billing

2. Practicum in programming

    a. Systems

        (1) Analysis
        (2) Design

    b. Programming essentials
    c. Report writing and analysis
    d. Gaming
    e. Simulation

        (1) Forms design
        (2) Flow charting
        (3) Writing programs
        (4) Operating computer
        (5) Debugging
        (6) Running live work

    f. Field project

Advanced programming (2nd Year, 2nd Semester-3 Units)

1. Report generators
2. Macro-generators
3. Assembly programs and compilers
4. Emulators
5. Data scheduling systems
6. Monitors and high level languages
7. Fixed and floating points

## HIGHLIGHTS OF THE FINDINGS AND THEIR IMPLICATIONS

The findings from this study seem to fall into three categories as follows:

### Findings Concerning Jobs and Job Opportunities in Data Processing

1. High school graduates from data processing programs may enter the following data processing jobs: key punch operator, unit record operator, tape librarian, and computer operator.

2. Graduates of two-year post high school institutions may enter the same jobs as those who graduate from high school data processing programs, but in addition, the following jobs are available to them: programmer, systems analyst (with some further experience and training), and supervisor of data processing (with experience and possibly further training).

3. Generally, the jobs in data processing will become more complex rather than proliferate.

4. Computer manufacturers indicated that little change would take place in computers in the next three to ten years except for miniaturization and greater memory unit capacity; thus, many of the jobs now available will continue to be prevalent for several years to come.

5. With the relative decrease in use of punched cards as input, the proportion of key punch and verifier operators will decrease.

6. Advances in the software will be extensive in the next three to ten years; consequently, opportunities will expand for persons trained in the use of the new software as it is developed and accepted.

7. Programmers will not need to be as technically trained as is presently true. Graduates of two-year post high school programs will be adequately trained for programming positions. However, the programmer as he is known today will become important to the business organization if he is prepared to move into a systems analysis position. Businesses will want their programmers to have the necessary background training to move into the position of systems analyst, or expect the programmer to continue his training on the job so that he may move into the higher level position.

8. Unit record equipment is being phased out with the installation of smaller computers. The position of unit record equipment operator will not be as prevalent in the near future as it has been in the past.

9. Opportunities for persons to program software equipment as it is developed will increase greatly.

10. Persons who will be classified as Applications Specialists will be increasingly in demand. These people will advise businesses on how to use automated systems.

11. An administrative level position possibly will emerge, a person known as an Automated Data Management Specialist, who will be responsible for deciding what to do with the data from the computer. His job will be to teach management through application.

12. As the use of time sharing increases, more and more business employees will need to understand automatic data processing. In a time-sharing installation many of the regular clerks will be responsible for originating and putting data into the automated data processing system. They will be required to be a part of the total system but will not necessarily hold a job classified as a data processing position.

Findings Concerning Teachers of Data Processing

13. A greater proportion of the high school data processing teachers hold degrees than post high school data processing teachers, but post high school teachers had had more advanced training in data processing.

14. More high school data processing teachers received at least some of their data processing background by attending manufacturers' schools than did the post high school data processing teachers.

15. More of the post high school data processing teachers had had work experience, data processing work experience, and on-the-job training than had the high school data processing teachers.

16. More high school data processing teachers are getting business experience in the summer than are post high school data processing teachers.

Findings Concerning Data Processing Curriculums

17. The educational institutions are not preparing enough persons to meet the demands of business. More emphasis must be placed on the preparation of more teachers so that more young people may have the opportunity to be trained in data processing.

18. Communication skills, both oral and written, are demanded of data processing personnel. Both the management personnel and the employees in data processing recognize a weakness in this area which is not being remedied by our educational institutions.

19. Data processing personnel need to be oriented to the total systems approach in business. The educational institutions have not been satisfying this need for the persons in data processing positions.

20. Because the field of data processing education is so relatively new, the programs in the high school and post high school institutions are somewhat similar except that more concentration in data processing courses is found at the post high school level. The major objective of the courses at both levels was vocational training.

21. Mathematics is considered a pre-requisite for data processing courses at the post high school level whereas it is not for the high school level programs in data processing. Managers felt that mathematics should be included as part of a data processing program for its logic values rather than as mathematics per se. Several managers suggested courses in logic be included in the curriculum.

22. Relatively few schools operate a cooperative part-time training program in data processing. Only 50 schools out of 176 schools surveyed had such a program.

23. Three-fourths of those high schools with a cooperative program in data processing require up to six weeks of on-the-job training.

24. Half of the cooperative programs in the post high schools (nine out of a total of 18 programs) have no set amount of time required for the on-the-job training phase of the cooperative part-time program.

25. No opportunities are available in data processing for workers with no specialized training. Persons must either have some specialized training before being placed on a data processing job or may transfer from a job within the firm and receive on-the-job training in data processing resulting in specialized training. Some companies may hire persons without specialized training and give that training to the new employee before putting him on the job.

26. Because the need for data processing employees is so much greater than the number of people being trained in our educational institutions, industry currently is willing to hire persons who have a specialized skill regardless of where they have received their training.

27. Computing machines will be more and more internally programmed, with the result that wiring will become less important in business. However, these persons still will be needed in the technical positions with the computer manufacturers. Many of the programs (particularly in post high school programs) devote a considerable amount of time on wiring boards. This is a skill development that needs less emphasis in training for business data processing jobs.

## RECOMMENDATIONS FOR FURTHER ACTION

1. The schools are not meeting the needs in training personnel for the many job opportunities in data processing in business. Much more effort needs to be exerted by school boards, school administrators, teachers, and state supervisors to inaugurate curriculums in data processing and to update the programs currently in existence.

2. Teacher training institutions must train more teachers for the field of business data processing. Since frequently the cost of such a teacher training program is too costly for an individual institution, they should be helped financially by state, federal and/or private business funds. Two approaches to increasing the number of teachers are: (a) summer programs for beginning teachers and for updating current data processing teachers, and (b) in-service training

programs during the academic year offered at strategic locations to train data processing employees as potential teachers and to prepare other teachers for teaching in the data processing area.

3. Businesses should make data processing jobs available for teachers during the summer months.

4. Workshops in data processing occupational information should be developed for counselors and school administrators and in data processing curriculums and equipment for school administrators.

5. Further research is needed in making in-depth analyses of course offerings in the field of data processing.

6. Further research is needed in the development of adequate teacher training programs for teachers of data processing.

7. A similar study to this one should be made again in about five to seven years to recommend changes in data processing curriculums as a result of the new devices and techniques and developments in the teaching of data processing; and also, more importantly, as a result of new developments just now being experimented with in education, such as the ES-70 project, the NOBELS project, use of block programming, use of modular scheduling, and expanded use of on line and real time applications in schools.

PART I

# CHAPTER I

## THE PROBLEM

The extensive introduction of electronic computers for data processing and other applications in business has created a critical need for greater numbers of more highly skilled personnel. The help-wanted sections of metropolitan newspapers provide ample evidence of this need. Attractive inducements are offered for electronic data processing managers, programmers, computer console operators, systems analysts, tabulating equipment operators, supervisors, punched-card machine operators and many others. To meet these personnel requirements, more people need to be trained, and many of the present management and operative personnel need to be retrained.

Implicit in these quantitative aspects of training for data processing employees are the qualitative facets, bringing up such questions as: What kind and how extensive should the training be for these various people? Who should provide this training and how and when should it be done? While considerable effort has been expended on training programs by several agencies, little objective research has been done to determine these needs.

## STATEMENT OF THE PROBLEM

The problem was to determine the implications of integrated data processing[1] for the preparation of office workers as it affects the development of office occupations curricula in public secondary and public post high school institutions offering less than baccalaureate degrees.

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1. Integrated data processing can be described briefly as automation of source data. The writing for an office operation is put into such a form that subsequent operations requiring this writing can be processed automatically. Integrated data processing, therefore, tends to tie office work together, to integrate it, or to form a whole from the various parts. Mechanization is used. The term "integrated mechanical data processing" would be more precise; but the modern and common term is "integrated data processing" and hence will be used here.

Three broad facets of the problem include:

1. The analysis and evaluation of existing integrated data processing training programs in public educational institutions.

    a. Determination of the location of public secondary and post high school non-degree granting institutions offering data processing courses in these institutions.

    b. Detailed analysis of curricular offerings in selected institutions and the scope of the offerings.

    c. Evaluation of course offerings of educational institutions as they relate to needs of business as determined under 2 below, through suggested curriculums.

2. A study of employees in the integrated data processing programs in selected business offices, as well as a study of the needs as expressed by the data processing management personnel of these offices, to determine the common body of knowledge needed for:

    a. Entry into selected office occupations affected by data processing.

    b. Adjustment to office occupations requiring knowledge or ability in automated data processing techniques.

    c. Patterns of advancement in such office occupations.

    d. Retraining

3. Determination of new and projected developments in data processing as forecasted by manufacturers and users of hardware and software and the influence of such developments on future job opportunities.

## PURPOSE OF THE STUDY

The purpose of the study is twofold: (1) to provide guidance for schools in evaluating existing programs and in establishing new programs in integrated data processing, and (2) to furnish information for counselors in providing students with occupational information about employment and career opportunities in the business data processing field.

To fulfill these purposes, data have been collected from four main sources:

1. Data processing management personnel

2. Data processing employees

3. Heads of data processing instructional departments in secondary schools, junior and community colleges, and vocational schools, and from data processing teachers in these schools.

4. Data processing equipment manufacturers.

Data were collected about employees, their preparation for the job, their prior work experience, the duties they perform in their data processing jobs, their evaluation of their education, requirements for entry into several data processing jobs, and information about the future technological developments in the field of data processing equipment that might influence the education of data processing employees. The specific kinds of information gathered are these:

1. Data processing instructional programs

    a. Curriculum

        (1) courses, coverage and sequencing of the units

        (2) expected competencies

        (3) criteria for selection of students

        (4) extent of cooperative work programs in data processing

    b. Instructional materials

    c. Equipment used

    d. Students, their grade level, characteristics

    e. Teachers, their education, work experience and training in data processing

    f. Problems in initiating and maintaining a data processing instructional program

2. Information regarding data processing employees

   a. Job titles and description of the duties involved in several jobs

   b. Educational preparation, including pre-employment training and on-the-job training

   c. Employment record, work history

   d. Employees' evaluation of their training and education

   e. Occupational mobility patterns

   f. Personal characteristics

3. The job

   a. Promotional patterns

   b. Criteria for selection of beginning employees

   c. Supervisory practices

   d. Recruitment practices

   e. Pay scales

4. Future developments of data processing equipment

In order to define the problem more specifically, answers were sought to the following questions:

1. Are data processing programs as taught in educational institutions meeting the demands of firms for data processing personnel?

2. What jobs are available for high school graduates from data processing programs?

3. What jobs are available for graduates from programs in two-year post high school institutions?

4. What major differences are there between data processing programs at the high school and post high school levels?

5. What differences are there in the preparation of teachers instructing data processing courses at the high school and post high school levels?

6. What kinds and amount of on-the-job training are required for graduates from data processing programs at the high school and post high school levels?

7. How much on-the-job (and what kind) of training is required for graduates from cooperative part-time training programs in data processing at either level of education?

8. What are the opportunities for employment of workers with no specialized training in data processing?

9. What significant characteristics distinguish strong from weak programs in data processing?

10. What are emerging job opportunities in new activities related to data processing that will develop in the future in light of developments in the technology of data processing?

## ORGANIZATION OF REPORT

The organizational pattern of this report follows the plan of giving the reader, in Part I, the problem under investigation and the findings of the study, followed by the curricular implications of data processing resulting from the analysis of the data collected. Part II is devoted to a presentation of descriptions of the seven major job categories in data processing and an analysis of the data collected from the schools offering course work in data processing in regard to the curricular patterns in those schools and the background of the teachers in data processing.

Part I is composed of five chapters: Chapter I, The Problem; Chapter II, Findings; Chapter III, Curricular Implications; Chapter IV, Review of Related Literature; and Chapter V, Procedures.

Part II presents the data gathered from 353 businesses and 174 school systems in the study. This section has seven chapters (VI through XII), each chapter devoted to one of the seven job categories into which the data processing employees are classified: key punch operator, unit record operator, computer operator, tape librarian, programmer, data processing manager, systems analyst.

Part III presents the data and analysis of the data collected from 380 teachers in 176 school systems that are offering data processing. Chapter XIII is a description of the curriculums in the schools surveyed; Chapter XIV presents information regarding qualifications and teaching responsibilities of teachers in the schools surveyed.

Major conclusions from which the curricular implications were derived and recommendations for further action are presented in the Summary at the beginning of this report.

## CHAPTER II

## FINDINGS

The first modern day computer to work successfully, the Mark I, was designed by Professor Howard Aiken of Harvard and built with the aid of IBM in 1944. In 1946, the ENIAC (Electronic Numerical Integrator and Calculator) was built and completed at the University of Pennsylvania. These were not electronic computers with internal storage of instructions as in today's computers, but the instructions were externally wired in a manner similar to the control panels of electromechanical equipment. The UNIVAC (Universal Accurate Computer), which came as a result of the ENIAC, was designed by Dr. J. Presper Eckert and Dr. John Mauchly who both joined the staff at Sperry Rand.

Computers, however, had been barely introduced into offices by 1954, when a model of the UNIVAC was used by General Electric for the first real application of computers to business data processing work (18:113-114). The computer was first used principally for performing the many repetitious jobs in the office, such as processing payroll and inventory records, and the computers were used for office work only after the mathematical and scientific problems in industry had been completed. As the paper work explosion in business progressed, the need for high-speed operations in the office became prevalent. Later, digital computers were designed especially for data processing in the office.

For the past twenty years, the number of office jobs has been growing at a faster rate than openings for other types of employment. This has been due mainly to the mounting volume of communications, recordkeeping, and other paper work. The use of electronic computers and other new office equipment will not likely keep pace with the increased amount of paper work required by modern business; hence, the need for more and more office workers.

### INFLUENCE OF COMPUTERS ON BUSINESS EDUCATION

The computer in the office, the big technological change of the 1950's, made obsolete business education as it had been known and taught. A new dimension, business data processing, was added to the sphere of training for business. The need for training young people for living and working in a computerized world is with us. We have been slow to realize fully the impact of this new technological change--it was not until the late 1950's that any school programs were established to train personnel for positions in data processing. During the years of 1961 to 1964, about 32 school programs per year were established to train data processing personnel, and since 1964 only two or three programs have been started each year. The reason stated most frequently for establishing these programs was the growing demand by industry for trained personnel. About 19 per cent of the high schools and 61 per cent of the junior colleges and vocational schools were offering course work in data processing in 1966, or were planning to offer it (Table 2-1).

Most of the high school data processing programs were found in the New England, Middle Atlantic, and Pacific regions of the United States while the data processing programs in junior colleges and vocational schools were located predominantly in the Pacific, Middle Atlantic, South Atlantic, and East North Central regions of the United States.

Schools have been slow to respond to the need for training young people for positions in data processing. With the ever-growing number of automated data processing installations in business offices, the education and training of workers for these jobs becomes a major concern to those persons responsible for preparing people for those positions. Because the schools have not graduated enough workers prepared for the available positions in data processing, industry has looked elsewhere for these employees; many of whom have come from other jobs and departments within the companies. Those persons today who are now in data processing positions and who have been employed in some other type of work have come principally from sales and services positions or from clerical positions (Table 2-2).

Several of the employees surveyed had had some experience in data processing work prior to coming to their present employer. Many of the data processing jobs held were different from their present job. More of the employees had served as tabulator operator than in any other position (Table 2-3).

Slightly more than four-fifths of the key punch operators have had no previous experience in data processing other than as a key punch operator. A few of them had held the positions of tabulator operator and supervisor. Over half of the unit record equipment operators had held no other data processing job than that before their present job, and over half the computer operators had been unit record equipment operators before their present job.

About 35 per cent of the programmers had held no other data processing position before their present job, and over one-fourth of them had been tabulator operators prior to their present position as programmers.

Table 2-1. Number of Schools Offering or Planning Course Work in Data Processing

| Section of Country | High Schools | | | | | | | Jr. Colleges & Voc. Schools | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Schools | Offering D.P. Courses | | Anticipating D.P. Courses | | Project. Tot. Schools with D.P. Courses | | Total Schools | Offering D.P. Courses | | Anticipating D.P. Courses | | Project.Tot. Schools with D.P. Courses | |
| | | N | % | N | % | N | % | | N | % | N | % | N | % |
| New England | 508 | 102 | 20 | 76 | 15 | 178 | 35 | 40 | 14 | 35 | 4 | 10 | 18 | 45 |
| Mid Atlantic | 1451 | 232 | 16 | 255 | 18 | 487 | 34 | 100 | 56 | 56 | 11 | 11 | 67 | 67 |
| So. Atlantic | 644 | 44 | 7 | 58 | 9 | 102 | 16 | 126 | 62 | 49 | 19 | 15 | 81 | 64 |
| E.So.Central | 492 | 8 | 2 | 28 | 6 | 36 | 7 | 54 | 18 | 33 | 10 | 19 | 28 | 52 |
| W.So.Central | 1237 | 26 | 2 | 63 | 5 | 89 | 7 | 52 | 25 | 48 | 1 | 2 | 26 | 50 |
| W.No.Central | 1797 | 80 | 4 | 145 | 8 | 225 | 13 | 102 | 29 | 28 | 18 | 18 | 47 | 46 |
| E.No.Central | 2248 | 146 | 6 | 274 | 12 | 420 | 19 | 157 | 78 | 50 | 13 | 8 | 98 | 62 |
| Mountain | 458 | 28 | 6 | 52 | 11 | 80 | 17 | 38 | 13 | 34 | 16 | 42 | 19 | 50 |
| Pacific | 649 | 75 | 12 | 90 | 14 | 165 | 25 | 114 | 79 | 69 | 13 | 11 | 94 | 82 |
| Totals | 9484 | 741 | 8 | 1041 | 11 | 1782 | 19 | 783 | 374 | 48 | 105 | 28 | 478 | 61 |

Table 2-2. Kinds of Jobs Prior to Employment in Data Processing

| Previous Job | Present Job | | | | | | |
|---|---|---|---|---|---|---|---|
| | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
| Clerical | 240 | 5 | 80 | 72 | 93 | 35 | 24 |
| Office Machines Operator | 61 | 0 | 18 | 8 | 11 | 9 | 7 |
| Steno-Typist | 134 | 1 | 23 | 14 | 20 | 3 | 1 |
| Accounting | 65 | 6 | 22 | 28 | 53 | 18 | 30 |
| Inventory Clerk | 18 | 1 | 25 | 22 | 22 | 6 | 7 |
| Trades | 34 | 0 | 41 | 40 | 74 | 13 | 13 |
| Factory | 30 | 1 | 32 | 37 | 37 | 19 | 6 |
| Supervisory | 6 | 0 | 16 | 10 | 21 | 12 | 21 |
| Sales & Service | 196 | 14 | 102 | 92 | 93 | 46 | 27 |
| Other | 44 | 1 | 25 | 22 | 45 | 8 | 15 |

Over one-fourth of the systems analysts had held no other data processing position prior to their present job. About one-fourth of them had been unit record equipment operators and about one-fourth of them had been programmers before assuming the position of systems analyst. The rest had held a variety of other data processing jobs.

On the other hand, about 70 per cent of the data processing managers had held other jobs in data processing before becoming manager. About 40 per cent of them had worked as unit record equipment operators before becoming supervisors of data processing.

Table 2-3. Kinds of Jobs Held in Data Processing Prior to Present Job

| Previous Job | Present Job | | | | | |
|---|---|---|---|---|---|---|
| | Key Punch Oper. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
| Key Punch Operator | 449 | 34 | 13 | 7 | 14 | 2 |
| Tabulator Operator | 50 | 90 | 93 | 68 | 62 | 37 |
| Computer Operator | 5 | 22 | 50 | 28 | 13 | 5 |
| Programmer | 1 | 2 | 7 | 87 | 15 | 39 |
| Supervisor D.P. | 33 | 21 | 12 | 19 | 46 | 24 |
| Systems Analyst | 0 | 0 | 1 | 23 | 8 | 41 |
| Other | 14 | 6 | 7 | 10 | 10 | 7 |
| Totals | 552 | 175 | 183 | 252 | 158 | 155 |

## CHARACTERISTICS OF DATA PROCESSING JOBS

Managers of data processing departments in 353 businesses throughout the United States who were interviewed and over 2,000 data processing employees in those businesses who completed questionnaires provided data and information about the data processing jobs being performed in business. The information sought about the jobs included such things as the duties the employees performed on the job, the amount of overtime required for the job, the amount of supervision required for the different jobs, the promotion patterns for the several jobs, and the salaries received by the employees in the several job categories.

The information concerning the employees in data processing positions collected from management personnel and the employees themselves included such items as ages, education accepted and preferred by management as well as the education of the individuals on the jobs, amount of experience accepted and preferred by management as well as the experience of the persons on the jobs, personal characteristics of individuals performing data processing jobs, and the mobility of data processing employees.

Insight into future technological developments in data processing equipment was obtained by interviews with the advance planning executives of the computer manufacturing companies, who were asked what was being planned in the next three to ten years that would affect the preparation of future data processing employees. The managers of the data processing departments were also asked in their interviews to project their needs and anticipated changes for the next five to ten years.

Data concerning these three aspects of data processing jobs and needs of personnel are presented and analyzed in the following three divisions of this chapter.

## Duties Performed in Data Processing Jobs

Table 2-4 shows the duties performed by employees in data processing. The duties are listed in order of frequency of mention, together with the percentage of employees in each of eight different job categories. Because the duties, qualifications and preparation of verifier operators so closely parallel those of the key punch operators, detailed analysis was not made of this particular job in the remaining part of the study. However, the duties are included in this table since the verifier's job is one that can be held by recent high school graduates.

Analysis of Table 2-4 seems to indicate that key punch operators should have knowledge of more than the key punch machine, since over a fourth of them report operating the interpreter, card sorter, and reproducer, and over 10 per cent of them operate an accounting machine as one of their duties.

Card punching was among the 10 most frequently mentioned duties for unit record machine operators (accounting machine operators) and for computer operators and programmers, as well as for the key punch and verifier operators. Programmers and systems analysts both prepare programs to a great extent. Over 95 per cent of the programmers and more than 75 per cent of the systems analysts write programs, and they use several different languages for their programming (Table 5). Autocoder is the language reported the most frequently, with COBOL and machine language reported slightly over half as frequently as was Autocoder.

Table 2-4. Most Commonly Mentioned Duties Performed by Data Processing Employees

| Duties | N | % |
|---|---|---|
| Key Punch Operator (N = 835) | | |
| Punch cards | 807 | 96.6 |
| Verify punched cards | 585 | 70.0 |
| Operate interpreter | 274 | 32.8 |
| Operate sorter | 254 | 30.4 |
| Operate reproducer | 209 | 25.0 |
| Operate typewriter | 115 | 13.8 |
| Operate collator | 105 | 12.6 |
| Supervise key punch operators | 92 | 11.0 |
| Operate accounting machine | 91 | 10.9 |
| Perform other clerical duties | 80 | 9.6 |
| Verifier Operator (N = 125) | | |
| Verify punched cards | 109 | 87.2 |
| Punch cards | 90 | 72.0 |
| Operate interpreter | 35 | 28.0 |
| Operate sorter | 30 | 24.0 |
| Operate reproducer | 29 | 23.2 |
| Wire reproducer board | 15 | 12.0 |
| Wire interpreter board | 11 | 8.8 |
| Supervise key punch operators | 10 | 8.0 |
| Operate collator | 9 | 7.2 |
| Operate typewriter | 8 | 6.4 |
| Tape Librarian (N = 26) | | |
| File and register tapes | 24 | 92.3 |
| Punch cards | 17 | 65.4 |
| Verify punched cards | 12 | 46.2 |
| Perform clerical duties | 11 | 42.3 |
| Operate sorter | 9 | 34.6 |
| Operate typewriters | 8 | 30.8 |
| Confer re computer time | 7 | 26.9 |
| Operate interpreters | 5 | 19.2 |
| Unit Record Equipment Operator (N = 374) | | |
| Operate the sorter | 338 | 90.4 |
| Operate reproducer | 315 | 84.2 |
| Operate interpreter | 289 | 77.3 |
| Operate collator | 237 | 63.4 |
| Operate accounting machines | 259 | 69.2 |
| Punch cards | 257 | 68.7 |
| Wire collator board | 237 | 63.3 |
| Wire reproducer board | 234 | 62.6 |

Table 2-4 (Continued)

| Duties | N | % |
|---|---|---|
| Wire interpreter board | 177 | 47.3 |
| Wire accounting machine boards | 150 | 40.1 |
| Computer Operator (N = 282) | | |
| Operate computer | 280 | 99.3 |
| Operate high speed printer | 195 | 69.1 |
| Operate sorter | 185 | 65.6 |
| Punch cards | 158 | 56.0 |
| Operate interpreter | 156 | 55.3 |
| Operate reproducer | 145 | 51.4 |
| Operate collator | 140 | 49.6 |
| Wire collator board | 136 | 48.2 |
| Wire reproducer board | 127 | 45.0 |
| Test sample routines | 111 | 39.3 |
| Programmers (N = 332) | | |
| Prepare programs | 316 | 95.2 |
| Make flow charts | 303 | 91.3 |
| Debug programs | 299 | 90.1 |
| Code for programming | 298 | 89.8 |
| Make block diagrams | 295 | 88.8 |
| Analyze data flow | 263 | 79.2 |
| Analyze systems | 216 | 65.1 |
| Operate computer | 207 | 62.3 |
| Test sample routines | 204 | 61.4 |
| Punch cards | 190 | 57.2 |
| Data Processing Supervisors (N = 175) | | |
| Confer regarding computer | 133 | 76.0 |
| Schedule computer time | 130 | 74.3 |
| Supervise computer personnel | 124 | 70.8 |
| Supervise auxiliary equipment personnel | 100 | 57.1 |
| Confer regarding key punching | 95 | 54.3 |
| Analyze data flow | 78 | 44.6 |
| Analyze systems | 75 | 42.8 |
| Supervise keypunch operators | 75 | 42.8 |
| Schedule key punching | 75 | 42.8 |
| Operate sorter | 74 | 42.3 |

Table 2-4 (Continued)

| Duties | N | % |
|---|---|---|
| Systems Analyst (N = 139) | | |
| Analyze systems | 133 | 95.7 |
| Analyze data flow | 121 | 87.1 |
| Make flow charts | 120 | 86.3 |
| Make block diagrams | 108 | 77.7 |
| Prepare programs | 107 | 77.0 |
| Confer regarding computer | 97 | 69.8 |
| Debug programs | 89 | 64.0 |
| Code for programs | 81 | 58.3 |
| Confer regarding key punching | 79 | 56.8 |
| Test sample routines | 73 | 52.5 |

Table 2-5. Programming Languages Used on the Job

| Language | Job | | | | |
|---|---|---|---|---|---|
| | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. | Total |
| Autocoder | 17 | 195 | 33 | 56 | 301 |
| COBOL | 6 | 104 | 13 | 46 | 169 |
| Machine | 5 | 108 | 13 | 41 | 167 |
| SPS | 9 | 75 | 19 | 25 | 128 |
| FORTRAN | 0 | 13 | 5 | 9 | 27 |
| PL-1 | 0 | 10 | 0 | 1 | 11 |
| Algo | 1 | 1 | 2 | 1 | 5 |
| SPA | 1 | 1 | 0 | 1 | 2 |

## Job Satisfactions and Dissatisfactions

As a group, data processing employees are very well satisfied with data processing as a field, say they enjoy it, and plan to stay in it (Table 2-6). Only 12 out of 2,098 employees who responded to this question indicated that they do not enjoy their work and want to change fields.

The smallest proportion of people who indicated enjoyment of the field was among the key punch operators, in which 89.5 per cent said that they liked it and planned to stay; and 3.3 per cent of them indicated that they do not enjoy working in this field. On the other hand, all of the tape librarians and 95 per cent of the programmers said they enjoyed working in data processing and plan to stay in it and none of these two groups of people said they disliked it enough to change fields.

When asked what they particularly liked about their jobs in data processing and what they did not like about their jobs, almost twice as many positive statements were made as negative. A total of 2,520 favorable comments were made in response to this open-end question and 1,376 were negative.

Table 2-6. Data Processing Employees' Degree of Satisfaction with Data Processing as a Field of Employment

| Degree of Satisfaction | Key Punch Oper. | | Tape Libr. | | Unit Recd Oper. | | Comp. Oper. | | Progr. | | Super. D.P. | | Sys. Anal. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Enjoy - plan to stay | 730 | 89.5 | 26 | 100 | 326 | 89.6 | 248 | 93.2 | 310 | 94.8 | 149 | 93.1 | 125 | 89.9 |
| Enjoy - but would like a change | 59 | 7.2 | 0 | 0 | 32 | 8.8 | 16 | 6.0 | 14 | 4.3 | 10 | 6.2 | 13 | 9.4 |
| Do not enjoy - will stay | 20 | 2.4 | 0 | 0 | 4 | 1.1 | 1 | .4 | 3 | .9 | 0 | 0 | 0 | 0 |
| Do not enjoy - wish to change | 7 | .9 | 0 | 0 | 2 | .5 | 1 | .4 | 0 | 0 | 1 | .6 | 1 | .7 |
| Totals | 816 | | 26 | | 364 | | 266 | | 327 | | 160 | | 139 | |

Job satisfactions. The pattern of what they enjoyed about their jobs differs somewhat according to the level of the job (Table 2-7).

Table 2-7. Sources of Job Satisfaction Expressed by Data Processing Employees

| Source of Satisfaction | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Variety | 193 | 8 | 66 | 44 | 37 | 30 | 24 |
| Interesting | 95 | 6 | 47 | 50 | 25 | 15 | 11 |
| Working conditions | 110 | 5 | 46 | 37 | 24 | 9 | 6 |
| Job routine | 13 | 1 | 1 | 1 | 2 | 0 | 0 |
| Problem solving | 22 | 3 | 32 | 17 | 131 | 35 | 70 |
| Challenge | 25 | 0 | 29 | 24 | 71 | 34 | 37 |
| Type of job | 227 | 1 | 103 | 57 | 52 | 9 | 4 |
| Co-workers | 77 | 4 | 39 | 19 | 13 | 33 | 13 |
| Enough work | 38 | 2 | 15 | 13 | 9 | 7 | 5 |
| Experience | 51 | 7 | 44 | 41 | 49 | 24 | 9 |
| Everything | 40 | 0 | 22 | 7 | 4 | 3 | 2 |
| Totals* | 932 | 37 | 444 | 310 | 417 | 199 | 181 |

*Respondents could each provide more than one reply.

The people working with unit record equipment and key punches and the computer console operators indicated with the greatest frequency that they just liked doing this kind of work and that they like this type of job. On the other hand, the programmers, systems analysts and the data processing department managers enjoyed the problem-solving aspects of their particular jobs. The next most frequently mentioned satisfaction in their jobs was the challenge of the job, which is perhaps closely related to the problem-solving aspect. The second most frequently mentioned satisfaction among the key punch operators and the unit record equipment operators was the variety they found in their jobs. They apparently were working on a variety of machines or with different kinds of documents and found this interesting.

Job dissatisfactions. Among the dissatisfactions with their jobs, the most frequently mentioned was "rush jobs" (Table 2-8).

Table 2-8. Sources of Job Dissatisfaction Expressed by Data Processing Employees

| Sources of Job Dissatisfaction | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Paperwork | 25 | 2 | 27 | 11 | 24 | 7 | 5 |
| Salary | 49 | 1 | 24 | 22 | 15 | 1 | 0 |
| Rush jobs | 82 | 5 | 38 | 32 | 31 | 24 | 3 |
| Physical aspects | 57 | 1 | 18 | 14 | 17 | 2 | 3 |
| Low probability of promotion | 17 | 1 | 9 | 2 | 6 | 3 | 0 |
| Type of job | 63 | 0 | 59 | 20 | 70 | 6 | 17 |
| Irregular hours | 26 | 2 | 18 | 30 | 19 | 18 | 8 |
| Monotony | 75 | 2 | 24 | 14 | 17 | 7 | 2 |
| Information gap | 42 | 0 | 7 | 6 | 8 | 2 | 4 |
| Poor equipment | 16 | 0 | 22 | 14 | 14 | 8 | 10 |
| Nothing | 78 | 3 | 27 | 17 | 7 | 16 | 0 |
| Totals | 530 | 17 | 273 | 182 | 228 | 94 | 52 |

This ranked either first or second by all the people in the various job classifications, with the exception of the systems analysts, for whom it was the third most frequently mentioned dissatisfaction. The particular type of job they were working on was the most frequently stated satisfaction for people operating unit record equipment, but it was also the most frequently mentioned dissatisfaction named by these people. Of the 444 satisfactions listed by operators of unit record equipment, about 23 per cent said that the "type of job" was what they like about their jobs, but of the 273 responses regarding dissatisfactions, the "type of job" was given by 21.6 per cent of this group.

Programmers, too, listed the "type of job" most frequently as a dissatisfaction, with 70 out of 228 responding this way.

The people in lower-level data processing jobs to a certain extent expressed dissatisfaction with salaries, but this was not true for programmers and people in other higher-level data processing jobs. Computer operators and data processing supervisors' second most frequently named dissatisfaction was the irregular hours. Almost as many key punch operators said they disliked nothing about their jobs as complained about rush jobs, which was the number one complaint.

Overtime

Table 2-9 shows the amount of overtime data processing employees work each week as estimated by the data processing managers. More than half of the firms reported that their key punch operators average up to three hours of overtime a week, and the managers estimated that unit record operators and computer operators spent up to seven hours a week in overtime work. About half the firms reported that these three groups of employees work up to seven hours of overtime, but about 40 per cent of the companies said their programmers work that amount of overtime and over 20 per cent of them said their programmers work more than eight hours a week overtime. Of 58 replies to this question concerning the data processing manager, 34 of them were that the amount of overtime was more than eight hours a week or else it was seasonal, depending on the particular jobs being run.

Supervision

The managers of data processing employees were asked to indicate the amount of supervision required for each of the data processing positions. The lower the level of job, the more supervision was required (Table 2-10). According to the managers, key punch operators and unit record operators need to be supervised either continuously or several times a day; whereas the programmers and systems analysts tend to be supervised only as needed or several times a week but not daily.

Table 2-9. Amount of Overtime Required in Data Processing Jobs as Estimated by Data Processing Managers

| Amount of Overtime | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| None | 73 | 25 | 39 | 21 | 34 | 7 | 11 |
| 1-3 hours, weekly | 101 | 10 | 56 | 54 | 44 | 9 | 15 |
| 4-7 hours, weekly | 51 | 6 | 51 | 60 | 55 | 8 | 14 |
| 8-11 hours, weekly | 9 | 0 | 20 | 33 | 35 | 11 | 6 |
| 12 or more hours, weekly | 1 | 1 | 15 | 19 | 24 | 12 | 8 |
| Seasonal | 54 | 4 | 36 | 27 | 35 | 11 | 9 |
| Totals | 289 | 46 | 217 | 214 | 227 | 58 | 63 |

Table 2-10. Amount of Supervision Required of Data Processing Employees by Rank of Frequency of Mention

| Amount of Supervision | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| None | | | | | | 2 | |
| Continuous | 2 | 3 | 3 | 3 | | | |
| Several times daily | 1 | 2 | 1 | | | | |
| Once a day | | 2 | | 1 | 3 | | |
| Several times weekly | | | | | 2 | | 2 |
| Weekly | | | | | | | 3 |
| As needed | 3 | 1 | 2 | 2 | 1 | 1 | 1 |

## Promotion Patterns

To determine whether certain data processing jobs might be dead-end jobs and to discover possible promotion patterns in the data processing field, the managers of data processing departments were asked to indicate the probability of promotion from each of the positions and to name the jobs into which people in each job category might be promoted (Tables 11 and 12). The responses indicate some variation in probability of promotion from job category to job category in the data processing field. The key punch operator's chance for advancement is relatively low; over 60 per cent of the managers indicated they have a low probability to little or no chance for promotion. With the exception of the data processing manager, all the other positions have a high to average probability of promotion to other positions, except the tape librarian about whom the opinions were quite evenly divided.

Key punch operators tend to be promoted to the position of unit record equipment operators, with about half as many responses indicating they might become computer operators, provided they had sufficient interest and aptitude. Unit record operators, on the other hand, tend to be promoted to the position of computer operator or to programmer, and computer operators are most likely either to programmers or are promoted to some supervisory position. Several avenues, however, are open to programmers, with over 100 responses each indicating a possibility of promotion to any one of four positions; namely, chief programmer, some supervisory position, data processing manager, or systems analyst. The data processing managers interviewed also said that programmers had the greatest probability of promotion of all the data processing employees.

The data processing managers were asked to indicate the probable effect of education on promotion, and for all positions they felt that education influenced promotion probability, at least somewhat (Table 2-13). Over half of the managers thought that education had no effect on promotion for key punch operators and about a fifth of them thought it might make some slight contribution in determining promotability. About half or more of the data processing managers indicated that education has quite a bit or a definite effect on promotion for all other jobs, with over 60 per cent of the managers indicating that education is a factor in promotion for programmers, data processing managers, and especially for systems analysts.

Table 2-11. Probability of Promotions for Data Processing Employees*

| Probability | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| High | 43 | 12 | 76 | 81 | 107 | 7 | 28 |
| Average | 80 | 16 | 91 | 107 | 101 | 16 | 20 |
| Low | 115 | 17 | 38 | 37 | 29 | 13 | 10 |
| Very little or none | 77 | 10 | 18 | 12 | 15 | 14 | 8 |

*The number refers to the number of times the job was mentioned by data processing managers.

Table 2-12. Jobs to Which Data Processing Employees May Be Promoted*

| To | From | | | | | | |
|---|---|---|---|---|---|---|---|
| | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
| Coding Clerk | 18 | | 4 | | | | |
| Tape Librarian | 33 | | 16 | | | | |
| Unit Recd Oper. | 168 | | 39 | | | | |
| Comp. Oper. | 65 | 28 | 126 | | | | |
| Programmer | 26 | 20 | 110 | 197 | | | |
| Chief Progr. | | | 11 | 21 | 157 | | |
| Supervisor | 67 | | 38 | 147 | 122 | 31 | 34 |
| Super., D.P. | | | 27 | 25 | 110 | | 36 |
| Sys. Anal. | | | 15 | 42 | 146 | | |
| Proj. Dir. | | | | 14 | 58 | | 37 |

*The number refers to the number of times the job was mentioned by data processing managers.

Table 2-13. Effect of Education on Promotion of Data Processing Employees*

| Effect | Key Punch Oper. | | Tape Libr. | | Unit Recd Oper. | | Comp. Oper. | | Progr. | | Super. D.P. | | Sys. Anal. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Definitely | 41 | 13.4 | 5 | 9.1 | 33 | 15.1 | 46 | 20.0 | 83 | 32.4 | 29 | 51.8 | 28 | 42.4 |
| Quite a bit | 30 | 9.7 | 11 | 20.0 | 47 | 21.5 | 65 | 28.2 | 73 | 29.3 | 6 | 10.7 | 15 | 22.7 |
| Some | 67 | 21.9 | 23 | 41.8 | 80 | 36.5 | 78 | 36.6 | 60 | 24.0 | 9 | 16.1 | 12 | 18.2 |
| None | 168 | 55.0 | 16 | 29.1 | 59 | 26.9 | 42 | 18.2 | 33 | 13.3 | 12 | 21.4 | 11 | 16.7 |
| Totals | 306 | | 55 | | 219 | | 231 | | 249 | | 51 | | 66 | |

*The number refers to the number of times the job was mentioned by data processing managers.

## Salaries

The median monthly salaries reported by the data processing employees range from $340 for key punch operators to $817 for systems analysts (Table 2-14). The salaries reported by the data processing employees in this study parallel closely those reported by the EDP Salary Study conducted by Business Automation (1). The median salary for men in each job category was $85 to $90 per month higher than for women in the same job classification (See Appendix A, Table 1).

Table 2-14. Median Monthly Salaries of Data Processing Employees

| | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Number of employees | 834 | 26 | 373 | 275 | 331 | 162 | 138 |
| Median Salaries | $340 | $425 | $428 | $478 | $627 | $741 | $817 |

## CHARACTERISTICS OF DATA PROCESSING EMPLOYEES

According to the managers who were interviewed, the personal characteristic common to people in all but one of the data processing job categories was the ability to work under pressure, emotional stability (Table 2-15). It ranked first, second or third in frequency of mention for all job categories except data processing manager and systems analyst. But the trait that was ranked first or second in most job categories was the ability to get along with people, perhaps of prime importance because of the amount of pressure under which many of the data processing employees have to work.

The data processing managers said the outstanding characteristic of key punch operators was that they liked routine, liked knowing exactly what a particular job was and how and when to do it. On the other hand, they felt that programmers, data processing managers and systems analysts were creative people who were logical thinkers. Programmers and tape librarians were described as being good detail workers who were very thorough in the work they did.

Table 2-15. Personal Characteristics of Data Processing Employees

| Characteristics | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Logical thinker | | | 16 | 23 | 77 | 14 | 22 |
| Get along with people | 20 | | | 24 | 39 | 14 | 24 |
| Can work under pressure | 24 | 6 | 21 | 29 | 38 | | 12 |
| Detail worker; thorough | | 7 | | | 37 | | |
| Dedicated; willing to work | 19 | | | 18 | 34 | 5 | |
| Creative; accepts challenge | | | | | 34 | 7 | 15 |
| Perfectionist | 16 | 6 | 14 | | | | |
| Accurate | | 4 | | | | | |
| Methodical | | 4 | | | | | |
| Machine inclined | | | 26 | 21 | | | |
| Drive; desire to get ahead | | | | | | 5 | |
| Persistent; patient | | | | | | 5 | |
| Flexible; Adaptable | | | 12 | | | | |
| Likes routine | 56 | | | | | | |

## Age

Data processing is a young man's field of endeavor (Table 2-16). The median age of all levels of data processing positions ranged between 25 years of age for key punch operators to 33 years of age for systems analysts and data processing supervisors. Key punch operators were the youngest group, with half of them 25 years or younger. Although the median age of computer operators is a little higher than for key punch operators, slightly over 70 per cent of them are 30 years or younger; and over 60 per cent of the tape librarians, unit record equipment operators, and programmers were in this age group.

Data processing has been and is a rapidly growing, rapidly changing field of work; possibly young people accept and adjust to change more easily than do older people; consequently, this is an attractive field for youngsters.

Table 2-16. Ages of Data Processing Employees

| Age | Per Cent of Employees | | | | | | |
|---|---|---|---|---|---|---|---|
| | Key Punch Oper. N=832 | Tape Libr. N=26 | Unit Recd Oper. N=373 | Comp. Oper. N=275 | Progr. N=331 | Super. D.P. N=162 | Sys. Anal. N=138 |
| Less than 21 | 24.0 | 26.9 | 11.8 | 8.4 | 2.4 | 0 | 0 |
| 21-25 | 26.1 | 15.4 | 29.2 | 37.4 | 30.2 | 6.8 | 13.0 |
| 26-30 | 15.4 | 19.2 | 19.6 | 24.8 | 30.8 | 26.5 | 27.5 |
| 31-40 | 18.8 | 30.8 | 20.9 | 22.9 | 28.7 | 45.1 | 42.8 |
| Over 40 | 15.7 | 7.7 | 18.5 | 6.5 | 7.9 | 21.6 | 16.7 |
| Median age | 25 | 28 | 28+ | 27 | 29 | 33 | 33 |

## Education

The managers of data processing departments in the 353 businesses participating in the study were asked what the minimum and preferred levels of education were for the several job levels in data processing. At least a high school education is the minimum amount of education acceptable for any of the positions (Table 2-17), but the higher the level of the job, the fewer the managers who find a high school education adequate preparation for the job.

Table 2-17. Minimum Amount of Education Acceptable by the Data Processing Managers for Each of the Data Processing Jobs

| Education | Percentage of Response | | | | | | |
|---|---|---|---|---|---|---|---|
| | Key Punch Oper. N=832 | Tape Libr. N=26 | Unit Recd Oper. N=373 | Comp. Oper. N=275 | Progr. N=331 | Super. D.P. N=162 | Sys. Anal. N=138 |
| High School | 84.4* | 95.2 | 88.5 | 83.2 | 57.7 | 49.1 | 31.9 |
| Junior college-Technical | | | 1.6 | 6.4 | 19.5 | 16.4 | 24.6 |
| Other post-High School | 15.6 | 4.8 | 9.5 | 10.4 | 14.2 | 16.4 | 5.8 |
| Degree | | | 0.4 | | 8.6 | 18.1 | 37.7 |

*The figures represent the percentage of responses by 353 managers.

A high school education was the minimum amount of education acceptable for the positions of key punch operator, tape librarian, unit record operator, and computer operator, although half the managers said they preferred that unit record equipment operators have some work beyond high school (Table 2-18), and over 65 per cent preferred to have computer operators with more than high school education. Post high school or junior college training was considered by 34 per cent of the managers to be the minimum amount of education acceptable for programmers, and about 58 per cent of them said they would accept high school education as a bare minimum for programmers. However, nearly 96 per cent stated that their preference was for programmers to have either a degree (61.4 per cent) or at least some work beyond high school, with nearly 35 per cent of the managers indicating that they preferred that programmers have at least a junior college or vocational school education.

Slightly less than half the managers said that high school was adequate education for the data processing manager, and about 32 per cent considered high school minimum acceptable education for the systems analyst. Slightly more than 93 per cent of the managers said that preferably data processing managers should have more than high school level work, with nearly two-thirds of them stating a preference for a college degree as minimum educational level for these managers; and according to 87 per cent of the managers, the systems analyst should have a college degree.

Table 2-18. Amount of Education Preferred by the Data Processing Managers for Each of the Data Processing Jobs

| Education | Percentage of Response | | | | | | |
|---|---|---|---|---|---|---|---|
| | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
| High School | 69.4* | 73.0 | 45.7 | 33.2 | 4.1 | 6.6 | 2.9 |
| Junior college-Technical | 8.2 | 15.9 | 23.4 | 36.4 | 24.7 | 15.0 | 5.8 |
| Other post-High School | 21.8 | 11.1 | 26.0 | 22.0 | 9.8 | 11.9 | 4.3 |
| Degree | 0.6 | 0 | 4.9 | 8.4 | 61.4 | 66.4 | 87.0 |

*The figures represent the percentage of responses by 353 managers.

In order to compare management requirements regarding educational level for data processing employees with that actually attained by the employees, the employees were asked to report their highest educational level (Table 2-19). Half the key punch operators had completed high school, and most of the other half had had some post high school training, although frequently this post high school training was only a short key-punch training sequence at a specialized school. The tape librarians had the least post high school education, with 77 per cent of them having only completed high school.

Over half the computer operators and 44 per cent of the unit record equipment operators had gone to school beyond the 12th grade; and 80 per cent of the programmers had more than a high school education. About half the programmers had attended either junior college or some specialized school after graduating from high school, and over 31 per cent of them held college degrees.

Nearly 90 per cent of the systems analysts had some education beyond high school, with over 40 per cent of them holding college degrees. In most of the job categories, the educational level of the data processing employees was above the minimum acceptable to the managers, but not as high as the managers would prefer.

Table 2-19. Educational Level Attained as Reported by Data Processing Employees

| Education | Percentage of Response | | | | | | |
|---|---|---|---|---|---|---|---|
| | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
| No. of people | 834 | 26 | 374 | 275 | 331 | 162 | 138 |
| Less than High School | 5.0 | 3.8 | 6.1 | 2.5 | 1.5 | 2.5 | 0.0 |
| High School | 54.1 | 76.9 | 49.7 | 43.3 | 18.7 | 37.0 | 12.3 |
| Some post-High School | 40.0 | 19.2 | 40.9 | 52.0 | 48.6 | 44.4 | 47.1 |
| Degree | 0.8 | 0.0 | 3.2 | 2.2 | 31.1 | 16.0 | 40.6 |

High school general education courses. The employees were asked to check the courses studied in high school that they have found most helpful and next most helpful in performing their jobs. The high school general education course of most value to the data processing employees in all job categories was general mathematics (Table 2-20). Advanced mathematics was considered most valuable by the three upper levels of positions, programmers, systems analysts, and data processing managers. For the lower level positions, key punch operator, unit record operator, and computer operator, English ranked second as most valuable general education course. English and general mathematics were considered to be second most helpful general education courses by all data processing personnel.

Advanced mathematics was named most frequently as the high school general education course in which more work should have been taken by all data processing employees except for key punch operators who wished they had taken more general mathematics (Table 2-21). Next in frequency of mention of courses in which data processing employees would have liked more background were English and social science.

Table 2-20. High School General Education Courses Considered Most Valuable by Data Processing Employees
(Ranked by Frequency of Mention)

| Courses | Key Punch Oper. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|
| **Most Helpful** | | | | | | |
| General Mathematics | 1 | 1 | 1 | 1 | 1 | 1 |
| Advanced Mathematics | 3 | 3 | 2 | 2 | 2 | 2 |
| English | 2 | 2 | 3 | 3 | 3 | 3 |
| Social Science | 4 | 4 | 4 | 5 | 4 | 4 |
| Science | | | | 4 | 4 | |
| Industrial Arts | 4 | | | | | |
| **Second Most Helpful** | | | | | | |
| General Mathematics | 2 | 2 | 1 | 2 | 2 | 1 |
| Advanced Mathematics | 4 | 4 | 3 | 1 | 3 | 3 |
| English | 1 | 1 | 2 | 2 | 1 | 2 |
| Social Science | 3 | 3 | 4 | 4 | 4 | 4 |
| Science | 5 | | | 5 | | |
| Industrial Arts | 6 | | | | | |

Table 2-21. High School General Education Courses in Which Data Processing Employees Wished More Work
(Ranked by Frequency of Mention)

| Courses | Key Punch Oper. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|
| General Mathematics | 1 | 2 | [illegible] | 4 | 3 | 3 |
| Advanced Mathematics | 2 | 1 | 1 | 1 | 1 | 1 |
| English | 3 | 3 | 3 | 2 | 2 | 2 |
| Social Science | 4 | 4 | 4 | 3 | 4 | 4 |
| Science | 6 | 5 | 5 | 5 | 5 | 5 |
| Industrial Arts | 5 | 6 | 6 | 6 | 6 | 6 |

The managers of data processing departments were asked which of the general education courses they considered helpful for their data processing personnel. Oral and written communication were named first or second most frequently as being the most helpful for almost all data processing employees in performing their jobs (Table 2-22), with algebra being named most frequently as the most helpful course only for programmers and for data processing managers.

Table 2-22. General Education Courses Considered by Management to be Most Helpful for Data Processing Personnel (Ranked by Frequency of Mention)

| Courses | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Oral Communication | 1 | 1 | 1 | 1 | 3 | 2 | 1 |
| Written Communication | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| Social Science | 6 | 3 | 5 | | | | |
| Logic/Philosophy | 5 | 3 | 4 | 4 | 4 | 4 | 3 |
| Algebra | 3 | 3 | 3 | 3 | 1 | 1 | 2 |
| Analytic Geometry | | | | | 5 | 5 | |
| Psychology | 4 | | | 5 | | 3 | 4 |

High school business courses. Although typing was considered the most helpful business course by some of the people in each job category (and especially by key punch operators), more people in the upper-level job listed it as being the least helpful of high school business courses (Table 2-23). Key punch operators tended to find that bookkeeping was not helpful and work in calculating machines was not mentioned very frequently as being either most or least helpful. More people than not considered business mathematics a helpful course in their work, which was true also for bookkeeping, with the exception of the key punch operators. Introduction to business was also a helpful course according to the data processing employees.

Table 2-23. High School Business Courses Named as Most and Least Helpful by Data Processing Employees

| Courses | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| **Most Helpful** | | | | | | | |
| Introduction to Business | 27 | 7 | 22 | 14 | | 10 | 8 |
| Typing | 554 | 10 | 68 | 23 | 19 | 10 | |
| Shorthand | | | | | | | |
| Calculating Machines | | | | | | 1 | |
| Business Math | | | 28 | 28 | 46 | 25 | 25 |
| Office Procedures | | | | | | | |
| Data Processing | | | | | | 8 | |
| Bookkeeping | 30 | | 69 | 57 | 39 | 36 | 22 |
| **Least Helpful** | | | | | | | |
| Introduction to Business | 26 | | 13 | | | 7 | |
| Typing | | | 65 | 43 | 52 | 27 | 28 |
| Shorthand | 328 | 6 | 71 | 40 | 27 | 25 | 10 |
| Calculating Machines | | | | | 7 | 1 | |
| Business Math | 22 | | | | | 2 | |
| Office Procedures | 26 | | | 10 | | 2 | |
| Data Processing | | | | | | | |
| Bookkeeping | 91 | 3 | | 8 | | 7 | 7 |

Post high school general education courses. The post high school general education courses considered to be most helpful in their work paralleled closely those mentioned by the data processing employees in evaluating their high school work (Table 2-24), with general mathematics being most frequently mentioned as most helpful by people in all job categories who had had some post high school education.

Table 2-24. Post High School General Education Courses Considered Valuable by Data Processing Employees
(Ranked by Frequency of Mention)

| Courses | Key Punch Oper. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|
| <u>Most Valuable</u> | | | | | | |
| General Math | 1 | 1 | 1 | 1 | 1 | 1 |
| Advanced Math | | | 3 | 2 | | 4 |
| English | 2 | 2 | 2 | 3 | 2 | 2 |
| Social Science | | 3 | 4 | | 3 | 4 |
| Psychology | 3 | | | | | |
| Philosophy/Logic | | | | | | 3 |
| <u>Second Most Valuable</u> | | | | | | |
| General Math | 2 | 2 | 2 | 1 | 3 | 2 |
| Advanced Math | | | 4 | 1 | | |
| English | 1 | 1 | 1 | 3 | 1 | 1 |
| Social Science | | 3 | 3 | 4 | 2 | 3 |
| Psychology | 3 | | | | | |

The ranks of the frequency with which English and advanced mathematics were mentioned as most helpful courses switched from the high school to the post high school level. Where advanced mathematics was second most frequently mentioned helpful course at the high school level, English ranks second of the post high school courses. At the post high school level, social science ranks higher in frequency of mention than at the high school level and psychology appears as a valuable course.

Advanced mathematics is considered only by programmers to be the second most valuable course at the post high school level, with English being most frequently mentioned by all other groups. Social science courses rank about the same at this level as they did at the high school level.

The data processing employees expressed their opinions about the area in which they would have liked to have had more work while in school. Again the most frequently mentioned is mathematics, general mathematics by the employees in the lower level jobs and advanced mathematics by those in programming, data processing management, and systems analysis (Table 2-25).

Table 2-25. Post High School General Education Courses in Which Data Processing Employees Wished More Work (Ranked by Frequency of Mention)

| Courses | Key Punch Oper. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|
| General Math | 1 | 2 | 2 | 4 | 3 | 3 |
| Advanced Math | 2 | 1 | 4 | 1 | 2 | 1 |
| English | 3 | 3 | 3 | 3 | 1 | 2 |
| Social Science | | 3 | 1 | 2 | 3 | |
| Psychology | 3 | | | | | |

Post high school business courses. The post high school business course considered most helpful by the data processing personnel was data processing equipment; this course was listed more than twice as many times as any other business course (Table 2-26).

The other post high school business courses listed as most helpful by the data processing employees in frequency order were: accounting principles, typewriting, business mathematics, intermediate accounting, data processing applications, calculating machines, statistics, and principles of management.

Shorthand was the most frequently mentioned as the least helpful of the post high school courses, although the number of people who listed "least helpful" courses is smaller than those who found courses valuable (Table 2-27). Business English is listed as a "least helpful" course quite frequently among the personnel in lower level jobs, but not by the employees in the higher data processing positions.

The managers of data processing personnel were asked their opinions of the kinds of business courses that would be helpful for their employees in their particular jobs (excluding courses directly in data processing and equipment operation). Introduction to business was one course to appear with relatively high frequency for each of the job categories, although accounting and introduction to systems were the most frequently listed courses for programmers (Table 2-28).

Table 2-26. Most Helpful Post High School Business Courses Mentioned by Data Processing Personnel*

| Courses | Key Punch Oper. (N=341) | Tape Libr. (N=5) | Unit Recd Oper. (N=165) | Comp. Oper. (N=149) | Progr. (N=264) | Super. D.P. (N=98) | Sys. Anal. (N=121) |
|---|---|---|---|---|---|---|---|
| Data Processing Equipment | 162 | 0 | 161 | 85 | 94 | 39 | 33 |
| Calculating Machines | 33 | 1 | 34 | 16 | 21 | 10 | 5 |
| Typing | 150 | 4 | 29 | 16 | 9 | 10 | 4 |
| Shorthand | 5 | 2 | 1 | 2 | 0 | 0 | 0 |
| Office Procedures | 20 | 1 | 9 | 3 | 3 | 3 | 2 |
| Business English | 14 | 1 | 14 | 4 | 24 | 19 | 18 |
| Report Writing | 2 | 0 | 4 | 4 | 20 | 9 | 16 |
| Other Business Skills | 21 | 1 | 11 | 19 | 23 | 8 | 6 |
| Accounting Principles | 34 | 1 | 41 | 50 | 69 | 36 | 43 |
| Intermediate Accounting | 15 | 1 | 34 | 12 | 37 | 29 | 24 |
| Cost Accounting | 5 | 1 | 11 | 5 | 24 | 14 | 9 |
| Income Tax Accounting | 5 | 0 | 2 | 2 | 1 | 2 | 2 |
| Advanced Accounting | 4 | 0 | 3 | 4 | 7 | 6 | 7 |
| Other Accounting | 1 | 0 | 3 | 2 | 1 | 3 | 4 |
| Management Principles | 4 | 0 | 12 | 12 | 26 | 22 | 23 |
| Office Management | 3 | 0 | 5 | 0 | 5 | 9 | 5 |
| Personnel Management | 4 | 0 | 2 | 7 | 6 | 7 | 11 |
| Decision Theory | 1 | 0 | 2 | 1 | 9 | 2 | 6 |
| Operative Research | 1 | 0 | 0 | 2 | 4 | 4 | 5 |
| Data Processing Applications | 10 | 0 | 21 | 21 | 40 | 15 | 22 |
| Other Management | 2 | 0 | 0 | 2 | 5 | 1 | 2 |
| Introduction to Business | 18 | 0 | 17 | 16 | 24 | 13 | 6 |
| Business Math | 27 | 0 | 32 | 18 | 45 | 24 | 21 |
| Statistics | 2 | 1 | 8 | 7 | 45 | 19 | 34 |
| Marketing | 0 | 0 | 6 | 3 | 7 | 6 | 13 |
| Finance | 3 | 0 | 5 | 11 | 10 | 4 | 18 |
| Other | 2 | 0 | 0 | 5 | 5 | 3 | 2 |

*Totals are greater or smaller than N because employees could check more than one course or not all employees had had particular courses.

Table 2-27. Least Helpful Post High School Business Courses Mentioned by Data Processing Employees*

| Courses | Key Punch Oper. (N=341) | Tape Libr. (N=5) | Unit Recd Oper. (N=165) | Comp. Oper. (N=149) | Progr. (N=264) | Super. D.P. (N=98) | Sys. Anal. (N=121) |
|---|---|---|---|---|---|---|---|
| Data Processing Equipment | 3 | 3 | 0 | 0 | 5 | 1 | 1 |
| Calculating Machines | 21 | 2 | 10 | 6 | 20 | 7 | 4 |
| Typing | 13 | 2 | 31 | 17 | 30 | 16 | 13 |
| Shorthand | 94 | 1 | 23 | 10 | 14 | 9 | 9 |
| Office Procedures | 23 | 2 | 8 | 8 | 7 | 7 | 2 |
| Business English | 50 | 2 | 27 | 19 | 16 | 11 | 10 |
| Report Writing | 33 | 1 | 9 | 8 | 7 | 4 | 4 |
| Other Business Skills | 14 | 0 | 11 | 7 | 4 | 0 | 2 |
| Accounting Principles | 7 | 0 | 8 | 4 | 14 | 6 | 5 |
| Intermediate Accounting | 3 | 1 | 3 | 2 | 13 | 5 | 2 |
| Cost Accounting | 6 | 1 | 7 | 5 | 11 | 5 | 9 |
| Income Tax Accounting | 13 | 0 | 12 | 7 | 18 | 15 | 16 |
| Advanced Accounting | 4 | 0 | 4 | 3 | 9 | 3 | 3 |
| Other Accounting | 1 | 0 | 2 | 1 | 12 | 2 | 4 |
| Management Principles | 2 | 0 | 8 | 8 | 9 | 6 | 7 |
| Office Management | 1 | 0 | 4 | 2 | 8 | 5 | 9 |
| Personnel Management | 0 | 0 | 5 | 1 | 10 | 2 | 20 |
| Decision Theory | 0 | 0 | 0 | 0 | 1 | 3 | 0 |
| Operative Research | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| Data Processing Applications | 1 | 0 | 0 | 0 | 2 | 2 | 2 |
| Other Management | 0 | 0 | 0 | 1 | 4 | 1 | 4 |
| Introduction to Business | 4 | 2 | 15 | 8 | 21 | 7 | 13 |
| Business Math | 4 | 1 | 4 | 7 | 7 | 3 | 4 |
| Statistics | 3 | 0 | 4 | 7 | 20 | 7 | 16 |
| Marketing | 5 | 0 | 6 | 7 | 26 | 14 | 16 |
| Finance | 3 | 0 | 11 | 2 | 24 | 11 | 18 |
| Other | 1 | 0 | 5 | 2 | 7 | 1 | 4 |

*Totals are greater than N because employees could check more than one course or not all employees had had particular courses.

Table 2-28. Business Courses Desired by Management for Data Processing Employees

| Courses | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| **Management** | | | | | | | |
| Principles | 11 | 4 | 34 | 48 | 134 | 69 | 52 |
| Personnel | 13 | 4 | 26 | 32 | 84 | 69 | 35 |
| Office Management | 42 | 13 | 50 | 47 | 105 | 62 | 39 |
| Records Management | 56 | 26 | 81 | 76 | 127 | 65 | 44 |
| Quality Control | 29 | 14 | 32 | 53 | 105 | 55 | 40 |
| Introduction to Systems | 37 | 16 | 84 | 126 | 227 | 71 | 60 |
| **Finance** | | | | | | | |
| Principles | 15 | 5 | 34 | 35 | 128 | 48 | 50 |
| Money and Banking | 17 | 4 | 20 | 22 | 66 | 22 | 28 |
| **Accounting** | | | | | | | |
| 1st Year | 58 | 10 | 106 | 105 | 214 | 51 | 48 |
| 2nd Year | 6 | 2 | 43 | 34 | 159 | 63 | 51 |
| Cost | 6 | 1 | 28 | 17 | 96 | 44 | 47 |
| Tax | 2 | 0 | 8 | 5 | 53 | 25 | 33 |
| **General Business** | | | | | | | |
| Introduction to Business | 128 | 25 | 95 | 144 | 200 | 53 | 56 |
| Statistics | 18 | 8 | 34 | 66 | 196 | 52 | 58 |
| Quantitative Analysis | 0 | 1 | 4 | 15 | 119 | 33 | 42 |
| Business Law | 4 | 2 | 4 | 35 | 55 | 26 | 26 |
| Economics | 21 | 5 | 21 | 2 | 111 | 41 | 42 |

Introduction to systems was the first or second most frequently mentioned course for all but the key punch operators. Although systems may not be directly of use to these people, most managers indicated they were interested in people in all these positions as promotable material and that such backgrounds would help them advance in the data processing field.

The quantitative courses appear to be considered valuable for the programmer and the systems analyst to a greater extent than for any other of the jobs. Although in some schools cost accounting is a prerequisite to programming courses, it is among the courses least frequently mentioned by managers as desirable background for programmers.

Three courses stand out as the ones that computer operators should have, according to the managers interviewed; namely, introduction to business, introduction to systems, and the first year accounting course. Data processing managers and systems analysts, along with the programmers apparently need rather broad business backgrounds according to the managers who were interviewed.

Employees' evaluation of their education. The data processing employees were asked how well they thought their education had prepared them for their jobs. They checked whether they felt very well prepared, adequately or inadequately prepared. About one-third of them felt inadequately prepared with the education they had received in school (Table 2-29), and this feeling was even more pronounced among the employees who had not studied data processing in school than it was for those whose education included some training in data processing. The percentage of employees who felt inadequately prepared for their jobs ranged from about a third of the key punch operators up to 41 per cent of the computer operators. The proportions of people in the other job categories who felt their education was inadequate were between these two extremes.

Key punch operators seemed most satisfied with their educational training, both those with and those without data processing background. Among the employees in the other data processing jobs, more of the computer operators and systems analysts than other personnel felt that their educational experience was either adequate or had prepared them very well for working in the data processing field, although the computer operators without data processing training were the most dissatisfied with the preparation they received in school. With the exception of key punch operators, a greater proportion of the programmers and the systems analysts who had studied data processing in school said they were very well prepared for their jobs on the basis of the education they had received (Appendix A, Table 2).

Table 2-29. Evaluation of Education by Data Processing Employees

| Position | Very Well | Adequate | Inadequate | Totals |
|---|---|---|---|---|
| Key Punch Operator (Total) | 125 | 439 | 183 | 747 |
| Had No D.P. Training | 19 | 200 | 112 | 331 |
| Had D.P. Training | 106 | 239 | 71 | 416 |
| Tape Librarian (Total) | 1 | 15 | 8 | 24 |
| Had No D.P. Training | 1 | 10 | 6 | 17 |
| Had D.P. Training | 0 | 5 | 2 | 7 |
| Unit Record Operator (Total) | 34 | 189 | 117 | 340 |
| Had No D.P. Training | 9 | 94 | 67 | 170 |
| Had D.P. Training | 25 | 95 | 50 | 170 |
| Computer Operator (Total) | 25 | 153 | 75 | 253 |
| Had No D.P. Training | 9 | 62 | 50 | 121 |
| Had D.P. Training | 16 | 91 | 25 | 132 |
| Programmer (Total) | 42 | 182 | 95 | 319 |
| Had No D.P. Training | 12 | 87 | 56 | 155 |
| Had D.P. Training | 30 | 95 | 39 | 164 |
| D.P. Supervisor (Total) | 14 | 83 | 52 | 149 |
| Had No D.P. Training | 8 | 52 | 34 | 94 |
| Had D.P. Training | 6 | 31 | 18 | 55 |
| Systems Analyst (Total) | 22 | 74 | 39 | 135 |
| Had No D.P. Training | 12 | 41 | 29 | 82 |
| Had D.P. Training | 10 | 33 | 10 | 53 |

## On-the-Job Training Courses

In spite of the fact that the employees said that their education prior to employment in data processing was adequate or that it prepared them very well for their jobs, the business firms in which these people work offer a variety of courses for their employees at all levels of data processing (Table 2-30). Over 75 per cent (271 out of 353 companies) provided further key punch training on the job for their key punch operators. Presumably, this is to teach them not so much the operation of the key punch machine but rather to familiarize them with the format of the data to be punched and the source documents on which these data appear.

Unit record equipment operators get further on-the-job training in board wiring and equipment operation, key punching and introduction to data processing. The on-the-job training in computer operation is perhaps to acquaint the operators with the particular makes and models of computers used by the companies. Several other courses quite widely offered on the job to these people appear to be the kind that not only help employees do a better job by providing more understanding of data processing as a whole, but they are the kinds of things management considers to be of particular use in higher level jobs. They seem to be helping their employees prepare for promotion with such courses as introduction to data processing, theory and logic of computers, flow charting, and data processing applications. These same courses are areas of on-the-job instruction for programmers in a good many companies also. Perhaps data processing managers and systems analysts, who tend to have more education than the other employees, are more adequately prepared, since relatively few companies provide on-the-job training courses for these people (Appendix A, Table 3).

## Experience

According to the data processing employees, they obtained their jobs through three main sources: they were told about openings by their friends, they obtained their jobs through services of private employment agencies, or they had made direct inquiry to the company (Table 2-31). More computer operators and key punch operators had answered advertisements to obtain their jobs than had any other group, and more programmers had received their jobs through school placement services than had any other category of employees.

However, when the employers were asked through what source they had obtained their data processing employees, their answers were different from the information given by the employees. Although most employees said they had obtained jobs through their friends, this was

Table 2-30. On-the-Job Training Courses Offered to Data Processing Employees.

| Courses | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Typing | 44 | 7 | 10 | 11 | 6 | 3 | 4 |
| Key Punch | 271 | 16 | 110 | 80 | 81 | 14 | 17 |
| Calculating Machine | 46 | 6 | 61 | 45 | 48 | 12 | 19 |
| Unit Record Operations | 65 | 14 | 195 | 132 | 111 | 18 | 28 |
| Wiring Boards | 36 | 6 | 179 | 82 | 56 | 17 | 12 |
| Operating Paper Tape | 19 | 3 | 29 | 47 | 47 | 11 | 15 |
| Computer Operations | 21 | 15 | 64 | 220 | 175 | 33 | 36 |
| Introduction to Data Processing | 65 | 26 | 107 | 162 | 178 | 33 | 48 |
| Theory Computations | 23 | 12 | 61 | 135 | 187 | 30 | 44 |
| Programming | 11 | 8 | 47 | 121 | 232 | 41 | 53 |
| Flow Charting | 15 | 11 | 87 | 111 | 207 | 30 | 46 |
| Data Processing Applications | 41 | 13 | 91 | 118 | 189 | 34 | 47 |

Table 2-31. Percentage of Data Processing Employees Who Obtained Their Jobs Through Various Means

| | Key Punch Oper. (N=834) | Tape Libr. (N=26) | Unit Recd Oper. (N=373) | Comp. Oper. (N=274) | Progr. (N=331) | Super. D.P. (N=162) | Sys. Anal. (N=139) |
|---|---|---|---|---|---|---|---|
| School | 9.8 | 0.0 | 9.4 | 9.1 | 12.4 | 4.9 | 7.9 |
| Referred by friend | 28.5 | 26.9 | 27.1 | 28.8 | 24.5 | 25.3 | 33.3 |
| Answered ad | 13.3 | 7.7 | 11.3 | 13.5 | 10.6 | 12.3 | 9.4 |
| U.S.E.S. | 7.3 | 7.7 | 4.6 | 5.1 | 3.9 | 2.5 | 2.2 |
| Private agency | 14.6 | 11.5 | 15.8 | 13.9 | 18.1 | 14.8 | 16.5 |
| Direct inquiry | 21.0 | 38.5 | 23.1 | 24.8 | 22.7 | 22.8 | 18.7 |
| Referred by equipment manufacturer | 1.2 | 3.8 | 2.4 | 1.1 | 3.6 | 11.1 | 7.2 |
| School work program | 0.8 | 0.0 | 1.1 | 1.4 | 0.6 | 0.6 | 0.7 |
| Other | 3.4 | 0.0 | 5.1 | 2.2 | 3.6 | 5.6 | 4.3 |

not even mentioned by the employers as a source of employees. Perhaps what employees considered referral by friends was considered by the employers to be direct inquiry to the company about possible openings.

The managers said that for the lower level jobs (key punch operator, tape librarian, and unit record equipment operator) most of their employees were hired through placement agencies; and for the higher level jobs (programmer, systems analysts, and supervisors of computer operations) most of their employees were hired from persons answering advertisements (Table 2-32).

Table 2-32. Sources of Data Processing Employees--by Rank as Mentioned by Data Processing Managers

| | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Schools | 2 | 2 | 3 | 2 | | | |
| Ads | 3 | 4 | 2 | 1 | 1 | 1 | 1 |
| Manufacturer | | | | | 3 | 3 | |
| Inquiry | | 3 | | 3 | | 4 | 3 |
| Friends | | | | | 3 | | |
| Agencies | 1 | 1 | 1 | 3 | 2 | 2 | 2 |
| Promotion | 4 | | 4 | | | | 4 |

The data processing managers were asked to indicate the minimum amount of experience in data processing they would expect prospective employees to have prior to employment with their firms, and their replies varied with the level of job (Table 2-33). For employees in the two lowest job categories (key punch operator and tape librarian) a great majority of the employers would accept people with no experience in data processing, but over a third of them said that for the other job categories, the employees should have had at least six months or more of experience in data processing; and 35 per cent indicated that a systems analyst should have two or more years of previous employment in data processing.

If the companies could designate a preferred amount of experience in data processing before hiring personnel, they would prefer more than six months of experience for the job levels of key punch operator, tape librarian, unit record equipment operator, and computer operators (Table 2-34). Over half of the managers would like to have their programmers have one to three years experience before they hire them.

Table 2-33. Minimum Data Processing Experience Acceptable by Data Processing Managers
(% of Managers Stating Preferences Indicated)

| Months | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Sys. Anal. |
|---|---|---|---|---|---|---|
| 0- 6 | 82.2 | 86.0 | 65.1 | 65.4 | 52.2 | 27.1 |
| 7-12 | 14.9 | 7.8 | 16.7 | 23.2 | 29.5 | 17.1 |
| 13-24 | 2.6 | 4.7 | 4.9 | 9.3 | 15.1 | 19.9 |
| 25-36 | | 1.6 | 2.0 | 1.2 | 1.8 | 18.6 |
| More than 36 | 0.3 | | 1.2 | 0.8 | 1.5 | 17.1 |

Table 2-34. Amount of Data Processing Experience Preferred by Data Processing Managers
(% of Managers Stating Preferences Indicated)

| Months | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| 0- 5 | 37.9 | 42.2 | 29.4 | 20.8 | 13.7 | 11.4 | 14.3 |
| 7-12 | 34.4 | 32.8 | 33.1 | 35.8 | 20.7 | 9.6 | 10.0 |
| 13-24 | 19.2 | 20.4 | 26.9 | 30.0 | 36.2 | 14.4 | 20.0 |
| 25-36 | 6.1 | 4.7 | 4.9 | 8.1 | 17.7 | 14.4 | 17.1 |
| More than 36 | 2.3 | | 5.7 | 5.3 | 11.8 | 50.2 | 38.6 |

Thirty-nine per cent of the companies prefer three years or more experience for their systems analysts, and 50 per cent prefer three years or more experience for the data processing managers.

Over 50 per cent of all the data processing personnel have had more than three years experience in data processing (Table 2-35). Two-thirds of the systems analysts have had more than five years experience in data processing, and 78 per cent of the data processing supervisors had worked in data processing for over five years (45 per cent of them with 10 years or more experience).

Table 2-35. Total Amount of Experience in Data Processing of Data Processing Employees.
(% of Employees Stating Experience)

| Years | Key Punch Oper. (N=832) | Tape Libr. (N=26) | Unit Recd Oper. (N=373) | Comp. Oper. (N=275) | Progr. (N=332) | Super. D.P. (N=162) | Sys. Anal. (N=138 |
|---|---|---|---|---|---|---|---|
| Under 1 Year | 22.8 | 30.8 | 23.1 | 15.2 | 18.4 | 1.8 | 2.9 |
| 1- 3 | 20.6 | 11.5 | 20.1 | 21.1 | 20.4 | 8.0 | 15.2 |
| 3- 5 | 16.7 | 19.2 | 11.8 | 19.3 | 19.9 | 11.7 | 15.2 |
| 5-10 | 21.8 | 23.1 | 22.5 | 26.2 | 30.4 | 33.3 | 38.4 |
| 10 or More | 18.1 | 15.4 | 22.5 | 18.2 | 10.8 | 45.1 | 28.2 |

Over two-thirds of the data processing employees have worked for their companies over one year (Table 2-36). Fifty per cent of the programmers have been with their companies from one to five years. Forty-seven per cent of the systems analysts have worked for their firms five years or more, and 78 per cent of the data processing supervisors have worked for their companies five or more years (36 per cent more than ten years).

## Mobility

Data processing personnel are frequently thought of as a rather mobile group of people. However, the fact that large percentages of them have been with their companies for relatively long periods of time would tend to discount this assumption (Table 2-36). Considerably over

Table 2-36. Length of Time Data Processing Employees Have Worked for Their Companies.
(% of Employees Stating Time)

| Years | Key Punch Oper. (N=833) | Tape Libr. (N=26) | Unit Recd Oper. (N=373) | Comp. Oper. (N=275) | Progr. (N=331) | Oper. D.P. (N=162) | Sys. Anal. (N=138) |
|---|---|---|---|---|---|---|---|
| Less than 1 Year | 33.6 | 30.8 | 26.3 | 29.4 | 26.8 | 6.8 | 21.7 |
| 1- 3 | 25.7 | 7.7 | 22.0 | 20.4 | 28.3 | 18.5 | 20.3 |
| 3- 5 | 13.6 | 7.7 | 12.1 | 14.5 | 13.3 | 16.0 | 10.9 |
| 5-10 | 15.0 | 30.8 | 20.1 | 20.4 | 17.5 | 22.8 | 20.3 |
| 10 or More | 12.1 | 23.1 | 19.6 | 15.3 | 14.1 | 35.8 | 26.8 |

half the data processing employees have been with their companies for more than three years. The youngest group of employees, the key punch operators (40.6 per cent), have worked in their present firms less than three years. Although tape librarians were not much older than key punch operators, over 60 per cent of them have worked in their present firms for more than three years.

Of the managers of data processing departments, about 75 per cent have been with the companies at least three years, with 59 per cent of them having been there five years or longer. With the exception of the tape librarians, the group with the longest time spent with their companies is the systems analysts and the unit record operators.

Data processing people tend also to be from the area of the country in which their company is located, with a median of about 15 per cent of them coming from geographic regions other than the one in which they are now living (Table 2-37). A smaller percentage of women than men has moved into each of the geographic regions, except into the West South Central states. There almost 27 per cent of the women, but 17 per cent of the men, have come from other areas of the United States.

Table 2-37. Geographic Area of the Country from Which Data Processing Employees Moved to Their Present Positions
(% of Employees Indicating Geographic Moves)

| Geographical Area | Men | Women | Total |
|---|---|---|---|
| East Atlantic | 19.0 | 12.5 | 17.2 |
| Mid Atlantic | 9.5 | 4.8 | 8.0 |
| South Atlantic | 12.2 | 6.1 | 9.2 |
| East South Central | 0 | 9.1 | 7.9 |
| West South Central | 16.7 | 26.8 | 21.9 |
| West North Central | 17.2 | 12.1 | 14.7 |
| East North Central | 11.9 | 7.6 | 9.9 |
| Mountain | 26.7 | 24.1 | 24.8 |
| Pacific | 24.8 | 15.1 | 20.0 |
| Total | 15.9 | 14.1 | 15.0 |

A greater proportion of the data processing people moved into the Pacific, Mountain, and West South Central states than into other regions of the country, with the least amount of immigration into the Middle Atlantic and East North Central sections of the country.

## Leisure-Time Interests

The leisure-time activities reported by the data processing employees tended to be those requiring use of the hands or were of an athletic nature (Table 2-38). The activity most frequently mentioned by the people in most job categories was participating in sports, with the most frequently named sport being bowling or golf. Between 17 and 25 per cent of the employees listed sports-participation as a leisure-time activity.

Table 2-38. Leisure Time Activities Reported by Data Processing Employees

| Activities | Key Punch Oper. | | Tape Libr. | | Unit Recd. Oper. | | Comp. Oper. | | Progr. | | Super. D.P. | | Sys. Anal. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Arts and Crafts | 281 | 21.0 | 4 | 10.3 | 63 | 10.6 | 35 | 7.6 | 48 | 8.3 | 20 | 7.2 | 20 | 8.1 |
| Household | 97 | 7.2 | 3 | 7.7 | 66 | 11.1 | 61 | 13.3 | 67 | 11.6 | 29 | 10.4 | 23 | 9.3 |
| Hunting/Fishing | 19 | 1.4 | 1 | 2.6 | 50 | 8.4 | 50 | 10.9 | 67 | 11.6 | 39 | 14.0 | 23 | 9.3 |
| Hiking/Camping | 185 | 13.8 | 2 | 6.1 | 50 | 8.4 | 42 | 9.1 | 48 | 8.3 | 23 | 8.3 | 27 | 10.9 |
| Reading | 214 | 16.0 | 7 | 17.9 | 88 | 14.9 | 50 | 10.9 | 83 | 14.4 | 33 | 11.9 | 34 | 13.7 |
| T.V./Movies | 45 | 3.4 | 2 | 5.1 | 15 | 2.5 | 10 | 2.2 | 8 | 1.4 | 4 | 1.4 | 4 | 1.6 |
| Dancing/Parties | 96 | 7.2 | 1 | 2.6 | 31 | 5.2 | 18 | 3.9 | 19 | 3.3 | 9 | 3.2 | 9 | 3.6 |
| Travel | 14 | 1.0 | 3 | 7.7 | 9 | 1.5 | 8 | 1.7 | 6 | 1.0 | 5 | 1.8 | 3 | 1.2 |
| Music | 64 | 4.8 | 2 | 5.1 | 39 | 6.6 | 23 | 5.0 | 32 | 5.6 | 12 | 4.3 | 10 | 4.0 |
| Sports, Participative | 239 | 17.8 | 10 | 25.6 | 101 | 17.1 | 94 | 20.4 | 115 | 20.0 | 57 | 20.5 | 44 | 17.7 |
| Sports, Spectator | 28 | 2.1 | 1 | 2.6 | 45 | 7.6 | 40 | 8.7 | 32 | 5.6 | 30 | 10.8 | 15 | 6.0 |
| Other | 59 | 4.4 | 3 | 7.7 | 35 | 5.9 | 29 | 6.3 | 13 | 2.3 | 17 | 6.1 | 36 | 14.5 |
| Totals | 1341 | | 39 | | 592 | | 460 | | 575 | | 278 | | 248 | |

Outdoor activities, such as hunting and fishing or camping and hiking, were frequently listed as leisure-time activities also. The key punch operators, however, tended to engage more in arts and crafts activities, more so than another group of employees; but people in other job categories quite frequently mentioned those activities which might be classified as household activities, including such things as interior decorating, furniture refinishing, or upholstering. A greater percentage of men than women listed the household category as their leisure-time interest (Appendix A, Table 4).

Key punch operators and unit record equipment operators listed reading as a leisure-time activity with about the same frequency as did systems analysts and programmers.

The employees were also asked whether or not they enjoyed working puzzles, and by far the majority of them said that puzzles were either "O.K." or they enjoyed them (Table 2-39). People in the higher level data processing jobs more often said they enjoyed the puzzles than did the key punch operators, unit record equipment operators, or computer operators. Over one-sixth of the key punch operators who answered this question said they hated puzzles, compared with about 1 per cent among all the other employee groups.

Table 2-39. Attitudes Toward Puzzle-Solving Activities

| Attitude | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. |
|---|---|---|---|---|---|---|---|
| Enjoy | 63 | 12 | 191 | 156 | 236 | 106 | 100 |
| O.K. | 59 | 13 | 174 | 114 | 89 | 52 | 36 |
| Hate | 24 | 1 | 5 | 4 | 5 | 4 | 1 |
| Total | 146 | 26 | 370 | 274 | 330 | 162 | 137 |

## PROJECTED DEVELOPMENTS IN DATA PROCESSING

In order to get some insight into the future of the data processing field and its effect on education of future employees, interviews were held with the vice presidents in charge of advance planning in several computer manufacturing companies; and the managers of the data processing departments of the businesses included in the study were asked about the changes they foresaw in data processing as a field and as it might affect their company.

### Opinions of Advance Planning Executives

Interviews were held with the vice presidents in charge of advance planning for the following computer manufacturers:

1. Burroughs Corporation
2. Clary Company
3. Control Data Corporation
4. Digital Equipment Corporation
5. Friden, Incorporated
6. Honeywell
7. International Business Machines Corporation
8. Monroe International, Incorporated
9. The National Cash Register Company
10. Philco Corporation
11. Radio Corporation of America
12. SCM Corporation
13. UNIVAC, Sperry Rand Corporation

In addition, an interview was held with a representative of the Diebold Group, Incorporated because of the extensive research and writing this group has done in the field of data processing.

The interviews were designed to discover plans for technological changes in hardware and software likely to come about in the next three to ten years that might have an effect on the education offered to future data processing employees (See Appendix B-6 for a copy of the interview guide).

The executives generally agreed regarding developments in data processing during the next three to ten years. Following is a summary of those areas of agreement:

1. Miniaturization of computers has and will reduce the cost of computers, so a greater number of even relatively small businesses will be able to afford electronic data processing in some form more than in the past.

2. Computers will have more memory capacity than in the past at less cost per bit. This will enlarge the applications that can be made on the computer, thereby permitting more effective usage of the computer.

3. Enlarged memory units will result in reduction in the need for exactness in programming (the programmer need not be as sophisticated), thus reducing the amount of training required of a programmer. Consequently, the programmer may be trained at the post high school level in the future rather than requiring him to have a college degree.

4. Advancements in the next few years will take place more in the software rather than in the computer. The computer is not used to maximum efficiency today because of the slowness of input devices. Many new advances will take place in the input and output devices of the computer.

5. The use of the punch card as an input device will diminish. This will result in a reduction in the proportion of persons needed to operate key punch machines with the actual number of operators remaining at about the same as the present number of operators. Other devices will be developed and used as input devices that will be more speedy and acceptable for the mass of data to be processed. (All computer manufacturers were of this belief, except one. Since the interviews, the exception has published a study, the results of which agree with the statement that the punched card may not continue as the major input device.)

6. Programmers need to have a logical mind, not mathematical training per se. Generally, the thought has been that the programmer should be highly mathematically oriented; however, algebra seems to be the extent of mathematics background required for business data processing.

7. A trend seems to be developing toward the necessity for the programmer to be an analyst in addition to his being able to program. This would indicate that the programmer will need to continue his training beyond a post high school program to hold and advance in his job as a programmer. A good programmer will likely become a systems analyst in six months to a year.

8. Hands-on training is probably more important psychologically to the prospective computer operator rather than for its actual learning value.

9. Data processing instruction should not be based on just one particular machine. Operators must be able to move from one make of machine to the other.

10. As optical scanning becomes more prevalent, the need for persons for the job of coding will diminish.

11. Time sharing (through service bureaus and computer service utilities) will increase. For the smaller companies, the input/output devices will be in their offices, giving access to a large processor at some other location. Operation of the input/output devices will be performed by regular employees of the small firm.

12. Low-cost remote terminals will be available soon.

13. Video data terminals are probably the greatest development thus far. These are presently technically operable, and will be reduced in cost during the next three to ten years, making them practical for business usage.

14. Machine languages will give way to the higher level languages, such as COBOL.

15. Data processing personnel need to know and understand systems as they relate to the interrelation of all the functions of business.

16. Understanding data processing applications is of more importance than understanding of the computer itself.

17. Unit record equipment is being replaced with computer installations. Unit record equipment will be gradually phased out.

18. The educational system needs to take over the training for data processing. It is not necessary to train on specific hardware; students should be trained with equipment independence.

19. Information will be more commonly fed into the computer using a language form rather than machine language.

20. Data processing employees must be communications oriented.

21. Computer design will change with increased emphasis on making them failsafe. One function may be taken over by another device in the system while the other is being fixed.

22. The wiring concept is decreasing. Programming will be internal with the machine.

<u>Opinions of Managers of Data Processing Departments</u>

The responses of the data processing managers to the question, "What changes in data processing do you see in the next three to five years?" were quite similar to those of the computer manufacturers. The following statements summarize the thinking of data processing managers regarding the future of data processing:

1. Improvement of input/output media and devices is necessary. The computer is too fast for the input/output equipment now used, and these media and devices must be improved in the very near future.

2. Teleprocessing and other data communications media and devices will be used much more widely in the future.

3. The cost of data processing equipment will decrease, making it possible for more and more companies to use electronic data processing in their business.

4. Because of increasing application of real-time and time-sharing equipment, faster core speed for computer and faster input/output media and devices will be developed.

5. The growth in time-sharing and service bureaus, even by companies with data processing installations, will be phenomenal.

6. The use of random access and mass memory for real-time processing will become very prominent in the near future.

7. Because of the newer techniques and newer equipment being installed in the businesses, the upgrading of present employees in business will be a definite trend.

8. Programming languages will be simplified.

9. Unit record equipment is being de-emphasized more and more in business and will continue to be so in the next few years.

10. More sophisticated use will be made of the computer. Instead of using the computer simply to process accounting work, the machine will be used to aid management's decision-making activities.

11. One trend about which nearly total agreement was evident was that the extreme shortage of skilled data processing personnel would continue, especially for programmers and systems analysts.

12. Software packages prepared by the manufacturer will be continually improved.

When asked what changes in their data processing they were contemplating in the next three to five years, the data processing managers suggested these:

1. The IBM 360 (models 30 and larger) will be used very extensively by a majority of the companies.

2. More and more applications will be placed on the data processing equipment.

3. Additional personnel will be added.

4. More "sophisticated" use will be made of the equipment.

5. Nearly all data processing managers indicated plans for use of either time-sharing or of random access and real-time concepts.

6. Wider use of data communications were being made and would continue to be made.

7. Re-education and upgrading of employees will take place, with particular emphasis on systems personnel.

8. A definite move toward centralization of a company's data processing is being planned for those companies spread geographically over a wide area.

9. The change to Report Program Generator or PL-1 programming is being planned.

10. Managers indicated the need to change or revamp their entire systems to be more compatible with the newer third generation equipment.

## RECOMMENDATIONS TO SCHOOLS BY EMPLOYEES

The data processing employees were asked to make three recommendations for schools in preparing young people for doing a job like the ones they were performing. Fifteen specific recommendations occurred enough times to be categorized (Table 2-40).

When the recommendations were analyzed according to the employees without and with data processing training, the same six recommendations occurred most frequently. They were to offer instruction in mathematics and accounting, unit record equipment, data processing concepts, a rounded business education, data processing applications, and logic. Those employees without training in data processing added the need for both oral and written communication (English), and those employees with training in data processing added the need for psychology (getting along with people).

If the totals of recommendations are considered, the same six recommendations were the most frequently mentioned. In addition, the recommendations are made that data processing training should begin in the high school and that preparation on the key punch machine should be included in the school curriculum.

## PROGRAMMING INSTRUCTION IN THE SECONDARY SCHOOLS

The managers of data processing departments were asked what their experience, if any, had been with prospective employees who have studied computer programming in high school. They were also asked if they had any opinions as to whether programming should be offered in high school. Their replies were tallied as follows:

| | |
|---|---|
| No response | 13 |
| No experience and no opinion | 37 |
| Have had employees who studied programming in high school and would recommend offering course in high school | 5 |
| Have had employees who studied programming in high school and would not recommend offering course in high school | 3 |

Table 2-40. Recommendations to Schools by Data Processing Employees (Possible Three Answers Per Employee)

| Recommendations | Key Punch Oper. | Tape Libr. | Unit Recd Oper. | Comp. Oper. | Progr. | Super. D.P. | Sys. Anal. | Total |
|---|---|---|---|---|---|---|---|---|
| Rounded business education | 87 | 3 | 33 | 30 | 59 | 34 | 24 | 270 |
| Prepare on key punch | 142 | 1 | 20 | 4 | 6 | 1 | 1 | 175 |
| Unit record equipment | 62 | 4 | 45 | 30 | 29 | 15 | 12 | 197 |
| Data processing concepts | 78 | 8 | 47 | 46 | 53 | 39 | 24 | 295 |
| Mathematics and/or accounting | 83 | 5 | 67 | 69 | 109 | 49 | 42 | 424 |
| Logic | 0 | 0 | 0 | 0 | 106 | 26 | 48 | 180 |
| Typing | 105 | 2 | 27 | 22 | 0 | 0 | 0 | 156 |
| Hands-on-training | 65 | 1 | 38 | 33 | 20 | 4 | 10 | 171 |
| On-the-job training | 55 | 0 | 29 | 21 | 19 | 11 | 7 | 142 |
| Computer theory | 3 | 0 | 7 | 9 | 21 | 4 | 11 | 55 |
| Data processing applications | 71 | 3 | 30 | 49 | 57 | 30 | 23 | 263 |
| Psychology | 23 | 1 | 14 | 10 | 7 | 17 | 11 | 83 |
| English | 33 | 3 | 15 | 12 | 46 | 26 | 23 | 158 |
| Work hard | 70 | 1 | 33 | 16 | 13 | 13 | 13 | 159 |
| Science | 0 | 0 | 2 | 1 | 8 | 2 | 2 | 15 |
| Starting high school | 98 | 0 | 24 | 23 | 23 | 18 | 11 | 197 |
| Other | 83 | 2 | 53 | 28 | 31 | 14 | 9 | 220 |

| | |
|---|---|
| Have had no experience in hiring employees who studied programming in high school. Opinion was that programming should not be offered in high school . . . . . . . . . . | 145 |
| Have had no experience in hiring employees who studied programming in high school. Opinion was that programming should be offered in high school (but only to develop basic concepts) . . . . . . . . | 124 |
| Have had no experience in hiring employees who studied programming in high school. Opinion was that they should hire such students as programmer trainees . . . . . . | 26 |
| Total | 353 |

Several of the managers expressed quite definite opinions regarding this matter. Several of their comments are given here because they are typical of the responses made to this question. Typical of the comments reflecting the opinion that programming should NOT be offered in the high school are these:

> Because each company's computer applications vary so greatly, programming could more profitably be delayed until college.

> Programming should be only for specialists--none should be taught in high school.

> Programming is a more specialized type of learning that should be taught to graduates of high school who would be more receptive to this type of training.

> High school students are not able to see programming in its correct relationship to the over-all system; hence, they would probably not gain much of any value from a course in high school.

> Students are not mature and responsible enough for programming, since programmers must work on their own a great deal of the time.

High school students are not ready for this type of training and there are too many languages. It is more important to get basic concepts.

It is questionable if a person that age has the necessary common sense for learning and applying programming.

We can teach the programming.

I cannot see the value in teaching programming in high school because adequate general background and maturity is lacking at that level.

High school should give them a strong business and accounting background and an introduction to data processing, but programming should wait for a more matured individual.

I would rather train my own programmers. The background is more important.

People cannot "grasp" programming until after high school.

A programmer should have more education, and therefore he should not have programming until later in college, or he will forget what he learned.

Programming changes so fast that by the time they got out of high school, it wouldn't apply.

What is given to high school people is so glorified they want $150 a week. Programming is hard work; it should be offered in college or trade school only.

A good programmer needs a good general and wide background; hence, the high school student does not have this requirement. So programming should be left until after high school.

If we give the high school students a good basic foundation, they won't have any trouble in picking up the programming in a post-secondary school.

Several of the comments indicated that even though they felt that programming should be offered in the high school, they would not employ a newly graduated high school student for a programming job. Typical comments follow:

It should be taught in high school--the earlier, the better.

It should be taught in high school as an introductory-type class, not at a skill level.

They should have the course to see if they like it.

Programming should definitely be in the high school. Should teach one basic language and spend the rest of the time studying logic.

Should be taught in high school for exposure--then the students would better be able to decide whether or not to enter the field of data processing.

Good idea to introduce programming in high school but maybe not practical because of changes being so rapid.

With the modern teaching methods, high school students definitely could learn programming.

Only teach elementary programming.

Keep the courses on an applications and concepts level--the rest will come from experience.

Kids at this age are mature enough and smart enough to grasp programming concepts.

Offer enough programming to let the students know if they want to go on.

Basic theory of programming should be taught in high school--but nothing specialized.

Courses should be used for finding out whether the students have an aptitude and interest in data processing.

Should take a basic course in high school, but not complete one, so they could go out and get a job. This would take too much time from more important areas of learning that they should pick up at the high school level.

Fundamentals of programming could be taught and used as a stepping stone for data processing in college.

Programming could be taught in high school. In its pure sense it could do no one any harm, since it is merely using ability to think logically.

This is the type of thing that would really interest students of this age.

It would be quite helpful for the student to be exposed to writing some programs. Then students would need additional training when they come to the company to work.

## AUTOMATED DATA PROCESSING AND THE TYPIST'S JOB

Data processing managers were asked if automated data processing has changed the nature of the typist's job. Of the 353 managers interviewed, 125 said that it had not, but several of them qualified their "No" with the statement that for some time past their reports had been prepared on machines, so even before they installed their computer systems the reports had not been typed by the typists.

The other data processing managers felt that it had changed the typist's job mostly by upgrading it, making it a more sophisticated job, requiring more knowledge of business and systems than ever before and requiring more judgment on the part of the typist. Of the managers who said the typist's job had changed, 55 said that these people type fewer statistical reports and 42 said that they type fewer reports and do less repetitious work. Only five of the managers felt that typists now are required to type more numbers than previously, and six reported that typists have to type computer input. Only two companies reported they had more typing done now than previously.

The feeling was expressed that the typist's job has become more complex, requires more judgment and more background in business and in data processing terminology, with more clerical responsibility attached such as checking details, looking up and compiling information and abstracting reports from computer printout. Typical of the comments about the typist's job and changes in it are these:

> It has changed in regard to terminology, vocabulary, format; block diagramming is required. Follow-up letters, statements, payroll, royalty checks, and cost reports are done on computers. Typists don't do nearly the number of routine jobs they were doing years ago. Instead they are doing the more complicated jobs that can't be done on the computer.

> It has changed the kind of reports that go to management. Now the typist does work on the refinement of the programs. For example, some reports are in too much detail or they don't need the information found on a particular report; so the typist fits it to the particular individual before typing up the report.

> The typist of today and tomorrow may tend to do more analyzing and production work, rather than straight copy work.

> The typist will do an analysis of the data rather than just compiling it and typing it.

Computers and data processing equipment have added a complexity to the typist's job that was not present before. They must do more detail work and more thinking about the work they are doing.

They help dig out information and facts and check them; hence becoming more of a clerical assistant.

Data processing has now taken over certain tasks formerly done by the typist. This includes making out stockholders' records, typing envelopes, typing of checks to employees, and typing labels. I expect further routine tasks to be taken over by the computer such as the typing of form letters, etc. The typist's job has become somewhat more sophisticated with added responsibility and a partial elimination of numerous routine tasks.

At one time our company had 150 typists answering the 7,000 letters a day that our company receives. Since the installation of the computer, this number of people has been cut to approximately 15. These people were absorbed or the slack taken up by normal attrition. The kind of typing job that now remains is more concerned with a more complex, more complicated kind of typing job. They answer the "problem" letters that include two-page letters, special inserts, more details that have to be checked out, and a higher level of analyzation. The computer does 93 per cent of the routine answering of letters, while the remaining 7 per cent are handled by the 15 typists.

# CHAPTER III

## RECOMMENDED CURRICULUMS

Curricular offerings in data processing at the secondary and post secondary levels became prevalent shortly after 1960. School administrators and business educators have been concerned with the rapid development of mechanized and automatic data processing equipment and its effect on business offices and on the vocational business education curriculum.

The extensive introduction of electronic computers for data processing and other applications has created a critical need for greater numbers of more highly skilled personnel. The rapid growth in this area has necessitated the development of some direction for schools as a basis for curriculum construction in data processing. This study was conducted to help school administrators and business educators establish some guidelines for curriculums to train prospective data processing employees at the secondary and two-year post high school levels.

Data for the study were collected from four major sources. Interviews were held with managers of data processing departments in industries selected at random throughout the United States. Employees in data processing departments of those selected industries completed questionnaires administered by the interviewers. Information about the schools' offerings in data processing was obtained by interviews with department heads and questionnaires from teachers in schools teaching data processing within a thirty-five mile radius of the businesses interviewed. Interviews with advanced planning executives in computer manufacturing industries gave information on what is being planned and on the drawing boards of those companies that will affect the educational process in data processing in the next three to ten years.

### HIGH SCHOOL CURRICULUM IN DATA PROCESSING

The curriculum presented for data processing in the high schools is designed to meet two objectives. First, a student will have enough academic credits to be admitted to college should he decide to attend; and second, a student will be able to enter upon a beginning job in a data processing department upon the completion of the program.

| 9th Grade | Units |
|---|---|
| Mathematics | 1 |
| English | 1 |
| Social Science | 1 |
| Science | 1 |
| Typing | 1 |
| Physical Education | 1 |

| 10th Grade | |
|---|---|
| Mathematics | 1 |
| English | 1 |
| Social Science | 1 |
| Science | 1 |
| Introduction to Data Processing | 1/2 |
| Physical Education | 1 |
| * | |

| 11th Grade | |
|---|---|
| Advanced Algebra | 1/2 |
| English | 1 |
| Social Science | 1 |
| Computer Concepts and Systems Development | 1 |
| Bookkeeping | 1 |
| Physical Education | 1 |

| 12th Grade | |
|---|---|
| Oral Communication | 1/2 |
| Written Communication | 1/2 |
| Business Organization and Management | 1/2 |
| Human Relations | 1/2 |
| Business and Office Procedures and Data Processing Applications | 1 |
| Physical Education | 1 |
| ** | |

*Electives:

Introduction to Business
Consumer Economics

**Elective:

Economics

Data Processing Courses

Among the specific topics and concepts to be included in the high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (10th Grade-1/2 Unit)

1. History of records systems and manual data processing
2. Tabulating cards and equipment
   a. Card layout and design
   b. Equipment (purposes and operation, excluding panel wiring)
      (1) Key punch and verifier
      (2) Sorter
      (3) Interpreter
      (4) Reproducer
      (5) Accounting machine
      (6) Collator
3. Electronic computer logic
   a. Memory
   b. Input of data
   c. Calculation (arithmetic)
   d. Output
4. Flow charting
5. Computer operation (using a type and model of computer and a symbolic language for which the teacher and student have access)

Computer concepts and systems development (11th Grade-1 Unit)

1. Review of electronic digital computers and principles of data processing
2. Computer logic
3. Logic development through problem solving in general
4. Procedures development
5. Forms design
6. Computer languages (two languages: COBOL and one other, possibly Autocoder)
7. Computer business applications

Data processing applications (12th Grade-1/2 Unit)
(This course should be coordinated with Bookkeeping and Business and Office Procedures)

1. Systems analysis and design
2. Programming essentials
3. Report writing and analysis from computer printout
4. Gaming (simulation)
5. Laboratory (or on a co-op basis)
   a. Forms design
   b. Flow charting
   c. Writing the programs
   d. Operating computer
   e. Debugging
   f. Running of live work

## Business and General Courses

Employment in business data processing departments requires more than technical know-how in machine operation. Background in how business is organized, how it operates, and how its records are kept is essential, together with good communications skills and knowledge of human relations. In order to provide these skills and knowledges, general background courses in business and the social sciences are an important part of a data processing curriculum.

Business courses. The course in Business Organization and Management should introduce the student to the business firm through a total systems approach. The approach will interrelate the functional areas of business, such as accounting, management, finance, marketing, and production so that the student will discover that no business activity, no matter how detailed, is an isolated event.

Ideally the Business and Office Procedures course and the Data Processing Applications course should be offered as a block during the last semester of the senior year. By teaching these two courses using the block method, the data processing applications can be closely related to the total business system through a more thorough analysis of the flow of data in a continuous sequence from its origin to its ultimate use.

The Bookkeeping course should be developed with an emphasis upon the use of electronic data processing equipment for compiling the records of a business. The emphasis in this course should be on a systems approach to accounting related to data processing accounting procedures.

General courses. The course in Human Relations should be basically a business psychology course. For some time data processing personnel lived in a world that was basically its own, with its own language. That day has passed, and now the data processing personnel is recognizing that its is a facilitating function for the total success of the business. In order for the employees to be effective in their jobs, they must communicate, orally and in writing, with others in the business; and they must be actively associated with all persons who prepare materials for the data processing activity or who receive materials resulting from the data processing activity. In other words, they must relate to all persons in the business organization; therefore, understanding people and knowing the principles of human relations are very important for the data processing personnel.

The Written Communication course should emphasize expository writing rather than the usual English writing course emphasizing literary or creative writing. The purpose of the course should be the development of the ability to express oneself clearly and tersely in writing. Much business information resulting from data processing is in numerical form and must be interpreted by businessmen for the reader. Report writing needs to be stressed in the written communication course as well as ability to express oneself clearly through business letters, directives, memorandums, etc.

Analysis of the data for this study indicated further that data processing personnel in business need not be sophisticated in mathematics to be successful in automated data processing positions. The mathematics program in the curriculum should take the student through advanced algebra, including concepts of Boolean algebra.

The most important characteristic required of individuals in data processing is that of a logical mind. All instruction in the data processing curriculum should strive to develop logical thinking -- through the use of as many problem solving situations as it is feasible to incorporate in the courses.

## POST HIGH SCHOOL CURRICULUM IN DATA PROCESSING*

The data processing program at the post high school level should be designed as a terminal program for persons planning to enter the business office through some data processing position. The program should vocationally prepare the graduate of the program with a marketable skill in data processing. In addition to a beginning skill, he should be prepared to move into higher level data processing jobs with experience and/or further training. The post high school program, in addition to satisfying the specific training in technical aspects of data processing, must include other course work that will enable the worker to advance in his chosen career. Adequate background in communications, mathematics, and human relations are vital to the data processing employee, and are an integral part of the curriculum.

*Typewriting is considered a prerequisite to this program.

## FIRST YEAR

1st Semester:

| | Units |
|---|---|
| College Algebra | 4 |
| Written Communication | 3 |
| Accounting Principles | 3 |
| Introduction to Data Processing | 4 |
| Principles of Economics | 3 |
| | 17 |

2nd Semester:

| | |
|---|---|
| Data Processing Mathematics | 3 |
| Oral Communication | 3 |
| Accounting Principles | 3 |
| Business Conditions (or Contemporary Economic Problems) | 3 |
| Logic and Introduction to Systems Analysis | 5 |
| | 17 |

## SECOND YEAR

1st Semester:

| | |
|---|---|
| Business Statistics | 4 |
| Psychology | 3 |
| Advanced Accounting | 3 |
| Introduction to Computer Programming | 3 |
| Data Processing Systems | 3 |
| | 16 |

2nd Semester:

| | |
|---|---|
| Principles of Management | 3 |
| Human Relations | 3 |
| Data Processing Applications and Practicum in Programming | 5 |
| Advanced Programming | 3 |
| | 14 |

## Data Processing Courses

Among the topics and concepts to be included in the post high school data processing courses, the following are recommended in the suggested courses:

Introduction to data processing (1st Year, 1st Semester-4 Units)

1. History of data processing
2. Principles of data processing
3. Overview of unit records
   a. Key punch and verifier
   b. Sorter
   c. Interpreter
   d. Reproducer
   e. Accounting machine
   f. Collator
   g. Principles of panel wiring
4. Card layout and design
5. Electronic computer equipment
   a. Types
   b. Logic
6. Flow charting
7. Elements of programming
8. Laboratory in data processing equipment
9. Number systems

Logic and introduction to systems analysis (1st Year, 2nd Semester-5 Units)

1. Procedures development
2. Forms design (source document)
3. General flow charting
4. Program flow charting and block diagramming
5. Computer logic
6. Analysis of information network systems
7. Coding and condensing data

Introduction to computer programming (2nd Year, 1st Semester-3 Units)

1. Review of computer equipment
2. Principles and theory of digital computers
3. Programming essentials
4. Computer logic
5. Block diagramming
6. Coding and condensing data
7. Purposes and functions of different languages

Introduction to computer programming (continued)

8. Uses of symbolic languages
9. Central processing unit
10. Computer applications
11. Registers
12. Assembly programs and compilers
13. Programming systems
14. Fixed and floating points
15. Macro-generators

Business systems design and development (2nd Year, 1st Semester-3 Units)

1. Identification of system objectives
2. Identification of system requirements
3. Methods for achieving system objectives
4. Development of operating procedures
5. Installation of system for each of the following
    a. Customer order and billing
    b. Customer accounts receivable
    c. Inventory control
    d. Sales information
    e. Payroll
    f. Purchasing and accounts payable
    g. General-ledger accounting

Data processing applications and practicum in programming (2nd Year, 2nd Semester-5 Units)

1. Data processing applications
    a. Payroll
    b. Inventory
    c. Accounts receivable and payable
    d. Sales analysis
    e. Policyholders records
    f. Cost accounting
    g. General accounting
    h. Billing
2. Practicum in programming
    a. Systems
        (1) Analysis
        (2) Design
    b. Programming essentials

2. Practicum in programming (continued)

    c. Report writing and analysis
    d. Gaming
    e. Simulation

        (1) Forms design
        (2) Flow charting
        (3) Writing programs
        (4) Operating computer
        (5) Debugging
        (6) Running live work

    f. Field project

Advanced programming (2nd Year, 2nd Semester-3 Units)

1. Report generators
2. Macro-generators
3. Assembly programs and compilers
4. Emulators
5. Data scheduling systems
6. Monitors and high level languages
7. Fixed and floating points

## Business and General Courses

Much of the philosophy underlying the courses described for the high school level applies also for the business and general courses at the post high school level. Particularly in the Written Communications course, the ideas apply at both levels; the approach for the Bookkeeping course at the high school level applies as well for the Accounting courses at the post high school level; and the philosophy of the Social Science and Human Relations courses at both levels will be the same. The level of materials and methods of instruction in these courses may differ, but philosophically they will be the same.

Since the digital computer operates on repetitive processes using binary number systems, the Data Processing Mathematics course should be designed to include such topics as the concept of an iterative process; solution of simultaneous linear equations; logic; Boolean algebra; number systems, particularly the binary and octal systems; classification of errors in the numerical solutions of a problem, especially the following: error in mathematical approximation, error in the measurement of parameters, truncation errors, round-off errors, and ill-conditioned equations.

The course Logic and Introduction to Systems Analysis should begin with an introduction to logic and an analysis of deductive and inductive problem-solving approaches. Procedures development with emphasis on work analysis and methods would precede the development of procedures for computer applications. Flow charting, block diagramming, and forms design would be included as a preface to analysis of information network systems.

Business Conditions is a vehicle in which economic theory is adapted to practical applications in business. An analysis of the American economy, its development and present condition, should be included. Contemporary economic problems involving the state of the economy and underlying factors affecting the economy should be analyzed.

The objectives of the Business Statistics course are to acquaint the student with the theory of statistics and its application in business today. The student should gain an understanding of the kinds of regularity that exist among random fluctuations. Mathematical models with which to interpret phenomena and predict outcomes of experiments related to practical business problems would be built and used through the use of the computer. Topics covered in such a course are probability; principles of sampling; bivariate data and regression analysis; correlation and the analysis of variance; statistical analysis of time series data; index numbers; forecasting; statistical quality control.

The Principles of Management course recommended is not the usual course offered in business curriculums, but a combination of several course offerings. Topics to be included in this course are types of business; organizational levels; departments in a business; principles of office management; and records management and control.

## CHAPTER IV

## RELATED LITERATURE

Many efforts have been made to identify problems created by the introduction of integrated data processing into business offices and to determine the educational implications of electronic data processing on the business curriculums in both high schools and colleges. These investigations have explored such areas as the duties of persons employed in the various electronic data processing occupations, the training and personal qualifications necessary to perform these duties successfully, the salaries paid in jobs in different levels, applications for which computers have been used in processing business data, the specialized training programs provided by business, and the types of equipment used. These elements have been studied in the hope that the information thus gathered would prove helpful in curriculum development in business education at both the high school and college levels.

However, when viewed as a whole, the literature in data processing has produced but little information that might serve as guides to schools in making decisions about the feasibility of having data processing programs in their institutions. Neither have the studies provided conclusive information that would help in deciding what offerings to include in a data processing program if it were to be part of a business education curriculum.

On only one point, however, do the studies agree somewhat; namely, that people in the management positions in data processing departments need at least four years of college work. However, for the lower echelons of management (supervisory levels) the findings are inconclusive.

In 1957, the Department of Labor (22) studied adjustments of employees to the introduction of office automation to determine the extent of displacement and reassignment of office employees as well as the characteristics of the employees whose jobs were eliminated and the practices in transferring, retraining and selecting employees for the new occupations. The report indicated that in offices into which automated data processing had recently been introduced, 42 per cent of the people had completed some college work or had graduated; however, 78 per cent of the newly hired employees had this amount of education. Goodman (12), four years later, reported that a survey of 100 data processing personnel in Los Angeles revealed that 30 per cent of the specialists in data processing and management had four years of college work.

Generally the specialized training on machine operation, from key punch through computer console operation, was commonly thought to be provided best by either the employing company or by the equipment manufacturer. Later studies (2,10,11,15,17) seem to show a slight trend toward hiring trained people from high schools, junior colleges and other post high school institutions for some of the machine operating jobs; however, the businesses who hired them then provided training in the special applications needed for their own purposes in a brief in-service training program.

Whether or not this is a trend is not clear, since in most of the studies the data were gathered before many educational institutions offered training in data processing. Perhaps because so few data processing programs were in existence at the time these studies were done, no real attempt was made to evaluate the effectiveness of the education and training provided or to draw many curricular implications.

Backlund, Dudley, Edwards, E. D. Gibson, and G. Gibson (1,3,7,9,10) conducted studies to determine the types of programs that should be offered in data processing at the collegiate baccalaureate level. Gibson (9:210) concluded that a four-year college degree was necessary for systems analysts; that it is helpful, but not essential, for the data processing manager and programmer; and that a high school graduate can easily obtain employment in the electronic data processing office as a console operator or a key punch operator. Further, Gibson reported that 63 per cent of the businessmen in her study, 103 businessmen belonging to the Boston Chapter of the Data Processing Management Association, hire only college graduates for the position of systems analyst; that 56 per cent hire only college graduates for the position of operations manager; that 33 per cent hire only college graduates for the position of programmer. Gibson further reports that 84 per cent of the businessmen hire high school graduates for the position of console operator and that 92 per cent hire high school graduates for the position of key punch operator (10:195-205). Participants in Gibson's study recommended the following high school courses for prospective data processing employees: typewriting, general business, operation of key punch machine, bookkeeping, operation of ten-key machine, operation of calculator, and operation of computer console (10:67).

Korn (17) constructed a standardized objective achievement test for the course Introduction to Business Data Processing that could be used as a means of evaluating a student's progress toward achieving the objectives of an introductory course in business data processing in a post high school program. Korn compiled a list of topics through textbook analysis and interviewing procedures to ascertain the units usually covered in a post high school course entitled Introduction to Business Data Processing. The list of topics compiled is as follows:

History of data processing
Purpose and function of unit record equipment
Input/output media and devices
Primary storage and retrieval
Arithmetic and logic functions of the computer
Control unit
Introduction of programming
Total systems concept

In spite of the fact that much effort has been expended in investigation of the educational implications of automation in the office, nothing conclusive has been produced. The studies tend to be unreliable because of the biased samples. The findings cannot be generalized either because the studies are extremely localized geographically or because of the inadequate sampling procedures.

Consequently, business educators know relatively little more about what to teach in and about data processing, or when and where to teach it. Thus, the present study was designed to supply information, not only about what business actually needs by way of qualified data processing employees, but also to provide a basis for evaluating current instructional programs in data processing offered in public educational institutions. The investigator in only one of the studies (5) interviewed the employees at all levels of data processing about the training they had. However, no indication is given that they were asked to evaluate what they had studied in the data processing programs in which they received their training.

This study, therefore, surveyed (1) business about its needs for data processing employees and the educational and personal qualifications they should possess, as well as about its evaluation of the products of data processing programs in public schools; (2) data processing employees about the training they have had and the adequacy of that training; (3) data processing equipment manufacturers about new developments anticipated in machines and procedures (scanning devices, program oriented languages, etc.) and their possible influence on the training and qualifications necessary to work with the devices being developed for the future; and (4) public educational institutions about current offerings in data processing and about the students who are taking advantage of what is offered.

# CHAPTER V

## PROCEDURES

This study was designed as an attempt to determine the implications of automated data processing for the preparation of office workers by public secondary schools and post high school institutions offering less than the baccalaureate degree. Data were gathered about data processing employees, from them and from the managers of the departments in which they were employed. Further data about the status of data processing instruction in the schools was gathered from heads of instructional units in high schools, junior colleges, and vocational-technical schools and from teachers of data processing courses. In order to determine what lies in the future in technological developments in data processing equipment, interviews were held with executives in the advance planning departments of leading computer and other data processing equipment manufacturing companies.

A sample survey design utilizing interviews and questionnaires was used for this study because of the kind of information needed. Also, because data were needed at the national level in order to determine common elements that may serve as a basis for curriculum development in business education departments over the country, teams of trained interviewers operating in seven areas of the United States collected data from the schools and offices concurrently. Interviews, rather than a mailed questionnaire, were the main means of collecting data since much of the data needed was of the type that could best be gathered with open-end questions and also because of the greater probability of a higher rate of response.

The factual information gathered on the questionnaires served as a point of departure for interviewers to probe more completely into motivations of the people involved, their evaluations of training programs, and their departmental plans for the future. Since characteristics of existing programs were not known (relatively new programs are the rule), interviews of school data processing teaching personnel permitted collection of more precise information regarding program content.

The interviewers used a prepared schedule of questions to gather information from data processing management personnel regarding the educational and skill requirements of data processing personnel. Information was gathered from the management personnel about promotion patterns, working conditions, characteristics of the people employed in various data processing jobs for the various job categories, and trends in the data processing field in general and in his own business.

The interviewers asked prepared questions of each of the data processing managers in 353 businesses and recorded the answers on the schedule provided to the interviewer. Insofar as possible, the questionnaire prepared to gather information from the employees was administered personally by one of the members of the interviewing team at the same time that the other member was interviewing the data processing manager. In a few companies the interviewers were asked to leave the questionnaires for the employees to fill out at their leisure. These questionnaires were then mailed directly to the study headquarters at Colorado University in Boulder.

## PREPARATION OF THE QUESTIONNAIRES

Preliminary forms of the questionnaires were prepared and were tried out to evaluate the wording of the questions, the length of time required to complete the questionnaire, and for omissions of information that should have been included in such a study. The try-outs were conducted in the Denver area using as interviewees three data processing managers who were willing to cooperate. From the suggestions given by these men and from the observations of the research team, the questionnaire format was revised, wording was refined, and other suggestions were incorporated into a shorter, less cumbersome format, which was again tried out with the same interviewees. With minor revisions, the management interview schedule was prepared as well as the employee questionnaires (see Appendix B-1 and B-2).

The same procedures were followed in the preparation of the schedules used in interviewing the heads of data processing departments in the secondary schools, the junior colleges, and the technical schools that were included in the study (see Appendix B-3 and B-4).

## SELECTING AND TRAINING THE INTERVIEWERS

Brochures were prepared announcing the need for interviewers to gather data for a national curriculum study in data processing. These brochures were distributed to all graduate deans in schools of business and to heads of business education departments in schools offering graduate programs in business education. Announcements were also made and prospective employees solicited at national and regional business education conventions.

Applications were received from 35 people from whom 14 interviewers were finally selected on the basis of data processing and/or business teaching experience (see Appendix C-1).

A three-day training session was held at Colorado University Business School on September 16 to 19, 1966, in which interviewing techniques were discussed, and during which the interviewers were provided opportunities to practice using the management interview schedule, actually using data processing managers as subjects. General instructions regarding the study were given, appointments for the first two weeks of the interviews with business firms were made, and itineraries were provided to each team of interviewers, who then began their interviews on September 21, 1966.

## SELECTION OF THE SAMPLES

Three different populations were to be studied in this investigation: businesses using either mechanical or electronic data processing, employees in data processing departments of these companies, and public high schools or junior colleges and/or technical schools.

### Selecting the Businesses

Dun and Bradstreet's 1963 Million Dollar Directory (4) listed some 28,000 businesses with net worth of one million dollars or more. This list constituted the population from which the sample of data processing equipment users was to be drawn since businesses of this size were the ones likely to be utilizing such equipment. Since such equipment represents large capital investment, larger companies were used as the source of information for the problem under investigation.

The N.E.A. small-sample formula (19) $n = \frac{X^2 Npq}{d^2(N-1) + X^2 pq}$

was to be used for determining the size of sample necessary to draw conclusions applicable to the entire population of businesses. Application of this formula shows that a sample of approximately 285 businesses would constitute a sample sufficient to provide 95 per cent reliability, with no more than 5 per cent error in the statements made on the basis of the sample.

However, since no information was available about the proportion of businesses listed in the Dun and Bradstreet Million Dollar Directory that had data processing installations, the decision was made to conduct a preliminary post card survey of a small sample of businesses to determine the kinds of computing and calculating machines and equipment used in their offices. Thus, a systematic random sample of 200 names was selected from the Directory. The returns from this brief questionnaire indicated that approximately 60 per cent of the businesses had data processing equipment, either unit record systems or computer systems. On the basis of this information, the decision was made to have the publishers of the Directory draw a systematic random sample of 500 businesses from their listing of million-dollar businesses. Dun and Bradstreet furnished the list printed on cards, together with the addresses and the standard industrial classification of each of 500 businesses.

Each interviewing team was supplied with a list of names of companies located in the particular geographic region to which the team was assigned. They were to contact the companies by telephone to determine whether or not they had either a mechanized or automated data processing department, and if so, to arrange an appointment to talk with the data processing manager. The teams were instructed to interview all companies on their list that had data processing installations, with or without computers. Consequently, some teams conducted more than 45 interviews since more than 60 per cent of the companies on their list had installations. The interviewing teams talked with data processing managers in 353 businesses. Six teams reported one refusal each, and the other team reported two refusals by the firms they contacted. Thus, approximately 98 per cent of the companies contacted agreed to talk with the interviewers. In most cases, the refusals were due to the fact that the companies were in the midst of a change-over from one computer to another or were converting from a unit record system to a computer system so the data processing manager was not available. Most of the companies invited the interviewers to come back at a later date, but this was impossible because of the distances involved and the time limits within which the teams had to work (see Appendix C-2 for list of companies interviewed).

Description of the Sample

Of the 353 data processing installations studied, 275 used computers and 78 had only unit record equipment. The businesses were located in 39 states and 148 cities. Table 5-1 shows how the businesses in the sample were distributed throughout the regions of the United States compared with the distribution of companies surveyed by the DPMA in their annual data processing salary survey (3).

Although an analysis showed that the two distributions were not the same, no information is available about the proportion of the return that the 2,324 businesses in the DPMA survey represents nor was any information given about the number of businesses to whom questionnaires were sent. The DPMA does not make clear in their report whether any of the data processing installations in their study were operating with no computer, while in the present study 78 of the 353 (22 per cent) of the data processing departments were unit record installations.

Since the Dun and Bradstreet Directory constituted the source of the sample selected for this present study, no government or educational installations were included in the present study.

Table 5-1. Geographic Distribution of Businesses in the Sample

| Area | DPMA Sample Salary Survey 1966 | | Current Study Sample | |
|---|---|---|---|---|
| | N | % | N | % |
| New England | 195 | 8.4 | 35 | 9.9 |
| Middle Atlantic | 455 | 19.6 | 60 | 17.0 |
| South Atlantic | 262 | 11.3 | 30 | 8.5 |
| East South Central | 53 | 2.3 | 12 | 3.4 |
| West South Central | 118 | 5.1 | 42 | 11.9 |
| East North Central | 598 | 25.7 | 80 | 22.7 |
| West North Central | 267 | 11.5 | 36 | 10.2 |
| Mountain | 83 | 3.6 | 19 | 5.4 |
| Pacific | 293 | 12.6 | 39 | 11.0 |
| Total | 2324 | | 353 | |

The companies were classified according to the major SIC categories and Table 5-2 shows how they were distributed into these classifications. (For a more detailed summary of the distribution of the kinds of businesses in the regions of the country, see Appendix C-3).

Table 5-2. Distribution of Businesses by Standard Industrial Classification

| Type of Industry | Number |
|---|---|
| Agriculture, forest, and fisheries | 2 |
| Mining and petroleum | 10 |
| Contract construction | 5 |
| Manufacturing | 158 |
| Transportation, public utilities, communication | 32 |
| Wholesale, retail | 54 |
| Finance, real estate, insurance | 79 |
| Service industries | 13 |
| Total | 353 |

<u>Size of the companies</u>. The businesses ranged in size from relatively small companies with under 40 employees to companies with over 3,000 employees. The sizes of the data processing departments varied greatly, with 14 companies (with computer installations) reporting between 1 and 4 data processing employees and 7 companies in which over 290 employees worked in the data processing department (Table 5-3). The median number of employees in data processing departments in the present study was 19. This was approximately the same as the median number reported by DPMA in the 1966 data processing salary survey (5). An analysis revealed that the differences between the two distributions of sizes of data processing departments are no larger than could be accounted for by chance.

Table 5-3. Number of Data Processing Employees in Companies with Computer Installations (% of Companies Employing Reported Number of Employees)

| Employees | Companies N=275 | DPMA Sample N=2324 |
|---|---|---|
| 1-4 | 5.09 | 4.1 |
| 5-9 | 19.27 | 16.3 |
| 10-17 | 24.00 | 20.5 |
| 18-30 | 18.91 | 19.6 |
| 31-50 | 16.36 | 15.8 |
| 51-80 | 4.73 | 9.6 |
| 81-125 | 5.82 | 6.9 |
| 126-192 | 2.18 | 3.5 |
| 193-290 | 1.09 | 1.7 |
| Over 290 | 2.55 | 2.0 |

The percentage of employees in data processing in the businesses selected for this study compares favorably with the number of data processing employees who completed the questionnaires left with them (Table 5-4).

Table 5-4. Number of Data Processing Employees in Businesses Interviewed and Employee Questionnaires Returned

| Job Title | Total Employees N | % | Questionnaires Returned N | % |
|---|---|---|---|---|
| Key punch operator | 4,312 | 40.4 | 835 | 39.0 |
| Tape librarian | 205 | 2.0 | 26 | 1.2 |
| Unit record equipment operator | 1,618 | 15.2 | 373 | 17.4 |
| Computer operator | 1,347 | 12.6 | 275 | 12.9 |
| Programmer | 2,114 | 19.8 | 332 | 15.5 |
| Data processing supervisor | 531 | 5.0 | 160 | 7.5 |
| Systems analyst | 544 | 5.1 | 138 | 6.5 |
| Totals | 10,671 | | 2,139 | |

When an analysis of the proportion of men to women in data processing jobs was made, comparing the total number of data processing employees in the 353 businesses and the number of questionnaires returned from each job category, a discrepancy is noted only in the job of tape librarian (Table 5-5). The information supplied by the 26 librarians who completed the questionnaire revealed that 22.5 per cent of them were men whereas the total number of male tape librarians in the 353 businesses was 34.1. This may perhaps be explained by the small number of tape librarians (only 70) in all of the companies surveyed.

Table 5-5. Proportions of Men and Women Employed in Data Processing Jobs, by Total Employed in Businesses Interviewed and by Employee Questionnaires Returned

| Job Title | Total Employed | | | | | Questionnaires Returned | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Men N | % | Women N | % | Total | Men N | % | Women N | % | Total |
| Key punch operator | 67 | 1.6 | 4,245 | 98.4 | 4,312 | 17 | 2.0 | 818 | 98.8 | 835 |
| Tape librarian | 70 | 34.1 | 135 | 65.9 | 205 | 3 | 11.5 | 23 | 88.5 | 26 |
| Unit record equipment operator | 1,030 | 63.6 | 588 | 36.4 | 1,618 | 210 | 56.3 | 163 | 43.7 | 373 |
| Computer operator | 1,213 | 90.1 | 134 | 9.9 | 1,347 | 226 | 82.2 | 49 | 17.8 | 275 |
| Programmer | 1,749 | 82.7 | 365 | 17.3 | 2,114 | 273 | 82.2 | 59 | 17.8 | 332 |
| Data processing supervisor | 487 | 91.7 | 44 | 8.3 | 531 | 149 | 93.1 | 11 | 6.9 | 160 |
| Systems analyst | 502 | 92.3 | 42 | 7.7 | 544 | 130 | 94.2 | 8 | 5.8 | 138 |
| Totals | 5,118 | 47.9 | 5,553 | 52.1 | 10,671 | 1,008 | 47.1 | 1,131 | 52.9 | 2,139 |

Size of data processing installations. In comparing the distribution of the number of companies according to the monthly rental spent for data processing equipment, the present sample seems to have in it more smaller installations than did the DPMA 1966 salary survey sample (Table 5-6).

Table 5-6. Monthly Rental for Total Data Processing Equipment

| | Total Companies N=300* | | Companies with Computers | | DPMA Sample N=2324 |
|---|---|---|---|---|---|
| Dollars | N | % | N | % | % |
| Up to $3,000 | 94 | 31.33 | 28 | 12.33 | 14.2 |
| $3,001-6,000 | 67 | 22.33 | 62 | 27.31 | 18.5 |
| $6,001-12,000 | 74 | 24.67 | 72 | 31.72 | 25.3 |
| $12,001-25,000 | 31 | 10.33 | 31 | 13.66 | 19.8 |
| $25,001-50,000 | 15 | 5.00 | 15 | 6.61 | 12.0 |
| Over $50,000 | 19 | 6.33 | 19 | 8.37 | 10.1 |

*Fifty-three of the businesses reported that they own their data processing equipment or have some other arrangement (leased-time, etc.) for use of data processing equipment.

This is perhaps due to the number of unit record installations reported in the present sample since omitting the unit record installations makes the distribution more like that reported by DPMA. Considering only computer installations, the median rental falls in the $6,000-12,000 bracket, which is also the median category of the DPMA sample.

When data processing departments were categorized according to computer rental (Table 5-7), the present sample seems to include a greater proportion of smaller computers than does the DPMA sample, although the median computer rental for both samples falls in the $6,000-12,000 category.

Table 5-7. Monthly Computer Rental

| Dollars | Current Survey N | Current Survey % | DPMA Survey % |
|---|---|---|---|
| Up to $3,000 | 42 | 19.4 | 9.6 |
| $3,001-6,000 | 61 | 28.2 | 21.7 |
| $6,001-12,000 | 56 | 25.9 | 28.4 |
| $12,001-25,000 | 29 | 13.4 | 19.6 |
| $25,001-50,000 | 9 | 4.2 | 11.3 |
| Over $50,000 | 19 | 8.8 | 9.4 |
| Total | 216* | | 2,422 |

*Sample includes only those companies actually renting computers and excludes those that owned them or had other arrangements for using computers.

Types of equipment in data processing installations. The companies visited reported using a variety of equipment, both in unit record and computer installations (Table 5-8). Apparently, because of the amount of input which can be processed by the computers, each computer installation had almost four times as many key punches as did the unit record installations. Reflecting the importance of accuracy in computer input, verifiers were used to a greater extent in computer installations than in unit record installations.

In comparing the number of computers and other peripheral equipment in the present study with figures published in the 1968 DPMA salary survey (6), the greatest difference seems to be in the number of disc packs and tape drives reported in the two samples. The businesses in the present study reported 5.4 disc packs per installation, but the DPMA report indicated 1.7 disc packs in each computer installation. The situation is reversed for tape drives, in that less than one tape drive was reported per installation in the present study, and the DPMA study shows nearly four tape drives per company.

Table 5-8. Number of Pieces of Data Processing Equipment

| | Current Survey | | | | DPMA 1968(6) Survey |
|---|---|---|---|---|---|
| | Companies with Computers N=275 | | Companies without Computers N=78 | | |
| Equipment | Total | Per Company | Total | Per Company | Per Company |
| Key punch | 2,770 | 10 7 | 209 | 2.7 | |
| Verifier | 1,271 | 4.6 | 66 | 0.8 | |
| Card sorter | 590 | 2.1 | 100 | 1.3 | |
| Reproducer | 330 | 1.2 | 75 | 0.9 | |
| Collator | 384 | 1.4 | 78 | 1.0 | |
| Accounting machine | 338 | 1.2 | 85 | 1.1 | |
| Interpreter | 199 | 0.7 | 26 | 0.3 | |
| Calculating punch | 40 | 0.1 | 44 | 0.6 | |
| Card reader | 364 | 1.3 | 11 | 0.1 | |
| Paper tape equipment | 292 | 1.1 | 7 | 0.1 | |
| Computer | 524 | 1.9 | | | 1.7 |
| Disc pack | 1,489 | 5.4 | | | 1.7 |
| Disc drive | 123 | 0.4 | | | 0.8 |
| Data converter | 67 | 0.2 | | | |
| Tape drive | 209 | 0.8 | | | 3.9 |
| Printer | 442 | 1.6 | | | 1.6 |
| Magnetic tape typewriter | 23 | 0.1 | | | |
| Optical scanner | 18 | 0.1 | | | 0.1 |

## Selecting the Schools

The person in charge of the data processing instructional program was interviewed in the secondary school system in each community in which business interviews were conducted. Also, the person in charge of business data processing was interviewed in any area vocational-technical school and in any public junior college located within a 25-mile radius of the city in which a selected business was situated. Besides interviewing the person in charge of the data processing programs, he and any other data processing teachers were asked to fill out a personal and educational information questionnaire. These questionnaires were either filled out while the interviewer was visiting the institution or they were left for the teachers to complete later and were to be returned by mail as soon as they were completed. Questionnaires were received from 477 data processing teachers in 176 school systems (see Appendix C-4).

## PRELIMINARY STUDY OF DATA PROCESSING EDUCATION

Prior to sending the interviewers to the schools to interview data processing instructional staff, a census survey was planned and conducted, utilizing a one-page optical scanning questionnaire asking whether or not the school offered any data processing courses or whether they were planning any data processing instruction in the next three years, with a brief section in which they could indicate the kinds and extent of instruction offered or planned.

Prior to sending out the optical scanning form, the questionnaire was revised twice and 10 high schools, 10 junior colleges and 10 area vocational-technical schools were asked for criticism and suggestions. Personnel in data processing programs in Denver and the surrounding areas also supplied suggestions. Of the 27 questionnaires sent out, 27 were returned with appropriate comments (see Appendix B-5).

The optical scanning form was sent to all high school districts in the United States, except in Hawaii and Alaska, to all public junior colleges, and to all area vocational-technical schools.

The population of high schools was all secondary school districts listed in the 1964 Directory of Secondary School Districts (21). The junior college list was taken from the 1965 World Almanac.

No current list of area vocational schools was available, so a letter was written to each of the state directors of vocational education in each of the states, asking for a list of the public vocational schools in his state, together with the name of the administrator of that school.

All questionnaires were addressed to the chief administrator of each school. A total of 10,885 questionnaires was mailed, of which 10,278 (94.4 per cent) were returned.

PART II

# CHAPTER VI

## KEY PUNCH OPERATOR*

More than 98 per cent of the key punch operators in the businesses contacted in this study were women, who had found their jobs primarily through school contacts, advertising, and through efforts of private employment agencies.

## CHARACTERISTICS OF KEY PUNCH OPERATOR'S JOB

The key punch job may be classified in the general clerical or office machines category in which the primary duty of the employee is operation of the key punch machine. Other duties, however, are performed by these people. Over a fourth of the key punch operators indicated that they verified punched cards, operated interpreters, sorters, and reproducers. Several of the key punch personnel also operated typewriters, collators, and accounting machines. About 11 per cent of them did some supervisory work and had some clerical duties.

### Work Experience Required

Key punch operators can obtain jobs if they have had as little as six months of experience in data processing (Table 6-1). This opinion was expressed by 82 per cent of the managers, although 15 per cent of them would not accept for employment applicants with less than six months experience in the past. However, over 62 per cent of them would prefer more than that amount of experience and nearly 29 per cent would prefer that applicants for the key punch job have at least a year or more of experience before hiring them.

### Educational Requirements

Data processing managers indicated that a high school education was sufficient for key punch operators, and since almost all (95 per cent) of them had completed at least this amount of education, apparently the educational level preferred by the managers is being satisfied. However, about 30 per cent of the management personnel interviewed said they would like to have key punch operators with some additional training either in a specialized school or in junior college or vocational school after high school graduation.

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*The job description of key punch operator is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 6-1. Amount of Data Processing Experience Prior to Employment as a Key Punch Operator
(% of Managers Indicating Stated Amount)

| Months | Minimum Acceptable | Amount Preferred |
|---|---|---|
| 0 - 6 | 82.2 | 37.9 |
| 7 - 12 | 14.9 | 34.4 |
| 13 - 24 | 2.6 | 19.2 |
| 25 - 36 | 0.0 | 6.1 |
| More than 36 | 0.3 | 2.3 |

General education. When managers were asked to list general areas of study they felt would be beneficial for key punch operators, they listed communications as being of prime importance, both written and oral, along with algebra. To a lesser extent they suggested psychology and logic as good background for these employees.

The employees themselves were asked to list general high school courses which they considered helpful in their work, and they were in agreement on the importance of such courses as general and advanced mathematics, English and social science. Mathematics and English were areas in which such employees felt they could profit by more training.

Key punch operators with some post high school training felt they should have training in about the same background courses as in high school, general mathematics, English, and psychology; and they also, to a certain extent, noted a need for advanced mathematics.

Business courses. Among high school business courses of most value to key punch operators in their job, typing (66.3 per cent) ranked highest by a great margin, although some of the responses indicated that bookkeeping and introduction to business were helpful courses.

Shorthand was listed most frequently as the least helpful course, and about 10 per cent of the key punch operators listed bookkeeping as not helpful; about 3 per cent of them felt that they had little help from introduction to business.

In the business skills, the people with some post high school training pointed out a need for knowledge of data processing equipment, typing, and to a certain extent, calculating machines; some listed accounting principles and business mathematics as desirable business background. At this level, too, shorthand was considered by these people to be their least helpful course.

Management responses regarding high school business courses these employees should study indicated key punch and typing to be most important (87 per cent). About half this number of the managers felt that these employees should also have some background in concepts of data processing, and about a third of the managers felt that prospective key punch operators should have some experience with other unit record equipment. More generally speaking, however, management would like to hire key punch operators with training in introduction to business, records management, or office management.

Promotion, Supervision, Overtime, and Salaries

The key punch operator's chance for advancement is relatively low; over 60 per cent of the managers indicated these employees have a low probability to little or no chance for promotion. They tend to be promoted to the position of unit record equipment operator, with about half as many managers indicating they might become computer operators, provided they had sufficient interest and aptitude.

Key punch operators work under considerable supervision, with supervision provided continuously or several times a day. More than half of the firms reported that their key punch operators average up to 3 hours of overtime a week, and between 15 and 20 per cent of them indicated that key punch operators might work as much as 7 hours a week overtime.

The median monthly salary for key punch operators was $340 (Table 6-2). Out of 835 key punch operators in the study, 27 reported salaries under $200 a month, a little more than 30 per cent of the girls reported that their monthly salary was between $200 and $299; but 23 reported salaries of over $600 a month, with 13 of them receiving as much as $1,000. However, six of the highest paid operators had been with their companies for more than ten years, and ten of them had been there over five years.

Apparently education has less influence on salary than does experience in data processing (Tables 6-2 and 6-3). The median salary is about the same for key punch operators with different amounts of education. However, for those with less than three years of experience and for those with more than ten years, the medians are below and above the median for the entire group. For those with less than one year of experience in data processing jobs, the median salary is less than $300 a month, $310 for those with one to three years of

Table 6-2. Salaries Paid Key Punch Operators According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| Under $200 | 4 | 16 | 7 | | 27 |
| $200-299 | 8 | 133 | 119 | 1 | 261 |
| $300-399 | 17 | 174 | 140 | 4 | 335 |
| $400-499 | 10 | 95 | 51 | | 156 |
| $500-599 | 1 | 20 | 11 | 1 | 33 |
| $600-699 | 1 | 4 | 2 | 1 | 8 |
| $700-799 | | 1 | | | 1 |
| $800-899 | | | | | 0 |
| $900-999 | | | | 1 | 1 |
| $1,000+ | 1 | 9 | 3 | | 13 |
| Totals | 42 | 452 | 333 | 8 | 835 |



3

Table 6-3. Salaries Paid Key Punch Operators According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 Years or More | Total |
|---|---|---|---|---|---|---|
| Under $200 | 15 | 5 | 2 | 3 | 2 | 27 |
| $200-299 | 127 | 76 | 30 | 19 | 9 | 261 |
| $300-399 | 42 | 68 | 85 | 88 | 52 | 335 |
| $400-499 | 3 | 21 | 20 | 57 | 55 | 156 |
| $500-599 | | | 1 | 12 | 20 | 33 |
| $600-699 | 1 | 1 | | | 6 | 8 |
| $700-799 | | | | | 1 | 1 |
| $800-899 | | | | | | 0 |
| $900-999 | | | | | 1 | 1 |
| $1,000+ | 2 | | 1 | 4 | 6 | 13 |
| Totals | 190 | 171 | 139 | 183 | 152 | 835 |

experience. Those with three to ten years of data processing experience are paid about the median salary although the range of salaries for this group goes up as high as $1,000 a month. Those with ten years or more of experience have a median salary of about $425 a month.

## DATA PROCESSING TRAINING

Generally speaking, key punch operators had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people to supplement their school training.

### Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for key punch operators prior to their entering employment, indicated that such training might best be secured at school in key punch, typing, and concepts of data processing.

The employees themselves indicated that prior to taking a job in the data processing field, their main source of training (75 per cent of it) was the special data processing school or manufacturers' classes where they learned such skills as key punching and operation of unit record equipment (Table 6-4). Those who indicated having had data processing courses in high school named key punch, data processing concepts and unit record equipment operation as the major areas studied, with more of them having received training on unit record equipment than in key punching.

Key punch operators under the age of 21 received such training in high school classes to a greater extent than did older employees. Those from 26 to 30 years of age tended to have received such training in the special data processing schools or in private business schools. As the age of the key punch operators rises, the proportion of them who have received training in a manufacturers' school prior to entering data processing work also rises.

### Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the key punch operators indicated they were trained on the job (Table 6-5). To a considerably lesser extent, key punch operators were sent by their employers to the manufacturers' schools. Over 77 per cent of the training in data processing listed by the operators themselves was received on the job, not only in key punching, but again more of it in unit record equipment.

Table 6-4. Training and Place of Training of Key Punch Operators in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Total |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 2 | 0 | 0 | 17 | 10 | 6 | 2 | 2 | 39 |
| Key punch machine | 32 | 8 | 19 | 148 | 10 | 123 | 5 | 17 | 362 |
| Card sorter | 15 | 10 | 6 | 75 | 30 | 27 | 4 | 12 | 179 |
| Unit records | 67 | 17 | 25 | 153 | 59 | 83 | 14 | 22 | 440 |
| Wiring boards | 10 | 2 | 5 | 34 | 13 | 12 | 1 | 4 | 81 |
| Console operation | 1 | 0 | 2 | 4 | 3 | 5 | 1 | 0 | 16 |
| Access devices | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 |
| Data converting | 0 | 0 | 2 | 2 | 1 | 0 | 2 | 0 | 7 |
| Paper tape equipment | 5 | 0 | 2 | 3 | 1 | 3 | 2 | 0 | 16 |
| Data processing concepts | 41 | 0 | 20 | 64 | 26 | 19 | 5 | 0 | 175 |
| Programming | 5 | 0 | 4 | 15 | 3 | 8 | 0 | 0 | 35 |
| Totals | 178 | 37 | 85 | 516 | 156 | 286 | 37 | 57 | 1,352 |
| Per Cent | 13.1 | 2.7 | 6.3 | 38.1 | 11.5 | 21.1 | 2.7 | 4.2 | |

Table 6-5. Training and Place of Training of Key Punch Operators in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 1 | 5 | 1 | 0 | 27 | 5 | 3 | 42 |
| Key punch machine | 17 | 51 | 13 | 23 | 378 | 41 | 14 | 537 |
| Card sorter | 9 | 9 | 7 | 7 | 277 | 2 | 5 | 316 |
| Unit record | 45 | 31 | 17 | 20 | 891 | 9 | 22 | 1,035 |
| Wiring boards | 4 | 11 | 3 | 3 | 108 | 3 | 6 | 138 |
| Summary punch | 1 | 6 | 0 | 1 | 66 | 1 | 1 | 76 |
| Console operation | 2 | 4 | 3 | 0 | 29 | 0 | 2 | 40 |
| Access devices | 0 | 2 | 0 | 0 | 12 | 0 | 0 | 14 |
| Converting equipment | 0 | 0 | 2 | 0 | 15 | 0 | 1 | 18 |
| Paper tape equipment | 7 | 0 | 2 | 2 | 25 | 0 | 2 | 38 |
| Data processing concepts | 3 | 9 | 4 | 18 | 19 | 8 | 5 | 66 |
| Programming | 1 | 5 | 0 | 7 | 3 | 3 | 2 | 21 |
| Data processing applications | 2 | 0 | 0 | 1 | 17 | 1 | 0 | 21 |
| Accounting | 1 | 0 | 0 | 10 | 14 | 2 | 4 | 31 |
| Management | 3 | 1 | 1 | 5 | 11 | 4 | 3 | 28 |
| Other business courses | 2 | 0 | 0 | 4 | 7 | 6 | 0 | 19 |
| Totals | 98 | 134 | 53 | 101 | 1,899 | 85 | 70 | 2,440 |
| Per Cent | 4.0 | 5.5 | 2.2 | 4.1 | 77.8 | 3.5 | 2.9 | |

Evaluation of Their Educational Preparation

In general, over 75 per cent of the key punch operators indicated that their education had adequately prepared them for their jobs or had prepared them very well. However, those with some data processing background in their educational experience were considerably more satisfied with their preparation than the others, with only 9.5 per cent of the trained key punch operators saying their preparation was inadequate.

## DATA PROCESSING EXPERIENCE

Most of the employees who had been with their companies less than three years apparently had received all their data processing experience in their present company, since 496 of the key punch operators had been with their companies up to three years; only 361 of them had had as much as three years of experience in data processing jobs (Table 6-6).

Table 6-6. Amount of Experience Reported by Key Punch Operators

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 year | 190 | 282 |
| 1 - 3 years | 171 | 214 |
| 3 - 5 years | 139 | 113 |
| 5 - 9 years | 183 | 125 |
| 10 or more years | 152 | 101 |
| Total | 835 | 835 |

Most of the key punch operators indicated that their only data processing experience was in key punching; about 8 per cent of them had worked as tab operators or had done some supervisory work previously.

Key punch operators who had had other types of experience in business offices indicated they had work in general clerical work (29 per cent), sales and service occupations (23.7 per cent), stenographer-typist (16.2 per cent), and in accounting work (7.8 per cent). About 8 per cent of the key punch operators had also done factory work.

## CHARACTERISTICS OF KEY PUNCH OPERATORS

Key punch operators were characterized by data processing managers as being people who like routine, who like to know just exactly what they are to do and how to do it; they are relatively stable emotionally and can work under pressure, an important characteristic since data processing personnel are frequently called on to do rush jobs and do work under pressure.

The leisure time interests of these people are rather wide, with the greater number of them indicating interest in the arts and crafts, reading and participating in sports, and to some extent in hunting and camping. They think puzzles are "O.K.," but over a sixth of them said they hated puzzles, which was considerably greater proportion than in any other job category.

## ATTITUDES TOWARD DATA PROCESSING AND THEIR JOBS

Generally speaking, key punch operators enjoy working in the data processing field and plan to remain in it, with nearly 90 per cent of them expressing their satisfaction with the field (Table 6-7). The proportions of people who stated that they enjoyed the field was the same whether or not they had had data processing training before entering the field.

Key punch operators felt that their work was interesting, and they liked their co-workers as well as the type of their job. Too, they felt that the work experiences they had were valuable and varied and that their working conditions were good.

However, certain features of the job were a source of dissatisfaction to the key punch operators. Among the dissatisfactions were the rush jobs that caused them to have to work under pressure, the monotony and certain physical aspects of the job ("having to sit eight hours a day" and the noise).

Table 6-7. Attitude of the Key Punch Operator Toward Data Processing Work

| Training | Enjoy-Will Remain | | Enjoy-Desire Change | | Dislike-Will Remain | | Dislike-Desire Change | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Without training | 340 | 89.7 | 28 | 7.4 | 8 | 2.1 | 3 | 0.8 | 379 |
| With training | 388 | 89.4 | 30 | 6.9 | 12 | 2.6 | 4 | 0.9 | 434 |
| Totals | 728 | 89.5 | 58 | 7.1 | 20 | 2.5 | 7 | 0.9 | 813 |

## SUMMARY

JOB: Key Punch Operator

Duties:

1. Punch Cards
2. Verify Punched Cards
3. Operate
   a. Interpreter
   b. Sorter
   c. Reproducer
   d. Collator
   e. Accounting Machine
   f. Typewriter
4. Supervise Key Punch Operators
5. Clerical Duties

Supervision Required:

Several Times Daily

Education:

Minimum: High School

Desired: High School

General Courses (High School):
1. General Math
2. Advanced Math
3. English
4. Key Punch Machine
5. Typing
6. Data Processing Theory
7. Unit Record
8. Oral and Written Communications
9. Algebra
10. Psychology
11. Logic and Philosophy
12. Social Science

Education (continued):

Business Courses (High School):
1. Introduction to Business
2. Record Management
3. Office Management
4. Typing
5. Bookkeeping
6. Office Procedures
7. Business Math

General Courses (Post High School):
1. General Math
2. English
3. Psychology

Business Courses (Post High School):
1. Data Processing Equipment
2. Typing
3. Calculating Machines
4. Accounting Machines
5. Business Math

(Shorthand, Business English and Report Writing were least helpful)

Experience:

Minimum: 3 Months or Less

Desired: 6 Months to 1 Year

Personal Characteristics:

1. 98% are women.
2. Jobs attained through schools, advertising, and private employment agencies.
3. Like routine work and be able to work under pressure.
4. Enjoys her work and desires to remain in it.
5. Generally feel their education adequately prepared them for their jobs, especially those who had training in data processing.
6. Like best the type of job they are doing; dislike having to do rush jobs.

Personal Characteristics (continued):

7. Hobbies are arts and crafts, participation in sports, and reading. Puzzles are "okay."

8. The median age is 25 years.

Promotional Probabilities: Low

Promoted to Unit Record Operator, Supervisory and Computer Operators.

Education has little or no effect upon promotion.

Salary:

| | |
|---|---|
| Median: | $340 |
| Men: | $450 |
| Women: | 340 |
| Less than 1 Year Experience | Less than $300 |

# CHAPTER VII

## TAPE LIBRARIAN*

The number of tape librarians in this survey was small (26 people). Sixty-five per cent of the tape librarians were women who had found their jobs primarily through answering advertisements, through promotion, and through friends.

## CHARACTERISTICS OF TAPE LIBRARIANS

The tape librarian may be classified in the general clerical or office machines category in which the primary duty of the employee is filing and registering tapes. Over forty per cent of the tape librarians indicated that they punched cards, verified punched cards, and performed clerical duties. A few of the employees also operated sorters, typewriters, and interpreters in addition to conferring with people concerning computer time for tape runs.

### Work Experience Required

Tape librarians can obtain jobs if they have had as little as six months of experience in data processing (Table 7-1). This opinion was expressed by 86 per cent of the managers. However, 57 per cent of the managers would prefer more than six months of experience and nearly 25 per cent would prefer that applicants for the tape librarian job have at least a year or more of experience before hiring them.

### Educational Requirements

Data processing managers indicated that a high school education was sufficient for tape librarians (95 per cent), and since almost all the tape librarians (96 per cent) had completed at least this amount of education, apparently the educational level preferred by the managers is being satisfied. However, about 27 per cent of the management personnel interviewed said they would like to have tape librarians with some additional training after high school graduation.

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*The job description of a tape librarian is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 7-1. Amount of Data Processing Experience Prior to Employment as a Tape Librarian
(% of Managers Indicating Stated Amount)

| Months | Minimum Acceptable | Amount Preferred |
|---|---|---|
| 0 - 6 | 86.0 | 42.2 |
| 7 - 12 | 7.8 | 32.8 |
| 13 - 24 | 4.7 | 20.4 |
| 25 - 36 | 1.6 | 4.7 |
| More than 36 | | |

General education. When managers were asked to list general areas of study they felt would be beneficial for tape librarians, they listed communications as being of prime importance, both written and oral, along with algebra. To a lesser extent they suggested logic and social science as good background for these employees.

The employees themselves were asked to list general high school courses which they considered helpful in their work, and they were in agreement on the importance of such courses as general and advanced mathematics and English.

Tape librarians with some post high school training felt their training in English had been the most helpful.

Business and data processing courses. Among high school business courses of most value to tape librarians in their jobs, typing (38 per cent) and introduction to business (27 per cent) ranked highest. Shorthand and bookkeeping were listed most frequently as the least helpful courses.

In the business skills, the people with some post high school training pointed out that typing was the most valuable course for them. Data processing equipment was considered by these people to be their least helpful course (only 3 persons out of the 26); and other courses, mentioned by 2 persons each, were calculating machines, typing, office procedures, business English, and introduction to business. The managers felt that these employees should have some background in records management and introduction to business.

## Promotion, Supervision, Overtime, and Salaries

The tape librarian's chance for advancement is relatively low; 48 per cent of the managers indicated these employees have a low probability to little or no chance for promotion. A few managers said that they could be promoted to computer operator or to programmer, provided they had sufficient interest and aptitude.

Tape librarians work under supervision as needed daily. About one-half of the firms reported that their tape librarians work no overtime with about one-fourth of them indicating that tape librarians might work overtime up to 3 hours weekly.

The median monthly salary for tape librarians was $425 (Table 7-2).

Table 7-2. Salaries Paid Tape Librarians According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| $200-299 | | 7 | | | 7 |
| $300-399 | | 2 | 1 | | 3 |
| $400-499 | 1 | 9 | 2 | | 12 |
| $500-599 | | 1 | 2 | | 3 |
| $600-699 | | 1 | | | 1 |
| Totals | 1 | 20 | 5 | 0 | 26 |

Seven of the 26 people received less than $330 per month and none received over $700 per month.

Apparently, education has less influence on salary than does experience in data processing (Tables 7-2 and 7-3). The median salary is about the same for tape librarians with different amounts of education. However, for those with less than one year of experience, the median is considerably below the entire group. For those with less than one year of experience in data processing jobs, the median salary is about $333 a month, $450 for those with three to five years of experience. Those with ten years or more of experience have a median salary of about $450 a month.

Table 7-3. Salaries Paid Tape Librarians According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 Years or More | Total |
|---|---|---|---|---|---|---|
| $200-299 | 6 | 1 | | | | 7 |
| $300-399 | 1 | 1 | | 1 | | 3 |
| $400-499 | 1 | 1 | 5 | 3 | 2 | 12 |
| $500-599 | | | | 2 | 1 | 3 |
| $600-699 | | | | | 1 | 1 |
| Totals | 8 | 3 | 5 | 6 | 4 | 26 |

## DATA PROCESSING TRAINING

Generally speaking, tape librarians had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people to supplement their school training.

### Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for tape librarians prior to their entering employment indicated that such training might best be secured at school for data processing theory, typing, and introduction to computer theory and logic.

The employees themselves indicated that prior to taking a job in the data processing field, their main source of training (27 per cent) was in private business schools, where they learned the skill of operation of unit record equipment (Table 7-4). Those who indicated having had data processing courses in high school named data processing concepts as the major area studied. Tape librarians under the age of 21 received such training in high school classes to a greater extent than did older employees.

Table 7-4. Training and Place of Training of Tape Librarians in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Total |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Key punch machine | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| Card sorter | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| Unit records | 1 | 5 | 2 | 0 | 4 | 0 | 0 | 0 | 12 |
| Wiring boards | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 3 |
| Console operation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Access devices | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Data converting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Paper tape equipment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Data processing concepts | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| Programming | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Totals | 6 | 9 | 4 | 0 | 7 | 0 | 0 | 0 | 26 |
| Per Cent | 23.1 | 34.6 | 15.4 | 0 | 26.9 | 0 | 0 | 0 | |

### Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the tape librarians indicated they were trained on the job (Table 7-5). To a considerably lesser extent tape librarians were sent by their employers to the manufacturers' schools. About 40 per cent of the training in data processing listed by the operators themselves was received on the job in operating unit records equipment. Other training on the job included the operation of the key punch machine and card sorter.

### Evaluation of Their Educational Preparation

In general, over 66 per cent of the tape librarians indicated that their education had adequately prepared them or had prepared them very well for their jobs. Those with some data processing background in their educational experience were more satisfied with their preparation than the others. Two of the five trained tape librarians said their preparation was inadequate.

## DATA PROCESSING EXPERIENCE

Almost half of the employees had been with their companies over five years (Table 7-6). Apparently all of the tape librarians had received all their data processing experience in their present companies, since all but four of them had been with their present company longer than they had been in data processing.

Tape librarians who had had other types of experience in business offices indicated they had work in sales and service occupations (54 per cent), accounting (23 per cent), and clerical (19 per cent).

## CHARACTERISTICS OF THE TAPE LIBRARIAN

Tape librarians were characterized by data processing managers as being people who like detail work and who were thorough in the performance of their duties, who are perfectionistic, and who are emotionally stable and can work well under pressure.

The leisure time interests of these people include participating in sports, reading, and arts and crafts. All of them enjoy puzzles or think they are "O.K."

Table 7-5. Training and Place of Training of Tape Librarians in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 4 |
| Key punch machine | 1 | 3 | 2 | 0 | 13 | 2 | 0 | 21 |
| Card sorter | 0 | 3 | 0 | 0 | 12 | 2 | 0 | 17 |
| Unit record | 3 | 14 | 2 | 0 | 30 | 6 | 0 | 55 |
| Wiring boards | 0 | 4 | 0 | 2 | 1 | 0 | 0 | 7 |
| Summary punch | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 4 |
| Console operation | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 5 |
| Access devices | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| Converting equipment | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 3 |
| Paper tape equipment | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| Data processing concepts | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| Programming | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 3 |
| Data processing applications | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 6 |
| Accounting | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| Management | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 |
| Other business courses | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Totals | 7 | 30 | 4 | 4 | 75 | 17 | 1 | 138 |
| Per Cent | 5.1 | 21.7 | 2.9 | 2.9 | 54.3 | 12.3 | .7 | |

Table 7-6. Amount of Work Experience Reported by Tape Librarians

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 year | 8 | 8 |
| 1 - 3 years | 3 | 2 |
| 3 - 5 years | 5 | 2 |
| 5 - 9 years | 6 | 8 |
| 10 or more years | 4 | 6 |
| Totals | 26 | 26 |

## ATTITUDES TOWARD DATA PROCESSING AND THEIR JOBS

All of the tape librarians enjoy their work in the data processing field and plan to stay with their jobs; there was no difference whether or not they had data processing training before going on the job.

Tape librarians liked the variety of their jobs; they felt the work experiences they had were valuable and varied; they found their jobs interesting; and they enjoyed the working conditions. They found dissatisfaction with the job in that there were too many rush jobs, a likely characteristic of the job to dislike because of the perfectionist nature of these people.

## SUMMARY

**JOB:** Tape Librarian

**Duties:**

1. Operate Data Processing Machines
   a. Key Punch
   b. Sorter
   c. Typewriter
   d. Interpreter

2. Handle Clerical Tasks
   a. File Register Tape
   b. Verify Punched Cards

3. Confer Regarding Computer

**Supervision Required:**

Only as Needed

**Education:**

Minimum: High School

Desired: High School

General Courses (High School):
1. General Math
2. Advanced Math
3. English

Business Courses (High School):
1. Typing
2. Introduction to Business

General Courses (Post High School):
Sample too small to be meaningful

Business Courses (Post High School):
Sample too small to be meaningful

Management Recommendations:
1. Oral and Written Communications
2. Algebra
3. Social Science

Experience:

Minimum: 3 Months or Less

Desired: 6 Months to 1 Year

Personal Characteristics:

1. 65% are women.
2. Jobs attained through promotion, advertising, and friends of the employee.
3. Tape librarians should like detail work, should be a perfectionist, and should be accurate and orderly.
4. The tape librarian enjoys her work and desires to remain in it.
5. Tape librarians feel education is adequate; majority indicated no data processing training prior to present job.
6. The tape librarian likes best the variety of the job; she likes least rush jobs.
7. Hobbies are reading, participation in sports, some arts and crafts. Puzzles are "okay" or enjoyed.
8. The median age is 28 years.

Promotional Probabilities: Low to Average

Promoted to Computer Operators or Programmers.

Education has some effect on promotion.

Salary:

Median: $425

## CHAPTER VIII

## UNIT RECORD EQUIPMENT OPERATOR*

About two-thirds of the unit record operators in the businesses contacted in this study were men whose jobs had been secured principally through the facilities of private employment agencies and by answering help wanted ads.

### CHARACTERISTICS OF THE JOB OF THE UNIT RECORD EQUIPMENT OPERATOR

The unit record equipment operator, commonly referred to as the tab operator, generally is responsible for the operation of the accounting machine which automatically performs the data processing operations of calculating and printing. The operator of the record equipment operates several other kinds of machines and wires boards for programming a particular operation. Over three-fourths of these employees operate the sorter, the reproducer, and the interpreter, with 63 per cent operating the collator, in addition to operating the accounting machine. Over three-fifths of the unit record equipment operators punch cards, and wire collator and reproducer boards; and over 40 per cent of them wire interpreter and accounting machine boards.

#### Amount of Work Experience Prior to Employment

Although unit record equipment operators can get jobs with less than six months of previous experience in data processing, 33 per cent of the managers would prefer that they have from six to twelve months of such experience (Table 8-1). About 35 per cent said that at least six months of experience is a minimum requirement for getting a job in their firms, and 3 per cent of them require applicants to have worked in data processing for more than two years before they would be considered for a job in their data processing department.

#### Educational Requirements

Data processing managers indicated that a high school education was sufficient for unit record operators; and since almost all (94 per cent) of them had completed at least this amount of education, they are meeting the minimum amount of education acceptable by the managers.

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*The job description of the unit record equipment operator is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 8-1. Amount of Data Processing Experience Prior to Employment as a Unit Record Equipment Operator
(% of managers indicating stated amount)

| Months | Minimum Acceptable | Amount Preferred |
|---|---|---|
| 0 - 6 | 65.1 | 29.4 |
| 7 - 12 | 16.7 | 33.1 |
| 13 - 24 | 4.9 | 26.9 |
| 25 - 36 | 2.0 | 4.9 |
| 37+ | 1.2 | 5.7 |

However, 55 per cent of the managers said they would prefer more than a high school education for their unit record operators, and 44 per cent of the operators had completed some education beyond high school.

General education. When managers were asked to list general areas of study that they felt would be beneficial for unit record operators, they listed communications as being of prime importance, both oral and written, along with algebra. They also listed logic and social science as good background for these employees.

The employees themselves were asked to list general high school courses that they considered helpful in their work, and they were in agreement on the importance of such courses as general mathematics, English, and social science. Mathematics and English were areas in which such employees felt they could profit by more training.

Tab operators with some post high school training felt they should have about the same background courses as in high school, particularly mathematics and English, and also they indicated a need for more social science.

Business courses. Among high school business courses of most value to them in their jobs, 68 unit record equipment operators named typing and 69 said bookkeeping. These two courses ranked highest by a great margin, although some responses indicated that business mathematics and introduction to business were helpful courses.

Shorthand was listed most frequently as the least helpful course; and nearly the same number (65) indicated that typing was the least helpful course as listed it as the most helpful course. Introduction to business was considered of little help by 13 of the unit record operators. Regarding business skills, the people with some post high school training pointed out a need for knowledge of data processing equipment, and to a certain extent, calculating machines and typing; some listed accounting principles and intermediate accounting and business mathematics as desirable business background. At this level, also, shorthand was considered by these people to be their least helpful course.

Management responses regarding high school business courses these employees should study indicated unit record equipment, wiring boards, key punch, and data processing theory to be most important (about 70 per cent). Slightly over half this number of the managers felt that these employees should also have some background in flow charting, data processing applications, typing, calculating machines, introduction to computer theory and logic, and computer console operation. More generally speaking, however, management would like to hire unit record operators with training in principles of accounting, introduction to business, introduction to systems, and records management in addition to the data processing courses.

Promotion, Supervision, Overtime, and Salaries

The unit record equipment operator's chance for advancement is average to high; 75 per cent of the managers indicated these employees have an average to high probability for promotion. They tend to be promoted to the position of computer operator or programmer.

Tab operators are supervised quite closely, with supervision provided several times a day. Over 65 per cent of the firms reported that their unit record operators average up to 3 hours of overtime a week, and about 40 per cent of them indicated that unit record operators worked from 4 to 12 hours a week overtime.

About 40 per cent of the unit record equipment operators had been with their companies for over five years and about 20 per cent of them had been in the firm over 10 years. On the other hand, over one-fourth of the tab operators had been employed by their firm for less than a year.

The median monthly salary for unit record operators was $428 (Table 8-2). Out of 374 unit record operators in the study, one-sixth reported salaries under $200 a month, and 8 per cent reported salaries of over $600 a month.

Apparently education has less influence on salary than does experience in data processing (Tables 8-2 and 8-3). The median salary is about the same for unit record operators with different amounts of education (a range of from $416 to $436 per month). However, for those with less than three years of experience and for those with more than five years, the medians are below and above the median for the entire group. For those with less than one year of experience in data processing jobs, the median salary is $333 a month. Those with 10 years of data processing experience are paid about $499 a month ($70 above the median). Also, the male tab operators have a median salary about $90 a month more than women accounting machine operators.

Table 8-2. Salaries Paid Tab Operators According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| Under $200 | 2 | 3 | 1 | 2 | 8 |
| $200-299 | 4 | 33 | 14 | 1 | 52 |
| $300-399 | 8 | 49 | 36 | 1 | 94 |
| $400-499 | 8 | 50 | 58 | 2 | 118 |
| $500-599 | 1 | 37 | 28 | 3 | 69 |
| $600-699 | | 9 | 11 | 2 | 22 |
| $700-799 | | 4 | 3 | | 7 |
| $800-899 | | | | 1 | 1 |
| $900-999 | | | | | |
| $1000+ | | 1 | 2 | | 3 |
| Totals | 23 | 186 | 153 | 12 | 374 |

Table 8-3. Salaries Paid Tab Operators According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 years or More | Total |
|---|---|---|---|---|---|---|
| Under $200 | 6 | 2 | | | | 8 |
| $200-299 | 22 | 16 | 7 | 3 | 4 | 52 |
| $300-399 | 27 | 19 | 14 | 20 | 14 | 94 |
| $400-499 | 14 | 32 | 22 | 28 | 22 | 118 |
| $500-599 | 4 | 5 | 6 | 29 | 25 | 69 |
| $600-699 | | 1 | 2 | 8 | 11 | 22 |
| $700-799 | | | | 2 | 5 | 7 |
| $800-899 | | | | | 1 | 1 |
| $900-999 | | | | | | |
| $1000+ | | | | 3 | | 3 |
| Totals | 73 | 75 | 51 | 93 | 82 | 374 |

DATA PROCESSING TRAINING

Generally speaking unit record equipment operators had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people.

## Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for unit record equipment operators prior to their entering employment, indicated that such training might best be secured at school in unit record equipment, wiring boards, data processing concepts, key punch, flow charting and data processing applications.

The employees themselves indicated that prior to taking a job in the data processing field, their main source of training was the special data processing school, where they learned such skills as operation of unit record equipment, data processing concepts, and wiring boards (Table 8-4). Most of the training in operating equipment (61 per cent) was received in special data processing schools and in equipment manufacturers' classes. Those who indicated having had data processing courses in high school named data processing concepts (11 per cent) as the major area studied.

Tab operators under the age of 21 received their training in both special data processing schools and private business schools, whereas the older employees received their training more often only in the data processing schools. As the age of unit record operators rises, the proportion of them who have received training in a manufacturer's school prior to entering data processing work also rises.

## Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the unit record equipment operators indicated they were trained directly on the job (Table 8-5). To a considerably lesser extent, unit record operators were sent by their employers to the manufacturers' schools. Over 70 per cent of the training in data processing listed by the operators themselves was received on the job, not only in accounting machine operation, but also in operating the card sorter, key punch and summary punch, as well as in wiring boards.

## Evaluation of Their Educational Preparation

In general, over 65 per cent of the tab operators indicated that their education had adequately prepared them for their jobs or had prepared them very well. Relatively little difference of opinion about adequacy of their education was found between those with data processing background in their education and those without (70 per cent versus 60 per cent).

Table 8-4. Training and Place of Training of Unit Record Equipment Operators in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Total |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 1 | 0 | 2 | 5 | 5 | 5 | 2 | 0 | 20 |
| Key punch machine | 3 | 2 | 6 | 54 | 37 | 34 | 21 | 6 | 163 |
| Card sorter | 2 | 4 | 11 | 67 | 28 | 24 | 21 | 1 | 158 |
| Unit records | 13 | 9 | 40 | 281 | 96 | 107 | 85 | 10 | 641 |
| Wiring boards | 1 | 3 | 15 | 67 | 18 | 22 | 17 | 1 | 144 |
| Console operation | 1 | 2 | 5 | 16 | 8 | 9 | 5 | 1 | 47 |
| Access devices | 0 | 1 | 3 | 6 | 2 | 4 | 2 | 1 | 19 |
| Data converting | 3 | 0 | 1 | 4 | 2 | 3 | 2 | 0 | 15 |
| Paper tape equipment | 0 | 0 | 0 | 10 | 3 | 2 | 5 | 0 | 20 |
| Data processing concepts | 31 | 3 | 29 | 102 | 41 | 48 | 23 | 0 | 277 |
| Programming | 0 | 0 | 7 | 31 | 13 | 17 | 4 | 0 | 72 |
| Totals | 55 | 24 | 119 | 643 | 253 | 275 | 187 | 20 | 1,574 |
| Per Cent | 3.5 | 1.5 | 7.6 | 40.9 | 16.1 | 17.5 | 11.9 | 1.3 | |

Table 8-5. Training and Place of Training of Unit Record Equipment Operators in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 0 | 3 | 0 | 4 | 11 | 2 | 0 | 20 |
| Key punch machine | 4 | 24 | 0 | 6 | 151 | 1 | 10 | 196 |
| Card sorter | 5 | 18 | 4 | 14 | 205 | 0 | 11 | 257 |
| Unit record | 23 | 140 | 15 | 52 | 800 | 5 | 49 | 1,084 |
| Wiring boards | 3 | 38 | 5 | 7 | 149 | 2 | 12 | 216 |
| Summary punch | 5 | 24 | 0 | 5 | 118 | 1 | 6 | 159 |
| Console operation | 3 | 18 | 4 | 3 | 61 | 1 | 2 | 92 |
| Access devices | 4 | 7 | 0 | 3 | 14 | 2 | 1 | 31 |
| Converting equipment | 4 | 3 | 0 | 3 | 21 | 0 | 1 | 32 |
| Paper tape equipment | 3 | 3 | 1 | 1 | 24 | 0 | 1 | 33 |
| Data processing concepts | 21 | 56 | 24 | 43 | 36 | 4 | 13 | 197 |
| Programming | 3 | 26 | 7 | 15 | 6 | 3 | 3 | 63 |
| Data processing applications | 3 | 11 | 0 | 9 | 23 | 0 | 3 | 49 |
| Accounting | 0 | 1 | 0 | 13 | 20 | 6 | 1 | 41 |
| Management | 3 | 1 | 3 | 15 | 18 | 0 | 1 | 41 |
| Other business courses | 2 | 0 | 2 | 12 | 7 | 2 | 1 | 26 |
| Totals | 86 | 373 | 65 | 205 | 1,664 | 29 | 115 | 2,537 |
| Per Cent | 3.4 | 14.7 | 2.6 | 8.1 | 65.5 | 1.1 | 4.5 | |

## DATA PROCESSING EXPERIENCE

Most of the equipment operators who had been with their companies less than three years apparently had received all their data processing experience in their present company, since 179 of the unit record operators had been with their companies up to three years and only 147 of them had had as much as three years of experience in data processing jobs (Table 8-6). Over half of the accounting machine operators indicated that their only data processing experience was in unit records operations; about 19 per cent of them had worked as key punch operators, but about 16 per cent had worked as computer operators.

Table 8-6. Amount of Work Experience Reported by Unit Record Equipment Operators

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 Year | 72 | 97 |
| 1 - 3 Years | 75 | 82 |
| 3 - 5 Years | 51 | 44 |
| 5 - 9 Years | 94 | 77 |
| 10 or More Years | 81 | 72 |
| Totals | 373 | 372 |

Unit record equipment operators who had had other types of experience in business offices indicated they had worked in sales and service occupations (27 per cent), as office machines operators (21 per cent), and in the trades (11 per cent). About 8 per cent of the unit record operators had also done factory work.

## CHARACTERISTICS OF THE UNIT RECORD EQUIPMENT OPERATORS

Unit record operators were characterized by data processing managers as being people who are mechanically inclined, who are relatively emotionally stable and can work under pressure; they are logical thinkers and perfectionists in the performance of their jobs.

The leisure time interests of these people are quite varied, with the greater number of them indicating interest in participating in sports, reading, household activities (refinishing furniture, upholstery, interior decorating), and arts and crafts. They enjoy puzzles, with over 97 per cent saying they think puzzles are "O.K." or enjoy them.

## ATTITUDES TOWARD DATA PROCESSING AND THEIR JOBS

Generally speaking, tab operators enjoy working in the data processing field and plan to remain in it, with nearly 90 per cent of them expressing their satisfaction with the field (Table 8-7). Apparently data processing training does not influence their attitudes toward enjoyment of the field, since about the same percentage of those with training as those without indicated they enjoyed working in the field and planned to stay in it.

Table 8-7. Attitude of the Unit Record Equipment Operator Toward Data Processing Work

| Training | Enjoy-Will Remain | | Enjoy-Desire Change | | Dislike-Will Remain | | Dislike-Desire Change | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Without Training | 169 | 89.4 | 18 | 9.5 | 2 | 1.1 | 0 | 0.0 | 174 |
| With Training | 158 | 90.8 | 14 | 8.0 | 2 | 1.1 | 0 | 0.0 | 189 |
| Totals | 327 | 90.1 | 32 | 8.8 | 4 | 1.2 | 0 | 0.0 | 363 |

Unit record equipment operators seem to like their jobs because of the kind of work involved and because of the variety they find in it. To a lesser extent they say the work is interesting and they like the working conditions. However, although these employees expressed fewer dissatisfactions than satisfactions with the job, the greater number of dissatisfactions stemmed from the "type of job" they are in. Having to do rush jobs was another source of dissatisfaction and they expressed some annoyance with the paper work involved in performing their jobs. About 10 per cent of them said they disliked nothing about their jobs.

SUMMARY

JOB: Unit Record Equipment Operator

Duties:

1. Operate Data Processing Machines
2. a. Sorter
   b. Reproducer
   c. Interpreter
   d. Collator
   e. Accounting Machine

2. Wire Boards
   a. Collator Board
   b. Reproducer Board
   c. Interpreter Board
   d. Accounting Machine Board

Supervision Required:

Several Times Daily

Education:

Minimum: High School

Desired: High School

General Courses:

1. General Math
2. Advanced Math
3. English
4. Social Science
5. Oral and Written Communications
6. Algebra

Business Courses (High School):

1. Typing
2. Business Math
3. Introduction to Business
4. First Year Accounting
5. Introduction to Systems

(Shorthand noted as least helpful; also, typing, introduction to business)

Business Courses (Post High School):

1. Data Processing Equipment
2. Accounting Principles
3. Intermediate Accounting
4. Business Math

(Typing and Business English least helpful; also, introduction to business and income tax accounting)

Management Recommendations:

1. Unit Record Equipment
2. Wiring Boards
3. Data Processing Concepts
4. Key Punch

Experience:

Minimum: 3 Months or Less

Desired: 6 - 12 Months

Personal Characteristics:

1. Over 63% are men; about 36% are women.

2. Jobs attained through promotions, private employment agencies, ads, and schools.

3. Tab Operator showed inclination to operate machines and emotional stability.

4. Most enjoy their work and desire to remain in it.

5. Tab Operators feel their education is adequate.

6. Hobbies are hunting, fishing, household activities, and sports, both participation and spectator. Puzzles are "okay" and enjoyed.

7. The median age is 28 years.

Promotional Probabilities: Average to High

Promoted to Computer Operator or Programmer.

Education has some effect on promotion.

Business Courses (Post High School):

1. Data Processing Equipment
2. Accounting Principles
3. Intermediate Accounting
4. Business Math

(Typing and Business English least helpful; also, introduction to business and income tax accounting)

Management Recommendations:

1. Unit Record Equipment
2. Wiring Boards
3. Data Processing Concepts
4. Key Punch

Experience:

Minimum: 3 Months or Less

Desired: 6 - 12 Months

Personal Characteristics:

1. Over 63% are men; about 36% are women.

2. Jobs attained through promotions, private employment agencies, ads, and schools.

3. Tab Operator showed inclination to operate machines and emotional stability.

4. Most enjoy their work and desire to remain in it.

5. Tab Operators feel their education is adequate.

6. Hobbies are hunting, fishing, household activities, and sports, both participation and spectator. Puzzles are "okay" and enjoyed.

7. The median age is 28 years.

Promotional Probabilities: Average to High

Promoted to Computer Operator or Programmer.

Education has some effect on promotion.

Monthly Salary:

| | |
|---|---|
| Median: | $413 (without computers)<br>433 (with computers) |
| Men: | Average approximately $90 more per month than women; women show more time with company. |
| High School: | $380 |
| College: | $450 |
| 10+ Years: | $520 |
| Top Salary: | $1000 |

# CHAPTER IX

## COMPUTER OPERATOR*

Over four-fifths of the computer operators in the businesses contacted in this study were men whose jobs had been secured principally through promotion.

### CHARACTERISTICS OF THE JOB OF THE COMPUTER CONSOLE OPERATOR

The computer console operator generally is responsible for the operation of the computer. The operator of the computer operates several other kinds of machines and wires boards for programming. Over half of these employees operate the high speed printer, sorter, interpreter, reproducer and collator in addition to punching cards. About half of these employees wire the collator and reproducer boards.

#### Amount of Work Experience Prior to Employment

Although computer operators can get jobs with less than six months of previous experience in data processing, nearly 70 per cent of the managers would prefer that they have more than six months of experience, with 65 per cent of them preferring from six months to two years of such experience (Table 9-1). Over 65 per cent of the

Table 9-1. Amount of Data Processing Experience Prior to Employment As a Computer Operator

| Months | Minimum Acceptable | Amount Preferred |
|---|---|---|
| 0 - 6 | 65.4 | 29.4 |
| 7 - 12 | 16.7 | 35.8 |
| 13 - 24 | 9.3 | 30.0 |
| 25 - 36 | 1.2 | 8.1 |
| 37+ | 0.8 | 5.3 |

*The job description of the computer console operator is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

managers said that up to six months of experience is a minimum requirement for getting a job in their firms. Over 11 per cent of them require applicants to have worked in data processing for more than one year before they would be considered for a job in their data processing departments.

Educational Requirements

Data processing managers indicated that a high school education was sufficient for computer console operators, and since almost all (97 per cent) of them had completed at least this amount of education, they are meeting the minimum amount of education acceptable by the managers. However, two-thirds of the managers said they prefer more than a high school education for their computer console operators, and 44 per cent of the operators had completed some education beyond high school.

General education. When managers were asked to list general areas of study that they felt would be beneficial for computer console operators, they listed communications as being of prime importance, both oral and written, along with algebra. They also listed logic and psychology as good background for these employees.

The employees themselves were asked to list general high school courses that they considered helpful in their work, and they were in agreement on the importance of such courses as general and advanced mathematics, English and social science. Mathematics and English were areas in which such employees felt they could profit by more training.

Computer console operators with some post high school training felt they should have about the same background courses as in high school, particularly mathematics and English, and they also indicated a need for more social science.

Business courses. Among high school business courses of most value to them in their jobs, 57 computer console operators named bookkeeping. Although bookkeeping ranked highest, 28 operators indicated that business mathematics and 23 operators indicated that typing were helpful business courses on their jobs.

Typing and shorthand were listed most frequently as the least helpful courses for the performance of the job of computer console operator. Regarding business skills, the people with some post high school training pointed out a need for knowledge of data processing equipment, and to a certain extent, calculating machines and typing; principles of accounting was listed as desirable business background. At this level report writing, shorthand and typing were considered by these people to be their least helpful courses.

Management responses regarding high school business courses these employees should study indicated data processing theory, computer console operation, introduction to computer theory and logic, and unit record equipment. Other courses managers would like for their computer console operators to study in high school are data processing applications, programming, flow charting, wiring boards and key punch. In addition to the data processing courses, management would like to hire these operators with training in introduction to business, introduction to systems, and first year accounting.

Promotion, Supervision, Overtime, and Salaries

The computer console operator's chance for advancement is average to high; 79 per cent of the managers indicated these employees have an average to high probability for promotion. They tend to be promoted to the position of programmer or supervisor.

Computer console operators need to be supervised about once a day. About 42 per cent of the firms reported that their computer console operators work overtime from 1 to 11 hours per week with most of the overtime in the 4-7 hours per week category.

The median monthly salary for computer console operators was $478 (Table 9-2). Out of 275 computer console operators in the study, only 3 people reported salaries under $200 a month, and only 2 people reported salaries over $800 a month.

About 40 per cent of the computer console operators had been with their companies for over five years, and about 20% of them had been in the firm over 10 years. On the other hand, 26 per cent of the computer operators had been employed by the firm for less than a year.

Apparently education has less influence on salary than does experience in data processing (Tables 9-2 and 9-3). The median salary is about the same for computer console operators with different amounts of education (a range of from $436 to $454 per month). However, for those with less than five years of experience and for those with more than five years, the medians are below and above the median for the whole group. For those with less than one year of experience in data processing jobs, the median salary is $374 a month. Those with ten years of data processing experience are paid about $568 a month ($90 above the median).

Table 9-2. Salaries Paid Computer Console Operators According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| Under $200 | 1 | 2 | | | 3 |
| $200-299 | | 9 | 3 | | 12 |
| $300-399 | | 15 | 31 | 2 | 48 |
| $400-499 | 2 | 41 | 51 | 1 | 95 |
| $500-599 | 4 | 36 | 38 | 1 | 79 |
| $600-699 | | 13 | 16 | 1 | 30 |
| $700-799 | | 3 | 2 | 1 | 6 |
| $800-899 | | | | | 0 |
| $900-999 | | | | | 0 |
| $1,000+ | | | 2 | | 2 |
| Totals | 7 | 119 | 143 | 6 | 275 |

## DATA PROCESSING EDUCATION OF COMPUTER CONSOLE OPERATORS

Generally speaking, computer console operators had had some training prior to entering the data processing field, although management seemed to provide considerable on-the-job training for these people.

### Training Prior to Entering the Data Processing Field

Executives who responded regarding the type of data processing training for computer console operators prior to their entering employment, indicated that such training might best be secured in school for data processing concepts, computer console operation, introduction to computer theory and logic, unit record equipment, data processing applications, programming, flow charting, and wiring boards.

Table 9-3. Salaries Paid Computer Console Operators According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 Years or More | Total |
|---|---|---|---|---|---|---|
| Under $200 | 2 | | | 1 | | 3 |
| $200-299 | 3 | 6 | 1 | 2 | | 12 |
| $300-399 | 19 | 16 | 8 | 2 | 3 | 48 |
| $400-499 | 15 | 21 | 25 | 25 | 9 | 95 |
| $500-599 | 3 | 13 | 17 | 27 | 19 | 79 |
| $600-699 | | 2 | 1 | 13 | 14 | 30 |
| $700-799 | | | | 1 | 5 | 6 |
| $800-899 | | | | | | |
| $900-999 | | | | | | |
| $1,000+ | | | 1 | 1 | | 2 |
| Totals | 42 | 58 | 53 | 72 | 50 | 275 |

The employees themselves indicated that prior to taking jobs in the data processing field, their main source of training was the special data processing schools and the equipment manufacturers' schools where they learned such skills as operation of unit record equipment and data processing concepts (Table 9-4). Most of the training in the operation of the computer console (73 per cent) was received in special data processing schools and in equipment manufacturers' classes. Those who indicated having had data processing courses in high school or college were a small per cent of the total (7 per cent) and their major area of study was in data processing concepts.

Computer operators under the age of 21 received their training in both special data processing schools and in private business schools, whereas the older employees received their training mostly in the equipment manufacturers' schools.

Table 9-4. Training and Place of Training of Computer Console Operators in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Total |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 1 | 0 | 0 | 5 | 2 | 0 | 5 | 0 | 13 |
| Key punch machine | 1 | 0 | 6 | 26 | 16 | 9 | 19 | 4 | 81 |
| Card sorter | 1 | 1 | 4 | 31 | 28 | 14 | 18 | 4 | 101 |
| Unit records | 4 | 4 | 17 | 136 | 128 | 81 | 75 | 21 | 466 |
| Wiring boards | 0 | 2 | 4 | 30 | 29 | 19 | 13 | 3 | 100 |
| Console operation | 0 | 1 | 2 | 17 | 9 | 39 | 6 | 3 | 77 |
| Access devices | 0 | 0 | 1 | 11 | 4 | 13 | 6 | 2 | 37 |
| Data converting | 0 | 0 | 1 | 6 | 3 | 10 | 6 | 0 | 26 |
| Paper tape equipment | 0 | 0 | 0 | 6 | 2 | 8 | 6 | 1 | 23 |
| Data processing concepts | 6 | 2 | 30 | 77 | 43 | 88 | 36 | 3 | 285 |
| Programming | 1 | 0 | 4 | 19 | 9 | 29 | 4 | 3 | 69 |
| Totals | 14 | 10 | 69 | 364 | 273 | 310 | 194 | 44 | 1,278 |
| Per Cent | 1.1 | 0.8 | 5.4 | 28.5 | 21.4 | 24.2 | 15.2 | 3.4 | |

### Training After Entering Data Processing

Of the training provided by management after they entered their jobs, most of the computer console operators indicated they were trained directly on the job (Table 9-5). To a considerably lesser extent, computer operators were sent by their employers to the manufacturers' schools. Over half of the training in data processing listed by the operators themselves was received on the job, principally the operation of unit record equipment, computer console operation, and operation of the card sorter and key punch machine.

### Evaluation of Their Educational Preparation

In general, about two-thirds of the computer console operators indicated that their education had adequately prepared them for their jobs or had prepared them very well. There was no difference of opinion about the adequacy of their education between those with data processing background in their education and those without.

## CHARACTERISTICS OF THE COMPUTER CONSOLE OPERATOR

Most of the computer console operators who had been with their companies one to three years apparently had received all their data processing experience in their present company, since 58 of the operators had been with their companies one to three years and 56 of them had been in data processing for one to three years (Table 9-6). About half of the computer operators who had been with the company for less than one year had had experience in data processing before coming to the company to work. Over a fourth of the computer console operators indicated that their only data processing experience was in computer console operation; about 50 per cent of them had worked as unit record equipment operators.

Computer console operators who had had other types of experience in business offices indicated they had worked in sales and service occupations (27 per cent), as clerical workers (21 per cent), and in the trades (12 per cent). About 6 per cent of the computer console operators had also done factory work.

### Personal Characteristics

Computer console operators were characterized by data processing managers as being people who are emotionally stable and can work under pressure; who are able to get along with people; and who are logical thinkers.

The leisure time interests of these people are quite varied, with the greater number of them indicating interest in participating

Table 9-5. Training and Place of Training of Computer Console Operators in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 2 | 1 | 0 | 5 | 19 | 1 | 1 | 29 |
| Key punch machine | 8 | 16 | 4 | 6 | 109 | 2 | 7 | 152 |
| Card sorter | 7 | 13 | 3 | 9 | 138 | 2 | 4 | 176 |
| Unit record | 34 | 105 | 12 | 42 | 518 | 23 | 19 | 753 |
| Wiring boards | 6 | 41 | 4 | 15 | 70 | 8 | 5 | 149 |
| Summary punch | 5 | 22 | 1 | 7 | 67 | 6 | 2 | 110 |
| Console operation | 17 | 28 | 13 | 4 | 162 | 5 | 4 | 233 |
| Access devices | 2 | 13 | 2 | 3 | 71 | 2 | 4 | 97 |
| Converting equipment | 6 | 7 | 6 | 2 | 48 | 1 | 0 | 70 |
| Paper tape equipment | 3 | 5 | 5 | 1 | 49 | 1 | 3 | 67 |
| Data processing concepts | 26 | 85 | 41 | 37 | 61 | 17 | 40 | 307 |
| Programming | 8 | 44 | 9 | 11 | 15 | 6 | 7 | 100 |
| Data processing applications | 6 | 10 | 6 | 5 | 21 | 3 | 7 | 58 |
| Accounting | 1 | 1 | 0 | 15 | 9 | 2 | 5 | 33 |
| Management | 1 | 3 | 0 | 12 | 11 | 2 | 4 | 33 |
| Other business courses | 0 | 1 | 0 | 20 | 6 | 5 | 4 | 36 |
| Totals | 132 | 395 | 106 | 194 | 1,374 | 86 | 116 | 2,403 |
| Per Cent | 5.5 | 16.4 | 4.4 | 8.1 | 57.2 | 3.6 | 4.8 | |

Table 9-6. Amount of Work Experience Reported by Computer Console Operators

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 year | 81 | 42 |
| 1 to 3 years | 56 | 58 |
| 3 to 5 years | 40 | 53 |
| 5 to 9 years | 56 | 72 |
| 10 years or more | 42 | 50 |
| Totals | 275 | 275 |

in sports, engaging in household activities, hunting and fishing, reading, and hiking and camping. They enjoy puzzles, with over 98 per cent saying they think puzzles are "O.K." or enjoy them.

Attitudes Toward Data Processing As an Occupational Field

Generally speaking, computer console operators enjoy working in the data processing field and plan to remain in it, with 93 per cent of them expressing their satisfaction with the field (Table 9-7). Apparently data processing training does not influence their attitudes toward enjoyment of the field, since about the same percentage of those with training as without indicated they enjoyed working in the field and planned to stay in it.

Computer console operators seem to like their jobs because of the kind of work involved and because they find the work interesting. To a lesser extent they say the job has variety and they like the working conditions. The greatest number of dissatisfactions resulted from the rush jobs and irregular hours. Other sources of dissatisfaction with their jobs were the salary and the kind of work involved. About 9 per cent of them said they disliked nothing about their job.

Table 9-7. Attitude of Computer Console Operators With and Without Data Processing Training Prior to Employment

| Training | Enjoy-Will Remain | | Enjoy-Desire Change | | Dislike-Will Remain | | Dislike-Desire Change | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Without training | 122 | 49.2 | 10 | 62.5 | 0 | | 1 | | 133 |
| With training | 126 | 50.8 | 6 | 37.5 | 1 | | 0 | | 133 |
| Totals | 248 | | 16 | | 1 | | 1 | | 266 |

## SUMMARY

JOB: Computer Console Operator

Duties:

1. Operate
   a. Computer
   b. High Speed Printer
   c. Sorter
   d. Interpreter
   e. Reproducer
   f. Collator

2. Punch Cards

3. Wire
   a. Collator Board
   b. Reproducer Board

4. Test Sample Routines on Computer

Supervision Required:

Once a Day

Education:

Minimum: High School

Desired: High School with some Post High School

General Courses (High School):
1. General Mathematics
2. Advanced Mathematics
3. English
4. Social Science

Business Courses (High School):
1. Bookkeeping
2. Business Mathematics
3. Typing

Education (continued):

General Courses (Post High School):

1. General Mathematics
2. English
3. Advanced Mathematics
4. Social Science
5. Oral and Written Communications
6. Logic and Philosophy
7. Psychology

Business Courses (Post High School):

1. Data Processing Theory
2. Principles of Accounting
3. Data Processing Application
4. Introduction to Business
5. Introduction to Systems
6. First Year Accounting

Experience:

Minimum: 3 Months to 1 Year

Desired: 6 Months to 18 Months

Personal Characteristics:

1. 90% are men. Women in manufacturing and transportation are in greater proportionate numbers to total than men in same industries.

2. Jobs attained through promotions and advertising.

3. Computer operator should be able to get along with people and should have the ability to work under pressure.

4. The computer operator enjoys his work and desires to remain in it.

5. Computer operators feel their education is adequate.

6. Computer operators like the job type best; they like rush jobs least.

7. Hobbies are participation in sports and reading. They enjoy puzzles.

8. The median age is 27 years.

Promotional Probabilities: Average to High

Promoted to Programmer, Supervisor

Education has some effect on promotion.

Salary:

| | |
|---|---|
| Median: | $478 |
| Large Installations | 560 |
| Medium or Small | 462 |
| | |
| Men: | $496 |
| Women: | 412 |
| | |
| High School: | $482 |
| Post High School-Degree | 500 |

# CHAPTER X

# THE PROGRAMMER

Programmers are, as a rule, men (89 per cent), who obtained their jobs primarily through promotions, although the private employment agency accounted for almost as many such jobs as did advertising. Schools as a job source for programmers ranked third.

## CHARACTERISTICS OF THE JOB OF THE PROGRAMMER

Primarily, the duties performed by a programmer in his job are preparing programs, making flow charts, debugging programs, coding for programming, making block diagrams, and analyzing data flow. The programmer also analyzes systems, operates the computer, makes test sample routine, and punches cards.

The programmers in this study reported that the programming language primarily used was Autocoder. Other languages used were machine language, COBOL and SPS. The use of Fortran as a programming language was not significant; only 13 such responses being received.

### Work Experience Required Prior to Employment

Programmers are expected to have had data processing experience in order to qualify for their jobs (Table 10-1). About 86 per cent of the managers indicated that up to six months' experience in data processing would be the minimum experience accepted for employment as a programmer. Over half of them said that at least seven months or more experience in data processing would be preferred for employment as a programmer.

### Educational Requirements

About one-third of the programmers hold at least a bachelor's degree. Nearly 90 per cent have had some education beyond high school but have not completed work for a degree. This educational level held by the programmers, however, does not meet the standards preferred by the data processing managers, of whom 61 per cent felt that people in this job should have at least a bachelor's degree.

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*The job description of the programmer is based on the data collected in this study and previously displayed and analyzed in earlier chapters in this report.

Table 10-1. Amount of Data Processing Experience Prior to Employment as a Programmer
(% of Managers Indicating Stated Amount)

| Months | Minimum Acceptable | Amount Preferred |
|---|---|---|
| 0 - 6 | 86.0 | 42.2 |
| 7 - 12 | 7.8 | 32.8 |
| 13 - 24 | 4.7 | 20.4 |
| 25 - 36 | 1.6 | 4.7 |

However, the education completed by programmers does meet the minimum standards acceptable to the data processing managers, in that only 9 per cent feel that a college degree is the minimum amount of education for people in this job, and another 34 per cent say they will consider someone for the job of programmer if he has some education beyond high school but not necessarily a degree.

General education. Programmers felt that general mathematics was the most valuable general education course they had studied in school, and they felt generally that they should have had more work in advanced mathematics. English, too, ranked high on the list of helpful courses, next to mathematics. This agrees with what management feels to be the most beneficial of the general education courses, although they emphasize the need for good written and oral communications. These courses ranked the same in importance at both high school and post high school levels.

Business courses. Of the business courses considered to be helpful in their jobs, programmers mentioned business mathematics at the high school level most frequently along with bookkeeping in the high school and accounting at the post high school level. Of the courses they had had in college, these people found courses in data processing equipment the most helpful. Statistics and data processing applications were mentioned by quite a number of these employees as being useful courses for their kind of work.

Management, however, felt that programmers should study more management courses, including introduction to systems, principles of management and records management. They felt, too, that a second year of accounting, introduction to business and statistics would be desirable preparation in business for these people.

## Promotion, Overtime, Supervision, and Salaries

The programmer has a high to average probability of being promoted, according to the managers of data processing departments in which they work. Over 32 per cent of the managers said that education has a definite bearing on promotability of the programmer, while about the same number say that education has "quite a bit" of influence on promotions of these people.

The programmer is likely to be promoted to a systems analyst position, to some higher level supervisory job, or to a data processing manager position.

Most programmers are required to work overtime. Only 15 per cent of the managers said that their programmers worked regular business hours. Most of them (43 per cent), however, said these employees in their departments work up to seven hours a week overtime, but about 10 per cent said that their employees work more than 12 hours weekly outside of regular hours.

Programmers work more or less independently and require little supervision, or, according to the data processing managers, "only as needed."

The median salary for programmers is $627 a month (Table 10-2). The median salary paid programmers who hold a college degree is somewhat higher than the general median ($647); and those without a degree but with some work beyond high school have a median salary of $607.

The amount of experience in data processing affects the salary of programmers more than does the amount of education (Table 10-3). The median salary for those programmers who have worked in data processing for less than one year is about $100 a month less ($526) than the median salary, and those with over ten years of experience in the field have a median salary of $745 a month.

Table 10-2. Salaries Paid Programmers According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| Under $200 | 0 | 0 | 1 | 1 | 2 |
| $200-299 | 0 | 1 | 1 | 0 | 2 |
| $300-399 | 0 | 0 | 7 | 2 | 9 |
| $400-499 | 0 | 7 | 33 | 9 | 49 |
| $500-599 | 2 | 17 | 36 | 23 | 78 |
| $600-699 | 1 | 18 | 40 | 36 | 95 |
| $700-799 | 2 | 10 | 24 | 10 | 46 |
| $800-899 | 0 | 8 | 14 | 14 | 36 |
| $900-999 | 0 | 1 | 2 | 4 | 7 |
| $1,000+ | 0 | 1 | 3 | 4 | 8 |
| Totals | 5 | 63 | 161 | 103 | 332 |

Table 10-3. Salaries Paid Programmers According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 Years or More | Total |
|---|---|---|---|---|---|---|
| Under $200 | 2 | 0 | 0 | 0 | 0 | 2 |
| $200-299 | 1 | 0 | 1 | 0 | 0 | 2 |
| $300-399 | 5 | 2 | 1 | 1 | 0 | 9 |
| $400-499 | 17 | 13 | 8 | 9 | 2 | 49 |
| $500-599 | 23 | 24 | 13 | 14 | 4 | 78 |
| $600-699 | 11 | 24 | 28 | 25 | 7 | 95 |
| $700-799 | 0 | 4 | 7 | 24 | 11 | 46 |
| $800-899 | 0 | 1 | 5 | 23 | 7 | 36 |
| $900-999 | 1 | 0 | 1 | 3 | 2 | 7 |
| $1,000+ | 1 | 0 | 2 | 2 | 3 | 8 |
| Totals | 61 | 68 | 66 | 101 | 36 | 332 |

## DATA PROCESSING EDUCATION

Programmers received most of the training in data processing prior to entering the data processing field in special data processing schools, colleges and in manufacturers' classes; training after entering the data processing field was again in manufacturers' classes with the largest percentage of training being accomplished on the job.

### Training Prior to Entering Data Processing

Programmers for the most part had their training in data processing after starting to work in the field. However, of the training they received before entering the data processing field, 28 per cent of the courses were received in special data processing schools, especially on unit record equipment and data processing concepts (Table 10-4). A large portion of the training was received in manufacturers' classes and in college, with more of these individuals having learned data processing concepts there than anywhere else. Most of the programming was learned at a manufacturer's school, or in college, or at a special data processing school.

### Training After Entering Data Processing

Following initial employment in the field of data processing, most of the programmers' training was on the job, but about a third of the training was done in manufacturers' classes (Table 10-5). Only 6 per cent of the courses were offered as classes operated by the companies themselves, and only about 2 per cent of the training was in classes in local institutions for which the company paid the fees; and about 9 per cent of the courses were taken by these employees in local education institutions and paid for by the employee himself. Most of the courses studied by these people after entering the data processing field dealt with data processing concepts, unit record equipment, and programming.

### Evaluation of Their Education

The programmers felt for the most part that their educational background was adequate (about 57 per cent), with about 13 per cent of them indicating that they were very well prepared. Although almost 30 per cent felt that they had not been trained adequately for their jobs, those who had had data processing courses before going into the field were more satisfied with their education. Less than 20 per cent of those with data processing training said they had been inadequately prepared for work in the field, while 41 per cent of those without prior data processing training felt this way.

Table 10-4. Training and Place of Training of Programmers in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Total |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 0 | 0 | 1 | 5 | 2 | 0 | 1 | 0 | 9 |
| Key punch machine | 0 | 1 | 25 | 30 | 15 | 4 | 17 | 1 | 93 |
| Card sorter | 0 | 2 | 18 | 38 | 21 | 10 | 17 | 1 | 107 |
| Unit records | 0 | 4 | 60 | 152 | 84 | 63 | 77 | 3 | 443 |
| Wiring boards | 0 | 1 | 11 | 35 | 18 | 16 | 15 | 0 | 96 |
| Console operation | 0 | 0 | 20 | 21 | 4 | 34 | 6 | 1 | 86 |
| Access devices | 0 | 1 | 6 | 8 | 3 | 29 | 3 | 0 | 50 |
| Data converting | 0 | 0 | 3 | 5 | 1 | 9 | 4 | 0 | 22 |
| Paper tape equipment | 0 | 0 | 2 | 5 | 2 | 10 | 3 | 0 | 22 |
| Data processing concepts | 8 | 1 | 183 | 108 | 33 | 150 | 26 | 3 | 477 |
| Programming | 0 | 1 | 41 | 30 | 7 | 58 | 5 | 0 | 142 |
| Totals | 8 | 11 | 370 | 437 | 190 | 348 | 174 | 9 | 1,547 |
| Per Cent | 0.5 | 0.7 | 24.0 | 28.0 | 12.0 | 22.0 | 11.0 | 0.6 | |

Table 10-5. Training and Place of Training of Programmers in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 1 | 1 | 0 | 3 | 8 | 1 | 0 | 14 |
| Key punch machine | 7 | 12 | 1 | 4 | 114 | 1 | 14 | 153 |
| Card sorter | 9 | 20 | 0 | 7 | 128 | 0 | 9 | 173 |
| Unit record | 33 | 152 | 13 | 29 | 413 | 3 | 35 | 678 |
| Wiring boards | 6 | 51 | 3 | 8 | 59 | 2 | 6 | 135 |
| Summary punch | 4 | 32 | 3 | 6 | 60 | 1 | 4 | 110 |
| Console operation | 7 | 55 | 15 | 3 | 128 | 2 | 9 | 219 |
| Access devices | 3 | 74 | 13 | 1 | 40 | 0 | 6 | 137 |
| Converting equipment | 3 | 14 | 4 | 0 | 26 | 0 | 3 | 50 |
| Paper tape equipment | 2 | 9 | 5 | 0 | 38 | 0 | 3 | 57 |
| Data processing concepts | 54 | 315 | 75 | 71 | 116 | 32 | 28 | 691 |
| Programming | 21 | 190 | 44 | 9 | 36 | 6 | 3 | 309 |
| Data processing applications | 10 | 42 | 10 | 9 | 79 | 3 | 7 | 160 |
| Accounting | 2 | 1 | 2 | 46 | 18 | 3 | 5 | 77 |
| Management | 13 | 1 | 4 | 39 | 33 | 6 | 9 | 105 |
| Other business courses | 3 | 1 | 4 | 65 | 23 | 9 | 14 | 119 |
| Totals | 178 | 970 | 196 | 300 | 1,319 | 69 | 155 | 3,187 |
| Per Cent | 5.8 | 30.0 | 6.0 | 9.0 | 41.0 | 2.0 | 5.0 | |

## DATA PROCESSING EXPERIENCE

About one-third of the 332 programmers had been in the data processing field from five to nine years (Table 10-6).

Table 10-6. Amount of Experience Reported by Programmers

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 year | 61 | 89 |
| 1 - 3 years | 68 | 94 |
| 3 - 5 years | 66 | 44 |
| 5 - 9 years | 101 | 59 |
| 10 or more years | 36 | 46 |
| Totals | 332 | 332 |

Those programmers with up to three years of experience in data processing apparently were promoted from other positions in the organization because they were with their present employer longer than they had been in data processing. About half of the programmers with three to nine years experience in data processing apparently were hired as programmers by their present employers, and so evidently business is able to recruit experienced data processing personnel into this position.

Their experience in data processing, however, has been mainly in the operation of unit record equipment, with over one-fourth of them reporting experience in this area. Slightly over a third of the programmers (34.5 per cent) had had experience in programming prior to this job.

Prior to entering into the field of data processing, programmers had worked in the clerical field, in sales and services occupations, in the trades occupations, and in accounting.

## PERSONAL CHARACTERISTICS

According to data processing managers, programmers are logical thinkers; they get along well with people; they are emotionally stable and can work under pressure; and they are thorough and detailed in the work. In addition, programmers are dedicated to their work and willing to work overtime to complete their jobs, and they are creative persons who are willing to accept challenge.

As to leisure-time activities, the programmer enjoys sports participation and reading, with household duties, outdoor activity, and some arts and crafts being mentioned as avocations or leisure-time activity. This employee is one who enjoys puzzles or finds them "O.K."; fewer than 4 per cent hated puzzle type activities.

## ATTITUDES TOWARD DATA PROCESSING AS AN OCCUPATIONAL FIELD

Perhaps reflecting the managers' characterization of the programmers as logical thinkers, and people who are emotionally stable and like detail work, the things that these people like about their job are the problem-solving aspects of it and the challenge it presents.

Programmers like data processing as a field (95 per cent of them say they enjoy it and plan to remain in it, Table 10-7). Those without data processing training before going into the field express about the same degree of satisfaction as those with prior training, perhaps because most of their training in data processing was received by these people after they had started work in the field.

Table 10-7. Attitude of the Programmer Toward Data Processing Work

| Training | Enjoy-Will Remain | | Enjoy-Desire Change | | Dislike-Will Remain | | Dislike-Desire Change | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Without training | 150 | 49.4 | 8 | 57.0 | 2 | 67.0 | 0 | 0 | 160 |
| With training | 160 | 51.6 | 6 | 43.0 | 1 | 33.0 | 1 | 0.3 | 168 |
| Totals | 310 | 94.5 | 14 | 4.3 | 3 | 0.9 | 1 | 0.3 | 328 |

## SUMMARY

JOB: Programmer

Duties:
1. Preparing Programs
2. Making Flow Charts
3. Debugging Programs
4. Coding for Programming
5. Making Block Diagrams
6. Analyzing Data Flow
7. Analyzing Systems
8. Operating the Computer
9. Making Test Sample Routines
10. Punching cards

Supervision Required:

Only as Needed

Education:

Minimum: High School
Junior College or Technical School

Desired: College Graduate

General Courses:
1. General Math
2. Advanced Math
3. English
4. Oral and Written Communication

Business Courses (Post High School):
1. Data Processing Equipment
2. Business English
3. Accounting Principles
4. Business Math and Statistics
5. Data Processing Applications
6. Introduction to Systems
7. First Year Accounting
8. Introduction to Business
9. Second Year Accounting
10. Principles of Management

Experience:

Minimum: 3 Months to 1 Year

Desired: 1 1/2 to 2 Years

Personal Characteristics:

1. 82% are men; 17.4% are women.

2. Jobs attained through promotions, private employment agencies, advertising and schools.

3. Programmer should be logical thinker and have the ability to get along with people.

4. The programmer enjoys his work and desires to remain in it; his attitude is not regulated by whether he had data processing work or not.

5. Programmers feel their education is adequate.

6. The programmer likes best the problem-solving factor of his job.

7. Hobbies are participation in sports and reading. Puzzles are enjoyed.

8. The median age is 29 years.

Promotional Probabilities: Average to High

Promoted to Chief Programmer, Systems Analyst, Supervisor, and Data Processing Manager; some are promoted to Project Director.

Education has a definite effect upon promotion.

Salary:

Median: $626
(Slight tendency for larger installations to pay higher salaries)

Men: $642
Women: 557

Trend shows programmers with total amount of 4-6 years data processing experience earn median salary of $718; those with programming experience only earn median salary of $683.

## CHAPTER XI

## DATA PROCESSING MANAGER

Data processing managers, generally speaking, were men (93 per cent). More of the data processing managers (40 per cent) had attained this level of job through promotions than in any other way, but about equal number (30 per cent) had obtained their positions either through the recommendations of equipment manufacturers or by answering advertisements.

### CHARACTERISTICS OF THE JOB OF THE DATA PROCESSING MANAGER

The data processing manager serves mainly in a supervisory-managerial capacity. The two tasks most frequently mentioned by the data processing managers were conferring with others about computer use and scheduling computer time. The data processing manager tends to be the supervisory of computer personnel, of auxiliary equipment operators, and of the key punch and unit record equipment operators. He also confers about and schedules work in the unit record equipment section and in the key punch section.

An important area of work for the data processing manager is in systems, analyzing systems and work flow and in preparing flow charts. He operates some equipment, particularly the computer, the card sorter, and the high-speed printer.

Although programming was an important duty, most of the managers indicated that they did some programming and that they used a variety of program languages on the job, but Autocoder was used the most with some use of SPS, COBOL and machine language. Fortran was mentioned by only five of the 65 data processing managers.

#### Work Experience Required Prior to Employment

Data processing managers are expected to have considerable data processing experience in order to qualify for their jobs. Over 50 per cent of the executives indicated that they would prefer someone with over three years' experience. Over one-fourth of the executives preferred between one and three years of data processing experience for their data processing managers. About one-fifth of the executives indicated that they would hire data processing managers with less than one year of experience in data processing.

## Educational Requirements

Evidently experience is more important for the data processing manager than is a college degree; only 16 per cent of them hold college degrees. There is an indication that some education beyond high school is important, because about 45 per cent of the data processing managers had completed some post high school education. This educational level held by the data processing managers, however, does not meet the standards preferred by the data processing managers, which is a college degree.

General education. Data processing managers felt that basic and advanced mathematics and English were the most valuable general education courses they had studied in school, and they felt generally that they should have had more work in advanced mathematics and English. This agrees with what management feels to be the most beneficial of the general education courses; they emphasized especially the need for good written and oral communications. These courses ranked the same in importance at both the high school and post high school levels.

Business courses. Of the business courses considered to be helpful in their jobs, data processing managers mentioned most frequently accounting at the post high school level and bookkeeping at the high school level, along with business mathematics at both levels. In addition, at the post high school level, data processing managers found courses in data processing equipment, intermediate accounting, and principles of management helpful to them on their jobs.

Management, however, felt that data processing managers should study more management courses, including introduction to systems, statistics, introduction to business, principles of management, intermediate accounting, and principles of finance. They felt, too, that cost accounting, records management, quantitative analysis and economics would be desirable preparation in business for these people.

## Promotion, Overtime, Supervision, and Salaries

The executives who were interviewed were about evenly divided in their opinions regarding the probability of promotion for data processing managers, with 23 of them saying that these people have an average (16) or high (7) chance for promotion; and 27 of them saying that data processing managers have little or no probability of promotion.

Over half of the managers of data processing departments felt that the amount of education had a bearing on whether or not a data processing manager would be promoted and another 10 per cent said that education affected promotability "quite a bit." However, a fifth of the executives felt that education was of little importance in determining promotion of data processing managers. The only promotion open to data processing managers is to some other supervisory position.

Most data processing managers are required to work overtime. Only 12 per cent of the managers said that their data processing manager worked only regular business hours. Most of them (40 per cent), however, said these employees in their departments work over 8 hours a week overtime. Data processing managers work more or less independently as supervisors and require little supervision of themselves.

The median salary for data processing managers is $741 a month (Table 11-1). However, the median salary paid data processing managers who hold a college degree is considerably higher than the general median ($850); and those without a degree but with some work beyond high school have a median salary of $740, and those with just a high school education have a median salary of $687.

Table 11-1. Salaries Paid Data Processing Managers According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| $400-499 | 0 | 2 | 1 | | 3 |
| $500-599 | 1 | 15 | 11 | 3 | 30 |
| $600-699 | 0 | 15 | 18 | 1 | 34 |
| $700-799 | 2 | 12 | 14 | 6 | 34 |
| $800-899 | | 10 | 10 | 6 | 26 |
| $900-999 | | 3 | 9 | 1 | 13 |
| $1,000+ | 1 | 3 | 9 | 9 | 22 |
| Totals | 4 | 60 | 72 | 26 | 162 |

The median salary is $818 for those data processing managers who have had ten years or more experience in data processing (Table 11-2). For those people who have had less than ten years experience, the median salaries are all lower than the $741 median for the total data processing managers.

Table 11-2. Salaries Paid Data Processing Managers According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 Years or More | Total |
|---|---|---|---|---|---|---|
| $400-499 | | | 2 | 1 | | 3 |
| $500-599 | 1 | 4 | 4 | 16 | 5 | 30 |
| $600-699 | 1 | 4 | 3 | 15 | 11 | 34 |
| $700-799 | 1 | 2 | 4 | 9 | 18 | 34 |
| $800-899 | | | 3 | 6 | 17 | 26 |
| $900-999 | | 1 | | 2 | 10 | 13 |
| $1,000+ | | 2 | 3 | 5 | 12 | 22 |
| Totals | 3 | 13 | 19 | 54 | 73 | 162 |

## DATA PROCESSING EDUCATION

Data processing managers have received most of their training in data processing in manufacturers' classes, both before and after they began working in the field. A few of these men received some data processing training in the military service and in special data processing schools.

### Training Prior to Entering Data Processing

Data processing managers for the most part had their training in data processing after starting to work in the field. However, of the training they received before entering the data processing field half of the courses were received in manufacturers' classes, especially on unit record equipment and data processing concepts (Table 11-3).

Table 11-3. Training and Place of Training of Data Processing Managers in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Totals |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 4 |
| Key punch machine | 0 | 1 | 3 | 5 | 4 | 15 | 9 | 0 | 37 |
| Card sorter | 0 | 0 | 2 | 13 | 6 | 24 | 11 | 0 | 56 |
| Unit records | 0 | 0 | 10 | 55 | 26 | 119 | 49 | 0 | 259 |
| Wiring boards | 0 | 0 | 2 | 12 | 5 | 28 | 11 | 0 | 58 |
| Computer operation | 0 | 0 | 1 | 6 | 0 | 22 | 2 | 0 | 31 |
| Access devices | 0 | 0 | 0 | 3 | 0 | 9 | 2 | 0 | 14 |
| Data converting | 0 | 0 | 0 | 2 | 0 | 9 | 1 | 0 | 12 |
| Paper tape equipment | 0 | 0 | 0 | 0 | 0 | 7 | 2 | 0 | 9 |
| Data processing concepts | 3 | 0 | 28 | 21 | 12 | 73 | 11 | 1 | 149 |
| Programming | 0 | 0 | 4 | 4 | 1 | 31 | 0 | 0 | 40 |
| Totals | 3 | 1 | 50 | 121 | 54 | 339 | 100 | 1 | 669 |
| Per Cent | 0.4 | 0.2 | 7.5 | 18.1 | 8.1 | 50.6 | 14.9 | 0.1 | |

The greater portion of their training was received, however, on the job and in manufacturers' classes where they learned the operation of unit record equipment and data processing concepts. Most of the programming was learned by the data processing managers in manufacturers' classes.

### Training After Entering Data Processing

Following initial employment in the field of data processing, most of the data processing managers' training was on the job (38.8 per cent) or in manufacturers' classes (34.7 per cent) (Table 11-4). Most of the courses studied by these people after entering the data processing field dealt with the operation of unit record equipment, data processing concepts, use of console devices, programming, and management training.

### Evaluation of Their Education

The data processing managers felt for the most part that their educational background was adequate (about 56 per cent), with about 9 per cent of them indicating that they were very well prepared. Although over a third of the people felt that they had not been trained adequately for their jobs, those who had had data processing courses before going into the field were more satisfied with their education. About a third of those with data processing training said they had been inadequately prepared for work in the field, while two-thirds of those without prior data processing training felt this way.

## DATA PROCESSING EXPERIENCE

Of the data processing employees who have been with their companies up to five years (67 of them), all of them went into the data processing field after starting to work with their present companies (Table 11-5). About one-fourth of the people who have been in data processing more than five years came to their present companies with data processing experience. Over half of the data processing managers have worked for their companies over five years, which would be an indication that this position is one that people are moved into after a period of work experience. Their experience in data processing, however, has been mainly in the operation of unit record equipment. About one-fourth of the data processing managers had had experience in supervision prior to this job.

Prior to entering into the field of data processing, data processing managers had worked in sales and services occupations, in clerical positions and in the trades.

Table 11-4. Training and Place of Training of Data Processing Managers in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 1 | 2 | 1 | 0 | 8 | 0 | 1 | 13 |
| Key punch machine | 5 | 11 | 4 | 0 | 62 | 0 | 7 | 89 |
| Card sorter | 5 | 23 | 5 | 0 | 62 | 0 | 4 | 99 |
| Unit record | 28 | 160 | 22 | 6 | 254 | 5 | 10 | 485 |
| Wiring boards | 6 | 48 | 6 | 4 | 34 | 3 | 1 | 102 |
| Summary punch | 5 | 30 | 1 | 1 | 45 | 2 | 1 | 85 |
| Console operation | 8 | 47 | 6 | 1 | 50 | 3 | 1 | 116 |
| Access devices | 4 | 28 | 7 | 2 | 22 | 2 | 0 | 65 |
| Converting equipment | 2 | 14 | 3 | 2 | 22 | 1 | 0 | 44 |
| Paper tape equipment | 3 | 10 | 5 | 1 | 21 | 1 | 1 | 42 |
| Data processing concepts | 22 | 183 | 16 | 36 | 63 | 23 | 5 | 348 |
| Programming | 7 | 63 | 13 | 11 | 11 | 6 | 3 | 114 |
| Data processing applications | 6 | 36 | 1 | 4 | 32 | 4 | 4 | 87 |
| Accounting | 1 | 1 | 1 | 29 | 11 | 5 | 7 | 55 |
| Management | 6 | 4 | 0 | 30 | 35 | 12 | 15 | 102 |
| Other business courses | 0 | 1 | 0 | 36 | 7 | 3 | 10 | 57 |
| Totals | 109 | 661 | 91 | 163 | 739 | 70 | 70 | 1,903 |
| Per Cent | 5.7 | 34.7 | 4.8 | 8.6 | 38.8 | 3.7 | 3.7 | |

Table 11-5. Amount of Work Experience Reported by Data Processing Managers

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 year | 3 | 11 |
| 1 - 3 years | 13 | 30 |
| 3 - 5 years | 19 | 26 |
| 5 - 9 years | 54 | 37 |
| 10 or more years | 73 | 58 |
| Total | 162 | 162 |

## PERSONAL CHARACTERISTICS

According to the executives in charge of data processing, data processing managers think logically, they get along well with people; to a lesser extent the executives said that data processing managers are creative and accept challenge in their work.

Leisure time activities of the data processing managers seem to be of an active nature. They indicated as outside interests such things as participation in sports and hiking and camping; also mentioned quite often as a leisure time activity was reading. These managers enjoy working puzzles, with less than 3 per cent of them saying they "hated" them; the rest said that puzzles were "O.K." or they enjoyed them.

## ATTITUDES TOWARD DATA PROCESSING AS AN OCCUPATIONAL FIELD

Perhaps reflecting the executives' characterization of the data processing managers as logical thinkers and people who get along with others, the things that these people like about their job are the problem solving aspects of it, the challenge the job presents, and liking their co-workers. They also like the variety in the job.

Data processing managers apparently like data processing as a field since over 93 per cent of them say they enjoy it and plan to remain in it (Table 11-6). Perhaps the satisfaction with their jobs is due to the fact that most of them received their training in data processing after they had started work in the field.

Table 11-6. Attitude Toward the Field of Data Processing Managers With and Without Data Processing Training

| Training | Enjoy-Will Remain | | Enjoy-Desire Change | | Dislike-Will Remain | | Dislike-Desire Change | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Without training | 93 | 62.4 | 7 | 70.0 | 0 | | 1 | | 101 |
| With training | 56 | 37.6 | 3 | 30.0 | 0 | | 0 | | 59 |
| Totals | 149 | 93.1 | 10 | 6.3 | 0 | | 1 | | 160 |

## SUMMARY

JOB: Data Processing Manager

Duties:

1. Operate
   a. Computer
   b. Sorter
   c. High Speed Printer

2. Confer regarding
   a. Computer
   b. Key Punch

3. Supervise
   a. Computer Personnel
   b. Auxiliary Equipment Operator
   c. Key Punch

4. Analyze
   a. Flow of Data
   b. Systems

5. Schedule Computer Time and Use

Supervision Required:

Only as Needed

Education:

Minimum: High School

Desired: College Graduate

General Courses (High School):
1. General Mathematics
2. Advanced Mathematics
3. English
4. Oral and Written Communications
5. Psychology

Education (continued):

Business Courses (High School):
1. Bookkeeping
2. Business Mathematics
3. Typing

General Courses (Post High School):
1. General Mathematics
2. English
3. Social Science

Business Courses (Post High School):
1. Data Processing Equipment
2. Accounting Principles
3. Business Mathematics
4. Principles of Management

Management Recommendations:
1. Introduction to Systems
2. Statistics
3. Introduction to Business
4. Principles of Management
5. Intermediate Accounting
6. Principles of Finance

Experience:

Minimum: 36 months

Desired: 36 months

Personal Characteristics:

1. 93 per cent are men.

2. Jobs attained through promotions, manufacturers' recommendations, ads, private employment agencies.

3. Data Processing Manager should be logical thinker and have the ability to get along with people.

4. Most feel education was adequate.

5. The data processing manager likes best the problem-solving and challenge factors of his job.

Personal Characteristics (continued):

6. Hobbies are hunting, fishing, participation in sports, and reading. Puzzles are enjoyed.

7. The median age is 33 years.

Promotional Probabilities: Average to Little or None

Promoted to Supervisor.

Education has a definite effect upon promotion.

Salary:

| | |
|---|---|
| Median: | $741 |

4

## CHAPTER XII

# THE SYSTEMS ANALYST*

Systems analysts are, as a rule, men (92 per cent), who obtained their jobs primarily through promotion, by answering advertisements, and through the services of private employment agencies.

## CHARACTERISTICS OF THE JOB OF THE SYSTEMS ANALYST

Primarily the duties performed by a systems analyst in his job are analyzing systems and data flow and preparing flow charts, making block diagrams and preparing programs. The systems analyst confers with other people regarding use of the computer and the preparation of data for it. He debugs programs and codes for programs and tests sample routines.

The systems analysts in this study reported using several program languages in their programming duties, of which autocoder was used by more of the analysts than the other languages, with COBOL and machine language ranking next in order of use, each by about half as many analysts as used autocoder.

### Work Experience Required Prior to Employment

Systems analysts are expected to have considerable data processing experience in order to qualify for their jobs (Table 12-1). Only 27 per cent of the managers indicated that, even with the shortages of systems analysts, they would of necessity consider someone with only up to six months of data processing experience. Over half of them said that at least a year of previous work in data processing was the minimum they would accept, and over 35 per cent felt that more than two years of experience was a necessity.

However, if they could get employees with the amount of experience they really felt was desirable, 75 per cent of the managers indicated that applicants for the job of systems analyst would have more than one year of previous employment in data processing, 55 per cent said more than two years, and almost 40 per cent said three years or more of data processing experience.

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*The job description of the systems analyst is based on the data collected in this study and previously displayed and analyzed in earlier chapters of this report.

Table 12-1. Amount of Data Processing Experience Prior to Employment as a Systems Analyst (% of managers indicating stated amount)

| Months | Minimum Acceptable | Amount Preferred |
|---|---|---|
| 0 - 6 | 27.1 | 14.3 |
| 7 - 12 | 17.1 | 10.0 |
| 13 - 24 | 19.9 | 20.0 |
| 25 - 36 | 18.6 | 17.1 |
| 37+ | 17.1 | 38.6 |

Educational Requirements

More systems analysts hold college degrees than do the individuals in any of the other job categories, with 40.6 per cent holding at least a bachelor's degree. Another 47 per cent have had some education beyond high school but have not completed work for a degree. This educational level held by the systems analyst, however, does not meet the standards preferred by the data processing managers, of whom 87 per cent felt that people in this job should have a least a bachelor's degree.

However, the education completed by systems analysts does meet the minimum standards acceptable to the data processing managers, in that 38 per cent feel that college degree is a minimum amount of education necessary for people in this job, and another 30 per cent say they will consider someone for the job of systems analyst if he has some education beyond high school but not necessarily a degree.

General education. Systems analysts felt that general mathematics was the most valuable general education course they had studied in school, and they felt generally that they should have had more work in advanced mathematics. English, too, ranked high on the list of helpful courses, next to mathematics. This agrees with what management feels to be the most beneficial of the general education courses, although they emphasize the need for good oral communications especially. The systems analysts rank English second in the list of courses in which they wish they had more work. These courses ranked the same in importance at both the high school and post high school levels.

Business courses. Of the business courses considered to be helpful in their jobs, systems analysts mentioned most frequently accounting at the post high school level and bookkeeping in the high school, along with business mathematics at both levels. Of the courses they had had in college, these people have found courses in data processing equipment and data processing applications the most helpful, and statistics is mentioned by quite a number of these employees as being a useful course for their kind of work.

Management, however, felt that systems analysts should study more management courses, including introduction to systems, principles of management and personnel management. They felt, too, that records management and a second year of accounting would be desirable preparation in business for these people.

Promotion, Overtime, Supervision, and Salaries

The systems analyst has a high to average probability of being promoted, according to the managers of data processing departments in which they work, with more of them saying the probability of promotion is high. Over 40 per cent of the managers said that education has a definite bearing on promotability of the systems analyst, while about the same number say that education has "quite a bit" or some influence on promotions of these people.

The systems analyst is likely to be promoted to some higher level supervisory job, to a data processing management position, or to project director.

Most systems analysts are required to work a little overtime. Only 17 per cent of the managers said that their systems analysts worked only regular business hours. Most of them (46 per cent), however, said these employees in their departments work up to seven hours a week overtime, but about 13 per cent said that their employees work more than 12 hours weekly outside of regular hours.

Systems analysts work more or less independently and require little supervision, or according to the data processing managers, "only as needed."

The median salary for systems analysts is $817 a month (Table 12-2). However, the median salary paid systems analysts who hold a college degree is considerably higher than the general median ($839); and those without a degree but with some work beyond high school have a median salary of $790.

The median salary is about $100 a month ($831) more for those with more than three years of data processing experience than those without that amount of experience; however, the median salary for those analysts who have worked between three and ten years is about equal to the total group median, and those with over ten years of experience in the field have a median salary of $865 a month (Table 12-3).

Table 12-2. Salaries Paid Systems Analysts According to Levels of Education

| Salary | Less than High School | High School | Post High School | Degree | Total |
|---|---|---|---|---|---|
| $400-499 | | | 1 | | 1 |
| $500-599 | | 3 | 6 | 1 | 10 |
| $600-699 | | | 7 | 3 | 10 |
| $700-799 | | 6 | 20 | 15 | 41 |
| $800-899 | | 5 | 22 | 13 | 40 |
| $900-999 | | 1 | 2 | 9 | 12 |
| $1000+ | | 2 | 7 | 15 | 24 |
| Totals | 0 | 17 | 65 | 56 | 138 |

Table 12-3. Salaries Paid Systems Analysts According to Amount of Data Processing Experience

| Salary | Under 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 9 Years | 10 Years or More | Total |
|---|---|---|---|---|---|---|
| $400-499 | | | | 1 | | 1 |
| $500-599 | | 5 | 1 | 4 | | 10 |
| $600-699 | 1 | 3 | | 5 | 1 | 10 |
| $700-799 | 1 | 8 | 6 | 17 | 9 | 41 |
| $800-899 | 2 | 2 | 10 | 12 | 14 | 40 |
| $900-999 | | 1 | | 7 | 4 | 12 |
| $1000+ | | 2 | 4 | 7 | 11 | 24 |
| Totals | 4 | 21 | 21 | 53 | 39 | 138 |

Systems analysts have received most of their training in data processing in manufacturers' classes, both before and after they began working in the field; and some of these men received some data processing training in the military service.

## Training Prior to Entering Data Processing

Systems analysts for the most part had their training in data processing after starting to work in the field. However, of the training they received before entering the data processing field, 23 per cent of the courses were received during military service, especially on unit record equipment and in card punching (Table 12-4). The greater portion of the training was received, however, at manufacturers' schools, with more of these individuals having learned data processing concepts there than anywhere else. More of them had received their unit record equipment training in the military service than in schools, however. Most programming was learned at a manufacturer's school, as was operation of the computer.

## Training After Entering Data Processing

Following initial employment in the field of data processing, most of the systems analysts' training was at manufacturers' schools, but almost as much was done on the job (Table 12-5). Only eight per cent of the courses were offered as classes run by the companies themselves, and about three per cent of the training was in classes in local institutions for which the company paid the fees; and about ten per cent of the courses were taken by these employees in local education institutions and paid for by the employee himself. Most of the courses studied by these people dealt with the computer, programming, data processing concepts, and data processing applications.

## Evaluation of Their Education

The systems analysts felt for the most part that their educational background was adequate (about 55 per cent), with about 16 per cent of them indicating that they were very well prepared. Although almost 30 per cent felt that they had not been trained adequately for their jobs, those who had had data processing courses before going into the field were more satisfied with their education. Less than 20 per cent of those with data processing training said they had been inadequately prepared for work in the field, while 35 per cent of those without prior data processing training felt this way.

Table 12-4. Training and Place of Training of Systems Analysts in Data Processing Prior to Entering the Field

| Training | High School | High School Part-time | College | Special Data Processing School | Private Business School | Equipment Manufacturing | Military | Place Not Given | Total |
|---|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 4 |
| Key punch machine | 0 | 0 | 2 | 4 | 2 | 9 | 11 | 0 | 28 |
| Card sorter | 0 | 0 | 1 | 6 | 3 | 7 | 11 | 0 | 28 |
| Unit records | 0 | 0 | 4 | 23 | 12 | 36 | 47 | 0 | 122 |
| Wiring boards | 0 | 0 | 1 | 5 | 2 | 11 | 7 | 0 | 26 |
| Console operation | 0 | 0 | 1 | 1 | 0 | 17 | 6 | 0 | 25 |
| Access devices | 0 | 0 | 1 | 1 | 1 | 13 | 5 | 0 | 21 |
| Data converting | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 0 | 13 |
| Paper tape equipment | 0 | 0 | 0 | 0 | 0 | 8 | 2 | 0 | 10 |
| Data processing concepts | 4 | 0 | 51 | 13 | 7 | 72 | 18 | 0 | 165 |
| Programming | 0 | 0 | 6 | 4 | 1 | 28 | 3 | 0 | 42 |
| Totals | 4 | 0 | 67 | 58 | 28 | 215 | 112 | 0 | 484 |
| Per Cent | 0.8 | .0 | 13.8 | 12.0 | 5.8 | 44.4 | 23.1 | 0 | 99.9 |

Table 12-5. Training and Place of Training of Systems Analysts in Data Processing After Entering the Field

| Training | Company's Classes | Manufacturer's School | Manufacturer's Representative | Local School | On-the-Job | Sent to Local School | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Key punch simulator | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 5 |
| Key punch machine | 8 | 7 | 0 | 1 | 50 | 0 | 6 | 72 |
| Card sorter | 11 | 13 | 0 | 2 | 53 | 0 | 4 | 83 |
| Unit record | 30 | 121 | 9 | 12 | 185 | 1 | 18 | 376 |
| Wiring boards | 5 | 33 | 2 | 1 | 24 | 1 | 6 | 72 |
| Summary punch | 4 | 24 | 2 | 2 | 23 | 0 | 2 | 57 |
| Console operation | 3 | 39 | 7 | 1 | 43 | 0 | 5 | 98 |
| Access devices | 2 | 43 | 10 | 1 | 7 | 1 | 2 | 66 |
| Converting equipment | 2 | 18 | 2 | 0 | 11 | 0 | 4 | 37 |
| Paper tape equipment | 3 | 10 | 4 | 1 | 14 | 0 | 7 | 39 |
| Data processing concepts | 38 | 158 | 26 | 45 | 64 | 16 | 33 | 380 |
| Programming | 11 | 79 | 12 | 6 | 9 | 3 | 3 | 123 |
| Data processing applications | 5 | 24 | 2 | 6 | 38 | 1 | 4 | 80 |
| Accounting | 1 | 0 | 0 | 22 | 8 | 7 | 7 | 45 |
| Management | 11 | 3 | 0 | 31 | 16 | 11 | 13 | 85 |
| Other business courses | 4 | 2 | 0 | 36 | 6 | 10 | 17 | 75 |
| Totals | 138 | 576 | 76 | 167 | 554 | 51 | 131 | 1,693 |
| Per Cent | 8.2 | 34.0 | 4.5 | 9.9 | 32.7 | 3.0 | 7.7 | |

DATA PROCESSING EXPERIENCE

Of the 30 systems analysts who had been with their company for less than a year, only four had had that little amount of data processing experience (Table 12-6). Most systems analysts had worked more than a year in data processing, with over 80 per cent of them with more than three years' experience, and nearly two-thirds of them had been in the field for more than five years. Nearly 60 per cent of the systems analysts had been with the company for more than three years, and 47 per cent had had more than five years' employment with their firms. A greater proportion of the systems analysts had had this amount of data processing experience, so apparently business is able to recruit experienced data processing personnel into this position.

Their experience in data processing, however, has been mainly in the operation of unit record equipment and in programming, with about one-fourth of them reporting experience in these areas. Slightly over a fourth of the analysts (26.4 per cent) had had experience in systems analysis prior to this job, and 15 per cent had served in a supervisory capacity.

Table 12-6. Amount of Work Experience Reported by Systems Analysts

| Amount of Experience | In Data Processing | Total with Present Company |
|---|---|---|
| Up to 1 Year | 4 | 30 |
| 1 - 3 Years | 21 | 28 |
| 3 - 5 Years | 21 | 15 |
| 5 - 9 Years | 53 | 28 |
| 10 or More Years | 38 | 37 |
| Totals | 138 | 138 |

Prior to entering into the field of data processing, systems analysts had worked in the sales and services occupations, accounting and clerical fields, and some had had supervisory experience in other areas of business.

## PERSONAL CHARACTERISTICS

According to data processing managers, systems analysts get along well with people, they are logical thinkers, they are creative and accept challenge. To a lesser extent, managers named emotional stability (in that they can work under pressure) as characteristic of systems analysts.

Systems analysts, whose jobs require little physical activity and much concentration, seem to have leisure time interests of a more active nature. They indicated as outside interests such things as participation in sports; outdoor activities such as hunting, fishing and camping; what might be classified "household activities" such as furniture refinishing, interior decorating, and gardening. Also mentioned quite often as leisure time activities were arts and crafts and reading. Systems analysts enjoy working puzzles, with less than one per cent of them saying they "hated" them; the rest said that puzzles were "O.K." or they liked them.

## ATTITUDES TOWARD DATA PROCESSING AS AN OCCUPATIONAL FIELD

Perhaps reflecting the managers' characterization of the systems analysts as logical thinkers, and people who are creative and who accept challenge, the things that these people like about their jobs are the problem-solving aspects of it and the challenge it presents. They also like the variety in the job.

Systems analysts apparently like data processing as a field since over 90 per cent of them say they enjoy it and plan to remain in it (Table 12-7). Those without data processing training before going into the field express about the same degree of satisfaction as those with prior training, perhaps because most of their training in data processing was received by these people after they had started work in the field.

Table 12-7. Attitude of the Systems Analyst Toward Data Processing Work

| Training | Enjoy-Will Remain | | Enjoy-Desire Change | | Dislike-Will Remain | | Dislike-Desire Change | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Without Training | 78 | 62.0 | 7 | 53.8 | 0 | 0 | 0 | 0 | 85 |
| With Training | 47 | 37.+ | 6 | 46.2 | 0 | 0 | 1 | | 54 |
| Totals | 125 | 90.5 | 13 | 8.6 | 0 | 0 | 1 | | 139 |

## SUMMARY

JOB: Systems Analyst

Duties:

1. Analyze systems and flow charts
2. Make flow charts
3. Make block diagrams
4. Prepare program
5. Debug programs
6. Code for programming
7. Test sample routines
8. Confer regarding
   a. Computer
   b. Key Punch

Supervision Required:

Only as needed

Education:

Minimum: College Degree

Desired: College Degree

General Courses (High School):

1. General Math
2. Advanced Math
3. English
4. Oral and Written Communications
5. Algebra
6. Logic

General Courses (Post High School):

1. General Math
2. English
3. Psychology
4. Advanced Math
5. Social Science

Business Course (High School):

1. Business Math
2. Bookkeeping
3. Introduction to Business

(Least helpful were typing and shorthand; some said bookkeeping)

Business Courses (Post High School):

1. Accounting Principles
2. Statistics
3. Data Processing Equipment

(Least helpful were personnel management, finance, and marketing)

Management Recommendations for Business Courses:

1. Introduction to Systems
2. Principles of Management
4. Records Management
5. Statistics
6. Introduction to Business
7. Second-year Accounting

(Not many responses indicating finance and advanced accounting courses needed)

Experience:

Minimum: 12 to 36 Months

Desired: Over 3 Years

Personal Characteristics:

1. 92% are men.

2. Jobs attained through promotion, ads, and private employment agencies.

3. Systems Analysts are logical thinkers and have the ability to to get along with people.

4. Most enjoy their jobs and wish to remain; this attitude differed little whether or not they had data processing training.

5. Systems Analysts feel to a certain extent that their education is adequate; 30% felt inadequately prepared by schools.

6. The Systems Analyst likes best the problem-solving factor of his job.

7. Hobbies are things requiring physical movement and reading; he enjoys puzzles.

8. The median age is 33 years.

9. The programming languages most frequently used: Autocoder, COBOL and machine language.

<u>Salary</u>:

| | |
|---|---|
| Median: | $810 |

(Salary ranges of $700-799 and $800-899 most often reported. These two ranges, $700-900 together, covered 58% of Systems Analysts.)

| | |
|---|---|
| Men: | $820 |
| Women: | 750 |

(Men earned within the entire scale, $400-1000; women earned within the scale of $500-900. Twenty-four men earned $1000 or more; no women.)

| | |
|---|---|
| High School: | $790 |
| Post High School: | 790 |
| Degree: | 869 |
| | |
| 1-10 Years | $700-900 |
| 10+ Years | 800-899 |

(There is no general trend indicating higher salary ranges as years worked for company increases.)

PART III

CHAPTER XIII

# CURRENT DATA PROCESSING INSTRUCTIONAL PROGRAMS

## STATUS OF DATA PROCESSING INSTRUCTION

In order to gather information about the status of data processing instruction in the public schools of the United States, both at the secondary and the two-year post high school levels, the interviewers talked with heads of data processing instructional departments in 72 high schools, 32 vocational technical schools and 72 junior colleges. The department heads were asked to have the teachers in his department fill out questionnaires concerned with their background, training in business, work experience, and teaching duties. Questionnaires were completed by 259 teachers from two-year post high school institutions and 172 from the 72 high schools. These schools were in the cities in which the businesses were located where the data processing managers were interviewed or were within a 25-mile radius of these cities.

Many of these schools had initiated data processing instructional programs before passage of the Vocational Education Act of 1963, with slightly over 30 per cent of the instructional programs having been begun since 1964, at which time federal funds were available for the purchase of equipment and supplies for instructional purposes (Table 13-1). Apparently the schools in which interviews were conducted had rather early seen the need for instruction in this field. Three of them offered work in data processing as early as 1958 and 14 more started programs in 1959. Of the schools included in this study, only three had started data processing programs as late as 1966. Prior to 1962 proportionally more programs were developed at the post high school level (about 58 per cent) than at the high school level (about 40 per cent). However, relatively more high school programs started in 1963 than did post high school programs so the proportion of programs started by that time was the same in all types of schools.

### Location of Data Processing Instructional Programs

Over half (52 per cent) of the schools in which interviews were held were in three sections of the country: the Middle Atlantic States, the East North Central States, and the Pacific States. This proportion is very close to that found in the census survey conducted prior to the interviews. In that survey, 50.7 per cent of the programs reported were in these three sections of the country (Table 13-2). If the projection of anticipated programs reported in the census survey may be considered valid, by 1969 a total of 60 per cent of the programs in data processing in public schools in the United States will be located in the schools in these three regions of the United States. In the country as a whole, 22 per cent of the schools reported that they definitely will have or are

Table 13-1. Number of Data Processing Instructional Programs Begun in the Years from 1958 to 1967.

| Year | High School | | Voc-Tech School | | Junior College | | Total | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| 1958 | 1 | 1.4 | 1 | 3.2 | 1 | 1.4 | 3 | 1.7 |
| 1959 | 4 | 5.6 | 4 | 12.9 | 6 | 8.3 | 14 | 8.0 |
| 1960 | 3 | 4.2 | 1 | 3.2 | 4 | 5.6 | 8 | 4.6 |
| 1961 | 11 | 15.3 | 5 | 16.1 | 14 | 19.4 | 30 | 17.1 |
| 1962 | 10 | 13.8 | 7 | 22.6 | 16 | 22.2 | 33 | 18.8 |
| 1963 | 19 | 26.4 | 4 | 12.9 | 9 | 12.5 | 32 | 18.3 |
| 1964 | 15 | 20.8 | 6 | 19.4 | 11 | 15.3 | 32 | 18.3 |
| 1965 | 8 | 11.1 | 3 | 9.7 | 8 | 11.1 | 19 | 10.8 |
| 1966 | 1 | 1.4 | 0 | | 2 | 2.8 | 3 | 1.7 |
| 1967 | 0 | | 0 | | 1 | 1.4 | 1 | 0.6 |
| Totals | 72 | 100.0 | 31* | 100.0 | 72 | 100.0 | 175 | |

*Data not available from one vocational-technical school.

Table 13-2. High Schoools, Public Junior Colleges and Vocational Schools Offering or Planning Data Processing Course Work

| Area | High Schools | Offering Courses | % | Anticipated | % | Total | % |
|---|---|---|---|---|---|---|---|
| | **High Schools** | | | | | | |
| New England | 508 | 102 | 20 | 76 | 15 | 178 | 35 |
| Middle Atlantic | 1451 | 232 | 16 | 255 | 18 | 487 | 34 |
| South Atlantic | 644 | 44 | 7 | 58 | 9 | 102 | 16 |
| E. So. Central | 492 | 8 | 2 | 28 | 6 | 36 | 7 |
| W. So. Central | 1237 | 26 | 2 | 63 | 5 | 89 | 7 |
| W. No. Central | 1797 | 80 | 4 | 145 | 8 | 225 | 13 |
| E. No. Central | 2248 | 146 | 6 | 274 | 12 | 420 | 19 |
| Mountains | 458 | 28 | 6 | 52 | 11 | 80 | 17 |
| Pacific | 649 | 75 | 12 | 90 | 14 | 165 | 25 |
| Total | 9484 | 741 | 8 | 1041 | 11 | 1782 | 19 |

| Area | Schools | Offering Courses | % | Anticipated | % | Total | % |
|---|---|---|---|---|---|---|---|
| | **Public Junior Colleges & Vocational Schools** | | | | | | |
| New England | 40 | 14 | 35 | 4 | 10 | 18 | 45 |
| Middle Atlantic | 100 | 56 | 56 | 11 | 28 | 67 | 67 |
| South Atlantic | 126 | 62 | 49 | 19 | 15 | 81 | 64 |
| E. So. Central | 54 | 18 | 33 | 10 | 19 | 28 | 52 |
| W. So. Central | 52 | 25 | 48 | 1 | 2 | 26 | 50 |
| W. No. Central | 102 | 29 | 28 | 18 | 18 | 47 | 46 |
| E. No. Central | 157 | 78 | 50 | 13 | 13 | 98 | 62 |
| Mountain | 38 | 13 | 34 | 16 | 16 | 19 | 50 |
| Pacific | 114 | 79 | 69 | 13 | 13 | 94 | 82 |
| Total | 783 | 374 | 48 | 13 | 13 | 478 | 61 |

anticipating beginning a data processing instructional program by 1969. By this date, over 60 per cent of the public post high school institutions anticipate offering some instruction in data processing and about 19 per cent of the high schools plan such course work (Table 13-2).

A direct relationship seemed to exist between the size of the high school and the likelihood of its offering work in data processing, both in current and anticipated programs. By 1969, over half (57 per cent) of the high schools with over 1,500 students will offer or anticipate offering data processing instruction (Table 13-3); these figures range downward to seven per cent in high schools with enrollments of less than 300.

With the exception of the very largest junior colleges and vocational technical schools, the same trend is apparent at the post high school level, in that the larger the school, the more likely it offers or anticipates offering data processing. By 1969 nearly all two-year post high school institutions with enrollments between 1,000 and 1,500 students will have or plan to have data processing courses, and over half of all the post high school institutions are offering or plan to offer work in data processing by the year 1969.

## INSTITUTING THE DATA PROCESSING CURRICULUM

When asked by the interviewers for the primary reason for starting data processing instruction in their schools, they reported that such programs were initiated because industry needed trained personnel in this field, with 89 out of 171 replies indicating this. About an eighth of the schools established the need for such a program through a community survey; and 20 of the schools (11.7 per cent) said that such courses were needed to update the curriculum (Table 13-4), this last answer being more prevalent among the secondary schools than in the post secondary institutions.

Considering all schools together, the administrators were in the main responsible for initiating the data processing instructional programs, according to the replies given by the data processing personnel interviewed in the schools, with 73 out of 176 schools (41.5 per cent) indicating thus (Table 13-5). On the other hand, in 45 schools (25.6 per cent) the business education faculty was reported to have provided the main impetus for starting the data processing instructional program. However, in the junior colleges, the business teachers were the people who tended to initiate data processing programs to a slightly greater degree than did the administrators (25 and 23 out of 72, respectively). However, administration together with the business education faculty generally provided the impetus for initiating data processing courses in their schools in that in nearly three-fourths of the schools these were the people credited with getting the program started.

Table 13-3. Number of High Schools, Public Junior Colleges and Vocational Schools Offering or Planning Data Processing Course Work. (Schools of Different Sizes)

| School Size | High Schools | | | | | | |
|---|---|---|---|---|---|---|---|
| | N | D.P. Courses | % | Anticipated | % | Total | % |
| 1- 299 | 3441 | 93 | 3 | 159 | 5 | 252 | 7 |
| 300- 599 | 2276 | 126 | 6 | 257 | 11 | 383 | 17 |
| 600- 999 | 1219 | 114 | 9 | 224 | 18 | 338 | 28 |
| 1000-1499 | 720 | 120 | 17 | 160 | 22 | 280 | 39 |
| 1500+ | 904 | 256 | 28 | 261 | 29 | 517 | 57 |
| Total | 8560 | 709 | 8 | 1061 | 12 | 1770 | 21 |

| School Size | Public Junior Colleges & Vocational Schools | | | | | | |
|---|---|---|---|---|---|---|---|
| | N | D.P. Courses | % | Anticipated | % | Total | % |
| 1- 299 | 277 | 73 | 26 | 38 | 14 | 111 | 40 |
| 300- 599 | 165 | 64 | 39 | 28 | 17 | 92 | 56 |
| 600- 999 | 129 | 62 | 48 | 24 | 19 | 86 | 79 |
| 1000-1499 | 108 | 88 | 81 | 11 | 10 | 99 | 92 |
| 1500+ | 75 | 43 | 57 | 3 | 4 | 46 | 61 |
| Total | 754 | 330 | 44 | 104 | 14 | 434 | 58 |

Table 13-4. Primary Reason for Initiating an Instructional Program in Business Data Processing

| Reason | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Need for trained personnel | 33 | 15 | 41 | 89 |
| Could place students | 2 | 2 | 1 | 5 |
| To update curriculum | 12 | 1 | 7 | 20 |
| Interest of teachers in data processing | 2 | 0 | 2 | 4 |
| Community survey showed need | 7 | 2 | 11 | 23 |
| Other | 14 | 6 | 10 | 30 |
| Totals | 70 | 29 | 72 | 171 |

Table 13-5. Persons Responsible for Initiating Data Processing Instructional Programs

| Persons Responsible | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Administration | 32 | 18 | 23 | 73 |
| Business education faculty | 18 | 2 | 25 | 45 |
| Administration and business education faculty | 6 | 1 | 3 | 10 |
| Business and industry | 5 | 3 | 4 | 12 |
| Advisory committee | 3 | 3 | 3 | 9 |
| Other | 8 | 5 | 14 | 27 |
| Total | 72 | 32 | 72 | 176 |

## Objectives of Data Processing Instruction

Providing vocational preparation in the field of data processing is the objective of data processing instruction in all three types of schools. This question was asked as an open-end, free-response question; and in all of them, except two, if not specifically using the word "vocational," it is implicit in the statements, summarized in Table 13-6. Only 23 responses out of 176 indicated that the primary objective of data processing instruction was to provide a general knowledge about data processing or to provide acquaintanceship level of machine operating skill. Among the "Other" responses were such things as vocational training for and upgrading of present employees and providing background for further study.

Table 13-6. Primary Objective of Data Processing Instruction

| Objective | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Vocational preparation of students | 44 | 27 | 47 | 118 |
| Provide general knowledge | 10 | 1 | 7 | 18 |
| Provide acquaintanceship level of skill in equipment operation | 3 | 0 | 2 | 5 |
| Vocational preparation and provide general knowledge | 5 | 2 | 9 | 16 |
| Vocational preparation-retraining | 3 | 1 | 0 | 4 |
| Other | 7 | 1 | 7 | 15 |
| Total | 72 | 32 | 72 | 176 |

When the decision had been made to include data processing instruction in the curriculum, the different schools chose different approaches to the introduction of such instruction. Vocational-technical schools tended to organize a series of courses, whereas junior colleges and high schools began their data processing instruction mainly through the inclusion of an introductory course in the curriculum (Table 13-7).

Table 13-7. Ways Data Processing Instruction Was Introduced into Curriculum.

| Ways | High Schools N | High Schools % | Voc-Tech Schools N | Voc-Tech Schools % | Junior Colleges N | Junior Colleges % | Total N | Total % |
|---|---|---|---|---|---|---|---|---|
| Introductory course | 28 | 45.9 | 8 | 25.8 | 27 | 41.5 | 63 | 40.1 |
| Sequence of courses | 10 | 16.4 | 13 | 41.9 | 22 | 33.8 | 45 | 28.7 |
| Unit in another class | 14 | 22.9 | 5 | 16.1 | 2 | 3.1 | 21 | 13.3 |
| A complete curriculum | 2 | 3.3 | 5 | 16.1 | 9 | 13.8 | 16 | 10.2 |
| Mentioned in other classes | 4 | 6.6 | 0 | | 0 | | 4 | 2.5 |
| Other | 3 | 4.9 | 0 | | 5 | 7.7 | 8 | 5.1 |
| Total | 61 | 100.0 | 31 | 99.9 | 65 | 99.9 | 157 | 99.9 |

About 10 per cent of the schools said they introduced a complete curriculum in data processing when introducing this instructional field into the curriculum. High schools tended more so than other schools to introduce data processing as a unit in other courses.

Problems in Establishing and Operating a Data Processing Program

Getting teachers, financing the program, and selecting equipment ranked, in that order, as the leading problems in establishing data processing programs in high schools and junior colleges (Table 13-8). Vocational schools reported more frequently than other schools that fixing responsibility for equipment maintenance was an initial problem. Junior colleges apparently had slightly more of a problem in getting teachers than did high schools, perhaps because junior colleges tended to offer more advanced work than did the high schools. However, high schools reported more problems in financing the program than did the junior colleges or vocational schools. Selecting equipment appeared to be more of a problem for the junior colleges than for the other kinds of schools, again perhaps because many high school programs were limited primarily to key punch instruction and introduction to data processing courses.

Table 13-8. Administrative Problems in Establishing the Data Processing Instructional Program.

| Problem | High Schools N 72* | % | Voc-Tech Schools N 32* | % | Junior Colleges N 72* | % | Total N 176* | % |
|---|---|---|---|---|---|---|---|---|
| Getting teachers | 37 | 51.4 | 17 | 53.1 | 41 | 56.9 | 95 | 54.0 |
| Financing | 34 | 47.2 | 12 | 37.5 | 28 | 38.9 | 74 | 42.0 |
| Selecting equipment | 16 | 22.2 | 7 | 21.9 | 21 | 29.2 | 44 | 25.0 |
| Fixing responsibility for maintenance of equipment | 11 | 15.3 | 10 | 31.2 | 8 | 11.1 | 29 | 16.5 |
| Selling program to administration | 7 | 9.7 | 2 | 6.2 | 10 | 13.9 | 19 | 10.8 |
| Scheduling administrative and instructional time on equipment | 4 | 5.6 | 1 | 3.1 | 9 | 12.5 | 14 | 8.0 |
| Selling program to the public | 5 | 6.9 | 3 | 9.4 | 4 | 5.6 | 12 | 6.8 |
| Other | 4 | 5.6 | 3 | 9.4 | 4 | 5.6 | 11 | 6.2 |

*Columns add to more than N since the schools may have listed more than one problem.

However, in operating the program, the relative importance of the problems shifted slightly, although getting teachers was still the number one problem in all three types of schools (Table 13-9). In operating the program (perhaps as programs expanded) high schools found that selecting equipment after the program was underway was more of a problem than it had been in establishing the program, and financing ranked third as a problem in operating the program in high schools. On the other hand, both junior colleges and the vocational technical schools indicated that financing the program was the second most serious problem and allocating and scheduling time on the equipment for administrative and instructional purposes ranked either second or third.

Table 13-9. Administrative Problems in Operating a Data Processing Instructional Program.

| Problem | High Schools N 72* | % | Voc-Tech Schools N 32* | % | Junior Colleges N 72* | % | Total N 176* | % |
|---|---|---|---|---|---|---|---|---|
| Getting teachers | 31 | 43.1 | 22 | 68.8 | 46 | 63.9 | 99 | 56.2 |
| Financing | 13 | 18.1 | 7 | 21.9 | 22 | 30.6 | 42 | 23.8 |
| Scheduling administrative and instructional time on equipment | 10 | 13.9 | 7 | 21.9 | 20 | 27.8 | 37 | 21.0 |
| Selecting equipment | 14 | 19.4 | 4 | 12.5 | 10 | 13.9 | 28 | 15.9 |
| Fixing responsibility for equipment maintenance | 9 | 12.5 | 1 | 3.1 | 13 | 18.1 | 23 | 13.1 |
| Selling program to administration | 7 | 9.7 | 1 | 3.1 | 5 | 6.9 | 13 | 7.4 |
| Getting maintenance service on equipment | 3 | 4.2 | 2 | 6.2 | 5 | 6.9 | 10 | 5.7 |
| Other | 1 | 1.3 | 3 | 9.4 | 4 | 5.6 | 8 | 4.5 |

*Columns add to more than N since the schools may have listed more than one problem.

Among the less frequently mentioned administrative problems both in establishing and in operating the data processing instruction program were those of fixing the responsibility for maintaining the equipment and selling the administration on the program. This last seems a bit inconsistent with the previous statement that the administrative people provided the primary impetus in initiating the data processing instructional programs.

Curricular and instructional problems. Philosophical differences among the several departments concerned with use of the data processing equipment (mathematics, science, engineering, business, etc.) was either the first or second ranked curricular problem reported by all three types of schools (Table 13-10). While developing appropriate curricula was the main problem among the high schools and vocational-technical schools, this was ranked fifth among the responses from the junior colleges. Other curricular and instructional problems included such things as scheduling the students on the equipment (too many students for the amount of equipment available), determining who should be admitted to the data processing programs, and keeping updated.

Table 13-10. Curricular and Instructional Problems in Operating a Data Processing Instructional Program.

| Problem | High Schools N 72 | % | Voc-Tech Schools N 32 | % | Junior Colleges N 72 | % | Total N 176 | % |
|---|---|---|---|---|---|---|---|---|
| Philosophic differences among departments involved | 31 | 43.1 | 14 | 43.8 | 29 | 40.3 | 74 | 42.0 |
| Curriculum | 36 | 50.0 | 14 | 43.8 | 14 | 19.4 | 64 | 36.4 |
| Scheduling students on equipment | 23 | 31.9 | 8 | 25.0 | 15 | 20.8 | 46 | 26.1 |
| Selecting students for the program | 18 | 25.0 | 8 | 25.0 | 16 | 22.2 | 42 | 23.9 |
| Keeping updated | 11 | 15.3 | 6 | 18.8 | 18 | 25.0 | 35 | 19.9 |
| Placement of students on job | 6 | 8.3 | 4 | 12.5 | 3 | 4.2 | 13 | 7.4 |
| Lack of student interest | 4 | 5.6 | 1 | 3.1 | 4 | 5.5 | 9 | 5.1 |
| Other | 11 | 15.3 | 9 | 28.1 | 25 | 34.7 | 45 | 25.6 |

Changes in curriculum. Teachers in all three types of schools reported that necessary changes in the data processing curriculum were determined mainly by talking with businessmen (Table 13-11). This basis for curriculum change was the most frequently reported, especially among the vocational schools and the junior colleges. Talks with other data processing teachers apparently gave data processing personnel ideas for needed curriculum changes also, since this was ranked second as the basis for curriculum change, although it was named only about one-third as often as talking with businessmen. Some schools did follow-up studies of students and some followed suggestions for curriculum made by equipment manufacturers.

Table 13-11. Bases for Making Curricular Changes.

| Basis for Change | High Schools N 72 | % | Voc-Tech Schools N 32 | % | Junior Colleges N 72 | % | Total N 176 | % |
|---|---|---|---|---|---|---|---|---|
| Talks with businessmen | 29 | 40.3 | 22 | 68.8 | 56 | 77.8 | 107 | 60.8 |
| Talks with other data processing teachers | 13 | 18.0 | 3 | 9.4 | 15 | 20.8 | 31 | 17.6 |
| Follow-up studies of students | 13 | 18.0 | 4 | 12.5 | 12 | 16.7 | 29 | 16.5 |
| Suggestions from equipment manufacturers | 8 | 11.1 | 4 | 12.5 | 12 | 16.7 | 24 | 13.6 |
| Evaluation by teachers | 8 | 11.1 | 3 | 9.4 | 7 | 9.7 | 18 | 10.2 |
| Reading journals | 9 | 12.5 | 1 | 3.1 | 8 | 11.1 | 18 | 10.2 |
| Reading research | 5 | 6.9 | 1 | 3.1 | 9 | 12.5 | 15 | 8.5 |
| Administrative directives | 7 | 9.7 | 0 | | 2 | 2.8 | 9 | 5.1 |

Differences Between Adult Evening School and Regular Data Processing Programs. Among the schools that offer adult evening programs in data processing, most indicated that they offer the same program in both the evening and day classes, with this tendency being the greatest among the junior colleges, with 48 out of 64 responses indicating this practice (Table 13-12). Eleven out of 64 responses from high schools indicated that they offer the same program for adults as they do in the daytime programs; however, the same number said that a different approach and emphasis was used in adult classes. A greater proportion of the high school responses said that adults work at a faster pace than regular students, but this was not true in the post high school institutions.

**Table 13-12. Differences Between Adult Evening School and Regular Data Processing Programs***

| Differences | High Schools N=48 | Voc-Tech Schools N=18 | Junior Colleges N=40 | Total N=106 |
|---|---|---|---|---|
| Different approach and emphasis | 11 | 54 | 8 | 23 |
| More advanced work | 5 | 4 | 3 | 12 |
| Fewer courses available to adults | 2 | 7 | 3 | 12 |
| Work presented at a slower pace | 4 | 6 | 1 | 11 |
| Work presented at a more rapid pace | 8 | 2 | 0 | 10 |
| More courses available to adults | 4 | 1 | 4 | 9 |
| Work presented in larger blocks | 4 | 3 | 1 | 8 |
| More hands-on experience for adults | 2 | 0 | 1 | 3 |
| Other | 13 | 4 | 5 | 22 |
| No difference | 11 | 5 | 48 | 64 |

*Respondents could make more than one response to this question.

In other areas of possible difference between adult and regular programs, no consistency was found. For example, nine schools said that more courses were available to adults; 12 said that fewer courses were offered to these students; ten schools indicated that adults work at a more rapid pace, but 11 said that the work was offered at a slower pace.

Reasons for adult programs in data processing. According to data processing instructional personnel in schools offering adult evening courses, the adult students are enrolled primarily to obtain the necessary background and skills to upgrade themselves from their present jobs (Table 13-13). Following closely in frequency of number of times mentioned is that these people are taking evening school courses in order to change jobs; that is, for the purpose of moving from their present jobs into the field of data processing.

Table 13-13. Reasons Given by Adult Evening Students for Enrolling in Data Processing Courses*

| Reasons | High Schools N=48 | Voc-Tech Schools N=18 | Junior Colleges N=40 | Total N=106 |
|---|---|---|---|---|
| Upgrading: moving from one data processing job to another | 25 | 20 | 50 | 95 |
| Retraining: moving from present job into a data processing job | | 11 | 41 | 84 |
| Pre-employment training | 24 | 9 | 32 | 65 |
| Updating managers and accountants | 4 | 3 | 16 | 23 |
| Interested and curious: want general understanding | 12 | 7 | 16 | 35 |
| Other | 1 | 1 | 10 | 12 |

*Respondents may have given more than one reason.

The reasons vary in importance according to the type of school. The most important function of the night school classes in the vocational-technical schools is given to upgrading within the data processing field, while the high schools claimed that the reason adults enroll in their evening school courses is for retraining; that is, employed adults get training in data processing in order to move from their present jobs into data processing. About an equal proportion of the responses indicated pre-employment training in all three kinds of schools, but the junior colleges indicated to a greater extent than the others that their courses provided updating for managers and accountants.

## DATA PROCESSING STUDENTS

Table 13-14 shows the grade levels at which students study data processing in the three kinds of schools, including night school classes and MDTA programs. A few of the high schools permit youngsters as low as the tenth grade to take data processing courses. Adult evening courses are relatively popular, in that over 50 per cent of each of the three types of schools offer adult evening courses in data processing. A few of the vocational-technical schools offer work to high school students as well as to those at the post high school level.

Table 13-14. Grade Level of Students in Data Processing Courses

| Grade Level | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total* N=176 |
|---|---|---|---|---|
| Secondary | | | | |
| 11th and 12th | 34 | 1 | 0 | 35 |
| 12th | 19 | 6 | 0 | 25 |
| 10th, 11th, 12th | 8 | 2 | 1 | 11 |
| Post High School | | | | |
| Adult evening | 48 | 18 | 40 | 106 |
| 13th and 14th | 7 | 28 | 66 | 101 |
| Pre-employment night | 14 | 12 | 44 | 70 |
| MDTA | 2 | 3 | 0 | 5 |
| Totals | 134 | 70 | 151 | 355 |

*Since schools may have had both day and evening classes, totals are greater than the number of schools interviewed.

Selection of Students

Of the 176 schools in the study, over one-third of them reported screening of students for entry into the data processing program (Table 13-15). High Schools tend to be more selective than are the post high school institutions, with slightly over 70 per cent of the 72 high schools using some criterion for selecting students, while only about 45 per cent of the 104 post high school institutions reported having admission standards.

Although not widely used, the most popular method of selecting students is on the basis of test scores. The test used by most of the schools, 48 out of 176, was a programming aptitude test (Table 13-16). Half that number, 24 schools, indicated that they used "company" tests; that is, data processing aptitude tests provided by equipment manufacturers; and 20 schools said they used general scholastic aptitude test scores for selecting students for their data processing programs.

Some of the schools indicated that certain courses were prerequisites for entry into the study of data processing (Table 13-17). To a certain extent, mathematics is a prerequisite, especially in the vocational-technical schools. Over half the vocational-technical schools and about one-third of the junior colleges specify mathematics as a prerequisite, while about a fourth of the high schools say that students must have studied mathematics before entering the data processing program.

Typing ranks second as a prerequisite, with its being required in 27 high schools (37.5 per cent); and 12 out of the 32 vocational schools (38.7 per cent) listed typing as a prerequisite course. However, only five junior colleges named typing as a course necessary for entrance into data processing courses.

Bookkeeping and accounting were required for entry into data processing by one-fourth of the high schools and an eighth of the junior colleges, and five out of the 32 vocational-technical schools specified bookkeeping or accounting as a prerequisite. Other courses were infrequently mentioned perhaps because some of these courses were the general education ones that are required of all students in many schools, no matter what the major interest of the students is.

Table 13-15. Bases for Selecting Students for the Data Processing Programs*

| Basis for Selection | High School N=72 | Post High School N=104 | Total N=176 |
|---|---|---|---|
| Test scores | 23 | 44 | 67 |
| Grade point average (specified courses) | 19 | 7 | 26 |
| Grade point average (over-all) | 13 | 10 | 23 |
| Counseling and advising | 16 | 5 | 21 |
| Selected background courses | 5 | 12 | 17 |
| Personal characteristics | 10 | 5 | 15 |
| Other | 4 | 12 | 16 |
| No selection done | 21 | 57 | 78 |

*Totals are greater than number of schools because some schools used more than one criterion in the student selection procedure.

Table 13-16. Kinds of Aptitude Tests Used in the Selection of Data Processing Students.

| Tests | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| Programming aptitude | 12 | 21 | 15 | 48 |
| "Company" tests | 16 | 5 | 3 | 24 |
| Scholastic aptitude | 5 | 4 | 11 | 20 |
| Math aptitude | 3 | 4 | 6 | 13 |
| Unspecified aptitude | 4 | 9 | 0 | 13 |
| Interest inventories | 1 | 3 | 2 | 6 |
| Logic | 1 | 2 | 0 | 3 |
| Other | 2 | 1 | 1 | 4 |

Table 13-17. Prerequisites for Entry into Data Processing Courses

| Prerequisite | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| Mathematics | 19 | 15 | 21 | 55 |
| Typing | 27 | 12 | 5 | 44 |
| Bookkeeping and/or accounting | 18 | 5 | 12 | 35 |
| English | | 2 | 2 | 4 |
| Introduction to business | 1 | | 3 | 4 |
| Office procedures | 3 | | 1 | 4 |
| Science | | 2 | 2 | 4 |

Characteristics of Data Processing Students

When asked to describe the outstanding personal characteristics of data processing students, teachers most frequently mentioned that these students showed a greater degree of neatness in their work than other students (Table 13-18). The next most outstanding characteristic was that of persistence on the part of these students in problem solving; they were not content to leave a problem until it was complete. Data processing students tend to pay attention to detail, are logical thinkers, and display systematic work habits. To a lesser extent, teachers mentioned that data processing students were eager and interested; they liked puzzles or problem-solving activities; they tended to be creative; and a few teachers mentioned that these students were "machine happy"--they liked working with the equipment and making the machines perform properly and liked to use the machines to solve problems.

Table 13-18. Personal Characteristics of Data Processing Students

| Characteristics | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| Neatness in work | 22 | 5 | 20 | 47 |
| Persistence in problem solving | 7 | 9 | 12 | 28 |
| Pay attention to details | 7 | 5 | 8 | 20 |
| Logical thinkers | 4 | 1 | 15 | 20 |
| Systematic work habits | 5 | 5 | 6 | 16 |
| Eager, interested | 5 | 4 | 4 | 13 |
| Likes puzzle problem-solving activities | 1 | 5 | 2 | 8 |
| Creative | 1 | 2 | 2 | 5 |
| "Machine-happy" | 2 | 0 | 2 | 4 |

## Placement of Data Processing Students in Business

The schools help their data processing students in a variety of ways to get employment in the business world. Primarily the data processing department helps them or the schools have a placement service (Table 13-19). In 24 schools, students are placed in their jobs as a result of business contacting the schools asking for students to fill openings in their data processing departments. To a lesser extent the student personnel office acts as a placement bureau and helps locate jobs for the students, or the student hears about jobs openings through the data processing teachers. Some schools reported working with public employment agencies and the advisory committee of the Data Processing Management Association helps students find jobs. However, 31 of the 176 schools reported that they provide no placement services.

Table 13-19. Job Placement Services Provided to Data Processing Students

| Job Placement Method | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| School has placement service | 16 | 7 | 33 | 56 |
| Department helps place students | 19 | 8 | 9 | 36 |
| Businesses contact school | 9 | 6 | 9 | 24 |
| Placed through student personnel office | 5 | 3 | 6 | 14 |
| Placed through teacher contacts | 7 | 3 | 2 | 12 |
| School works with publc employment agency | 2 | 4 | 4 | 10 |
| Advisory committee of D.P.M.A. | 2 | 4 | 3 | 9 |
| Informal placement | 4 | 0 | 2 | 6 |
| Other | 3 | 4 | 3 | 10 |
| No placement service | 16 | 2 | 13 | 31 |

Location of jobs received by students. By far, most of the jobs obtained by the students are in local businesses (remembering that, for the most part, the interviews in the schools in this study were conducted in urban or industrial areas), with 115 of 154 schools responding to this question indicating local placement of students (Table 13-20). Twenty-five of the schools said their students receive jobs in nearby large cities; and a few said their students find employment all over the country.

Problems in placing students. Considerably over half the schools expressed no particular problem in placing their data processing students in jobs, although 23 did say that the demand for their students was greater than the supply of students available for placement (Table 13-21). Sixteen schools stated that one of the major problems was that students were hired by business before they had completed their studies, and about an equal number said that business wanted only top students, making it a problem to place the poor students in this field.

Among the miscellaneous problems brought out by a few of the schools was that businesses wanted experienced people and were reluctant to hire their students because the companies felt that many of the young people would leave shortly and go on to college.

Table 13-20. Location of Jobs in Which Students are Placed

| Location | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| Locally | 45 | 23 | 47 | 115 |
| Nearby large cities | 10 | 6 | 9 | 25 |
| All over the country | 2 | 2 | 3 | 7 |
| Program too new, don't know | 1 | 0 | 6 | 7 |

Table 13-21. Problems in Placing Data Processing Students

| Problems | High Schools N=72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| No particular problems | 31 | 12 | 38 | 81 |
| Demand greater than supply | 6 | 6 | 11 | 23 |
| Students hired before courses completed | 5 | 4 | 7 | 16 |
| Placing poor students; business wants top students | 6 | 3 | 6 | 15 |
| Program too new | 1 | 2 | 6 | 9 |
| Business reluctant to hire girls | 2 | 3 | 1 | 6 |
| Miscellaneous problems | 20 | 10 | 12 | 42 |

## COURSES AND COURSE CONTENT

### High Schools

Course coverage in data processing courses at the high school level in the schools included in this study is relatively limited, with the exception of a few schools. The head of the data processing departments in each of the schools was asked to examine a list of course titles to select those most closely resembling the titles of the courses offered in his school and to supply the title used in his school for the course. The course titles given by the interviewees are listed in Appendix C-5.

Compilation of the data regarding courses offered revealed that in general high school data processing is offered mainly in three courses: Introduction to Data Processing, Unit Record Systems and Equipment, and Data Processing Applications. Ten schools also reported offering a course entitled Introduction to Programming. Other courses reported by high schools in lesser numbers are shown, together with the number of schools in which they are offered, in Appendix C-5.

Concepts and topics developed. The figures in the appendix tables as well as in Tables 13-22 and 13-23 include not only the introduction of the concepts, but in addition reflect the further development of the topic in other courses; for instance, the concept of flow charting may be introduced in the introductory data processing course, further developed in a data processing applications course. The tables represent the total number of times the concepts and applications were mentioned by the school but they give no indication of whether or not the topics and applications were mentioned by the same school more than once in different courses.

Table 13-22 shows the concepts and topics incorporated in the four main courses by at least 10 of the 72 high schools. The Introduction to Data Processing course seems to be a rather broad course covering the field of data processing at least to the extent that the student might develop a "feel" for what data processing is and have some idea of the means by which data processing is done in business offices. The topics developed in this course include basically an overview of the concept of unit record systems and the functions of the machines involved in such systems. In about 30 per cent of the secondary schools such topics as flow charting, principles of data processing, card layout and design and computer equipment are covered in the introductory course. Such topics as block diagramming, number systems, coding and condensing data, computer logic, essentials of programming, and principles and theory of digital computers were discussed in an introductory course in less than 20 per cent of the secondary schools in this study.

Table 13-22. Topics and Concepts Discussed in Data Processing Courses by 10 or More Secondary Schools

| Topic or Concept | Data Processing Courses | | | |
|---|---|---|---|---|
| | Intro. to D.P. | Unit Record Sys.& Equip. | Data Processing Applications | Intro. to Programming |
| Overview of unit record system | 34 | 11 | 12 | |
| History of data processing | 34 | | 13 | |
| Functions of key punch | 30 | 16 | 14 | |
| Functions of sorter | 30 | 16 | 14 | |
| Functions of accounting machine | 30 | 17 | 14 | |
| Functions of collator | 29 | 13 | 15 | |
| Functions of reproducer | 29 | 16 | 14 | |
| Card layout and design | 29 | 13 | 14 | |
| Flow charting | 23 | | 12 | |
| Principles of data processing | 22 | | 11 | |
| Forms design | 21 | 16 | 14 | |
| Computer equipment | 20 | | 10 | (9) |
| Procedures development | 18 | | 10 | |
| Central processing unit | 18 | | | |
| Block diagramming | 15 | | 10 | (9) |
| Number systems | 14 | | 11 | |
| Purpose/functions-language | 14 | | | |
| Coding, condensing data | 14 | | | (9) |
| Computer applications | 14 | | | (9) |
| Computer logic | 13 | | 10 | |
| Programming essentials | 11 | | | 10 |
| Principles & theory of digital computers | 10 | | | |

Less than 20 per cent of the schools had a course which might be entitled Data Processing Applications in which several of the topics from the introductory course could be developed further. The topics included in the course called Introduction to Programming included coding and condensing data, purposes and functions of different languages, and block diagramming as well as programming essentials.

Applications and skills developed. Along with the discussions "about" data processing topics in these courses, the students in some schools were reported to have opportunity to apply their knowledges and develop certain skills (Table 13-23). Generally speaking, the applications and skills were those connected with unit record equipment, but some schools reported that students prepared flow charts, designed forms, and planned punch card layouts. (Details of the skills developed and the application of the knowledges are shown in Appendix C-6.)

Table 13-23. Skills and Knowledges Applied in Data Processing Courses by 10 or More Secondary Schools

| Skills and Knowledges | Data Processing Courses | | |
|---|---|---|---|
| | Introduction to Data Processing | Unit Record Sys.& Equip. | Data Processing Applications |
| Operate key punch | 26 | 20 | 17 |
| Plan and punch program card | 22 | 17 | 16 |
| Operate sorter | 21 | 20 | 16 |
| Operate accounting machine | 20 | 20 | 15 |
| Card layout and design | 20 | 16 | 17 |
| Wire accounting machine panel | 14 | 18 | 13 |
| Flow charting | 17 | 10 | 14 |
| Operate collator | 15 | 14 | 14 |
| Operate reproducer | 16 | 16 | 15 |
| Design forms | | 14 | 10 |
| Wire reproducer panel | 12 | 14 | 14 |
| Wire collator panel | 10 | 12 | 12 |

The extent to which skills are developed is shown in Table 13-24. With the exception of skill in operating the key punch and the sorter, less than half of the secondary schools interviewed in the study claimed to develop vocational level competency in operating skills on data processing equipment. Of the high schools offering experience in operating data processing equipment, the machine on which most schools claimed to develop vocational skill was the interpreter. Nearly three-fourths of the schools provided experience on the sorter and the collator; however, vocational skills are developed in only 56 and 38 of the 72 high schools, respectively. Operation of the accounting machine (tabulator) was taught in 54 of the 72 schools, of whom 63 per cent said their students were vocationally competent in operating this machine and 31.5 per cent said they provided opportunity to develop an acquaintanceship level of skill. Some programming is done in 38 out of 72 schools (52.8 per cent); and out of the 38, fifteen (35.9 per cent) claimed that their students acquire a vocational level of skill in programming.

A list of the textbooks used in the data processing courses taught in the schools surveyed is displayed in Appendix D.

Table 13-24. Operational Skills With the Degree of Proficiency Developed by Students in Secondary Schools Offering Training on Machines and in Programming

| Skill | Total Schools Offering | General Knowledge About | | Knowledge About Applications | | Acquaintanceship | | Vocational | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % |
| Key punch simulator | 28 | 4 | 14.3 | 0 | 0.0 | 17 | 60.7 | 7 | 25.0 |
| Key punch | 68 | 1 | 1.5 | 0 | 0.0 | 21 | 30.9 | 46 | 67.6 |
| Verifier | 29 | 6 | 20.7 | 0 | 0.0 | 6 | 20.7 | 17 | 58.6 |
| Sorter | 56 | 1 | 1.8 | 0 | 0.0 | 15 | 26.8 | 40 | 71.4 |
| Reproducer | 47 | 3 | 6.4 | 1 | 2.1 | 12 | 25.5 | 31 | 66.0 |
| Collator | 38 | 3 | 7.9 | 2 | 5.3 | 6 | 15.8 | 27 | 71.1 |
| Interpreter | 27 | 2 | 7.4 | 2 | 7.4 | 4 | 14.8 | 25 | 92.6 |
| Accounting machine | 54 | 3 | 5.6 | 0 | 0.0 | 17 | 31.5 | 34 | 63.0 |
| Computer | 28 | 1 | 3.6 | 3 | 11.0 | 10 | 35.7 | 14 | 50.0 |
| Card processor | 14 | 0 | 0.0 | 0 | 0.0 | 7 | 50.0 | 7 | 50.0 |
| Tape drive | 8 | 2 | 25.0 | 1 | 12.5 | 3 | 37.5 | 2 | 25.0 |
| Data converter | 3 | 1 | 33.3 | 0 | 0.0 | 1 | 33.3 | 1 | 33.3 |
| Random access devices | 11 | 2 | 18.2 | 0 | 0.0 | 3 | 27.3 | 6 | 54.5 |
| High speed printer | 17 | 2 | 11.1 | 1 | 5.9 | 6 | 35.3 | 8 | 47.0 |
| Programming | 38 | 4 | 10.5 | 1 | 2.6 | 8 | 21.0 | 15 | 39.5 |

Post High School Institutions

Course coverage is broader in the post high schools institutions than in the secondary schools, both in content and in number of courses (Table 13-25).

Concepts and topics developed. Whereas high school work in data processing was confined mainly to three courses, ten different courses were named by at least ten post high school institutions. Although a general introduction to data processing and a course in unit record systems and equipment were offered in junior colleges and vocational-technical schools as well as in high schools, these courses at the post high school level included more topics of a more technical nature than did courses with those titles offered at the high school level.

Other courses provided more depth in programming, systems analysis, procedures development, technical information about computers (both their functions and operation), and logic. (Details of the concepts presented are shown in Appendix C-7.)

Applications and skills. The junior college and vocational-technical students seemed to have more opportunity than did high school students to apply knowledges and develop skills in various aspects of data processing (Table 13-26). Aspects of systems analysis are carried out in several courses at the post high school level and more work is done in programming and related activities than at the high school level.

The degree of proficiency attained by the post high school students in the operation of certain machines and in programming is shown in Table 13-27. All the vocational-technical schools and junior colleges develop some degree of skill in both key punch and on the sorter, and nearly all of them on the accounting machine. However, more post high school than secondary schools claimed to develop only general knowledge about the operation of these machines or a knowledge about the applications of them in business, with fewer of them developing vocational skill than at the high school level. About the same proportion of schools at both levels reported developing vocational competency in the operation of the accounting machines, but more high schools than post high schools gave only general knowledge of the accounting machine.

Relatively more post secondary schools develop a vocational level of skill in programming than do high schools, with 90 out of 104 junior colleges and vocational-technical schools (86.5 per cent) developing programming skill compared with 52.8 per cent of the high schools. Of the high schools, only 15 (20.8 per cent) claimed to develop vocational competency in programming, while 71 (68.3 per cent) of the post high school institutions claim their students attain vocational competency in programming in their courses.

A smaller proportion of the post high school institutions developed vocational skill in computer operation than in programming. Also about 60 to 65 per cent of these institutions develop skills in operating unit record equipment to a level of vocational competency. The proportions at the high school level are slightly higher (Table 13-24).

Table 13-25. Topics and Concepts Included in Data Processing Courses in 10 or More Post Secondary Schools

| Topics and Concepts | Data Processing Courses | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D. P. | Unit Record Sys.& Equip. | Intro. to Comp.Prog. | Intro. to Dig. Comp. | Intro. to Sys. Anal. | Advanced Prog. | D. P. Math | D. P. Sys. | Prog. Sys. | D. P. Appli. |
| History of data processing | 76 | 20 | | | | | | | | |
| Principles of data processing | 70 | 19 | 13 | 11 | | | | | | |
| Overview of unit record system | 59 | 38 | | | | | | | | |
| Functions of key punch | 57 | 54 | | | | | | | | |
| Functions of sorter | 55 | 55 | | | | | | | | |
| Functions of collator | 52 | 58 | | | | | | | | |
| Functions of reproducer | 50 | 58 | | | | | | | | |
| Card layout and design | 50 | 41 | 11 | | 10 | | | | | |
| Functions of accounting | 48 | 58 | | | | | | | | |
| Computer equipment | 46 | | 30 | 21 | 30 | 10 | | | | |
| Central processing unit | 42 | | 29 | 28 | | | | | | |
| Flow charting | 40 | 29 | 33 | 12 | 15 | | | | | |

Table 13-25 (continued)

| Topics and Concepts | Data Processing Courses | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D. P. | Unit Record Sys.& Equip. | Intro. to Comp.Prog. | Intro. to Dig. Comp. | Intro. to Sys. Anal. | Advanced Prog. | D. P. Math | D. P. Sys. | Prog. Sys. | D. P. Appli. |
| Principles and theory-digital computers | 36 | | 26 | 25 | | | | | | |
| Block diagramming | 36 | 11 | 43 | 14 | 11 | 11 | | | | |
| Number systems | 35 | | 17 | 14 | | | 27 | | | |
| Purposes/functions-language | 32 | | 33 | 16 | | 19 | | | | |
| Computer logic | 31 | | 36 | 20 | | 10 | 10 | | | |
| Forms design | 26 | 35 | 10 | | 16 | | | 13 | | |
| Computer applications | 26 | | 31 | | | 19 | | 14 | 17 | 22 |
| Registers | 25 | | 38 | 24 | | 12 | | | | |
| Coding and condensing data | 23 | 16 | 32 | | 11 | 10 | | 15 | | |
| Procedures development | 23 | 18 | 12 | | 22 | | | 17 | | |
| Programming essentials | 22 | | 56 | 13 | | 19 | | | | |
| Uses of symbolic language | 22 | | 49 | 14 | | 14 | | | | |

Table 13-25 (continued)

| Topics and Concepts | Data Processing Courses | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D. P. | Unit Record Sys.& Equip. | Intro. to Comp.Prog. | Intro. to Dig. Comp. | Intro. to Sys. Anal. | Advanced Prog. | D. P. Math | D. P. Sys. | Prog. Sys. | D. P. Appli. |
| Evaluation of auxiliary equipment | 18 | | 12 | | | | | 16 | | |
| Logic | 17 | | 15 | | | | 27 | | | |
| Boolean Algebra | 14 | | | | | | 39 | | | |
| Programming systems | 11 | | 31 | | | 17 | | 18 | 20 | |
| Assembly programming and compiler | 11 | | 47 | 11 | | 21 | | | | |
| Macro-generators | | | 26 | | | 31 | | | 12 | |
| Report generators | | | 26 | | | 27 | | | 14 | |
| Data scheduling systems | | | | | 10 | 11 | | 12 | 11 | |
| Monitors and high level languages | | | 12 | | | 39 | | | 23 | |
| Analysis-information systems | | | | | 16 | 11 | | 13 | 12 | |
| Fixed and floating points | | | 28 | 10 | | 18 | 16 | | | |

Table 13-26. Skills Developed and Knowledges Applied in Data Processing Courses in 10 or More Post High School Institutions

| Skills and Knowledges | Data Processing Courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D. P. | Unit Record Sys.& Equip. | Intro. to Comp.Prog. | Intro. to Dig. Comp. | Intro. to Sys. Anal. | Advanced Prog. | D. P. Sys. | Prog. Sys. | D. P. Appli. |
| Operate key punch | 25 | 64 | 10 | | | | | | |
| Operate sorter | 22 | 66 | | | | | | | |
| Operate collator | 17 | 62 | | | | | | | |
| Operate reproducer | 16 | 64 | | | | | | | |
| Operate accounting machine | 17 | 63 | | | | | | | |
| Wire collator panel | 11 | 60 | | | | | | | |
| Wire reproducer panel | 12 | 61 | | | | | | | |
| Wire accounting machine panel | 13 | 67 | | | | | | | |
| Plan and punch program card | 28 | 54 | | | | | | | |
| Card layout and design | 27 | 48 | 11 | | 11 | | | | |
| Design forms | | 29 | 11 | | 21 | | 14 | | |
| Flow charting | 21 | 25 | 36 | 12 | 14 | 12 | 10 | | |
| Work load evaluation | | 15 | | | 17 | | 14 | | |
| Coding, condensing data | 20 | 19 | 30 | 13 | 11 | 11 | 10 | | |
| Block diagramming | 17 | | 49 | 17 | 10 | 12 | 10 | | |

Table 13-26 (continued)

| Skills and Knowledges | Data Processing Courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D. P. | Unit Record Sys.& Equip. | Intro. to Comp.Prog. | Intro. to Dig. Comp. | Intro. to Sys. Anal. | Advanced Prog. | D. P. Sys. | Prog. Sys. | D. P. Appli. |
| Operate computer | 12 | | 62 | 17 | | 23 | | | |
| Program instructions | 10 | | 52 | | | 21 | | | |
| Machine language | 11 | | 62 | 14 | | 13 | | | |
| Autocoder | | | 30 | | | 25 | | | |
| Fortran | | | 26 | | | 38 | | 12 | |
| Cobol | | | 13 | | | 36 | | 17 | |
| Other languages | | | 22 | | | 22 | | 13 | |
| Maintaining program library | | | 15 | | | 22 | | 12 | |
| Maintaining magnetic tape library | | | 11 | | | 14 | | 11 | |
| Operate card processor | | | 34 | 10 | | 16 | | | |
| Computer applications | | | 35 | | | 14 | 10 | 11 | 21 |
| Loops and indexing | | | 56 | 13 | | 36 | | | |
| Subroutines | | | 52 | 11 | | 40 | | 11 | |
| I/O controls | | | 50 | 10 | | 33 | | 12 | |
| Programming a tape system | | | 20 | | | 31 | | 10 | |

Table 13-26 (continued)

| Skills and Knowledges | Data Processing Courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D. P. | Unit Record Sys.& Equip. | Intro. to Comp.Prog. | Intro. to Dig. Comp. | Intro. to Sys. Anal. | Advanced Prog. | D. P. Sys. | Prog. Sys. | D. P. Appli. |
| Job timing | | | 17 | | | 21 | | | |
| Programming random access devices | | | 21 | | | 45 | | 10 | |
| Debug programs | | | 63 | 12 | | 38 | | 17 | |
| Sort-merge programming | | | 18 | | | 38 | | 19 | |

Table 13-27. Operational Skills With the Degree of Proficiency Developed by Students in Post Secondary Schools Offering Training on Machines and in Programming

| Skill | Total Schools Offering | General Knowledge About | | Knowledge About Applications | | Acquaintanceship | | Vocational | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % |
| Key punch simulator | 19 | 2 | 10.5 | 2 | 10.5 | 10 | 52.6 | 5 | 26.3 |
| Key punch | 104 | 11 | 10.6 | 8 | 7.7 | 39 | 37.5 | 46 | 44.2 |
| Verifier | 77 | 16 | 20.8 | 10 | 13.0 | 19 | 24.7 | 32 | 41.6 |
| Sorter | 104 | 10 | 9.6 | 8 | 7.7 | 19 | 18.2 | 67 | 64.4 |
| Reproducer | 93 | 11 | 11.8 | 9 | 9.7 | 16 | 17.2 | 57 | 61.3 |
| Collator | 87 | 11 | 12.6 | 9 | 10.3 | 12 | 13.8 | 55 | 63.2 |
| Interpreter | 89 | 13 | 14.6 | 12 | 13.5 | 13 | 14.6 | 51 | 57.3 |
| Accounting machine | 99 | 11 | 11.1 | 7 | 7.1 | 18 | 18.2 | 63 | 63.6 |
| Computer | 92 | 7 | 7.6 | 8 | 8.7 | 13 | 14.1 | 64 | 69.6 |
| Card processor | 50 | 7 | 14.0 | 5 | 10.0 | 6 | 12.0 | 32 | 64.0 |
| Tape drive | 49 | 12 | 24.5 | 13 | 26.5 | 3 | 6.1 | 21 | 42.8 |
| Data converter | 30 | 12 | 40.0 | 9 | 30.0 | 1 | 3.3 | 8 | 26.7 |
| Random access devices | 66 | 11 | 16.7 | 8 | 12.1 | 6 | 9.1 | 41 | 62.1 |
| High speed printer | 73 | 8 | 11.0 | 8 | 11.0 | 8 | 11.0 | 49 | 67.1 |
| Programming | 90 | 6 | 6.7 | 4 | 4.4 | 9 | 10.0 | 71 | 78.9 |

Cooperative Part-time Work Experience Programs

Training students in data processing through a cooperative work experience program is not a common practice, with only 50 of the 176 schools reporting such a program (Table 13-28). Over half the high schools in the study reported having work experience programs in office occupations, but a little over 30 per cent of them offer work experience in data processing. A greater proportion of vocational-technical schools have work experience programs in data processing than do either high schools or junior colleges. Only about a fifth of the junior colleges provide on-the-job work experience for their data processing students.

These cooperative work experience programs are coordinated most frequently by the office occupations coordinator, especially in the high schools (Table 13-29). No trend is apparent as to who coordinates the program in the vocational-technical schools, but in the junior colleges about a third of the programs were coordinated by the data processing instructor. At one of the junior colleges, the work experience program was coordinated by a distributive education coordinator. Data processing instructors or the department head did the coordinating in eight of the junior colleges. In seven of these schools a special data processing coordinator performs this function.

Certain prerequisites are set up for entry into the cooperative part-time training programs in data processing, including course grades, interest of the students, and the students' skills and abilities. The most common criterion for the selection of students is the students' over-all course grades (Table 13-30), followed in frequency by the grades achieved in data processing courses and interest in such a program. None of the schools mentioned business courses as prerequisites.

In more programs than not, the students are required to have operational skills before they are placed in their work stations, or at least they are required to have beginning vocational skill (Table 13-31). Apparently the schools require no set amount of time to be spent on the job, since the most frequent answer to this inquiry was either "No set amount" or "As much as possible" (Table 13-32).

In general, data processing students seem to be relatively easy to place in work stations, since 28 out of 41 schools reported that their students were as easily or more easily placed on the job than are general office occupations students (Table 13-33). High schools reported in greater proportion than the other schools that data processing students are more difficult to place on the job than are office occupations students. The junior colleges, on the other hand, report that data processing students are easier to place than the office students.

Table 13-28. Cooperative Part-Time Programs

| Type | High Schools N=72 N | % | Voc-Tech Schools N=32 N | % | Junior Colleges N=72 N | % | Total N=176 N | % |
|---|---|---|---|---|---|---|---|---|
| General office | 39 | 54.2 | 9 | 28.1 | 20 | 27.7 | 68 | 38.6 |
| Data processing | 23 | 31.9 | 12 | 37.5 | 15 | 20.8 | 50 | 28.4 |

Table 13-29. Coordinator for Cooperative Students in Data Processing

| Coordinator | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Office occupations | 10 | 1 | 0 | 13 |
| Special data processing | 2 | 2 | 3 | 7 |
| Diversified occupations | 0 | 1 | 2 | 3 |
| Data processing instructors | 2 | 2 | 4 | 8 |
| Department head or supervisor | 3 | 3 | 2 | 8 |
| Distributive education | 2 | 0 | 1 | 3 |
| Vocational education | 3 | 2 | 1 | 6 |
| Other | 1 | 1 | 2 | 4 |

Table 13-30. Bases for Selection of Students for Work Experience Programs

| Basis for Selection | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Business course grades | 3 | 1 | 0 | 4 |
| Overall course grades | 8 | 2 | 3 | 13 |
| Data processing course grades | 6 | 2 | 0 | 8 |
| Special tests | 2 | 0 | 0 | 2 |
| Interested students | 5 | 2 | 0 | 7 |
| Students' Skill and ability | 2 | 2 | 1 | 5 |
| Other | 2 | 2 | 4 | 8 |

Table 13-31. Level of Skill Required for Placement in Work Stations in Cooperative Work Experience Programs

| Level of Skill | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Acquaintance | 4 | 0 | 3 | 7 |
| Beginning vocational skill | 3 | 4 | 4 | 11 |
| Good operational skill | 7 | 5 | 5 | 17 |
| Other | 9 | 3 | 3 | 15 |

Table 13-32. Amount of On-the-Job Training Required of Cooperative Students

| Amount | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| No set amount | 3 | 4 | 5 | 12 |
| As many weeks as possible | 17 | 1 | 3 | 21 |
| 6 weeks | 0 | 0 | 2 | 2 |
| 1 semester | 3 | 1 | 1 | 5 |
| 2 years | 0 | 0 | 1 | 1 |

Table 13-33. Placement of Data Processing Students in Work Stations Compared with Office Occupations Students (Degree of Placement Ease)

| Degree | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| More easily placed | 4 | 5 | 7 | 16 |
| As easily placed | 5 | 2 | 5 | 12 |
| Not as easily placed | 9 | 1 | 3 | 13 |

## EQUIPMENT

The data processing equipment reported in the secondary schools tended to be unit record equipment, including key punches reported by 97 per cent of the schools; sorter, 80.6 per cent; accounting machines, 69.4; reproducer, 58.3 per cent; and collator, 54.2 per cent (Table 13-34). Verifiers and interpreters were reported by between 30 and 40 per cent of the schools.

One-third of the high schools included in the study reported having a computer available for instruction, and these schools had 24 computers available for instructional use (Table 13-34). However, other peripheral equipment was found to a lesser extent in the secondary schools than were computers, with about one-sixth of the schools having a printer available and about one-seventh of the schools with some random access device available. Card processors were reported in nine out of the 72 high schools. The amount of equipment available for use in the schools surveyed compared favorably with the available equipment reported in all the schools as a result of the national survey of secondary and two-year post high schools (see Appendix C, Table C-8).

### Acquisition of Equipment

The equipment used by the high schools is, generally speaking, purchased outright, rented, or leased (Table 13-34). About 70 per cent of the schools reported renting or leasing key punches, but 22 out of the 72 schools reported owning key punch machines. The other equipment is owned, rented, or leased in about the same proportions as are key punches. Of the schools that have computers available, however, ten reported having purchased them (41.7 per cent) and 13 schools rent or lease them. One school reported that their students were permitted to use a computer in a business office downtown.

A greater proportion of post high school institutions have equipment available for instruction in data processing than do high schools, especially computers and peripheral equipment. While one-third of the high schools reported having a computer available, over 80 per cent of the post high school institutions indicated the availability of computers for instruction. More of the post secondary schools than high schools reported having peripheral equipment also. More than 40 per cent of them, for instance, reported having some random access devices, while about 14 per cent of the high schools indicated having such equipment; and nearly half the post high school institutions have printers, but only about one-sixth of the high schools have printers available for training.

Table 13-34. Data Processing Equipment Available for Post High School and High School Student Use

| Equipment | Ownership or Location of Equipment Used | | | | | | Total Schools with Equip | Percent* |
|---|---|---|---|---|---|---|---|---|
| | Gift | Purchase | Lease | Rent | Use Equip Admin Off | Use Equip in Downtown Off | | |
| Key punch simulator | | | | | | | | |
| Post high school | 0 | 11 | 2 | 0 | 0 | 1 | 14 | 13.5 |
| High school | 0 | 23 | 1 | 1 | 0 | 0 | 25 | 34.9 |
| Key punch | | | | | | | | |
| Post high school | 1 | 37 | 35 | 23 | 0 | 3 | 99 | 95.2 |
| High school | 3 | 22 | 24 | 20 | 1 | 0 | 70 | 97.2 |
| Verifier | | | | | | | | |
| Post high school | 1 | 22 | 24 | 8 | 0 | 3 | 58 | 55.8 |
| High school | 3 | 8 | 7 | 10 | 0 | 0 | 28 | 38.9 |
| Sorter | | | | | | | | |
| Post high school | 2 | 36 | 32 | 16 | 0 | 2 | 88 | 79.8 |
| High school | 2 | 18 | 21 | 15 | 2 | 0 | 58 | 80.6 |
| Reproducer | | | | | | | | |
| Post high school | 1 | 27 | 28 | 14 | 0 | 2 | 72 | 61.5 |
| High school | 2 | 11 | 17 | 10 | 1 | 1 | 42 | 58.3 |

*The percentages are based on 104 post high school institutions and 72 secondary schools.

Table 13-34 (continued)

| Equipment | Ownership or Location of Equipment Used | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gift | Purchase | Lease | Rent | Use Equip Admin Off | Use Equip in Downtown Off | Total Schools with Equip | Percent* |
| Collator | | | | | | | | |
| Post high school | 1 | 28 | 28 | 13 | 0 | 3 | 73 | 70.2 |
| High school | 2 | 14 | 13 | 8 | 2 | 0 | 39 | 54.2 |
| Interpreter | | | | | | | | |
| Post high school | 1 | 23 | 24 | 14 | 0 | 2 | 64 | 69.2 |
| High school | 1 | 9 | 10 | 6 | 1 | 0 | 27 | 37.5 |
| Accounting machine | | | | | | | | |
| Post high school | 3 | 37 | 27 | 14 | 0 | 2 | 83 | 84.6 |
| High school | 2 | 15 | 17 | 14 | 1 | 1 | 50 | 69.4 |
| Computer | | | | | | | | |
| Post high school | 3 | 28 | 31 | 16 | 0 | 6 | 84 | 80.8 |
| High school | 0 | 10 | 7 | 6 | 0 | 1 | 24 | 33.3 |
| Card processor | | | | | | | | |
| Post high school | 2 | 11 | 14 | 6 | 0 | 3 | 36 | 34.6 |
| High school | 0 | 4 | 3 | 2 | 0 | 0 | 9 | 12.5 |

*The percentages are based on 104 post high school institutions and 72 secondary schools.

Table 13-34 (continued)

| Equipment | Ownership or Location of Equipment Used | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gift | Purchase | Lease | Rent | Use Equip Admin Off | Use Equip in Downtown Off | Total Schools with Equip | Percent* |
| Tape drive | | | | | | | | |
| Post high school | 1 | 5 | 6 | 5 | 0 | 4 | 21 | 20.2 |
| High school | 0 | 1 | 2 | 1 | 0 | 0 | 4 | 5.6 |
| Data converter | | | | | | | | |
| Post high school | 2 | 2 | 2 | 1 | 0 | 2 | 9 | 8.6 |
| High school | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1.4 |
| Random access devices | | | | | | | | |
| Post high school | 1 | 12 | 20 | 8 | 1 | 2 | 44 | 42.3 |
| High school | 0 | 4 | 4 | 2 | 0 | 0 | 10 | 13.9 |
| High-speed printer | | | | | | | | |
| Post high school | 1 | 9 | 26 | 10 | 1 | 3 | 50 | 48.1 |
| High school | 0 | 3 | 5 | 4 | 0 | 0 | 12 | 16.7 |

*The percentages are based on 104 post high school institutions and 72 secondary schools.

More of the post high school institutions reported renting or leasing their data processing equipment than owning it, although a slightly greater proportion of them reported purchase of their equipment compared with the secondary schools. About three-eighths of the post secondary schools own their unit record equipment, while about 30 per cent of the high schools do. One-third of the post high school institutions own their computers; but a smaller proportion of them own peripheral equipment, with about 27 per cent reporting ownership of random access devices and 18 per cent owning a printer.

Three of the post high school institutions reported that business had donated a computer to them.

High schools tend to have slightly more unit record equipment per school than do the other schools (Table 13-35). They also make more use of key punch simulators, with an average of about six simulators per school compared with two and a half simulators in each of the post high school institutions. The high schools also have one more key punch per school than do the other schools. On the other hand, the junior colleges and vocational-technical schools have more computers and peripheral equipment.

Source of Funds for Equipment and Supplies

Four main sources of funds for equipment and supplies were reported by the schools in this study; namely, under provisions of NDEA, from funds provided by the Vocational Education Act, from MDTA funds, or from state or local funds (Table 13-36). Most of the schools, 133 out of 176 reported that their equipment was financed wholly or in part by local funds and half that number (66) reported use of state funds for financing data processing equipment, wholly or in part.

Of the federal funds available for purchase of equipment for vocational training programs, the most commonly reported source is from funds provided under the Vocational Education Act, through which 53 of the 176 schools (about 30 per cent) obtained at least some of the necessary equipment. Thirteen of the schools (seven of those 13 were high schools) reported getting as much as 91 per cent of their funds from this source. Most of the schools (35) reporting use of Vocational Education Act funds said they received from 26 to 50 per cent of their money for equipment through this act.

Table 13-35. Data Processing Equipment for Instruction at Beginning of Program and Equipment Added Later

| Equipment | High School | | | | | | Post High School | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Beginning | | Added | | Total | | Beginning | | Added | | Total | |
| | Sch. | Mach. | Sch. | Mach. | Mach. | % | Sch. | Mach. | Sch. | Mach. | Sch. | Mach. |
| Key punch simulator | 25 | 318 | 16 | 121 | 439 | 6.1 | 9 | 73 | 14 | 187 | 260 | 2.5 |
| Key punch | 61 | 288 | 28 | 108 | 396 | 5.5 | 80 | 253 | 51 | 207 | 460 | 4.4 |
| Verifier | 20 | 36 | 8 | 10 | 46 | .6 | 43 | 85 | 17 | 25 | 110 | 1.0 |
| Sorter | 46 | 57 | 16 | 22 | 79 | 1.1 | 71 | 75 | 25 | 28 | 103 | 1.0 |
| Reproducer | 36 | 41 | 11 | 15 | 56 | .8 | 54 | 55 | 21 | 21 | 76 | .7 |
| Interpreter | 23 | 27 | 5 | 23 | 50 | .7 | 41 | 41 | 23 | 24 | 65 | .6 |
| Collator | 32 | 40 | 10 | 14 | 54 | .75 | 49 | 49 | 23 | 23 | 72 | .7 |
| Accounting machines | 43 | 66 | 13 | 21 | 87 | 1.2 | 67 | 69 | 21 | 22 | 91 | .9 |
| Computer | 17 | 18 | 14 | 16 | 34 | .5 | 46 | 49 | 33 | 36 | 85 | .8 |
| Card processor | 8 | 8 | 3 | 3 | 11 | .2 | 20 | 21 | 13 | 14 | 35 | .3 |
| Tape drive | 5 | 27 | 3 | 10 | 37 | .5 | 6 | 12 | 14 | 36 | 48 | .5 |
| Random access devices | 5 | 6 | 7 | 22 | 28 | .4 | 16 | 19 | 28 | 41 | 60 | .6 |
| Printer | 8 | 8 | 8 | 9 | 17 | .2 | 20 | 22 | 35 | 39 | 61 | .6 |
| Data converter | 2 | 1 | | | 3 | | 1 | 1 | 4 | 4 | 5 | |

Table 13-36. Sources of Funds for Data Processing Equipment in Schools

| Source | % of Source | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|---|
| NDEA | 0-25 | 2 | 1 | 1 | 4 |
| | 26-50 | 3 | 2 | 12 | 17 |
| | 51-75 | 3 | 0 | 1 | 4 |
| | 76-90 | 1 | 0 | 0 | 1 |
| | 91-100 | 0 | 1 | 0 | 1 |
| Totals | | 9 | 4 | 14 | 27 |
| Voc. Ed. Act | 0-25 | 2 | 1 | 0 | 3 |
| | 26-50 | 14 | 8 | 13 | 35 |
| | 51-75 | 0 | 0 | 1 | 1 |
| | 76-90 | 1 | 0 | 0 | 1 |
| | 91-100 | 7 | 4 | 2 | 13 |
| Totals | | 24 | 13 | 16 | 53 |
| MDTA | 0-25 | 0 | 1 | 0 | 1 |
| | 26-50 | 1 | 1 | 1 | 3 |
| | 51-75 | 0 | 0 | 0 | 0 |
| | 76-90 | 0 | 1 | 0 | 1 |
| | 91-100 | 1 | 1 | 0 | 2 |
| Totals | | 2 | 4 | 1 | 7 |
| State Funds | 0-25 | 2 | 2 | 2 | 6 |
| | 26-50 | 17 | 8 | 18 | 43 |
| | 51-75 | 1 | 2 | 6 | 9 |
| | 76-90 and 91-100 | 2 | 2 | 4 | 8 |
| Totals | | 22 | 14 | 30 | 66 |
| Local Funds | 0-25 | 3 | 4 | 6 | 13 |
| | 26-50 | 27 | 7 | 30 | 64 |
| | 51-75 | 4 | 1 | 6 | 11 |
| | 75-90 and 91-100 | 16 | 1 | 23 | 40 |
| Totals | | 50 | 13 | 65 | 128 |

The purchase of supplies also is mainly financed through local funds (Table 13-37), with 117 schools reporting that all or part of their funds for supplies come from local sources; and 50 receive state funds for the purchase of supplies. Although over 50 schools received funds under the Vocational Education Act for equipment, only 25 reported using such funds for supplies. High schools tended more frequently to report state and local funds being used for purchase of supplies than did the other types of schools. On the other hand, junior colleges reported in greater proportion having received VEA funds for supplies than did the high schools. Supplies were purchased with student fees in 27 of the schools; and MDTA was the source of funds for supplies in only four of the schools, with three out of the four being vocational-technical schools.

Sources of Equipment

Less than half (44.3 per cent) of the schools reported owning data processing equipment, excluding computers (Table 13-38). Out of 78 schools reporting that they own data processing equipment (as opposed to leasing or "borrowing" it), 50 of them reported buying the equipment new from a manufacturer and 15 of the schools had obtained used equipment from a manufacturer.

Less than a third of the schools (31.2 per cent) own computers (Table 13-39). Over half the vocational-technical schools own a computer compared with 29.2 per cent of the junior colleges and 20.8 per cent of the high schools. Of the schools that have purchased computers, two-thirds of the high school computers were purchased new from the manufacturer; over three-fourths of the vocational-technical schools and about one-fifth of the junior colleges obtained new computers. One-fifth of the 54 computers reported had been purchased as used equipment, either from the manufacturer or from a used machine dealer. One high school reported that its computer was donated to the school by a business.

Location of the Equipment

The equipment with which the students work tended to be in the school in which the students were located, except in the high schools (Table 13-40). The schools in which interviews took place in this study were mostly in larger metropolitan areas, with each school district containing more than one high school. Forty out of the 66 high school districts reporting owning data processing equipment reported that it was centralized in a single school. A few junior colleges and vocational-technical schools reported having equipment in more than one location; but most of them reported that if the school district was comprised of more than one school, the equipment tended to be centralized in one building.

On the other hand, regarding computers owned by the high schools, 13 of the 23 were in the schools' own data processing departments (Table 13-41). In only two vocational-technical and nine out of 44 junior colleges either the students or the data were transported to a computer away from the school.

Table 13-37. Source of Funds for Data Processing Supplies

| Source | % of Source | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|---|
| Voc. Ed. Act. | 0-25 | 0 | 1 | 0 | 1 |
| | 26-50 | 5 | 2 | 9 | 16 |
| | 51-75 | 0 | 0 | 2 | 2 |
| | 76-100 | 3 | 1 | 2 | 6 |
| Totals | | 8 | 4 | 13 | 25 |
| MDTA | 0-25 | 0 | 1 | 0 | 1 |
| | 26-50 | 1 | 1 | 0 | 2 |
| | 51-75 | 0 | 0 | 0 | 0 |
| | 76-100 | 0 | 1 | 0 | 1 |
| Totals | | 1 | 3 | 0 | 4 |
| State Funds | 0-25 | 2 | 0 | 2 | 4 |
| | 26-50 | 10 | 5 | 12 | 27 |
| | 51-76 | 2 | 2 | 5 | 9 |
| | 76-100 | 2 | 3 | 5 | 10 |
| Totals | | 16 | 10 | 24 | 50 |
| Local Funds | 0-25 | 1 | 3 | 5 | 9 |
| | 26-50 | 18 | 2 | 22 | 42 |
| | 51-75 | 2 | 1 | 2 | 5 |
| | 76-100 | 33 | 8 | 20 | 61 |
| Totals | | 54 | 14 | 49 | 117 |
| Student Fees | 0-25 | 0 | 1 | 1 | 2 |
| | 26-50 | 1 | 4 | 6 | 11 |
| | 51-75 | 0 | 0 | 2 | 2 |
| | 76-100 | 4 | 6 | 2 | 12 |
| Totals | | 5 | 11 | 11 | 27 |

Table 13-38. Source of Purchase of Data Processing Equipment, Except Computer

| Source | High Schools | Voc-Tech Schools | Junior Colleges |
|---|---|---|---|
| Government surplus | 0 | 1 | 0 |
| Used from manufacturer | 3 | 7 | 5 |
| New from manufacturer | 20 | 15 | 15 |
| Used machines from dealer | 0 | 1 | 3 |
| New machines from dealer | 2 | 2 | 0 |
| DPMA | 2 | 1 | 0 |
| Donated by business | 1 | 0 | 0 |
| Totals | 28 | 27 | 23 |

Table 13-39. Source of Computer (Purchase)

| Source | High Schools | Voc-Tech Schools | Junior Colleges |
|---|---|---|---|
| Government surplus | 1 | 1 | 2 |
| Used from manufacturer | 3 | 3 | 3 |
| New from manufacturer | 10 | 14 | 15 |
| Used machine from dealer | 0 | 0 | 1 |
| Donated by business | 1 | 0 | 0 |
| Totals | 15 | 18 | 21 |

Table 13-40. Location of Data Processing Equipment, Except Computer

| Location | High Schools | Voc-Tech Schools | Junior Colleges |
|---|---|---|---|
| In centralized school | 40 | 27 | 58 |
| In each school | 16 | 4 | 4 |
| In administrative offices | 6 | 0 | 4 |
| In business/government offices | 2 | 1 | 3 |
| In adult vocational center | 1 | 0 | 0 |
| Other | 1 | 0 | 1 |

Table 13-41. Location of Computer

| Location | High Schools | Voc-Tech Schools | Junior Colleges |
|---|---|---|---|
| In own department | 13 | 22 | 35 |
| Outside of school | | | |
| Transport student | 8 | 1 | 6 |
| Transport data | 2 | 1 | 3 |

Maintenance of Equipment

Most of the schools reported that repairs and service of their equipment is done under terms of service contracts (Table 13-42). Only about one-third of the schools reported not having service contracts, and the proportion is about the same for all kinds of equipment.

Table 13-42. Data Processing Equipment Maintenance

| Equipment | High School | | Post High School | |
|---|---|---|---|---|
| | On Call | Service Contract | On Call | Service Contract |
| Key punch simulator | 8 | 10 | 4 | 5 |
| Key punch | 16 | 43 | 20 | 60 |
| Verifier | 8 | 17 | 11 | 39 |
| Accounting (Tab) Machines | 13 | 32 | 18 | 50 |
| Interpreter | 6 | 20 | 10 | 41 |
| Collator | 13 | 22 | 14 | 46 |
| Reproducer | 9 | 27 | 13 | 45 |
| Sorter | 13 | 35 | 15 | 53 |
| Computer | 3 | 18 | 10 | 51 |
| Card processor | 3 | 3 | 6 | 23 |
| Tape drive | 1 | 3 | 3 | 10 |
| Data converter | 1 | 0 | 0 | 4 |
| Random access devices | 4 | 6 | 3 | 31 |
| Printer | 3 | 8 | 4 | 35 |

## STAFFING DATA PROCESSING INSTRUCTIONAL DEPARTMENTS

Out of the 176 schools which supplied information for this investigation, 159 reported having full-time teachers in data processing (Table 13-43). All of the vocational-technical institutions reported full-time teachers, but 62 out of 72 high schools and 66 out of 72 junior colleges reported having full-time teachers in data processing.

Table 13-43. Full-Time and Part-Time Data Processing Teachers in High Schools and Post High Schools Offering Data Processing

| Teachers | High Schools N=72 | Voc-Tech Schools N=31 | Junior Colleges N=72 | Total N=175 |
|---|---|---|---|---|
| <u>Full-time teachers</u> | | | | |
| Number of schools | 62 | 31 | 66 | 159 |
| Number of teachers | 172 | 94 | 165 | 431 |
| Mean no. of teachers | 2.77 | 3.0 | 2.5 | |
| <u>Part-time teachers</u> | | | | |
| Number of schools | 30 | 22 | 66 | 117 |
| Number of teachers | 91 | 79 | 321 | 491 |
| Mean no. of teachers | 3.0 | 3.6 | 4.9 | |

The same number of junior colleges reported employing part-time instructors in data processing as reported full-time teachers; namely, 66. However, less than half the high schools employ part-time data processing teachers, and about two-thirds of the vocational-technical schools have part-time instructors.

### Size of Staff

Table 13-43 also shows that although the mean number of full-time data processing teachers in junior colleges is smaller than in either of the other two kinds of institutions, the junior colleges have a higher average number of part-time instructors, with the 66 junior colleges averaging about five part-time instructors each. This compares with about three and 3.5 part-time instructors in the high schools and vocational schools, respectively.

Of the 62 high schools employing full-time data processing teachers, 12 reported more than four full-time data processing instructors, with one school having as many as 13 data processing teachers (Table 13-44). In 24 out of the 62 high schools only one data processing teacher was employed. Thirty-one of the 32 vocational-technical institutions have full-time teachers; six of the 31 vocational-technical institutions have only one full-time data processing instructor. One vocational school reported 12 full-time data processing teachers. Junior colleges, however, hire a greater number of part-time teachers than do high schools or vocational schools. Four junior colleges reported employing 13 or more part-time instructors.

## Teaching Assignments

Table 13-45 shows that the part-time instructors are employed mainly in evening classes, with only 16 schools reporting the use of data processing employees from business firms as daytime instructors.

The courses most frequently taught by part-time personnel from business data processing departments are programming, key punch, unit record systems, and board wiring (Table 13-46). Programming ranked either first or second in frequency of mention by all three kinds of schools employing business personnel as instructors. Key punch was the course most frequently taught by data processing employees from business in both high schools and in vocational schools. In vocational schools, unit record systems held a rank equal to that of key punch, however. In nearly half the high schools in which business personnel taught courses, programming was taught by these people. This was also true of the vocational schools.

Qualifications required of part-time teachers. In evaluating qualifications of people to hire as part-time instructors in data processing, the most frequently mentioned background was that of work experience in data processing, either in a business or government office (Table 13-47). This was true in all three kinds of schools. In fact, work experience was listed as a requirement for part-time teaching almost three times as often as teaching experience. Part-time teachers in a large number of schools need a college degree, although not necessarily a graduate degree, even for teaching in junior college programs. Of the courses these people should have studied, data processing and business courses were most frequently mentioned, with mathematics being the next most frequently listed course requirement. In only ten of the 117 schools hiring part-time teachers was state certification a requirement for employment of part-time teachers.

Table 13-44. Number of Full-Time and Part-Time Data Processing Teachers

| No. of Teachers | Full-Time Teachers: High Schools N=72 | Full-Time Teachers: Voc-Tech Schools N=32 | Full-Time Teachers: Junior Colleges N=72 | Part-Time Teachers: High Schools N=72 | Part-Time Teachers: Voc-Tech Schools N=32 | Part-Time Teachers: Junior Colleges N=72 |
|---|---|---|---|---|---|---|
| 1 | 24 | 6 | 15 | 14 | 3 | 8 |
| 2 | 14 | 9 | 31 | 2 | 7 | 12 |
| 3 | 8 | 7 | 9 | 8 | 2 | 12 |
| 4 | 4 | 5 | 3 | 3 | 6 | 11 |
| 5 | 4 | 1 | 4 | 1 | 1 | 4 |
| 6 | 4 | 2 | 1 | 0 | 1 | 5 |
| 7 | 2 | 0 | 1 | 0 | 0 | 4 |
| 8 | 0 | 0 | 2 | 0 | 0 | 3 |
| 9 | 1 | 0 | 0 | 0 | 1 | 0 |
| 10 | 0 | 0 | 0 | 1 | 0 | 1 |
| 11 | 0 | 0 | 0 | 0 | 0 | 2 |
| 12 | 0 | 1 | 0 | 0 | 1 | 0 |
| 13 or more | 1 | 0 | 0 | 1 | 0 | 4 |
| Totals | 62 | 31 | 66 | 30 | 22 | 66 |

Table 13-45. Day and Night Data Processing Classes Instructed by Employees from Business

| Classes | High Schools N-72 | Voc-Tech Schools N=32 | Junior Colleges N=72 | Total N=176 |
|---|---|---|---|---|
| Day | 4 | 4 | 8 | 16 |
| Night | 22 | 24 | 61 | 103 |

Table 13-46. Courses Taught by Part-Time Personnel from Business

| Courses | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| Key punch | 17 (1)* | 14 (1) | 16 (4) | 47 (2) |
| Unit record (except machine accounting) | 8 | 11 (3) | 13 | 32 |
| Accounting machine wiring | 12 (3) | 12 (2) | 18 (3) | 42 (4) |
| Unit record systems | 10 (4) | 14 (1) | 20 (2) | 44 (3) |
| Computer theory and logic | 7 | 8 | 12 | 27 |
| Systems analysis | 4 | 5 | 13 | 22 |
| Programming | 14 (2) | 12 (2) | 28 (1) | 54 (1) |
| Program systems | 3 | 5 | 11 | 19 |
| Computer operation | 5 | 9 | 11 | 25 |
| Data processing applications | 4 | 7 | 11 | 22 |
| Data processing math | 3 | 2 | 6 | 11 |
| Data processing systems | 4 | 3 | 11 | 18 |
| Introduction to data processing | 7 | 4 | 15 | 26 |

*The numbers in parentheses represent the rank by frequency of mention.

Table 13-47. Preparation Background and Experience of Part-Time Data Processing Teachers

| Preparation and Experience | High Schools | Voc-Tech Schools | Junior Colleges | Total |
|---|---|---|---|---|
| <u>Education</u> | | | | |
| High school | 4 | 4 | 1 | 9 |
| Business or trade schools | 4 | 2 | 1 | 7 |
| Some college | 2 | 1 | 2 | 5 |
| Bachelor's degree | 13 | 5 | 33 | 51 |
| Graduate degree | 0 | 2 | 11 | 13 |
| <u>Background courses</u> | | | | |
| Business | 7 | 5 | 17 | 29 |
| Data processing courses | 13 | 8 | 14 | 35 |
| Mathematics | 6 | 4 | 11 | 21 |
| Science | 2 | 2 | 4 | 8 |
| Psychology | 0 | 0 | 2 | 2 |
| Psychology of learning | 0 | 0 | 0 | 0 |
| Other | 2 | 1 | 2 | 5 |
| <u>State certification</u> | 6 | 1 | 3 | 10 |
| <u>Experience</u> | | | | |
| Teaching | 8 | 3 | 25 | 36 |
| Business or government data processing | 24 | 21 | 60 | 105 |
| <u>Miscellaneous</u> | 0 | 0 | 2 | 2 |

## CHAPTER XIV

## DATA PROCESSING TEACHERS

Teachers were asked to fill out a questionnaire regarding their education and work experience backgrounds in order to get an indication of the type of people who are now teaching in the data processing field to see how they acquired the background to teach data processing.

### EDUCATION

A total of 475 teachers filled out questionnaires, of whom 279 (58.7 per cent) were teaching at the high school level, and 196 (41.3 per cent) were in the secondary schools (Table 14-1).

Table 14-1. Education of High School and Post High School Data Processing Teachers

| Education | High School | Voc-Tech Junior College | Total |
|---|---|---|---|
| High school or less | 6 | 15 | 21 |
| Private business school | 4 | 10 | 14 |
| Public voc-tech school | 5 | 8 | 13 |
| One or two years college | 9 | 16 | 25 |
| Two years college (no degree) | 3 | 19 | 22 |
| College degree | 169 | 211 | 380 |
| Totals | 196 | 279 | 475 |

5

Degrees

A greater proportion of the secondary school teachers held degrees than did the post high school teachers, 86.2 per cent and 75.6 per cent, respectively. In many states, however, certification laws are more rigid for the secondary schools than they are for junior colleges, which may account for the higher percentage of degrees among the high school teachers.

The same proportion of people teaching at both the secondary and the post high school levels (81 per cent) have had education beyond the bachelor's degree, about half of whom have completed at least a master's degree (Table 14-2). Also, the proportion of teachers who hold advanced degrees is very nearly equal among the teachers at both educational levels.

Table 14-2. Levels of College Work Completed by High School and Post High School Data Processing Teachers

| Levels | High School | Voc-Tech Junior College | Total |
|---|---|---|---|
| Bachelor's degree only | 32 | 40 | 72 |
| Graduate work, but no advanced degree | 59 | 69 | 128 |
| Master's degree | 26 | 37 | 63 |
| Work beyond master's, but not a doctorate | 50 | 63 | 113 |
| Doctorate | 2 | 2 | 4 |
| Totals | 169 | 211 | 380 |

Areas of Study in College

A greater proportion of the high school teachers with at least a bachelor's degree (60.9 per cent) declared business or business education as a major than did teachers at the post secondary level, of whom 53.7 per cent had business or business education majors (Table 14-3). Mathematics and science account for over 21 per cent of the majors completed by the post high school teachers

Table 14-3. Bachelor's Degree Majors of High School and Post High School Data Processing Teachers

| Major | High School | Voc-Tech Junior College | Total |
|---|---|---|---|
| Business | 58 | 85 | 143 |
| Business education | 45 | 23 | 68 |
| Mathematics | 19 | 31 | 50 |
| Science | 4 | 12 | 16 |
| Engineering | 2 | 12 | 14 |
| Education | 1 | 5 | 6 |
| More than one major | 18 | 16 | 34 |
| Other | 11 | 17 | 28 |
| No response | 11 | 10 | 21 |
| Totals | 169 | 211 | 380 |

and by less than 14 per cent of the high school teachers of data processing.

The major areas of interest seemed to shift somewhat for teachers teaching at both levels of education in their graduate work. (Table 14-4). Of the people who responded to the inquiry about their area of study at the graduate level, 22 per cent declared education as their field. This may be because in many graduate schools the major is declared in education with a field of specialization within it in business education. The proportion who were in business or business education remained about the same. However, the number of teachers who continued study in mathematics at the graduate level decreased some. The figures for graduate study, however, are based only on those who actually responded to this question. Apparently some question existed regarding this inquiry since only 149 out of a possible 308 junior college technical school people answered this question.

Table 14-4. Field of Graduate Study of High School and Post High School Data Processing Teachers

| Field | High School | Voc-Tech Junior College | Total |
|---|---|---|---|
| Business | 15 | 49 | 64 |
| Business education | 41 | 23 | 64 |
| Mathematics | 4 | 19 | 23 |
| Science | 4 | 3 | 7 |
| Engineering | 3 | 5 | 8 |
| Education | 34 | 26 | 60 |
| Other | 13 | 20 | 33 |
| More than one major | 8 | 4 | 12 |
| Totals | 122 | 149 | 271 |

## SOURCES OF DATA PROCESSING BACKGROUND

Data processing teachers have received their background in data processing in several different ways. Some have had courses in summer school sessions, in manufacturers' schools or in special workshops for teachers. Others have developed their background further by doing data processing work in business offices or in the military.

### Schools Attended

Over half the data processing teachers had acquired at least some of their data processing background by attending manufacturers' schools, 272 out of 475 teachers, and 229 (48.3 per cent) of the teachers had had work experience in business (Table 14-5).

Table 14-5. Source of Data Processing Background of High School and Post High School Data Processing Teachers

| | High School N=196 | | Post High School N=279 | | Total N=475 | |
|---|---|---|---|---|---|---|
| Source | No. | %* | No. | % | No. | % |
| Attended manufacturer's school | 90 | 45.9 | 182 | 65.2 | 272 | 57.2 |
| College classes | 81 | 41.3 | 120 | 43.0 | 201 | 42.3 |
| Attended data processing workshops | 71 | 36.2 | 60 | 21.5 | 131 | 27.6 |
| Worked in data processing department | 67 | 34.2 | 162 | 58.0 | 229 | 48.2 |
| Attended night classes | 33 | 16.8 | 42 | 15.1 | 75 | 15.8 |
| Self-study with programmed textbooks | 70 | 35.7 | 112 | 40.1 | 182 | 38.3 |
| On-the-job training | 62 | 31.6 | 127 | 45.5 | 189 | 39.8 |
| Military | 16 | 8.2 | 30 | 10.8 | 46 | 9.7 |
| Other | 14 | 7.1 | 28 | 10.0 | 42 | 8.8 |

*Percentages add to more than 100% because each teacher could make more than one response to the question.

However, this was true for more of the post high school teachers than for the secondary schools. Nearly two-thirds of the post secondary teachers had attended manufacturers' schools, while only slightly over 45 per cent of the high school teachers had done so. Perhaps this is because the most popular high school course is instruction in key punch operation, and more sources of instruction are available on this machine than on the other more advanced machines which are taught in the post high school institutions.

More than half again as many post high school teachers had had work experience than had high school teachers, 58 and 34 per cent, respectively (Table 14-5). Also, more of the post secondary teachers reported having had on-the-job training (45.5 per cent) than high school teachers (31.6 per cent) and a slightly greater percentage of the junior college and vocational-technical school teachers had used programmed textbooks on their own (40.1 per cent) than high school teachers (35 per cent).

Data Processing Work Experience

Over all, many data processing teachers have had some actual work experience in the field of data processing, with 60 per cent of them reporting at least one year of employment in data processing, and one-fifth of them having worked in data processing more than 8 years (Table 14-6).

Table 14-6. Amount of Teachers' Work Experience in Data Processing

| | High School N=196 | | Post High School N=279 | | Total N=475 | |
|---|---|---|---|---|---|---|
| Amount of Experience | No. | % | No. | % | No. | % |
| No experience | 95 | 48.5 | 54 | 19.4 | 149 | 31.4 |
| 1- 6 months | 15 | 7.7 | 10 | 3.6 | 25 | 5.3 |
| 6-12 months | 6 | 3.1 | 11 | 3.9 | 17 | 3.6 |
| 12-18 months | 5 | 2.6 | 5 | 1.8 | 10 | 2.1 |
| 18-24 months | 7 | 3.6 | 14 | 5.0 | 21 | 4.4 |
| 2 years | 14 | 7.1 | 24 | 8.6 | 38 | 8.0 |
| 3 years | 11 | 5.6 | 21 | 7.5 | 32 | 6.7 |
| 4 years | 5 | 2.5 | 26 | 9.3 | 31 | 6.5 |
| 5 years | 5 | 2.5 | 21 | 7.5 | 26 | 5.5 |
| 5- 8 years | 5 | 2.5 | 24 | 8.6 | 29 | 6.1 |
| Over 8 years | 28 | 14.3 | 69 | 24.7 | 97 | 20.4 |

However, among the high school teachers, only slightly over half have any work experience in data processing at all, and 60 per cent of them had not had over a year's experience. On the other hand, of the teachers in the post secondary schools, over four-fifths reported having had some data processing experience in business, and nearly three-fourths (73.1 per cent) had had over a year's experience. Nearly a fourth of the post secondary school teachers had worked in data processing eight years or more, but only 14 per cent of the high school teachers had had that amount of experience.

Kinds of firms in which teachers gained data processing experience. Data processing teachers in the main had acquired their data processing experience in accounting firms, educational institutions, or manufacturing concerns (Table 14-7). In addition, especially the post high school teachers had gained their experience in government offices. The pattern, generally speaking, was the same for both the high school and the post secondary teachers. (See Appendix A-Table 5 for activities performed by teachers in data processing departments.)

Table 14-7. Types of Business Firms in Which High School and Post High School Teachers Had Data Processing Work Experience

| Types of Businesses | High School | Post High School | Total |
|---|---|---|---|
| Accounting | 20 | 37 | 57 |
| Consulting | 3 | 15 | 18 |
| Education | 23 | 50 | 73 |
| Mining petroleum | 1 | 7 | 8 |
| Government | 9 | 28 | 37 |
| Distributive | 4 | 4 | 8 |
| Insurance | 8 | 7 | 15 |
| Manufacturing | 15 | 30 | 45 |
| Public utility | 1 | 5 | 6 |
| Financial | 1 | 3 | 4 |
| Military | 5 | 8 | 13 |
| Other | 4 | 12 | 16 |
| More than two businesses | 6 | 16 | 22 |
| No response | 1 | 4 | 5 |

Job activities performed in data processing jobs and in schools. Data processing activities performed by the teachers, both on the job and in school, during their training are shown in Table 14-8.

Table 14-8. Data Processing Activities Performed by Teachers in Businesses and in School
(By Rank)

| Activity | Business | | | School | | |
|---|---|---|---|---|---|---|
| | High School Teachers | Voc-Tech Junior College Teachers | Total | High School Teachers | Voc-Tech Junior College Teachers | Total |
| Operated key punch | 1 | 3 | 1 | 1 | 5 | 3 |
| Operated verifier | 11 | | | 10 | | |
| Operated collator and reproducer | 3 | 4 | 4 | 5 | 9 | 9 |
| Wired boards | 5 | 12 | 8 | 2 | 4 | 5 |
| Planned wiring diagrams | 7 | | 12 | 5 | 6 | 6 |
| Operated sorter | 2 | 1 | 2 | 3 | 9 | 7 |
| Operated tab machines | 4 | 7 | 5 | 8 | 8 | 8 |
| Operated computer console | 10 | 9 | 9 | 11 | 11 | 11 |
| Wrote programs | 8 | 5 | 6 | 5 | 1 | 1 |
| Made block diagrams | 9 | 6 | 7 | 9 | 3 | 4 |
| Made flow charts | 5 | 2 | 3 | 4 | 2 | 2 |
| Debug programs | | 10 | 11 | | 6 | 10 |
| Run test programs | 11 | 8 | 9 | 12 | 12 | 12 |
| Analyzed systems | | 11 | | | | |

The ranks of the activities to which these people had been exposed in school differs somewhat from the ranks of the duties they actually performed on the job.

The most commonly performed activity for high school teachers was that of operating the key punch machine, both in business and in school. Wiring boards was the second ranked activity for high school teachers but it was fifth in the activities performed on the job by these people. On the other hand, operating the collator and reproducer was the third most common activity on the job, but it ranked fifth in the activities they had performed in school. Rather disparate ranks were observed regarding operation of tabulating equipment, with its being ranked eighth in school activities but fourth in the activities done on the job. Other ranks were in relative agreement between job and school activities.

The post high school teachers on the other hand listed the operation of the sorter as the most frequently performed duty on the job, but it was ranked ninth in frequency of mention as an activity they had performed in school. The sorter, however, is a relatively easy machine to learn to operate, and thus its operation may not have been carried on to any extent during school training. Writing programs was the activity most often reported as a school activity by the post high school teachers, but it was the fifth most frequently mentioned duty on the job they held. Flow charting, however, was ranked second both as a job activity and as a school activity. The post high school teachers also reported wiring boards as a relatively frequently performed activity in the school, ranking it fourth, but it was ranked 12th in on-the-job activities performed by these people.

Junior college and vocational-technical school teachers apparently received different kinds of experience on the job from those of the high school teachers. The activity in business ranked first by the high school teachers was operating the key punch machine, and it is ranked third by the post high school teachers. Operating the sorter was ranked very high for both groups, and nearly the same rank is shown for the operation of the collator and reproducer by both groups. However, the second ranked activity by post high school teachers was making flow charts, but this ranked fifth among the high school teachers' activities.

Some difference in ranks of the data processing activities occurred also in the type of activities carried on in school during training. The most frequently mentioned activity of the post secondary teachers is writing programs, but this is fifth highest ranked activity of the high school teachers; making flow charts, which was ranked second by the post secondary teachers was the fourth ranked activity of the secondary school teachers. The junior college-vocational technical school teachers reported making block diagrams as their most frequent activity in school training, but it was ranked ninth by the high school teachers.

Several other activities listed by the teachers, but with less frequency, in both school and business include these (in rank order):

1. Operating paper-tape equipment
2. Operating data-converting equipment
3. Preparing PERT charts
4. Determining critical path
5. Designing forms for the optical scanner
6. Using random access devices
7. Operating high-speed printer.

Further details regarding frequencies of these activities are shown in Appendix A - Table 6.

Courses Studied by Data Processing Teachers

Data processing teachers have studied in many areas of data processing and have taken work in several background areas to gain greater understanding of business and its uses of data processing equipment. The data processing courses studied by the teachers tended to be mainly in the unit record area, especially among the high school teachers; while post secondary teachers concentrated more in the computer and programming areas.

Data processing courses. The courses studied most frequently by the data processing teachers were Introduction to Data Processing, Unit Record Equipment, Wiring Boards, Key Punch, and Introduction to Programming (Table 14-9). Some difference is apparent in the types of courses the two groups of teachers have studied; for example, Introduction to Computer Programming was listed with the greatest frequency by the post high school teachers (nearly 73 per cent), but it was the fifth most frequently named course by the high school teachers, of whom about 55 per cent listed this course. Although it ranked sixth among the high school teachers' courses, Introduction to Digital Computers was a course studied by only 78 (about 40 per cent) of the 196 high school teachers and by 54 per cent of the post secondary teachers.

Junior college and vocational-technical school teachers seemed to have studied more advanced courses than had high school teachers. The proportion of post high school teachers who had studied advanced programming was about twice that of the high school teachers and over twice as many of the post high school teachers had had operations research as had high school teachers. Over twice as many post high school teachers had studied data processing mathematics (35.5 per cent) as secondary school teachers (15.5 per cent).

Table 14-9. Data Processing Courses Studied by Teachers

| Courses | High School | Post High School | Total |
|---|---|---|---|
| Introduction to data processing | 140 | 198 | 338 |
| Unit record equipment | 124 | 170 | 294 |
| Wiring | 115 | 166 | 281 |
| Key punch | 109 | 135 | 244 |
| Data processing applications | 76 | 141 | 217 |
| Data processing systems | 65 | 117 | 182 |
| Systems analysis | 52 | 93 | 145 |
| Introduction to systems analysis | 44 | 81 | 125 |
| Introduction to digital computers | 78 | 153 | 231 |
| Introduction to computer programming | 107 | 205 | 312 |
| Advanced computer programming | 47 | 135 | 182 |
| Computer applications | 44 | 117 | 161 |
| Operations research | 17 | 51 | 68 |
| Data processing math | 30 | 100 | 130 |
| Computer theory and logic | 52 | 90 | 142 |
| Other | 11 | 33 | 44 |

The teachers who had had work experience showed some tendency to have studied more in the computer areas such as theory and logic of computers, programming, data processing systems, computer applications, and advanced programming than do those who had not worked in business. Perhaps this may be attributed to the fact that much of the work experience of these people has been with unit record equipment and they are now preparing more for the computer field.

Background courses. Levels at which teachers taught seemed to make some difference in the kinds of background courses teachers felt were the most helpful, both for teaching in and for understanding the data processing field. Whether or not the teacher had had work experience apparently influenced his thinking also about the usefulness of certain background courses. (See Appendix A, Table 7, for lists of courses that have been helpful to the teachers.)

Post secondary school teachers felt to a greater degree than high school teachers did that for teaching in the data processing field these courses were most helpful (Table 14-10):

1. Bookkeeping and accounting

2. Management

3. English

4. Mathematics

5. Statistics

The differences in the percentages of the secondary and post high school teachers in each instance was at least 13 per cent. The greatest divergence of opinion concerned mathematics, where 61.1 per cent of the post high school teachers felt this to be a valuable area of study, while this was the opinion of 35.2 per cent of the high school teachers, a difference of 25.6 per cent. The differences in opinion regarding bookkeeping and accounting, management, and statistics were about the same for all three areas, about 17 per cent.

On the other hand, secondary school teachers, more so than post high school teachers, felt that calculating machines and secretarial practice courses helped them in teaching data processing.

The differences were not quite so great regarding the helpfulness of background courses for understanding of data processing in general, but the same courses in general showed differences between high school and post high school teachers regarding their value.

Post high school teachers considered to even a greater extent than did high school teachers that mathematics was necessary for understanding the data processing field than they did for teaching in this field. Also, the difference between high school and post high school teachers regarding the value of science in helping to understand data processing is considerably more than the difference in opinion regarding science as background for teaching data processing. Also, considerably more of the post high school teachers felt that mathematics was essential for understanding than felt that it was necessary for teaching.

The opinions of teachers with work experience tended to be different from those who had not had work experience in this field in business. The teachers without work experience tended, more than teachers with, to consider as good background for teaching such courses as bookkeeping and accounting, calculating machines and office practice. The differences in opinion regarding mathematics was not quite so great between teachers with and without work experience than it was for high school and post high school teachers. However, the differences were not as great generally between the "with and

Table 14-10. Background Courses Helpful for Teaching and for Understanding Data Processing Courses

| Courses | For Teaching | | | | | | | | For Understanding | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | High School N=196 | | Post High School N=279 | | No Work Experience N=149 | | Work Experience N=326 | | High School N=196 | | Post High School N=279 | | No Work Experience N=149 | | Work Experience N=326 | |
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Bookkeeping and accounting | 122 | 62.2 | 166 | 78.7 | 97 | 65.1 | 191 | 55.6 | 126 | 64.3 | 167 | 79.1 | 101 | 67.8 | 192 | 58.9 |
| Management | 47 | 24.0 | 87 | 41.2 | 29 | 19.5 | 105 | 32.2 | 45 | 23.0 | 84 | 39.8 | 31 | 20.8 | 98 | 65.8 |
| Office management | 26 | 13.3 | 42 | 19.9 | 21 | 14.1 | 47 | 14.4 | 19 | 9.7 | 46 | 21.8 | 17 | 11.4 | 48 | 14.7 |
| Calculating machine | 41 | 20.9 | 29 | 13.7 | 35 | 23.5 | 35 | 10.7 | 42 | 21.4 | 37 | 17.5 | 35 | 23.5 | 44 | 13.5 |
| English | 19 | 9.7 | 47 | 22.3 | 12 | 8.1 | 54 | 16.6 | 21 | 10.7 | 32 | 15.2 | 15 | 10.1 | 38 | 11.7 |
| Mathematics | 69 | 35.2 | 129 | 61.1 | 47 | 31.5 | 151 | 46.3 | 75 | 38.3 | 148 | 70.1 | 55 | 36.9 | 168 | 51.5 |
| Science | 21 | 10.7 | 38 | 18.0 | 12 | 8.1 | 47 | 14.4 | 20 | 10.2 | 52 | 24.6 | 15 | 10.1 | 57 | 17.5 |
| Statistics | 33 | 16.8 | 71 | 33.6 | 20 | 13.4 | 84 | 25.8 | 45 | 23.0 | 81 | 38.4 | 29 | 19.5 | 97 | 29.8 |
| Office procedures | 62 | 31.6 | 76 | 36.0 | 47 | 31.5 | 91 | 27.9 | 61 | 31.1 | 75 | 35.5 | 50 | 33.6 | 86 | 26.4 |
| Secretarial/ clerical practice | 24 | 12.2 | 16 | 7.6 | 21 | 14.1 | 19 | 5.8 | 20 | 10.2 | 14 | 7.1 | 18 | 12.1 | 16 | 4.9 |
| Education | 42 | 21.4 | 62 | 29.4 | 27 | 18.1 | 77 | 23.6 | 25 | 12.8 | 26 | 12.3 | 17 | 11.4 | 34 | 10.4 |

without work experience" teachers as between secondary and post high school teachers, and many were about the same.

However, in the value for providing understanding of data processing, the differences for certain courses were considerably greater among the various groups of teachers. Nearly two-thirds (65.8 per cent) of the teachers with work experience (compared with about 30 and 40 per cent of teachers when classified according to level of teaching) felt that management courses were helpful for understanding data processing; and they felt more strongly that mathematics was a helpful course than when they were classified according to the level at which they taught. Over half (51.5 per cent) of the teachers with work experience said that mathematics was a course that helped in understanding data processing.

Updating Themselves in Data Processing

In the fast developing field like data processing the teachers must constantly keep up-to-date. Teachers accomplished updating by several different means: reading periodicals, attending summer sessions and professional meetings, attending manufacturers' schools, and working in data processing departments in business.

Methods of updating. By far the most popular way for teachers to update themselves in the data processing field is to read periodicals, reported by 83.6 per cent of the teachers (Table 14-11). Reading the current literature was reported by a greater proportion of the post high school teachers than by high school teachers. Half the teachers are on the manufacturers' mailing lists to receive releases about equipment developments and other publications available from equipment and software manufacturers. Again this was reported more frequently by the post high school than high school teachers. Also, relatively frequently mentioned as a means of keeping up-to-date was attending manufacturers' schools, attending data processing seminars and going to meetings of data processing organizations, each reported by about 40 per cent of the teachers, although again reported by a considerably greater percentage of the post high school teachers.

High school teachers tended to keep updated mainly by the same means as do the post high teachers, but to a lesser extent over all.

Membership in professional organizations tends to be mainly in the National Business Education Association and in the Data Processing Management Association, with about an equal proportion of teachers belonging to each of these two organizations, 22.3 per cent and 21.3 per cent, respectively (Table 14-12). However, high school teachers belong to a greater extent to the NBEA (30.6 per cent) than do post high school teachers (16.5 per cent); but the reverse is true with respect to DPMA with 15.8 per cent of the high school

Table 14-11. Methods Used by High School and Post High School Data Processing Teachers to Keep Updated

| Method | High School N=196 | | Post High School N=279 | | Total N=475 | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Read periodicals | 156 | 79.6 | 241 | 86.4 | 397 | 83.6 |
| Attend professional data processing meetings | 66 | 33.7 | 124 | 44.4 | 190 | 40.0 |
| On manufacturers' mailing list | 91 | 46.4 | 150 | 53.8 | 241 | 50.7 |
| Summer work experience | 20 | 10.2 | 38 | 13.6 | 58 | 12.2 |
| Attend summer school | 37 | 18.9 | 53 | 19.0 | 90 | 18.9 |
| Attend night classes | 37 | 18.9 | 35 | 12.5 | 72 | 15.2 |
| Attend manufacturers' schools | 65 | 33.2 | 148 | 53.0 | 213 | 44.8 |
| Attend data processing seminars | 69 | 35.2 | 133 | 47.7 | 202 | 42.5 |
| Other | 31 | 15.8 | 67 | 24.0 | 98 | 20.6 |

Table 14-12. Professional Organization Memberships Held by Data Processing Teachers

| Organization | High School N=169 No. | High School N=169 % | Post High School N=211 No. | Post High School N=211 % | Total N=380 No. | Total N=380 % |
|---|---|---|---|---|---|---|
| **Data processing and business organizations** | | | | | | |
| Data Processing Management Association | 31 | 18.3 | 70 | 33.2 | 101 | 26.6 |
| Systems and Procedures Association | 6 | 3.5 | 19 | 9.0 | 25 | 6.6 |
| Association for Computing Machinery | 5 | 3.0 | 16 | 7.6 | 21 | 5.5 |
| Machine Accounting Association | 2 | 1.2 | 12 | 5.7 | 14 | 3.7 |
| Association for Educational Data Systems | 4 | 2.4 | 4 | 1.9 | 8 | 2.1 |
| Other | 5 | 3.0 | 7 | 3.3 | 12 | 3.1 |
| **Business Education Organizations** | | | | | | |
| United Business Education Association | 60 | 35.5 | 46 | 21.8 | 106 | 27.9 |
| American Vocational Association | 1 | 0.6 | 9 | 4.3 | 10 | 2.6 |
| Delta Pi Epsilon | 2 | 1.2 | 1 | 0.5 | 3 | 0.8 |
| Other | 11 | 6.5 | 1 | 0.5 | 12 | 3.1 |
| Unspecified | 18 | 10.6 | 34 | 16.1 | 52 | 13.7 |

teachers having membership in this organization and 25.1 per cent of the post high school teachers. Other organizations mentioned, but with considerably less frequency are the Systems and Procedures Association, the Machine Accounting Association and the Association for Computing Machinery.

Of the journals read by data processing teachers, the two most frequently mentioned business and data processing periodicals are Datamation and Computer Digest, with the Journal of Data Management as the third most frequently reported journal read (Table 14-13).

Table 14-13. Periodicals Read by Data Processing Teachers

| Periodicals | High School N=196 | Post High School N=279 | Total N=475 |
|---|---|---|---|
| Data processing and business | | | |
| Datamation | 36 | 87 | 123 |
| Business Automation | 33 | 67 | 100 |
| Journal of Data Management | 28 | 60 | 88 |
| Data Processing Magazine | 12 | 23 | 35 |
| Computers & Data Automation | 7 | 24 | 31 |
| Journal of the Association of Computing Machinery | 9 | 18 | 27 |
| Data Processor (IBM) | 10 | 16 | 26 |
| Business education and education | | | |
| Balance Sheet | 59 | 25 | 84 |
| Business Education World | 34 | 20 | 54 |
| N. E. A. Journal | 32 | 14 | 46 |
| Business Education Forum | 23 | 12 | 35 |
| State Education Journal | 15 | 15 | 30 |
| Business Teacher | 20 | 8 | 28 |
| Today's Secretary | 10 | 5 | 15 |

Other journals read, but to a limited extent, are Data Processing Magazine, Computers and Automation, Journal of the Association of Computing Machinery, Data Processor (IBM), and Data Processing. A total of 66 other periodicals were listed by the teachers to this free response question, but each of these journals was named by only a very small number of teachers. These journals range from Business Week, Fortune, and Nation's Business to Electromechanical Design, CPA Journal, and Computer Design.

Among the most widely read education and business education journals were The Balance Sheet (a publication mailed free of charge to business teachers by a textbook publisher), Business Education World, Business Education Forum and Journal of Business Education. The high school teachers tended to read these periodicals more widely than the post high school teachers did.

Frequency of updating. When asked their opinions about how often data processing teachers as compared with other teachers attended some instructional unit or program such as workshops or summer sessions in order to keep themselves updated, 107 out of 147 department heads felt that data processing teachers attended such classes and programs more often than do other teachers. Only five said they attended less often than other teachers (Table 14-14).

Table 14-14. Frequency With Which High School and Post High School Data Processing Teachers Attend Classes to Keep Updated Compared With Other Teachers

| Frequency | High School | Voc-Tech | Junior College | Total |
|---|---|---|---|---|
| About the same | 13 | 9 | 13 | 35 |
| More often | 39 | 20 | 48 | 107 |
| Less often | 2 | 1 | 2 | 5 |
| No opinion | 18 | 1 | 9 | 28 |
| Totals | 72 | 31 | 72 | 175 |

Kinds of programs preferred for updating. Courses in manufacturers' schools were considered by a little over 40 per cent of the data processing department heads to be the most helpful kind of program for updating data processing teachers (Table 14-15). The next most frequently mentioned source of updating programs were the special summer workshops in data processing offered on college campuses, along with institutes and seminars in data processing. The number of department heads expressing these opinions agrees with the number of teachers (40 per cent) who have attended such sessions to update themselves.

Summer work experience. Heads of data processing instructional departments tend not to require their data processing teachers to work in business data processing departments in the summer, with 98 out of 152 saying that getting work experience is not required of the teachers in their schools (Table 14-16). Only two responses indicated that summer work experience was required of the teachers in their schools. However, in the junior colleges over one-fourth of the respondents recommended that teachers work in the summer, although getting such experience was not required. More teachers in high schools than in post high school institutions were reported to be voluntarily getting business experience in the summer even though this was not a requirement in their schools.

Table 14-15. Preferences for Kinds of Programs for Updating High School and Post High School Data Processing Teachers

| Preference | High School | Voc-Tech | Junior College | Total |
|---|---|---|---|---|
| Manufacturers' schools | 22 | 11 | 29 | 62 |
| Special summer workshops | 17 | 4 | 10 | 31 |
| Institute seminars | 4 | 2 | 7 | 13 |
| Regular summer sessions | 3 | 0 | 5 | 8 |
| Combinations of above programs | 4 | 5 | 10 | 19 |
| Few or not helpful | 0 | 2 | 2 | 4 |
| Miscellaneous | 4 | 2 | 2 | 8 |
| Totals | 54 | 26 | 65 | 145 |

Table 14-16. Summer Work Experience Required of High School and Post High School Data Processing Teachers

| | High Schools | | Voc-Tech Schools | | Junior Colleges | | Total | |
|---|---|---|---|---|---|---|---|---|
| Work Experience Required | No. | % | No. | % | No. | % | No. | % |
| None | 38 | 65.5 | 22 | 73.3 | 38 | 59.4 | 98 | 64.5 |
| None, but recommended | 8 | 13.8 | 4 | 13.3 | 18 | 28.1 | 30 | 19.7 |
| None, but done voluntarily | 9 | 15.5 | 2 | 6.7 | 8 | 12.5 | 19 | 12.5 |
| None, but visit offices | 3 | 5.2 | 0 | 0.0 | 0 | 0.0 | 3 | 2.0 |
| Yes | 0 | 0.0 | 2 | 6.7 | 0 | 0.0 | 2 | 1.3 |
| Totals | 58 | 100 | 30 | 100 | 64 | 100 | 152 | 100 |

# THE DATA PROCESSING TEACHER AND HIS JOB

As a rule, data processing teachers are rather well satisfied with teaching in this field, in which they started to teach mainly because someone asked them to. They teach a variety of students in many fields, both in and outside of data processing.

## Reasons for Entering the Data Processing Teaching Field

In about equal numbers data processing teachers said that they started teaching in this field either because administrators had asked them to or because they had worked in the field and thought they would like to teach it (Table 14-17). However, proportionately more post high school teachers had worked in the field (32.5 per cent) than high school teachers (14.7 per cent), and more high school teachers had been asked to teach in data processing than had teachers in the post secondary schools. About one-fifth of the teachers at both levels were interested in the field and had asked to teach it, and a few had been exposed to it in college classes and thought they would like it as a teaching field.

## Job Satisfactions and Dissatisfactions

Basically data processing teachers are satisfied with teaching in this field, although some problems do occur. However, considerably fewer teachers expressed dissatisfaction than satisfaction with the field. They seem to derive their satisfactions from the students and from the content of the field itself, while most of the dissatisfaction stems from inadequacy of supplies and facilities.

Satisfactions with teaching in data processing. When asked what satisfactions they derived from the teaching of data processing courses, most of the teachers said that working with students in one way or another was the main source of their satisfaction with teaching in this field (Table 14-18). The reasons they liked working with students are different, however, for the teachers at the high school and the post high school levels. Proportionately, only about half as many post high school as secondary teachers liked working with students because the attitudes of the students were good, while not quite half as many high school (7.7 per cent) as junior college-vocational technical school teachers (13.5 per cent) indicated that teaching in this field gave them the opportunity to share their knowledge with the students.

Table 14-17. Reasons for High School and Post High School Data Processing Teachers Entering Data Processing Teaching Field

| Reasons | High School | Voc-Tech Junior College | Total |
|---|---|---|---|
| Asked by administration | 69 | 64 | 133 |
| Was interested and asked to do it | 43 | 50 | 93 |
| Had worked in it and wanted to teach it | 28 | 90 | 118 |
| Had had class work and wanted to teach it | 12 | 16 | 28 |
| Combinations of these reasons | 38 | 57 | 95 |
| Totals | 190 | 277 | 467 |

Table 14-18. Satisfactions of High School and Post High School Data Processing Teachers in Teaching Data Processing

| Satisfactions | High School N=195 No. | High School N=195 % | Post High School N=282 No. | Post High School N=282 % |
|---|---|---|---|---|
| Helping students | 137 | 70.3 | 184 | 65.9 |
| Like to encourage students in the field | 16 | 8.2 | 28 | 9.9 |
| Students' attitudes are good | 40 | 20.5 | 28 | 9.9 |
| Sharing knowledge | 15 | 7.7 | 38 | 13.5 |
| Helping students prepare for a job | 27 | 13.8 | 27 | 9.6 |
| Like to watch student progress | 20 | 10.2 | 39 | 13.8 |
| Like being of service to young people | 12 | 6.2 | 16 | 5.7 |
| Other | 7 | 3.6 | 8 | 2.8 |
| Like being in data processing | 66 | 33.8 | 117 | 41.5 |
| Increases one's own competency | 3 | 1.5 | 27 | 9.6 |
| Keeps one up-to-date | 5 | 2.6 | 16 | 5.7 |
| Future is promising | 23 | 11.8 | 16 | 5.7 |
| Challenging field | 22 | 11.3 | 24 | 8.5 |
| New field | 25 | 12.8 | 24 | 8.5 |

A greater proportion (41.5 per cent) of post high school teachers indicated their satisfaction with teaching in data processing came from being in this particular field than did high school teachers (33.8 per cent). Twice as great a proportion of high school teachers (11.8 per cent) as post high school teachers (5.7 per cent) liked the data processing field because they felt the future in it was promising. On the other hand, over six times as many junior college-vocational technical school teachers liked the data processing field because of the opportunity it gave them for improving their own competency.

Dissatisfactions with teaching in data processing. Fewer expressions of dissatisfactions were made than of satisfactions, with 504 expressions of satisfactions and 424 dissatisfactions listed by the teachers (Table 14-19). High school and post high school teachers were to a great extent agreed on their dissatisfactions with teaching in data processing, the greatest dissatisfaction being materials, supplies, and facilities, with 40.5 per cent of the high school teachers and 37.2 per cent of the post high school teachers listing dissatisfactions in this area. Lack of equipment was the greatest source of dissatisfaction in both levels of schools and lack of textbooks was the next most frequently named complaint about teaching in the data processing field.

About one-fifth of the high school teachers and about one-fourth of the post secondary teachers felt that pay and working conditions were inadequate. However, very few of the teachers named any one aspect of working conditions as unsatisfactory, with salaries listed the most frequently, although by only 1.0 per cent of the high school teachers and by 6.7 per cent of the post high school teachers. Junior college-vocational technical school teachers were a little more concerned with lack of time for adequate preparation for teaching than were high school teachers, with 4.2 per cent of the post high school teachers listing this as a source of dissatisfaction as against 2.1 per cent of the high school teachers.

## Types of Students Taught by Data Processing Teachers

Data processing teachers are more commonly employed in teaching day students than any other group according to the responses made by the teachers to this question. Of the high school data processing teachers, 133 reported teaching day students (Table 14-20), while a greater proportion of post high school teachers reported teaching adults in evening programs than day time students. A greater proportion of the secondary teachers working with high school day students have had no work experience in data processing. On the other hand, a slightly greater proportion of the post high school teachers teaching at the post high school and adult levels have no degrees, but they have work experience in data processing to a greater extent than do the high school teachers.

Table 14-19. Dissatisfactions of High School and Post High School Data Processing Teachers in Teaching Data Processing

| Dissatisfactions | High School N=195 No. | High School N=195 % | Post High School N=282 No. | Post High School N=282 % |
|---|---|---|---|---|
| Students and classes | 46 | 23.6 | 83 | 29.4 |
| No selection of students | 14 | 7.2 | 26 | 9.2 |
| Poor background of students | 7 | 3.6 | 14 | 5.0 |
| Lack of student interest | 10 | 5.1 | 9 | 3.2 |
| Too many students | 6 | 3.1 | 11 | 3.9 |
| Hard field | 4 | 2.1 | 13 | 4.6 |
| Too many levels of instruction | 4 | 2.1 | 2 | 0.7 |
| Data processing credits not accepted for college entrance | 0 | 0.0 | 3 | 1.1 |
| Lack of direction | 1 | 0.5 | 3 | 1.1 |
| Other | 0 | 0.0 | 2 | 0.7 |
| Materials, supplies and facilities | 79 | 40.5 | 105 | 37.2 |
| Lack of textbooks | 24 | 12.3 | 32 | 11.3 |
| Lack of equipment | 46 | 23.6 | 52 | 18.4 |
| Lack of cooperation | 3 | 1.5 | 2 | 0.7 |
| Long hours | 1 | 0.5 | 9 | 3.2 |
| Lack of standard teaching methods | 3 | 1.5 | 6 | 2.1 |
| Other | 2 | 1.0 | 4 | 1.4 |
| Pay and working conditions | 39 | 20.0 | 72 | 25.5 |
| Lack of preparation time | 4 | 2.1 | 12 | 4.2 |
| Poor pay | 2 | 1.0 | 19 | 6.7 |
| Not enough class time | 4 | 2.1 | 6 | 2.1 |
| Standards not coordinated | 6 | 3.1 | 7 | 2.5 |
| Hard to keep updated | 3 | 1.5 | 6 | 2.1 |
| Poor publicity | 5 | 2.6 | 6 | 2.1 |
| Lack of teacher background | 8 | 4.1 | 3 | 1.1 |
| Dislike the field | 2 | 1.0 | 4 | 1.4 |
| Administrative policies | 4 | 2.1 | 7 | 2.6 |
| Other | 1 | 0.5 | 2 | 0.7 |

Table 14-20. Types of Students Taught by Data Processing Teachers With and Without Degrees and With and Without Work Experience in Data Processing

| Types of Students | Degree | | Work Experience | |
|---|---|---|---|---|
| | With | Without | With | Without |
| <u>High school teachers</u> | | | | |
| High school day students | 133 | 6 | 54 | 85 |
| Post high school day students | 21 | 2 | 15 | 8 |
| Adult evening students | 72 | 19 | 69 | 22 |
| Other | 6 | 0 | 5 | 1 |
| Totals | 232* | 27 | 143 | 116 |
| <u>Post high school teachers</u> | | | | |
| High school day students | 25 | 7 | 20 | 12 |
| Post high school day students | 128 | 24 | 118 | 34 |
| Adult evening students | 121 | 49 | 151 | 21 |
| Other | 33 | 12 | 38 | 7 |
| Totals | 307 | 92 | 327 | 74 |

*Totals are greater than the number of teachers since teachers may teach both day and evening students or both high school and post high school students.

## Instructional Area

Data processing teachers instruct in a variety of courses, some of which are outside the data processing field. Post high school teachers tend to teach a greater variety of data processing courses, while high school teachers are involved in more courses outside the field of data processing. High school teachers taught slightly over three different data processing courses apiece while the post high school instructors taught nearly five courses apiece.

Data processing areas. The teachers were asked to list the courses they taught in data processing, a summary of which appears in Table 14-21, showing the number of teachers who indicated teaching each of the various courses. At both the high school and post high school levels, instruction on the key punch and unit record equipment were the most frequently named areas, with introductory work in programming being the third most frequently named area at both educational levels. Post high school programs included introduction to digital computers and unit record systems in quite substantial numbers also. At the high school level, the number of teachers who list teaching of other than key punch and unit record equipment drops considerably with only about three-eighths of the high school teachers indicating they taught some programming, while nearly five-eighths of the post high school teachers indicated that they taught beginning courses in programming. However, nearly an equal proportion of high school teachers and post high school teachers said they taught introduction to digital computers (about 43 and 44 per cent, respectively).

Areas outside of data processing. Data processing teachers did some teaching outside of the data processing field also, more so at the secondary level than at the post high school level (Table 14-22). Of the 169 high school teachers, 53 (31 per cent) said that they taught bookkeeping, and 60 of the 211 post high school teachers (about 28 per cent) taught bookkeeping or accounting besides the data processing courses. At the high school level, the course next most frequently taught by the data processing teachers was typing, while mathematics was the course outside of data processing taught by data processing instructors in the post high school institutions. However, some teachers do teach only in the data processing field, about 22 per cent of the teachers in the secondary schools and over 35 per cent of the junior college-vocational technical teachers.

## TEACHERS' OPINIONS

The teachers were asked to express opinions on some matters pertinent to the data processing instructional area. Because people seem to have differing opinions about when students should first be exposed to the concepts of data processing, the teachers who actually teach young people in this field were asked for their ideas concerning this matter. They were also asked about how they thought business could and should contribute to the education of young people going into occupations in the data processing field.

Table 14-21. Data Processing Areas in Which Teachers Are Now Teaching

| Areas | High School | | | Post High School | | | Totals |
|---|---|---|---|---|---|---|---|
| | Degree | No Degree | Total | Degree | No Degree | Total | |
| Introduction to data processing | 104 | 13 | 117 | 131 | 34 | 165 | 282 |
| Unit record equipment | 91 | 17 | 108 | 115 | 42 | 157 | 265 |
| Unit record system | 47 | 9 | 56 | 54 | 19 | 73 | 129 |
| Introduction to systems analysis | 19 | 0 | 19 | 44 | 12 | 56 | 75 |
| Data processing systems | 24 | 4 | 28 | 47 | 14 | 61 | 89 |
| Introduction to digital computer | 47 | 3 | 50 | 72 | 20 | 92 | 142 |
| Computer theory and logic | 28 | 3 | 31 | 38 | 15 | 53 | 84 |
| Introduction to programming | 57 | 6 | 63 | 106 | 24 | 130 | 193 |
| Advanced programming | 13 | 1 | 14 | 59 | 16 | 75 | 89 |
| Data processing applications | 36 | 4 | 40 | 43 | 19 | 62 | 102 |
| Field work in data processing | 6 | 2 | 8 | 16 | 13 | 29 | 37 |
| Data processing math | 15 | 2 | 17 | 27 | 7 | 34 | 51 |
| Other | 14 | 0 | 14 | 9 | 4 | 13 | 27 |

Table 14-22. Areas Other Than Data Processing in Which Teachers are Now Teaching

| Areas | High School | | | Post High School | | | Totals |
|---|---|---|---|---|---|---|---|
| | Degree | No Degree | Total | Degree | No Degree | Total | |
| None | 43 | 21 | 64 | 101 | 50 | 151 | 215 |
| Bookkeeping/ accounting | 53 | 0 | 53 | 53 | 7 | 60 | 113 |
| Shorthand | 19 | 0 | 19 | 8 | 0 | 8 | 27 |
| Typing | 45 | 1 | 46 | 17 | 1 | 18 | 64 |
| Office Procedures/ management | 11 | 1 | 12 | 9 | 6 | 15 | 27 |
| Secretarial/ clerical practice | 39 | 0 | 39 | 11 | 2 | 13 | 52 |
| Introduction to business | 18 | 1 | 19 | 12 | 4 | 16 | 35 |
| Management | 8 | 0 | 8 | 8 | 6 | 14 | 22 |
| Math | 26 | 0 | 26 | 35 | 5 | 40 | 66 |
| Science | 6 | 0 | 6 | 3 | 0 | 3 | 9 |
| Social science | 5 | 0 | 5 | 3 | 2 | 5 | 10 |
| English | 3 | 0 | 3 | 5 | 1 | 6 | 9 |
| Other | 26 | 0 | 26 | 9 | 2 | 11 | 37 |

Grade Level for Introduction of Data Processing

The teachers were asked to express their opinions, on the basis of their experience in teaching data processing, at what level and how should data processing be introduced to young people in schools. Most teachers (both secondary and post high school) felt that data processing should be introduced at the high school level, preferably at the eleventh and/or twelfth grades (Table 14-23).

Table 14-23. Education Level for Introducing Data Processing as Recommended by High School and Post High School Data Processing Teachers

| Level | High School | Post High School | Total |
|---|---|---|---|
| Post high school | 7 | 33 | 40 |
| Freshman (post high school) | 3 | 16 | 19 |
| Sophomore (post high school) | 0 | 2 | 2 |
| High school | 57 | 109 | 166 |
| 9th grade | 11 | 1 | 12 |
| 10th grade | 15 | 12 | 27 |
| 11th grade | 27 | 17 | 44 |
| 12th grade | 27 | 23 | 50 |
| 9th and 10th grade | 5 | 1 | 6 |
| 11th and 12th grade | 18 | 16 | 34 |
| Junior high school | 2 | 9 | 11 |
| Elementary school | 2 | 4 | 6 |
| Miscellaneous | 1 | 4 | 5 |

The teachers were in definite agreement that data processing should be introduced in a general introductory course, or at least in a formal course situation (Table 14-24). About half of the teachers who suggested an introductory course seemed to think that data processing should be presented as a unit in another course first. Although one of the common courses in high schools is in operation of the key punch machine, only nine teachers felt that data processing should be introduced through such a course and only a few more indicated that it should be introduced through unit record courses.

Table 14-24. Methods for Introducing Business Data Processing as Recommended by High School and Post High School Data Processing Teachers According to Their Degrees and Work Experience

| Method | High School | Post High School | Total |
|---|---|---|---|
| Introductory course (general) | 36 | 89 | 125 |
| Practical courses | 14 | 19 | 33 |
| Introduction to equipment | 2 | 1 | 3 |
| Key punch | 6 | 3 | 9 |
| Key punch and other unit record equipment | 8 | 6 | 14 |
| Programming | 0 | 6 | 6 |
| Unit in other courses | 40 | 25 | 65 |
| Formal classes (general) | 11 | 14 | 25 |
| Introduction and practical or hands on | 6 | 5 | 11 |
| Students work at companies (on-the-job training) | 3 | 5 | 8 |
| Introduction and unit record equipment | 0 | 1 | 1 |
| Integrated into other courses | 0 | 2 | 2 |
| Unit record and computer | 3 | 3 | 6 |
| Complete curriculum | 10 | 24 | 34 |
| Introduction to unit record and programming | 2 | 3 | 5 |
| Miscellaneous | 2 | 1 | 3 |

## The Business Community's Contribution in Data Processing Instruction

Data processing teachers felt that the business community could contribute to the preparation of students in several different ways, especially in providing actual experience either through participation or observation (Table 14-25). Among the most frequently mentioned ways in which business could contribute were these (in order of frequency of mention):

1. To provide opportunities for field trips, to give explanations, and to demonstrate operation of data processing equipment, etc.

2. To provide on-the-job training.

3. To give advice to the schools about curriculum and equipment.

4. To train for the company's specific needs.

Two other phases were mentioned quite frequently, although not as widely as the above four items, both dealing with work experience, are (1) to provide work experience for teachers as well as for students, and (2) to participate in a cooperative work experience program. Although slightly different in the ranking of their suggestions to business, teachers at the high school and post high school levels made the same suggestions.

Table 14-25. Phases of Business Data Processing that Businesses Should Be Expected to Provide as Recommended by High School and Post High School Data Processing Teachers

| Phases | High School | Post High School | Total |
|---|---|---|---|
| On-the-job training | 29 | 30 | 59 |
| Training for companies' specific needs | 19 | 28 | 47 |
| Field trip opportunities, lectures, etc. | 27 | 50 | 77 |
| Advice to schools | 16 | 32 | 48 |
| Hiring students with little or no experience | 6 | 13 | 19 |
| Use of equipment for data processing classes | 9 | 12 | 21 |
| Provide work experience (for teachers and students) | 11 | 19 | 30 |
| Participate in cooperative education program | 13 | 18 | 31 |
| In-service advanced training | 9 | 12 | 21 |
| Send employee to manufacturer's school | 3 | 8 | 11 |
| Financial help in setting up program | 9 | 4 | 13 |
| Orientation | 2 | 6 | 8 |
| None or very little | 4 | 7 | 11 |
| Miscellaneous | 4 | 7 | 11 |

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## BIBLIOGRAPHY


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# APPENDIX A

Table A-1. Monthly Salary, by Sex, of Data Processing Employees

| Salary | Key Punch Oper. | | Tape Libr. | | Unit Rec. Oper. | | Comp. Oper. | | Progr. | | D.P. Super. | | Sys. Anal. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Under $200 | 0 | 3 | 0 | 0 | 0 | 4 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| $200-299 | 0 | 50 | 0 | 7 | 4 | 10 | 5 | 7 | 1 | 1 | 0 | 0 | 0 | 0 |
| $300-399 | 0 | 50 | 1 | 2 | 12 | 13 | 34 | 14 | 7 | 2 | 0 | 0 | 0 | 0 |
| $400-499 | 3 | 20 | 0 | 12 | 20 | 17 | 75 | 20 | 34 | 15 | 2 | 1 | 1 | 0 |
| $500-599 | 0 | 0 | 2 | 1 | 8 | 2 | 74 | 5 | 58 | 20 | 24 | 6 | 9 | 1 |
| $600-699 | 0 | 0 | 0 | 1 | 8 | 0 | 28 | 2 | 81 | 15 | 32 | 2 | 8 | 2 |
| $700-799 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 44 | 1 | 33 | 1 | 39 | 2 |
| $800-899 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 4 | 26 | 0 | 39 | 1 |
| $900-999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 13 | 0 | 10 | 2 |
| Over $1,000 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 7 | 1 | 21 | 1 | 24 | 0 |
| Totals | 3 | 124 | 3 | 23 | 52 | 47 | 226 | 49 | 273 | 59 | 151 | 11 | 130 | 8 |

Table A-2. Evaluation of Education According to Type of School Attended

| Position | Very well N | Very well % | Adequate N | Adequate % | Inadequate N | Inadequate % | Total |
|---|---|---|---|---|---|---|---|
| Key Punch Operator | 125 | 16.7 | 441 | 58.9 | 183 | 24.4 | 749 |
| Less than high school | 2 | 6.4 | 22 | 71.0 | 7 | 22.6 | 31 |
| High school | 40 | 9.9 | 252 | 62.5 | 111 | 27.5 | 403 |
| Private business school | 50 | 28.1 | 97 | 54.5 | 31 | 17.4 | 178 |
| Some college - no degree | 29 | 22.3 | 68 | 52.3 | 33 | 25.4 | 130 |
| Degree | 4 | 57.1 | 2 | 28.6 | 1 | 14.3 | 7 |
| Tape Librarian | 1 | 4.2 | 15 | 62.5 | 8 | 33.3 | 24 |
| Less than high school | 0 | 0.0 | 1 | 100.0 | 0 | 0.0 | 1 |
| High school | 1 | 5.3 | 13 | 68.4 | 5 | 26.3 | 19 |
| Private business school | 0 | 0.0 | 0 | 00.0 | 2 | 100.0 | 2 |
| Some college | 0 | 0.0 | 1 | 50.0 | 1 | 50.0 | 2 |
| Degree | 0 | 0.0 | 0 | 00.0 | 0 | 00.0 | 0 |
| Unit Record Equipment Operator | 34 | 10.0 | 189 | 55.4 | 118 | 34.6 | 341 |
| Less than high school | 1 | 5.6 | 8 | 44.4 | 9 | 50.0 | 18 |
| High school | 14 | 82.4 | 92 | 54.1 | 64 | 37.6 | 170 |
| Private business school | 3 | 6.1 | 29 | 59.2 | 17 | 34.7 | 49 |
| Some college | 14 | 15.0 | 54 | 58.1 | 25 | 26.9 | 93 |
| Degree | 2 | 18.2 | 6 | 54.5 | 3 | 2.7 | 11 |
| Computer Operator | 25 | 9.9 | 153 | 60.5 | 75 | 29.6 | 253 |
| Less than high school | 1 | 25.0 | 3 | 75.0 | 0 | 0.0 | 4 |
| High school | 9 | 8.4 | 58 | 54.2 | 40 | 37.4 | 107 |
| Private business school | 6 | 16.7 | 21 | 58.3 | 9 | 25.0 | 36 |
| Some college | 8 | 8.0 | 68 | 68.0 | 24 | 24.0 | 100 |
| Degree | 1 | 16.7 | 3 | 50.0 | 2 | 33.3 | 6 |
| Programmer | 42 | 13.2 | 182 | 57.0 | 95 | 29.8 | 319 |
| Less than high school | 0 | 0.0 | 2 | 40.0 | 3 | 60.0 | 5 |
| High school | 1 | 1.7 | 29 | 50.0 | 28 | 48.3 | 58 |
| Private business school | 4 | 13.8 | 11 | 37.9 | 14 | 48.3 | 29 |
| Some college | 20 | 15.7 | 80 | 63.0 | 27 | 21.2 | 127 |
| Degree | 17 | 17.0 | 60 | 60.0 | 23 | 23.0 | 100 |
| Data Processing Manager | 14 | 9.4 | 83 | 55.7 | 52 | 34.9 | 149 |
| Less than high school | 0 | 0.0 | 0 | 0.0 | 3 | 100.0 | 3 |
| High school | 2 | 3.7 | 27 | 50.0 | 25 | 46.3 | 54 |
| Private business school | 1 | 5.0 | 16 | 80.0 | 3 | 15.0 | 20 |
| Some college | 8 | 17.4 | 25 | 54.3 | 13 | 28.3 | 46 |
| Degree | 3 | 11.5 | 15 | 57.7 | 8 | 30.8 | 26 |
| Systems Analyst | 22 | 16.3 | 74 | 54.8 | 39 | 28.9 | 135 |
| Less than high school | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| High school | 1 | 5.9 | 7 | 41.2 | 9 | 59.2 | 17 |
| Private business school | 0 | 0.0 | 4 | 66.7 | 2 | 33.3 | 6 |
| Some college | 14 | 24.1 | 29 | 50.0 | 15 | 25.9 | 58 |
| Degree | 7 | 13.0 | 34 | 63.0 | 13 | 24.1 | 54 |

Table A-3. On-The-Job Training Given Data Processing Employees

| Job Title | Typing | Key Punch | Calc. Machine | Unit Record Op. Eqpt. | Wiring Boards | Paper Tape | Computer Console Operation | Intro. to D.P. Concepts | Theory/ Logic | Program-ming | Flow Charting | D.P. Appli-cation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Key Punch Operator | 44 | 271 | 46 | 99 | 36 | 19 | 21 | 65 | 23 | 11 | 15 | 41 |
| Unit Record | 10 | 110 | 61 | 195 | 179 | 29 | 64 | 107 | 61 | 47 | 87 | 91 |
| Tape Librarian | 7 | 16 | 6 | 14 | 6 | 3 | 15 | 26 | 12 | 8 | 11 | 13 |
| Computer Console Operator | 11 | 80 | 45 | 132 | 82 | 47 | 220 | 162 | 135 | 121 | 111 | 118 |
| Supervising Computer Operator | 12 | 75 | 54 | 108 | 80 | 45 | 158 | 145 | 146 | 156 | 152 | 156 |
| Programmer | 6 | 81 | 48 | 111 | 56 | 47 | 175 | 178 | 187 | 232 | 207 | 189 |
| (Manager, Data Processing (Assistant Manager, Data Processing | 3 | 14 | 12 | 18 | 17 | 11 | 33 | 33 | 30 | 41 | 30 | 34 |
| Systems Analyst | 4 | 17 | 19 | 28 | 12 | 15 | 36 | 48 | 44 | 53 | 46 | 47 |

Table A-4. Leisure Time Activities of Data Processing Employees

| Activity | Sex | Key Punch Oper. 1,341 ans. | Tape Libr. 39 ans. | Unit Rec. Oper. 158 ans. | Comp. Oper. 460 ans. | Progr. 575 ans. | D.P. Super 278 ans. | Sys. Anal. 248 ans. |
|---|---|---|---|---|---|---|---|---|
| Arts and crafts | M | 2 | 0 | 18 | 25 | 29 | 17 | 17 |
| | W | 279 | 4 | 45 | 10 | 19 | 3 | 3 |
| | Total | 281 | 4 | 63 | 35 | 48 | 20 | 20 |
| Household | M | 1 | 1 | 46 | 54 | 63 | 28 | 22 |
| | W | 96 | 2 | 20 | 7 | 4 | 1 | 1 |
| | Total | 97 | 3 | 66 | 61 | 67 | 29 | 23 |
| Hunting and fishing | M | 4 | 1 | 48 | 49 | 66 | 39 | 23 |
| | W | 15 | 0 | 2 | 1 | 1 | 0 | 0 |
| | Total | 19 | 1 | 50 | 50 | 67 | 39 | 23 |
| Outdoor | M | 1 | 0 | 28 | 31 | 37 | 22 | 25 |
| | W | 184 | 2 | 22 | 11 | 11 | 1 | 2 |
| | Total | 185 | 2 | 50 | 42 | 48 | 23 | 27 |
| Reading | M | 2 | 1 | 32 | 30 | 53 | 30 | 31 |
| | W | 212 | 6 | 56 | 20 | 30 | 3 | 3 |
| | Total | 214 | 7 | 88 | 50 | 83 | 33 | 34 |
| TV and movies | M | 0 | 0 | 6 | 8 | 6 | 3 | 4 |
| | W | 45 | 2 | 9 | 2 | 2 | 1 | 0 |
| | Total | 45 | 2 | 15 | 10 | 8 | 4 | 4 |
| Dancing and parties | M | 1 | 0 | 15 | 8 | 15 | 8 | 8 |
| | W | 95 | 1 | 16 | 10 | 4 | 1 | 1 |
| | Total | 96 | 1 | 31 | 18 | 19 | 9 | 9 |
| Travel | M | 0 | 0 | 4 | 6 | 5 | 4 | 2 |
| | W | 14 | 3 | 5 | 2 | 1 | 1 | 1 |
| | Total | 14 | 3 | 9 | 8 | 6 | 5 | 3 |
| Music | M | 2 | 0 | 24 | 18 | 21 | 10 | 8 |
| | W | 62 | 2 | 15 | 5 | 11 | 2 | 2 |
| | Total | 64 | 2 | 39 | 23 | 32 | 12 | 10 |
| Sports participation | M | 7 | 2 | 67 | 79 | 103 | 50 | 44 |
| | W | 232 | 8 | 34 | 15 | 12 | 7 | 0 |
| | Total | 239 | 10 | 101 | 94 | 115 | 57 | 44 |
| Sports spectator | M | 7 | 1 | 39 | 38 | 31 | 30 | 15 |
| | W | 21 | 0 | 6 | 2 | 1 | 0 | 0 |
| | Total | 28 | 1 | 45 | 40 | 32 | 30 | 15 |
| Other | M | 1 | 0 | 16 | 28 | 37 | 16 | 35 |
| | W | 58 | 3 | 19 | 1 | 13 | 1 | 1 |
| | Total | 59 | 3 | 35 | 29 | 50 | 17 | 36 |
| Totals | M | 28 | 6 | 343 | 374 | 466 | 257 | 234 |
| | W | 1,313 | 33 | 249 | 86 | 109 | 21 | 14 |
| | Total | 1,341 | 39 | 592 | 460 | 575 | 278 | 248 |

Table A-5. Data Processing Activities Performed by Teachers in Data Processing Departments

| Activity | High School | Post High School |
|---|---|---|
| Operated Key Punch | 90 | 178 |
| Operated Verifier | 58 | 123 |
| Operated Collater, Reproducer | 81 | 175 |
| Wired Boards | 77 | 150 |
| Planned Wiring Diagram | 69 | 141 |
| Operated Sorter | 83 | 182 |
| Operated Accounting Machine | 78 | 165 |
| Operated Paper-Tape | 27 | 98 |
| Operated Data-Converting | 28 | 78 |
| Operated Computer Console | 60 | 158 |
| Written Programs | 66 | 172 |
| Make Block Diagrams | 63 | 168 |
| Make Flow Charts | 77 | 181 |
| Performed Systems Analysis | 55 | 152 |
| Prepared Pert Charts | 17 | 51 |
| Determined Critical Path | 16 | 53 |
| Design Forms for Optical Scanner | 9 | 27 |
| Use Random Access Device | 32 | 106 |
| Operate High-Speed Printer | 53 | 140 |
| Debug Programs | 57 | 157 |
| Run Test Programs | 58 | 160 |
| Other | 18 | 41 |

Table A-6. Data Processing Activities Performed by Data Processing Teachers in Business, Government, Etc., and in Schools

| Activity | BUS., GOV'T, ETC. High School | BUS., GOV'T, ETC. Post H.S. | BUS., GOV'T, ETC. Total | SCHOOLS High School | SCHOOLS Post H.S. | SCHOOLS Total |
|---|---|---|---|---|---|---|
| Operated Key Punch | 90 | 178 | 268 | 125 | 139 | 264 |
| Operated Verifier | 58 | 123 | 181 | 73 | 93 | 166 |
| Operated Collator, Rep. | 81 | 175 | 256 | 104 | 129 | 233 |
| Wired Boards | 77 | 150 | 227 | 111 | 142 | 253 |
| Planned Wiring Diagrams | 69 | 141 | 210 | 104 | 134 | 238 |
| Operated Sorter | 83 | 182 | 265 | 108 | 129 | 237 |
| Operated Tab. Mach. | 78 | 165 | 243 | 101 | 133 | 234 |
| Oper. Paper Tape Equip. | 27 | 98 | 125 | 24 | 50 | 74 |
| Oper. Data Converter | 28 | 78 | 106 | 9 | 41 | 50 |
| Oper. Computer Console | 60 | 158 | 218 | 64 | 128 | 192 |
| Written Programs | 66 | 172 | 238 | 104 | 184 | 288 |
| Make Block Diagrams | 63 | 168 | 231 | 89 | 171 | 260 |
| Make Flow Charts | 77 | 181 | 258 | 105 | 172 | 277 |
| Performed System Ana. | 55 | 152 | 207 | 36 | 75 | 111 |
| Prepared PERT Charts | 17 | 51 | 68 | 12 | 35 | 47 |
| Deter. Critical Path | 16 | 53 | 69 | 12 | 36 | 48 |
| Design Forms for Op. Scan. | 9 | 27 | 36 | 1 | 8 | 9 |
| Used Random Access Dev. | 32 | 106 | 138 | 28 | 73 | 101 |
| Oper. Hi Speed Printer | 53 | 140 | 193 | 36 | 75 | 111 |
| DeBug Programs | 57 | 157 | 214 | 60 | 134 | 194 |
| Run Test Programs | 58 | 160 | 218 | 63 | 112 | 175 |
| Other | 18 | 41 | 59 | 13 | 20 | 33 |

Table A-7. Courses Teachers Have Taken That Are Helpful in Their Teaching of Data Processing

| | High School | Post High School | Other |
|---|---|---|---|
| UNDERSTANDING | | | |
| Bookkeeping/Accounting | 120 | 156 | 17 |
| Management | 36 | 83 | 10 |
| Office Management | 20 | 41 | 4 |
| Calculating Machines | 40 | 35 | 4 |
| English | 17 | 34 | 2 |
| Mathematics | 61 | 152 | 10 |
| Science | 15 | 55 | 2 |
| Statistics | 36 | 83 | 7 |
| Office Procedures | 59 | 72 | 5 |
| Secretarial/Clerical Practice | 18 | 16 | 0 |
| Education | 21 | 29 | 1 |
| Other | 13 | 23 | 1 |
| TEACHING | | | |
| Bookkeeping/Accounting | 114 | 155 | 19 |
| Management | 30 | 94 | 10 |
| Office Management | 22 | 40 | 6 |
| Calculating Machines | 38 | 31 | 1 |
| English | 15 | 49 | 2 |
| Mathematics | 52 | 137 | 9 |
| Science | 15 | 43 | 1 |
| Statistics | 24 | 72 | 8 |
| Office Procedures | 60 | 72 | 6 |
| Secretarial/Clerical Practice | 22 | 18 | 0 |
| Education | 38 | 64 | 2 |
| Other | 10 | 20 | 1 |

APPENDIX B

APPENDIX B - 1

Management Interview Guide

NATIONAL DATA PROCESSING CURRICULUM STUDY

University of Colorado
Boulder, Colorado

MANAGEMENT INTERVIEW SCHEDULE

| | |
|---|---|
| Company . . . . . . . . . . . . . . | |
| SIC . . . . . . . . . . . . . . . . | |
| Total No. Employees . . . . . . . . | |
| DP Employees . . . . . . . . . . . | |
| Monthly rental DP eqpt . . . . . . | |
| Monthly rental computers . . . . . | |

| EQUIPMENT | No. |
|---|---|
| Key punch . . . . . . . . . . . . | |
| Verifier . . . . . . . . . . . . | |
| Card sorter . . . . . . . . . . . | |
| Reproducer . . . . . . . . . . . | |
| Collator . . . . . . . . . . . . | |
| Acctg machines . . . . . . . . . | |
| Calculating punch . . . . . . . . | |
| Card reader . . . . . . . . . . . | |
| Paper-tape machines . . . . . . . | |
| Disc pack (disc storage) . . . . | |
| Card to tape converter . . . . . | |
| Mag tape typewriters .......... | |
| Computer . . . . . . . . . . . . | |
| Printer . . . . . . . . . . . . . | |
| ____________ | |
| ____________ | |

____________________
Interviewee

____________________
Position

____________________
Interviewer

| Key Punch Oper | Unit Rcrd Eqpt Oper | Tape Lbrn | Cmptr Cnsl Oper | AMT OF EDUCATION | Prgmr | Supvr Cmptr Oprns | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Desired | | | | |
| | | | | Minimum | | | | |
| | | | | **AMT OF EXPERIENCE** | | | | |
| | | | | Desired | | | | |
| | | | | Minimum | | | | |
| | | | | **TRAINING IN DATA PROCESSING** | | | | |
| | | | | Typing Sch | | | | |
| | | | | OJT | | | | |
| | | | | Key punch | | | | |
| | | | | Calc. Machines | | | | |
| | | | | Unit Rcrd Eqpt--Operating concepts | | | | |
| | | | | Wiring boards | | | | |
| | | | | Paper tape eqpt | | | | |
| | | | | Computer Console Oprn | | | | |
| | | | | Intro. to DP concepts | | | | |
| | | | | Intro. to computers--theory and logic | | | | |
| | | | | Programming | | | | |
| | | | | Flow charting | | | | |
| | | | | DP applications | | | | |
| | | | | | | | | |
| | | | | | | | | |

What is the minimum ) desirable) level of educ. for these jobs?
1= H.S.
2= J.C.-Tech.
3= Degree
4= Priv.Bus.Sch.
5= Any post h.s.

In hiring a prospective employee from outside your company, how much previous DP experience do you require for these job categories?

What is the minimum amount of previous experience you will accept?

Which data processing areas do you prefer employees to have studied in school?
At what level?
1 - Secondary
2 - Post h.s.

In which DP areas do you require (provide) on--the-job training for each of the jobs?

Where are the OJT classes provided--taught by whom?

1 - In house, own company personnel
2 - Mfr rep, in house
3 - Mfr school
4 - OJT, no formal classes
5.- Local school--on their own
6 --Local school--reimbursed

In which of the following educational areas should people in these jobs have had courses?

| Key Punch Oper | Unit Rcrd Eqpt Oper | Tape Lbrn | Cmptr Cnsl Oper | OTHER EDUCATION<br>General Background | Prgmr | Supvr Cmptr Oprns | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Communications--Oral | | | | |
| | | | | Written | | | | |
| | | | | Arts | | | | |
| | | | | Sciences | | | | |
| | | | | Social Sciences | | | | |
| | | | | Logic/Philosophy | | | | |
| | | | | Algebra | | | | |
| | | | | Anal. Geometry | | | | |
| | | | | Trigonometry | | | | |
| | | | | Calculus | | | | |
| | | | | Languages | | | | |
| | | | | Psychology | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | **Management Courses** | | | | |
| | | | | Gen. Princ. Mgt. | | | | |
| | | | | Personnel | | | | |
| | | | | Office | | | | |
| | | | | Records | | | | |
| | | | | Qual. Control | | | | |
| | | | | Intro. to Systems | | | | |
| | | | | | | | | |
| | | | | **Finance** | | | | |
| | | | | Principles | | | | |
| | | | | Money and Banking | | | | |
| | | | | | | | | |
| | | | | **Accounting** | | | | |
| | | | | 1 yr. Princ/Theory | | | | |
| | | | | 2 yr. Princ/Theory | | | | |
| | | | | Cost | | | | |
| | | | | Tax | | | | |
| | | | | | | | | |

| Key Punch Oper | Unit Rcrd Eqpt Oper | Tape Lbrn | Cmptr Cnsl Oper | General Business | Prgmr | Supvr Cmptr Oprns | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Intro. to Business | | | | |
| | | | | Statistics | | | | |
| | | | | Quant. Analysis | | | | |
| | | | | Business Law | | | | |
| | | | | Economics | | | | |
| | | | | | | | | |

PERSONAL TRAITS

What personal characteristics and/or traits do you consider most typical of the people in DP jobs in general?

Are any especially typical of any one particular job?

| Key Punch Oper | Unit Rcrd Eqpt Oper | Tape Lbrn | Cmptr Cnsl Oper | NUMBER OF EMPLOYEES | Prgmr | Supvr Cmptr Oprns | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Men | | | | |
| | | | | Women | | | | |
| | | | | SOURCES OF EMPLOYEES | | | | |
| | | | | Schools | | | | |
| | | | | Ads | | | | |
| | | | | Mfrs. Recommendations | | | | |
| | | | | Inquiries | | | | |
| | | | | Friends of employees | | | | |
| | | | | Public Empl Agencies | | | | |
| | | | | Private Emp. Agencies | | | | |
| | | | | Promotions | | | | |

Where do you get most of the personnel for each of these jobs?
Rank the 3 most impt. sources.

SUPERVISION REQUIRED

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

How often is supervision usually necessary on each of these jobs?

1 - None
2 - Several times daily
3 - Once a day
4 - Several times wkly
5 - Weekly
6 - Continuous
7 - As needed

SHIFTS AND OVERTIME

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Shifts | | | | |
| | | | | Amt. of overtime | | | | |

Is there more than one shift for each of these jobs?
How much o/t is usual for each job?

1 - None
2 - 1-3 hrs. wkly
3 - 4-7 hrs. wkly
4 - 8-11 hrs wkly
5 - 12 or more

| Key Punch Oper | Unit Rcrd Eqpt Oper | Tape Lbrn | Cmptr Cnsl Oper | PROMOTION PATTERNS | Prgmr | Supvr Cmptr Oprns | | |
|---|---|---|---|---|---|---|---|---|
| | | | | None | | | | |
| | | | | Key punch operator | | | | |
| | | | | Data typist | | | | |
| | | | | Coding clerk | | | | |
| | | | | Tape librarian | | | | |
| | | | | Unit recd eqpt oper | | | | |
| | | | | Computer console oper | | | | |
| | | | | Supvr. computer oprns | | | | |
| | | | | Tab operator | | | | |
| | | | | Programmer | | | | |
| | | | | Chief programmer | | | | |
| | | | | Systems analyst | | | | |
| | | | | Proj.Dir.-Sr.Sys Anal | | | | |
| | | | | Manager, DP | | | | |
| | | | | Other supervisory | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

To what job may this person be promoted? (Assuming adequate aptitude scores)

| | | | | PROBABILITY OF PROMOTION | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | High | | | | |
| | | | | Average | | | | |
| | | | | Low | | | | |
| | | | | Hardly any or none | | | | |

What is the probability of a person's being promoted from this job?

| | | | | EFFECT OF EDUCATION ON PROMOTABILITY | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | None or little | | | | |
| | | | | Some | | | | |
| | | | | Quite a bit | | | | |
| | | | | Definitely | | | | |

Other things being equal, would the amt of education affect his chances for promotion?

What tests do you use for selection of employees for any of these jobs?

Some people say programming should be taught in the high schools, but others say that instruction in computer programming should be left until after high school. What has been your experience, if any, with prospective employees who have studied computer programming in high school?

Has installation of computers and other DP equipment changed the nature of the typist's job in your office? How?

What changes in data processing do you see in the next 3 - 5 years?

Do you plan to change your data processing system in the next 3 - 5 years? How?

APPENDIX B - 2

Data Processing Employee Questionnaire

## DATA PROCESSING EMPLOYEE QUESTIONNAIRE

This booklet contains some questions about the education, training, and business office experience of people who work in data processing departments throughout the country. What you, as an employee in a data processing department, tell us will help us provide accurate information to schools for developing better training programs for young people entering this rapidly expanding field.

The questions, for the most part, require only a check mark as an answer, and there are only one or two questions on each page. Your answers are confidential and your questionnaire will in no way be identified with you. We have no record of your name.

We sincerely appreciate your help in this important piece of research.

Mildred Hillestad
Research Associate

F. K. Banga
Principal Investigator

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### INSTRUCTIONS

This questionnaire consists of two parts. Instructions for Part I are listed below. Instructions for Part II will be found when you reach that point in the survey.

\- - - - - -

### Part I

For each statement except the first, make a check mark in the appropriate box at the right side of the page. You need nor concern yourself with the numbers appearing next to the boxes--they are for the keypunch operator's use in our office.

University of Colorado
Data Processing Research Project
National Survey

Code

1. My present job title is ____________________ [ ] 9-1

2. I got my first job with this company through the following source:

| | | |
|---|---|---|
| School placement service . . . . . . . . . . . . . . . | [ ] | 1 |
| Someone I know told me about an opening . . . . . . | [ ] | 2 |
| Answered an advertisement . . . . . . . . . . . . . . | [ ] | 3 |
| U.S. or State Employment Service . . . . . . . . . . | [ ] | 4 |
| Private employment agency . . . . . . . . . . . . . . | [ ] | 5 |
| Came or wrote to the company about possible opening | [ ] | 6 |
| Referred by the equipment manufacturer . . . . . . . | [ ] | 7 |
| Cooperative work program in my school . . . . . . . | [ ] | 8 |
| Other ____________________ . . . . . | [ ] | 9 |
| | (10-1) | |

3. I have worked for this company for

| | | |
|---|---|---|
| Less than 6 months . . . . . . . . . . . . . | [ ] | 1 |
| Six months but less than 1 year . . . . . | [ ] | 2 |
| One year but less than 2 years . . . . . . | [ ] | 3 |
| Two years but less than 3 years . . . . . | [ ] | 4 |
| Three years but less than 4 years . . . . | [ ] | 5 |
| Four years but less than 5 years . . . . . | [ ] | 6 |
| Five years but less than 10 years . . . . | [ ] | 7 |
| Ten or more years . . . . . . . . . . . . . | [ ] | 8 |
| | (11-1) | |

4. I earn a monthly salary, before any deductions, of:

| | | |
|---|---|---|
| Under $200 . . . . . | [ ] | 1 |
| $200 - $299 . . . . . . | [ ] | 2 |
| $300 - $399 . . . . . . | [ ] | 3 |
| $400 - $499 . . . . . . | [ ] | 4 |
| $500 - $599 . . . . . . | [ ] | 5 |
| $600 - $699 . . . . . . | [ ] | 6 |
| $700 - $799 . . . . . . | [ ] | 7 |
| $800 - $899 . . . . . . | [ ] | 8 |
| $900 - $999 . . . . . . | [ ] | 9 |
| $1,000 or over . . . . . | [ ] | 0 |
| | (12-1) | |

4. My sex is

Male . . . . . . . [ ] 1
Female . . . . . . [ ] 2
(13-1)

5. My age is

Less than 21 . . . . . . [ ] 1
21 through 25 . . . . . . [ ] 2
26 " 30 . . . . . . [ ] 3
31 " 35 . . . . . . [ ] 4
36 " 40 . . . . . . [ ] 5
41 " 45 . . . . . . [ ] 6
46 " 50 . . . . . . [ ] 7
51 " 55 . . . . . . [ ] 8
56 " 60 . . . . . . [ ] 9
Over 60 . . . . . . . . . [ ] 0
(14-1)

6. Concerning 'brain twister' or puzzle-type activities:

I enjoy them . . . . [ ] 1
They are O.K. . . . . [ ] 2
I hate them . . . . . [ ] 3
(15-1)

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7. Of the following statements, the one which best describes my attitude toward work in data processing is:

I enjoy this work and desire to remain in it . . . . [ ] 1

I enjoy this work but would like a position outside the data processing field . . . . . . . . [ ] 2

I do not enjoy this work but plan to remain in the data processing field . . . . . . . . . . . . [ ] 3

I do not enjoy this work and plan to get a job outside the data processing field . . . . . . [ ] 4
(16-1)



8. The type of business in which my present firm is engaged is:

Financial (banks, savings & loan, real estate, etc.) [ ] 1
Insurance . . . . . . . . . . . . . . . . . . . . . . [ ] 2
Marketing (retail, wholesale, distribution, etc.) . [ ] 3
Service industries (laundry, advertising, etc.) . . [ ] 4
Transportation (trucking, railroads, etc.) . . . . . [ ] 5
Utilities (electric, gas, telephone, etc.) . . . . . [ ] 6
Agriculture (farming, ranching, feed & grain products) [ ] 7
Mining (minerals, petroleum, etc.) . . . . . . . . . [ ] 8
Construction, engineering . . . . . . . . . . . . . [ ] 9
Other . . . . . . . . . . . . . . . . . . . . . . . [ ] 0
(17-1)

9. Considering both present and past jobs, my total work experience in data processing is:

Less than 6 months . . . . . . . . . . . [ ] 1
6 - 12 months . . . . . . . . . . . [ ] 2
13 - 24 months . . . . . . . . . . . . [ ] 3
2 years but less than 3 years . . . . [ ] 4
3 years but less than 4 years . . . . [ ] 5
4 years but less than 5 years . . . . [ ] 6
5 years but less than 7 years . . . . [ ] 7
7 years but less than 10 years . . . . [ ] 8
10 years but less than 15 years . . . [ ] 9
15 years or more . . . . . . . . . . . [ ] 0
(18-1)

10. My present job

does not require me to do programming . . . . . . . [ ] 19-1

requires me to do programming in one or more of the following computer languages:

ALGOL . . . . . . . . [ ] 20
COBOL . . . . . . . . [ ] 21
SPA . . . . . . . . . [ ] 22
PL-1 . . . . . . . . . [ ] 23
SPS . . . . . . . . . [ ] 24
Autocoder . . . . . . [ ] 25
Fortran . . . . . . . [ ] 26
SOAP . . . . . . . . . [ ] 27
Machine language . . . [ ] 28
Other . . . . . . . . [ ] 29

11. My highest level of education is:

| | | |
|---|---|---|
| 8th grade or less | [ ] | 1 |
| Less than 4 years of high school | [ ] | 2 |
| Completed high school | [ ] | 3 |
| Private business school | [ ] | 4 |
| Public vocational-technical school | [ ] | 5 |
| One year of college | [ ] | 6 |
| Completed junior college | [ ] | 7 |
| Two years of college | [ ] | 8 |
| More than two years of college but no degree | [ ] | 9 |
| Hold at least one college degree | [ ] | 0 |
| | (30-1) | |

12. I attained the above educational level in the year [ ] 31,32-1

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NOTE: If you have a college degree, please answer the following question; otherwise go directly to question 14 on the next page.

13. My highest college degree or postgraduate level is:

| | | |
|---|---|---|
| Bachelor's degree | [ ] | 1 |
| Graduate work but no advanced degree | [ ] | 2 |
| Master's degree | [ ] | 3 |
| Work beyond master's but no doctorate | [ ] | 4 |
| Doctorate | [ ] | 5 |
| Post doctoral work | [ ] | 6 |
| | (33-1) | |



14. Concerning my high school education,

I did not attend high school (Go directly to item 21. p. 10) [ ] 01

| | | | | | |
|---|---|---|---|---|---|
| 41 | Alabama | 42 | Kentucky | 66 | N. Dakota |
| 91 | Alaska | 52 | Louisiana | 74 | Ohio |
| 81 | Arizona | 12 | Maine | 53 | Oklahoma |
| 51 | Arkansas | 34 | Maryland | 94 | Oregon |
| 92 | California | 13 | Massachusetts | 23 | Pennsylvania |
| 82 | Colorado | 73 | Michigan | 15 | Rhode Island |
| 11 | Connecticut | 63 | Minnesota | 36 | S. Carolina |
| 31 | Delaware | 43 | Mississippi | 67 | S. Dakota |
| 39 | Dist. C. | 64 | Missouri | 44 | Tennessee |
| 32 | Florida | 84 | Montana | 73 | Texas |
| 33 | Georgia | 65 | Nebraska | 87 | Utah |
| 93 | Hawaii | 85 | Nevada | 16 | Vermont |
| 83 | Idaho | 14 | New Hampshire | 37 | Virginia |
| 71 | Illinois | 21 | New Jersey | 95 | Washington |
| 72 | Indiana | 86 | New Mexico | 38 | W. Virginia |
| 61 | Iowa | 22 | New York | 75 | Wisconsin |
| 62 | Kansas | 35 | N. Carolina | 88 | Wyoming |
| | | | | 02 | Other than one of the states |

(Cols. 34-35)

15. This item concerns business courses that you may have studied in high school. Please read the list of 8 courses shown below and complete the following statements about them:

| | | |
|---|---|---|
| I studied no business courses in high school . . . | [ ] | 1 |

The one course that has been most helpful in my present job is

| | | |
|---|---|---|
| Introduction to business (basic business) . . . | [ ] | 2 |
| Typing . . . | [ ] | 3 |
| Shorthand . . . | [ ] | 4 |
| Calculating machines . . . | [ ] | 5 |
| Business math . . . | [ ] | 6 |
| Office or secretarial practice . . . | [ ] | 7 |
| Data processing . . . | [ ] | 8 |
| Bookkeeping . . . | [ ] | 9 |
| | (36-1) | |

The one course that has been least helpful in my present job is

| | | |
|---|---|---|
| Introduction to business (basic business) . . . | [ ] | 2 |
| Typing . . . | [ ] | 3 |
| Shorthand . . . | [ ] | 4 |
| Calculating machines . . . | [ ] | 5 |
| Business math . . . | [ ] | 6 |
| Office or secretarial practice . . . | [ ] | 7 |
| Data processing . . . | [ ] | 8 |
| Bookkeeping . . . | [ ] | 9 |
| | (37-1) | |

In addition to the courses shown as most and least helpful, I also studied these courses:

| | | Col. |
|---|---|---|
| Introduction to business (basic business) . . . | [ ] | 38 |
| Typing . . . | [ ] | 39 |
| Shorthand . . . | [ ] | 40 |
| Calculating machines . . . | [ ] | 41 |
| Business math . . . | [ ] | 42 |
| Office or secretarial practice . . . | [ ] | 43 |
| Data processing . . . | [ ] | 44 |
| Bookkeeping . . . | [ ] | 45 |

303



16. This item concerns other general courses that you may have studied in high school. Check in the appropriate column the extent to which the course has helped you on your present job.

| | The most helpful course | The second most helpful course | I wish I could have had more work in these | |
|---|---|---|---|---|
| General math . . . | | | | 1 |
| Elementary algebra . . . | | | | 2 |
| Advanced algebra . . . | | | | 3 |
| Geometry . . . | | | | 4 |
| Trigonometry . . . | | | | 5 |
| Analytic geometry . . . | | | | 6 |
| Calculus . . . | | | | 7 |
| English--Writing and/or speech . . . | | | | 8 |
| English--Reading, literature . . . | | | | 9 |
| Economics . . . | | | | 10 |
| Social studies, history, govt. . . . | | | | 11 |
| Science . . . | | | | 12 |
| Industrial arts . . . | | | | 13 |
| Other vocational classes (ag., home ec.) | | | | 14 |
| | (46-47) | (48-49) | (50-59) | |

17. While in high school

| | | |
|---|---|---|
| I participated in a cooperative part-time program (attended class for a half-day and worked under supervision a half-day) . . . | [ ] | 1 |
| I did not participate in a cooperative part-time program . . . | [ ] | 2 |
| | (60-1) | |

## EDUCATION BEYOND HIGH SCHOOL

18. Concerning education beyond high school,

| | | |
|---|---|---|
| I did not attend school beyond high school (Go directly to item 21) | | 1 |
| I attended school byond high school and my MAJOR area of study was | | |
| Social Science (Anthro., Soc., Hist., etc.) | | 2 |
| Math | | 3 |
| Science (Biol., Physics, Chem., etc.) | | 4 |
| Economics | | 5 |
| Business | | 6 |
| English | | 7 |
| Education | | 8 |
| Engineering | | 9 |
| Psychology | | 0 |
| Other | | X |
| | (9-2) | |

19. This item concerns general courses that you may have studied in school after graduating from high school. Check in the appropriate column the extent to which any course has helped you on your present job.

304

| | The most helpful course | The second most helpful course | I wish I could have had more work in these | |
|---|---|---|---|---|
| General math | | | | 01 |
| Algebra | | | | 02 |
| Trigonometry | | | | 03 |
| Analytic geometry | | | | 04 |
| Calculus | | | | 05 |
| English--Writing and/or speech | | | | 06 |
| English--Reading, literature | | | | 07 |
| Economics | | | | 08 |
| Social studies, history, govt. | | | | 09 |
| Science | | | | 10 |
| Education | | | | 11 |
| Psychology | | | | 12 |
| Philosophy, logic | | | | 13 |
| Foreign languages | | | | 14 |
| Art, music | | | | 15 |
| | (10-2) | (11-2) | (12-2) | |



20. This item concerns business courses studied in schools after high school graduation before you started working. Check in the appropriate column the courses you have had, the TWO most helpful courses on your present job, and the TWO least helpful.

| | The courses I took | Col. | TWO most helpful courses | | TWO least helpful courses |
|---|---|---|---|---|---|
| **BUSINESS SKILLS** | | | | | |
| Data processing equipment operation | | 22 | | 01 | |
| Calculating machines | | 23 | | 02 | |
| Typing | | 24 | | 03 | |
| Shorthand | | 25 | | 04 | |
| Office or secretarial procedures | | 26 | | 05 | |
| Business English - letter writing | | 27 | | 06 | |
| Business report writing | | 28 | | 07 | |
| Other | | 29 | | 08 | |
| **ACCOUNTING** | | | | | |
| Principles (up to one year) | | 30 | | 09 | |
| Intermediate (second year, general) | | 31 | | 10 | |
| Cost | | 32 | | 11 | |
| Income Tax | | 33 | | 12 | |
| Advanced | | 34 | | 13 | |
| Other | | 35 | | 14 | |
| **MANAGEMENT** | | | | | |
| Principles of Management | | 36 | | 15 | |
| Office Management | | 37 | | 16 | |
| Personnel Management | | 38 | | 17 | |
| Decision Theory | | 39 | | 18 | |
| Operations Research | | 40 | | 19 | |
| Data Processing Applications | | 41 | | 20 | |
| Other | | 42 | | 21 | |
| **GENERAL BUSINESS COURSES** | | | | | |
| Introduction to Business | | 43 | | 22 | |
| Business Math | | 44 | | 23 | |
| Statistics | | 45 | | 24 | |
| Marketing | | 46 | | 25 | |
| Finance | | 47 | | 26 | |
| Other | | 48 | | 27 | |
| | | | (49-52) | | (53-56) |

## YOUR JOB

21. This item concerns duties you may perform on your job. As you read the list of 47 duties, check off all those that you do. However, for the three duties that take up most of your time, put a 1 in the box for the one you spend most of your time on, 2 for the next most time-consuming, and 3 for the next.

### UNIT RECORDS

| | | Col. |
|---|---|---|
| Punch cards | | 9-3 |
| Verify punched cards | | 10 |
| Operate collator | | 11 |
| Wire collator board | | 12 |
| Operate interpreter | | 13 |
| Wire interpreter board | | 14 |
| Operate reproducer | | 15 |
| Wire reproducer board | | 16 |
| Operate accounting machines | | 17 |
| Wire accounting machine boards | | 18 |
| Sort cards on sorter | | 19 |
| Code data for unit records system | | 20 |

### SYSTEMS AND PROGRAMMING

| | | |
|---|---|---|
| Program preparation | | 21 |
| Make block diagrams | | 22 |
| Analyze flow of data | | 23 |
| Make flow charts | | 24 |
| Analyze systems | | 25 |
| File and register tapes for future use | | 26 |
| Prepare PERT charts | | 27 |
| Determine critical path scheduling | | 28 |
| Prepare forms for optical scanning | | 29 |
| Prepare marked sense cards | | 30 |
| Prepare wiring diagrams | | 31 |

### PERIPHERAL EQUIPMENT

| | | |
|---|---|---|
| Operate paper-tape equipment | | 32 |
| Operate data-converting equipment (card-to-tape) | | 33 |
| Operate teletype | | 34 |
| Operate typewriter | | 35 |
| Use dataphone | | 36 |
| Operate computer | | 37 |



### COMPUTER WORK

| | | |
|---|---|---|
| Operate a computer console | | 38-3 |
| Use random access devices | | 39 |
| Operate high speed printer | | 40 |
| Wire high speed printer | | 41 |
| Test sample routines on the computer | | 42 |
| Debug computer programs | | 43 |
| Monitor computer console | | 44 |
| Coding for programming | | 45 |
| Operate optical scanner | | 46 |

### SUPERVISORY AND MANAGEMENT

| | | |
|---|---|---|
| Schedule computer time | | 47 |
| Confer with other personnel about problem to run on computer | | 48 |
| Confer with other personnel about forms design for key-punch recording | | 49 |
| Supervise key-punch operators | | 50 |
| Supervise auxiliary equipment operators | | 51 |
| Supervise computer personnel | | 52 |
| Schedule work for key-punch unit | | 53 |
| Schedule work for tab unit | | 54 |
| Revise and update data on basic punch card file | | 55 |

### OTHER DUTIES NOT LISTED (Please specify)

| | | |
|---|---|---|
| ______________________ | ____ | 56 |
| ______________________ | ____ | 57 |
| ______________________ | | |
| ______________________ | | |

NOTE: The next and final section of Part I concerns specific training you may have had in data processing both before and after starting to work in the data processing field.

TRAINING IN DATA PROCESSING

22. BEFORE starting work in data processing, I

| | | |
|---|---|---|
| did not have training of any kind in that field . . (Go directly to item 23) | ☐ | 1 |
| did have training in some phase(s) of data processing . . . . . . . . . . . . . . . . . . | ☐ | 2 |
| | (9 - 4) | |



Following is a list of places where training in several areas of data processing may be obtained. On the opposite page is a list of data processing areas in which you may have had training. This time instead of putting a check in the box, please write in the number of the place where you obtained MOST of your training in that particular area. Leave blank any area in which you have not had any training.

1 - High school

2 - High school cooperative -- part-time work

3 - College or other public school following high school

4 - Special data processing school

5 - Private business school

6 - Classes run by equipment manufacturer (IBM, Univac, CD)

7 - Military



These are the areas of data processing in which you may have received training before working in the field. Please refer to the list of training institutions on the opposite page to find the number to insert in the boxes.

| | | |
|---|---|---|
| Key punch simulator . . . . . . . . . . . | ☐ | 10-4 |
| Key punch machine . . . . . . . . . . . . | ☐ | 11 |
| Card sorter . . . . . . . . . . . . . . . | ☐ | 12 |
| Accounting machines (tabulator) . . . . . | ☐ | 13 |
| Collator . . . . . . . . . . . . . . . . | ☐ | 14 |
| Reproducer . . . . . . . . . . . . . . . | ☐ | 15 |
| Interpreter . . . . . . . . . . . . . . . | ☐ | 16 |
| Wiring boards . . . . . . . . . . . . . . | ☐ | 17 |
| Computer console operation . . . . . . . | ☐ | 18 |
| Random access devices . . . . . . . . . . | ☐ | 19 |
| Data converting equipment . . . . . . . . | ☐ | 20 |
| Paper-tape equipment . . . . . . . . . . | ☐ | 21 |
| Introduction to data processing . . . . . | ☐ | 22 |
| Computer logic/theory . . . . . . . . . . | ☐ | 23 |
| Introduction to systems . . . . . . . . . | ☐ | 24 |
| Operations research . . . . . . . . . . . | ☐ | 25 |
| Math for data processing . . . . . . . . | ☐ | 26 |
| Number systems (binary, octal, etc.) . . | ☐ | 27 |
| Programming . . . . . . . . . . . . . . . | ☐ | 28 |
| Other tab equipment operation . . . . . . | ☐ | 29 |
| Other . . . . . . . . . . . . . . . . . . | ☐ | 30 |

23. AFTER starting work in data processing,

I have not received on-the-job training of any kind (Go directly to Part II of the questionnaire) . . . 1

I have received on-the-job training . . . . . . . . 2

Following is a list of ways in which in-service training may have been provided by the companies for which you have worked. On the opposite page is a list of areas in which you studied after starting work. For each of the areas listed on the opposite page in which you have received in-service training, write in the number of the way the company provided this training.

1 - Company provided classes taught by someone in the company

2 - Company sent me to the equipment manufacturer's school

3 - Company provided classes on-the-job taught by a representative from the equipment manufacturer

4 - I took classes on my own at a nearby school outside of working hours

5 - Learned it on-the-job by doing it under supervision

6 - Company sent me to a local school (paid my tuition)

7 - Company gave me time off from work to attend classes at a local school in the city (at my own expense)

8 - Other





These are areas of data processing in which you may have received training AFTER you started working in the data processing field. Please refer to the list of ways the company may have provided the training on the opposite page to find the number to insert in the appropriate boxes.

| | |
|---|---|
| Key punch simulator . . . . . . . . | 30-4 |
| Key punch machine . . . . . . . . | 31 |
| Card sorter . . . . . . . . | 32 |
| Accounting machine (tabulator) . . . . . . . . | 33 |
| Collator . . . . . . . . | 34 |
| Reproducer . . . . . . . . | 35 |
| Interpreter . . . . . . . . | 36 |
| Wiring boards. . . . . . . . | 37 |
| Summary punch . . . . . . . . | 38 |
| Other tab equipment operation . . . . . . . . | 39 |
| Computer console operation . . . . . . . . | 40 |
| Random access devices . . . . . . . . | 41 |
| Data converting equipment . . . . . . . . | 42 |
| Introduction of data processing (a course) . . . | 43 |
| Paper-tape equipment . . . . . . . . | 44 |
| Computer logic/theory . . . . . . . . | 45 |
| Introduction to systems . . . . . . . . | 46 |
| Operations research . . . . . . . . | 47 |
| Math for data processing . . . . . . . . | 48 |
| Number systems (binary, octal, etc.) . . . . . . | 49 |
| Programming (specify) . . . . . . . . | 50 |
| Data processing applications . . . . . . . . | 51 |
| Accounting . . . . . . . . | 52 |
| Management . . . . . . . . | 53 |
| Office management . . . . . . . . | 54 |
| Financial analysis . . . . . . . . | 55 |
| Statistics . . . . . . . . | 56 |
| Economics . . . . . . . . | 57 |
| Production courses . . . . . . . . | 58 |
| Marketing . . . . . . . . | 59 |

DATA PROCESSING EMPLOYEE QUESTIONNAIRE

PART II

The remainder of the questionnaire is to be completed by filling in the appropriate blanks or checking the blocks to complete the statements. Please write your answers in the space provided for each item.

31. My present job is

The first and only position I have held in this company ☐ 1

Not the only position I have held in this company. The other job titles, in order from my first job up to the current one, were: ☐ 2

(10-5)

☐ 11
☐ 12
☐ 13

32. That which I like BEST about my present job is:

☐ 14
☐ 15
☐ 16

33. That which I like LEAST about my present job is:

☐ 17
☐ 18
☐ 19

4. Before coming to this company,

I had not held other data processing jobs . . . . . . ☐ 1

I held the data processing jobs identified below . . ☐ 2

(20)

| Job Title | | Location (State) | | Type of Industry (See code below) | |
|---|---|---|---|---|---|
| | 21 | | 24 | | 27 |
| | 22 | | 25 | | 28 |
| | 23 | | 26 | | 29 |

Industry Code

1 - Agriculture, forestry, and fisheries
2 - Mining
3 - Contract construction
4 - Manufacturing
5 - Transportation, communication
6 - Electric, gas, and sanitary services
7 - Wholesale and retail trade
8 - Finance
9 - Insurance, real estate
0 - Services
X - Government
XY - Nonclassifiable establishments

5. Before starting work in data processing

I had held no other jobs in any capacity . . . . . . . . ☐ 1

I held the jobs listed below, not in data processing . . ☐ 2

(30-1)

| Job Title | | Location (State) | | Type of Industry (Code above) | |
|---|---|---|---|---|---|
| | 31 | | 34 | | 37 |
| | 32 | | 35 | | 38 |
| | 33 | | 36 | | 39 |

6. My two major hobbies, leisure, or pasttime interests are:

☐ 40

☐ 41

7. I feel that the education I received before starting work in the field of data processing:

Prepared me extremely well for this type of work . . . ☐ 1

Gave me adequate preparation for this type of work . . ☐ 2

Failed to prepare me adequately for this type of work ☐ 3

(42-1)

8. What recommendations would you make for schools in preparing young people for doing a job like yours?

☐ 43

☐ 44

☐ 45

APPENDIX B - 3

Data Processing Teacher Questionnaire

## G. TEACHERS

1. In what DP areas are you teaching now?

| | | |
|---|---|---|
| Intro. to DP | [ ] | 10-1 |
| Unit record eqpt. | [ ] | 11-1 |
| Unit record systems | [ ] | 12 |
| Intro. to systems analysis | [ ] | 13 |
| DP systems | [ ] | 14 |
| Intro. to digital computers | [ ] | 15 |
| Computer theory/logic | [ ] | 16 |
| Intro. programming | [ ] | 17 |
| Advanced programming | [ ] | 18 |
| DP applications | [ ] | 19 |
| Field work in DP | [ ] | 20 |
| Data processing math | [ ] | 21 |
| Other | [ ] | 22 |

2. In what areas do you teach other than in DP?

| | | |
|---|---|---|
| None | [ ] | 23-1 |
| Bookkeeping/ Accounting | [ ] | 24 |
| Shorthand | [ ] | 25 |
| Typing | [ ] | 26 |
| Office procedures/management | [ ] | 27 |
| Secretarial/Clerical practice | [ ] | 28 |
| Intro. to Business | [ ] | 29 |
| Management | [ ] | 30 |
| Math (Alg., Geom., etc.) | [ ] | 31 |
| Science | [ ] | 32 |
| Social Science | [ ] | 33 |
| Engineering | [ ] | 34 |
| Other | [ ] | 35 |

3. What group(s) of students do you teach?

| | | |
|---|---|---|
| High school day students | [ ] | 36 |
| Post high school day students | [ ] | 37 |
| Adult evening students | [ ] | 38 |
| Other | [ ] | 39 |

4. Please indicate the highest level of education you have completed by writing the year you completed school in the appropriate blank.

| | | |
|---|---|---|
| Less than four years of high school | [ ] | 1 |
| Completed high school | [ ] | 2 |
| Private business school | [ ] | 3 |
| Public vocational-technical school | [ ] | 4 |
| One year of college | [ ] | 5 |
| Two years of college | [ ] | 6 |
| More than two years of college, but no degree | [ ] | 7 |
| Hold at least one college degree | [ ] | 8 |
| Other ______________ | [ ] | |
| | (40-1) | |

IF YOU HAVE A DEGREE, please check the highest degree you hold:

| | | |
|---|---|---|
| Bachelor's | [ ] | 1 |
| Graduate work, but no advanced degree | [ ] | 2 |
| Master's | [ ] | 3 |
| Work beyond master's, but not a doctorate | [ ] | 4 |
| Doctorate | [ ] | 5 |
| | (41-1) | |

5. IF YOU HAVE A DEGREE, what was your college major? your minor?

| | Major: Under grad. | Major: Grad. | | Minor: Under grad. | Minor: Grad. | |
|---|---|---|---|---|---|---|
| 1 | [ ] | [ ] | Business | [ ] | [ ] | 1 |
| 2 | [ ] | [ ] | Business education | [ ] | [ ] | 2 |
| 3 | [ ] | [ ] | Math | [ ] | [ ] | 3 |
| 4 | [ ] | [ ] | Science | [ ] | [ ] | 4 |
| 5 | [ ] | [ ] | Social sciences | [ ] | [ ] | 5 |
| 6 | [ ] | [ ] | Psychology | [ ] | [ ] | 6 |
| 7 | [ ] | [ ] | Engineering | [ ] | [ ] | 7 |
| 8 | [ ] | [ ] | English | [ ] | [ ] | 8 |
| 9 | [ ] | [ ] | Ind. Arts; Agr., etc. | [ ] | [ ] | 9 |
| 0 | [ ] | [ ] | Education | [ ] | [ ] | 0 |
| X | [ ] | [ ] | Other | [ ] | [ ] | X |
| | (42) | (43) | | (44) | (45) | |

5. How did you get started teaching in DP field?

| | | |
|---|---|---|
| Was asked to by administration | [ ] | 1 |
| Interested in it and asked to do it | [ ] | 2 |
| Thought someone had to do it | [ ] | 3 |
| Had worked in the field and thought I'd like to teach it | [ ] | 4 |
| Had some class work in it and thought I'd like to teach it | [ ] | 5 |
| Other | [ ] | 6 |
| | (46) | |

6. How did you get the DP background to prepare for teaching in this field? Indicate each of the ways in which you received preparation in DP by writing in the year you did this.

| | | |
|---|---|---|
| Attended manufacturers schools | [ ] | 47 |
| College classes | [ ] | 48 |
| Attended DP workshops during summer | [ ] | 49 |
| Had work experience in DP department | [ ] | 50 |
| Attended night classes in a school | [ ] | 51 |
| Used programmed textbooks on my own | [ ] | 52 |
| On-the-job training | [ ] | 53 |
| Military | [ ] | 54 |
| Other | [ ] | 55 |

7. How many months of data processing work experience have you had?

[ ] (56-57)

8. If you have worked in DP, in what two types of business firms have you had most of your DP work experience?

| | | | | | |
|---|---|---|---|---|---|
| Accounting | 1 | [ ] | Insurance | 7 | [ ] |
| Consulting | 2 | [ ] | Manufacturing | 8 | [ ] |
| Education | 3 | [ ] | Public Utility | 9 | [ ] |
| Mining-Petroleum | 4 | [ ] | Financial | 10 | [ ] |
| Government | 5 | [ ] | Military | 11 | [ ] |
| Distributive | 6 | [ ] | Other | 12 | [ ] |

9. Which of the following list of DP activities have you performed in the courses you have had in schools (include mfrs. schools) or in getting actual experience in a business, govt., or military DP installation?

| | | DP Dpt. | School | |
|---|---|---|---|---|
| Operated key punch | 10 | [ ] | [ ] | 32 |
| Operated verifier | 11 | [ ] | [ ] | 33 |
| Operated collator, reproducer, or interpreter | 12 | [ ] | [ ] | 34 |
| Wired boards | 13 | [ ] | [ ] | 35 |
| Planned wiring diagrams | 14 | [ ] | [ ] | 36 |
| Operated sorter | 15 | [ ] | [ ] | 37 |
| Operated acctg. (tab) machines | 16 | [ ] | [ ] | 38 |
| Operated paper-tape equipment | 17 | [ ] | [ ] | 39 |
| Operated data-converting equipment | 18 | [ ] | [ ] | 40 |
| Operated computer console | 19 | [ ] | [ ] | 41 |
| Written programs | 20 | [ ] | [ ] | 42 |
| Make block diagrams | 21 | [ ] | [ ] | 43 |
| Make flow charts | 22 | [ ] | [ ] | 44 |
| Performed systems analysis | 23 | [ ] | [ ] | 45 |
| Prepared PERT charts | 24 | [ ] | [ ] | 46 |
| Determined critical path schedule | 25 | [ ] | [ ] | 47 |
| Designed forms for optical scanning | 26 | [ ] | [ ] | 48 |
| Used random access devices | 27 | [ ] | [ ] | 49 |
| Operated high-speed printer | 28 | [ ] | [ ] | 50 |
| Debug programs | 29 | [ ] | [ ] | 51 |
| Run test programs | 30 | [ ] | [ ] | 52 |
| Other | 31 | [ ] | [ ] | 53 |

10. What data processing courses have you studied? (Check the course titles closest to ones you may have had.)

| | | |
|---|---|---|
| Intro. to DP | | 10-2 |
| Unit record equipment | | 11 |
| Wiring | | 12 |
| Keypunch | | 13 |
| DP applications | | 14 |
| DP systems | | 15 |
| Systems analysis | | 16 |
| Intro. to systems analysis | | 17 |
| Intro. to digital computers | | 18 |
| Intro. to computer programming | | 19 |
| Advanced computer programming | | 20 |
| Computer applications | | 21 |
| Operations research | | 22 |
| Data processing math | | 23 |
| Computer theory/logic | | 24 |
| Other | | 25 |

11. What three areas other than strictly DP courses have you found particularly helpful in your understanding of DP and for teaching DP courses? (Rank them 1 - 3, 1 most helpful)

| | For Tchg. | For Under-standing | |
|---|---|---|---|
| Bookkeeping and accounting | | | 1 |
| Management courses | | | 2 |
| Office management | | | 3 |
| Calculating machines | | | 4 |
| English | | | 5 |
| Math | | | 6 |
| Science | | | 7 |
| Statistics | | | 8 |
| Office procedures | | | 9 |
| Secretarial/Clerical practice | | | 0 |
| Education | | | X |
| Other | | | Y |

12. How do you keep updated in data processing?

| | | |
|---|---|---|
| Read periodicals | | 1 |
| Attend meetings of DP organization | | 2 |
| On mailing list of eqpt. and supplies manufacturers | | 3 |
| Get summer work experience in DP | | 4 |
| Attend summer school | | 5 |
| Attend night school (extension, etc.) | | 6 |
| Attend manufacturers schools | | 7 |
| Attend seminars, etc., sponsored by DP professional organizations | | 8 |
| Other | | 9 |

(32-3)

13. To what DP organizations and/or business education organizations do you belong?

| | | |
|---|---|---|
| NBEA and allied associations | | 1 |
| Data Processing Management Assn. | | 2 |
| Systems and Procedures Assn. | | 3 |
| Administrative Management Society | | 4 |
| Cost Accounting Assn. | | 5 |
| Machine Accountants Assn. | | 6 |
| Other | | 7 |
| | | 8 |

(33-3)

14. What professional journals do you read?

| Data Processing | Education and Business Education |
|---|---|
| | |
| | |
| | |
| | |
| (34 - 37) | (38 - 41) |

15. What satisfactions do you find in teaching in the data processing field?

______ 42
______ 43
______ 44

16. What dissatisfactions do you have with teaching in the data processing field?

______ 45
______ 46
______ 47

17. At what education level do you think business data processing should be <u>introduced</u>?

How?

[ ] 48
[ ] 49

18. At what level should these phases of DP be taught for vocational competency?

Keypunch . . . . . . . . . . [ ] 50
Other unit record eqpt. . [ ] 51
Computers and other eqpt. [ ] 52

19. What, if any, phases of business data processing should business be expected to provide?

[ ] 53
[ ] 54
[ ] 55

APPENDIX B - 4

School Questionnaire

I. ORIGIN AND DEVELOPMENT OF THE PROGRAM

1. When did your school first offer instruction in any phase of data processing for business?

   (10-1)

2. What was the primary reason for starting this work in your school?

| | |
|---|---|
| Industry needed trained personnel | 1 |
| Could place students with this training | 2 |
| Needed it to keep curriculum updated | 3 |
| Industry wanted to upgrade DP employees | 4 |
| Ind. wanted to retrain employees for DP | 5 |
| Teacher(s) interested in DP as a field | 6 |
| Community survey showed a need for it | 7 |
| Students were interested in it | 8 |
| Money was available for equipment | 9 |
| Other reasons | 0 |

(11-1)

3. Who more than anyone else provided the impetus to start the program?

| | |
|---|---|
| Administration | 1 |
| Community (parents) | 2 |
| Business and industry | 3 |
| Business education faculty | 4 |
| Math and/or science faculty | 5 |
| Eng. and/or tech. faculty | 6 |
| Equipment manufacturers | 7 |
| Students | 8 |
| Other | 9 |

(12-1)

National Data Processing Curriculum Study
School of Business
University of Colorado
Boulder, Colorado 80302

4. When the decision was made to include data processing in the curriculum, how was it introduced?

| | |
|---|---|
| Mentioned in other classes--no formal unit | 1 |
| Introduced as a unit in another class | 2 |
| Used a practice set in another class | 3 |
| Organized a series of courses | 4 |
| Organized an introductory class | 5 |
| Other | 6 |

(13-1)

5. What three administrative problems have you found to be most serious in establishing your program? In operating it? (Rank, with 1 the most serious)

| | Est. | Oper. | |
|---|---|---|---|
| Financing the program | 14 | | 23-1 |
| Selection of equipment | 15 | | 24 |
| Selling the program to the public. | 16 | | 25 |
| Selling program to the admin. | 17 | | 26 |
| Fixing resp. of mntng. eqpt. | 18 | | 27 |
| Getting service on equipment | 19 | | 28 |
| Getting teachers | 20 | | 29 |
| Schedg. adm., instr. time on eqpt. | 21 | | 30 |
| Other | 22 | | 31 |

6. What three instructional problems have you found most serious? (Rank, with 1 most serious)

| | |
|---|---|
| Curriculum development | 32-1 |
| Phil. difference among depts. involved | 33 |
| Placement of students on jobs | 34 |
| Scheduling students on the eqpt. | 35 |
| Selecting the students for the program | 36 |
| Eval. student work in class, setting standards, est. grades, etc. | 37 |
| Getting DP grades accepted by colleges | 38 |
| Arranging for field experience | 39 |
| Keeping updated | 40 |
| Asked to do too many outside jobs on eqpt. | 41 |
| Other | 42 |

INTERVIEW GUIDE FOR SCHOOL INTERVIEWS

7. What is the primary objective of your dept in offering DP instruction?

| | |
|---|---|
| Vocational preparation of students | 1 |
| Provide general knowledge about DP | 2 |
| Provide acquaintanceship skill in equipment operation and allied procedures | 3 |
| Provide knowledge of business applications of DP | 4 |
| Provide retraining of employees not now in DP | 5 |
| Upgrade present DP employees | 6 |
| Other | |

(43-1)

8. How has your DP program changed since you started it?

| | |
|---|---|
| Added courses | 44-1 |
| Combined courses (detail below) | 45 |
| Added eqpt (more on next sheet) | 46 |
| Standards have changed | 47 |
| Students selected more carefully | 48 |
| Other | 49 |

9. How do you determine necessary changes?

| | |
|---|---|
| Follow-up studies of students | 50 |
| Talk with businessmen | 51 |
| Read research | 52 |
| Read journals | 53 |
| Talk with other DP teachers | 54 |
| Eqpt. manufacturers suggestions | 55 |
| Administrative directives | 56 |
| Other | 57 |

10. What, if any, differences are there in the program offered to adult evening school students and the regular students?

| | |
|---|---|
| More advanced work offered to adults | 58-1 |
| Work presented at a more rapid pace | 59 |
| Work presented at a slower pace | 60 |
| More courses are available to adults | 61 |
| Fewer courses available to adults | 62 |
| More hands-on training for adults | 63 |
| Work presented in larger blocks of time, less often, for adults | 64 |
| Different approach and emphasis | 65 |
| Same program | 66 |
| Other | 67 |

11. If you have adult evening students, what reasons do they have for taking the programs you offer?

| | |
|---|---|
| Retraining--moving from present job into a DP job | 68-1 |
| Upgrading--moving from one DP job to another | 69 |
| Pre-employment training | 70 |
| Updating for mgrs. and accountants | 71 |
| Other | 72 |

12. Are your adult programs designed for these specific needs?

| | |
|---|---|
| Yes | 1 |
| No | 2 |

(73-1)

## II. STUDENTS

1. Students in which grades are enrolled in your DP courses?

| | | | |
|---|---|---|---|
| **Secondary:** | 10, 11, 12 | [ ] | 1 |
| | 11, 12 . | [ ] | 2 |
| | 12 . . . | [ ] | 3 |
| | 11 . . . | [ ] | 4 |
| | 10 . . . | [ ] | 5 |
| | Other . . | [ ] (10-1) | |
| **Post High School:** | Pre-employment day classes . . | [ ] | 11-1 |
| | Pre-employment night classes . | [ ] | 12 |
| | Adult evening program . . . . . | [ ] | 13 |
| | MDTA . . . . . . . . . . . . . . | [ ] | 14 |

2. How do you select students for the DP courses?

| | | Sec. | PHS | |
|---|---|---|---|---|
| Test scores . . . . . . . | 15 | [ ] | [ ] | 21 |
| GPA - general . . . . . . | 16 | [ ] | [ ] | 22 |
| GPA - specific courses. | 17 | [ ] | [ ] | 23 |
| Certain characteristics | 18 | [ ] | [ ] | 24 |
| No selection is done . | 19 | [ ] | [ ] | 25 |
| Other . . . . . . . . . . | 20 | [ ] | [ ] | 26 |

3. If tests are used, which ones?

| | | | |
|---|---|---|---|
| Math Apt | ______ | [ ] | 27-1 |
| Math Achv | ______ | [ ] | 28 |
| Logic | ______ | [ ] | 29 |
| Schol.Apt | ______ | [ ] | 30 |
| Quant | ______ | [ ] | 31 |
| Ling | ______ | [ ] | 32 |
| Reading | ______ | [ ] | 33 |
| Programmers | ______ | [ ] | 34 |
| Other | ______ | [ ] | 35 |

4. How are the tests used?

| | | |
|---|---|---|
| Established cut-off scores . . . . | [ ] | 36-1 |
| Over-all pattern of test scores . | [ ] | 37 |
| Establishing norms . . . . . . . . | [ ] | 38 |
| Other . . . . . . . . . . . . . . | [ ] | 39 |

5. Courses in what areas are prerequisites for the DP program? Do you require certain grades in them?

| | | | Crs. | Gr. | |
|---|---|---|---|---|---|
| Math | ______ | 39 | [ ] | [ ] | 47-1 |
| Science | ______ | 40 | [ ] | [ ] | 48 |
| Typing | ______ | 41 | [ ] | [ ] | 49 |
| Bkpg./Acctg. | ______ | 42 | [ ] | [ ] | 50 |
| Office Prcdrs | ______ | 43 | [ ] | [ ] | 51 |
| Intro. Bus | ______ | 44 | [ ] | [ ] | 52 |
| English | ______ | 45 | [ ] | [ ] | 53 |
| Other | ______ | 46 | [ ] | [ ] | 54 |

6. Have you noticed any particular personal characteristics in the successful DP students?

| | | |
|---|---|---|
| Persistence in problem solving . . . | [ ] | 55-1 |
| Liking for puzzle-type activities . | [ ] | 56 |
| Creativeness, novel approaches to problem solving . . . . . . . . . | [ ] | 57 |
| Systematic work habits . . . . . . . | [ ] | 58 |
| Attention to details . . . . . . . . | [ ] | 59 |
| "Machine happy" . . . . . . . . . . | [ ] | 60 |
| Other . . . . . . . . . . . . . . . | [ ] | 61 |

## III. STAFFING

1. How many teachers do you have instructing in your DP program?

| | | |
|---|---|---|
| Full-time | [ ] | 10,11 |
| Part-time | [ ] | 12,13 |

### Full-time Teachers

2. Compared with other teachers, how often do DP teachers attend summer sessions, workshops, institutes or special classes to keep updated?

| | | |
|---|---|---|
| About the same . . | [ ] | 1 |
| More often . . . . | [ ] | 2 |
| Not as often . . . | [ ] | 3 |
| | (14-1) | |

3. What kinds of schools are most effective for updating DP teachers?

| | | |
|---|---|---|
| Special summer DP workshops . . . . | [ ] | 1 |
| Regular summer session classes . . | [ ] | 2 |
| Manufacturers schools . . . . . . . | [ ] | 3 |
| Other . . . . . . . . . . . . . . . | [ ] | 4 |
| | (15-1) | |

4. Are your full-time teachers expected to work in DP departments in business during the summer to get actual work experience on the equipment?

| | | |
|---|---|---|
| Yes . . . . . . . . . . . . . . . | [ ] | 1 |
| No . . . . . . . . . . . . . . . | [ ] | 2 |
| No, but recommended . . . . . . | [ ] | 3 |
| No, but they do voluntarily . . | [ ] | 4 |
| No, but they visit offices . . | [ ] | 5 |

### Part-time Teachers

5. Do you use DP personnel from business offices to teach some courses?

| | | | |
|---|---|---|---|
| Day classes: | Yes | [ ] | 1 |
| | No | [ ] | 2 |
| | | (17-1) | |
| Night classes: | Yes | [ ] | 1 |
| | No | [ ] | 2 |
| | | (18-1) | |

6. What courses do these people teach?

| | | |
|---|---|---|
| Key punch . . . . . . . . . . . . . . . . | [ ] | 19-1 |
| Reproducer, collator, interpreter, etc. . | [ ] | 20 |
| Tab (acctg) machines (wiring) . . . . . . | [ ] | 21 |
| Unit record systems . . . . . . . . . . . | [ ] | 22 |
| Computer theory/logic . . . . . . . . . . | [ ] | 23 |
| Systems analysis . . . . . . . . . . . . | [ ] | 24 |
| Programming . . . . . . . . . . . . . . . | [ ] | 25 |
| Programming systems . . . . . . . . . . . | [ ] | 26 |
| Computer console operation . . . . . . . | [ ] | 27 |
| DP applications . . . . . . . . . . . . . | [ ] | 28 |
| DP math . . . . . . . . . . . . . . . . . | [ ] | 29 |
| DP systems . . . . . . . . . . . . . . . | [ ] | 30 |
| Other | [ ] | 31 |
| | [ ] | 32 |
| | [ ] | 33 |

3. What qualifications (preparation) do you look for in selection of your part-time instructors?

| | | | |
|---|---|---|---|
| Experience: | Teaching . . . . . . . . . | [ ] | 34-1 |
| | Business/Govt. DP . . . . | [ ] | 35 |
| Education: | H.S. . . . . . . . . . . . | [ ] | 36 |
| | Bus. or trade school . . | [ ] | 37 |
| | J.C. or some college . . | [ ] | 38 |
| | College degree . . . . . | [ ] | 39 |
| | Graduate degree . . . . . | [ ] | 40 |
| Background Courses: | Business courses . . . . | [ ] | 41 |
| | DP courses . . . . . . . | [ ] | 42 |
| | Math . . . . . . . . . . . | [ ] | 43 |
| | Science . . . . . . . . . | [ ] | 44 |
| | Psychology . . . . . . . | [ ] | 45 |
| | Psychology of learning . | [ ] | 46 |
| | Other education courses . | [ ] | 47 |
| | Other . . . . . . . . . . | [ ] | 48 |

## D. Placement Procedures

1. What placement services does your school offer the DP students?

| | | |
|---|---|---|
| | | 10-11 |
| Department helps place them | [ ] | 11 |
| School has a placement service | [ ] | |
| Work through public employment agencies (USES or State Employment Service) | [ ] | 12 |
| Work through private employment agencies | [ ] | 13 |
| No placement service provided | [ ] | 14 |
| Other | [ ] | 15 |

2. Where do most of your students get jobs? (Check only one choice.)

| | | |
|---|---|---|
| All over the country | [ ] | 1 |
| Locally | [ ] | 2 |
| Nearby large cities | [ ] | 3 |
| Other | [ ] | 4 |
| | (16-11) | |

3. What problems do you have in placing students? (Rank from 1-3 most impt. probs., 1 most serious)

| | | |
|---|---|---|
| No particular problems | [ ] | 17-11 |
| Businesses hire students before they complete their DP course work | [ ] | 18 |
| Business reluctant to hire girls | [ ] | 19 |
| Jobs above tab eqpt. operation seem to require more education than we provide | [ ] | 20 |
| Other | [ ] | 21 |



## E. Financing the Program

1. Where does the money come from to buy, rent, or lease your equipment and supplies? (Indicate the percentage coming from each source. Figures should add to 100% in each column.)

| | | Eqpt. | Suppl. | |
|---|---|---|---|---|
| Fed. Govt. NDEA | 22,23 | [ ] | [ ] | 36,37 |
| Voc. Ed. Act | 24,25 | [ ] | [ ] | 38,39 |
| MDTA | 26,27 | [ ] | [ ] | 40,41 |
| State Funds | 28,29 | [ ] | [ ] | 42,43 |
| Local Funds | 30,31 | [ ] | [ ] | 44,45 |
| Foundation Grant | 32,33 | [ ] | [ ] | 46,47 |
| Other | 34,35 | [ ] | [ ] | 48,49 |

2. If you bouth your computer and other equipment, from whom did you buy it?

| | | Comp. | Other | |
|---|---|---|---|---|
| Government surplus | 50 | [ ] | [ ] | 55 |
| Used eqpt. from manufacturer | 51 | [ ] | [ ] | 56 |
| New eqpt from manufacturer | 52 | [ ] | [ ] | 57 |
| Used eqpt from machines dealer. | 53 | [ ] | [ ] | 58 |
| Other | 54 | [ ] | [ ] | 59 |

3. Where is your equipment located (other than computer)?

| | | |
|---|---|---|
| In each school | [ ] | 1 |
| Centralized in one school | [ ] | 2 |
| Bus./Govt. Office | [ ] | 3 |
| Other | [ ] | 4 |
| | (60-11) | |

4. Where is your computer, and how do students get to use it?

| | | | |
|---|---|---|---|
| Bus./Govt. Office | - Transport students | [ ] | 1 |
| | - Transport data | [ ] | 2 |
| | - Dataphone | [ ] | 3 |
| | - Teletype | [ ] | 4 |
| Sch. Adm. Office | - Transport students | [ ] | 5 |
| | - Transport data | [ ] | 6 |
| | - Dataphone | [ ] | 7 |
| | - Teletype | [ ] | 8 |
| Our own department | | [ ] | 9 |
| | | (61-11) | |

## F. Cooperative Part-time Programs

1. Do you have a cooperative part-time program in office occupations?

   Yes [ ] 1
   No [ ] 2
   (62-11)

2. Is DP one of the areas in which students may work in business for their on-the-job training?

   Yes [ ] 1
   No [ ] 2
   (63-11)

3. Who does the coordinating in the DP area?

   Office occupations coordinator . [ ] 1
   Special DP coordinator . . . . . [ ] 2
   Voc. Ed. coordinator . . . . . . [ ] 3
   Div. occupations coordinator . . [ ] 4
   Other . . . . . . . . . . . . . . [ ] 5
   (64-11)

4. On what bases are DP students selected for participation in the coop. program?

   No selection process used . . [ ] 65-11
   Business course grades . . . . [ ] 66
   Over-all course grades . . . . [ ] 67
   DP course grades . . . . . . . [ ] 68
   Special tests . . . . . . . . [ ] 69
   Other . . . . . . . . . . . . [ ] 70

5. Do the cooperative part-time DP students take the same sequence of DP courses that other students take?

   Yes [ ] 1
   No [ ] 2
   (71-11)

   If not, how does their program differ? [ ] 72-11

6. Do the coop. students complete all their class work in DP before they are placed in their work stations?

   Yes [ ] 1
   No [ ] 2
   (73-11)

7. What level of skill is required before placement in their work stations?

   Acquaintance . . . . . . . . . [ ] 1
   Beginning vocational skill . [ ] 2
   Good operational skill . . . [ ] 3
   Other . . . . . . . . . . . . [ ] 4
   (74-11)

8. Do the students receive h.s. course credit for their on-the-job work?

   Yes [ ] 1
   No [ ] 2
   (75-11)

9. How many semester do students work on a job in business?

   [ ] 76-11

10. Compared with general office occupations placements, how difficult is it to find work stations for DP students?

    As easy to place as general O.O. students . . [ ] 1
    More easily placed . . . . . . . . . . . . . [ ] 2
    Not as easily placed . . . . . . . . . . . . [ ] 3
    (77-11)

    If NOT AS EASILY PLACED, what are reasons given by businesses for not offering work stations for these people?

    [ ] 78-11

## H. Textbooks and Supplies

| Text | Supp. | |
|---|---|---|
| ____ | ____ | Arnold, Hill, and Nichols, INTRODUCTION TO DATA PROCESSING, John Wiley & Sons |
| ____ | ____ | Awad, BUSINESS DATA PROCESSING, Prentice-Hall, Inc. |
| ____ | ____ | Bell, A MANAGEMENT GUIDE TO ELECTRONIC COMPUTERS, McGraw-Hill Book Co. |
| ____ | ____ | Boulding & Spivey, LINEAR PROGRAMMING AND THE THEORY OF THE FIRM, The Macmillan Co. |
| ____ | ____ | Canning, ELECTRONIC DATA PROCESSING FOR BUSINESS AND INDUSTRY, John Wiley & Sons |
| ____ | ____ | Chapin, AN INTRODUCTION TO AUTOMATIC COMPUTERS, D. Van Nostrand |
| ____ | ____ | Davis, AN INTRODUCTION TO ELECTRONIC COMPUTERS, McGraw Hill Book Co. |
| ____ | ____ | Desmonde, COMPUTERS AND THEIR USES, Prentice-Hall, Inc. |
| ____ | ____ | Elliott & Wasley, BUSINESS INFORMATION PROCESSING SYSTEMS, Richard D. Irwin, Inc. |
| ____ | ____ | Gotlieb & Hume, HIGH SCHOOL DATA PROCESSING, McGraw-Hill Book Co. |
| ____ | ____ | Grabbe, Ramo & Wooldridge, CONTROL FUNDAMENTALS. VOLUME 1 of HANDBOOK OF AUTOMATION, John Wiley & Sons |
| ____ | ____ | Gregory & Van Horn, AUTOMATIC DATA PROCESSING SYSTEMS, 2nd EDITION, Wadsworth Publishing Co. |
| ____ | ____ | Gregory & Van Horn, BUSINESS DATA PROCESSING AND PROGRAMMING, Wadsworth Publishing Co. |

| Text | Supp. | |
|---|---|---|
| ____ | ____ | Gregory & Van Horn, PROGRAMMING PACKAGE, Wadsworth Publishing Company |
| ____ | ____ | Haga, UNDERSTANDING AUTOMATION, The Business Press |
| ____ | ____ | Hein, INTRODUCTION TO ELECTRONIC DATA PROCESSING, D. Van Nostrand |
| ____ | ____ | Inman, FUNDAMENTALS OF ELECTRONIC DATA PROCESSING: A PROGRAMMED TEXT, Prentice-Hall, Inc. |
| ____ | ____ | Jeenel, PROGRAMMING FOR DIGITAL COMPUTERS, McGraw-Hill Book Company |
| ____ | ____ | Kahn, BUSINESS DATA PROCESSING: BASIC PRINCIPLES AND APPLICATIONS, McGraw-Hill Book Co. (Gregg) |
| ____ | ____ | Kaufmann, METHODS AND MODELS OF OPERATIONS RESEARCH, Prentice-Hall, Inc. |
| ____ | ____ | Kozmetsky & Kircher, ELECTRONIC COMPUTERS AND MANAGEMENT CONTROL, McGraw-Hill Book Co. |
| ____ | ____ | Laurie, COMPUTERS AND HOW THEY WORK, South-western Publishing Co. |
| ____ | ____ | Lazzaro, SYSTEMS AND PROCEDURES: A HANDBOOK FOR BUSINESS AND INDUSTRY, Prentice-Hall |
| ____ | ____ | Leeds & Weinberg, COMPUTER PROGRAMMING FUNDAMENTALS, McGraw-Hill Book Co. |
| ____ | ____ | Littlefield & Rachel, OFFICE AND ADMINISTRATIVE MANAGEMENT: SYSTEMS ANALYSIS DATA PROCESSING, AND OFFICE SERVICES, 2nd EDITION, Prentice-Hall |

| Text | Supp. | |
|---|---|---|
| ____ | ____ | Maley & Skiko, MODERN DIGITAL COMPUTERS, Prentice-Hall, Inc. |
| ____ | ____ | Martin, ELECTRONIC DATA PROCESSING: AN INTRODUCTION, Richard D. Irwin, Inc. |
| ____ | ____ | McCracken, A GUIDE TO FORTRAN PROGRAMMING, John Wiley and Sons |
| ____ | ____ | McCracken, DIGITAL COMPUTER PROGRAMMING, John Wiley and Sons |
| ____ | ____ | McCracken, Weiss & Lee, PROGRAMMING BUSINESS COMPUTERS, John Wiley & Sons |
| ____ | ____ | McMillan & Gonzalez, SYSTEMS ANALYSIS: A COMPUTER APPROACH TC DECISION MODELS, Richard D. Irwin, Inc. |
| ____ | ____ | Naylor & Byrne, LINEAR PROGRAMMING, Wadsworth Publishing Co. |
| ____ | ____ | Nelson & Woods, ACCOUNTING SYSTEMS AND DATA PROCESSING, South-western Publishing Co. |
| ____ | ____ | Optner, SYSTEMS ANALYSIS FOR BUSINESS MANAGEMENT, Prentice-Hall |
| ____ | ____ | Postley, COMPUTERS AND PEOPLE, McGraw-Hill Book Co. |
| ____ | ____ | Randall, Weimer & Greenfield, SYSTEMS AND PROCEDURES FOR AUTOMATED ACCOUNTING, South-Western Publishing Co. |
| ____ | ____ | Robichaud, UNDERSTANDING MODERN BUSINESS DATA PROCESSING, McGraw-Hill Book Co. (Gregg) |
| ____ | ____ | Salmon, IBM MACHINE OPERATION AND WIRING, 2nd Edition, Wadsworth Publishing Co. |

| Text | Supp. | |
|---|---|---|
| ____ | ____ | Schmidt & Meyers, ELECTRONIC DATA PROCESSING, Holt Rinehart |
| ____ | ____ | Van Ness, PRINCIPLES OF DATA PROCESSING WITH COMPUTERS, The Business Press |
| ____ | ____ | Van Ness, PRINCIPLES OF PUNCHED CARD DATA PROCESSING, The Business Press |
| ____ | ____ | Wanous & Wanous, DATA PROCESSING OFFICE PRACTICE (Set), South-Western Publishing Co. |
| ____ | ____ | Wrubel, A PRIMER OF PROGRAMMING FOR DIGITAL COMPUTERS, McGraw-Hill Book Co. |

## IV. PROGRAM COVERAGE

This is a set of course titles that were collected from DP curriculum guides. What do you call the similar course in your school? Write its title in the space provided under the suggested course title. Put an X in the space if any course is not offered in your school.

1. Write the number of the appropriate course title in the blank before the topic.
2. In the space at the bottom of the list of topics, list any other major topic that you cover in your courses, together with the code for the title of the course in which it is presented.

### SUGGESTED COURSE TITLES

| |
|---|
| 1. Introduction to DP |
| 2. Unit record systems & eqpt. |
| 3. Intro. to systems analysis |
| 4. DP systems |
| 5. Intro. to digital computers (Comp. theory/logic) |
| 6. Intro. computer programming |
| 7. Advanced programming |
| 8. Programming systems |
| 9. DP applications |
| 0. Field work in DP |
| X. Data processing math |

### A. CONCEPTS - Discussion and Presentations About

| Topic | | No. | Topic | | No. |
|---|---|---|---|---|---|
| Functions of key punch . . . . | | 10 | Boolean algebra . . . . . . . . . | | 31 |
| " " sorter . . . . . | | 11 | Logic . . . . . . . . . . . . . . | | 32 |
| " " collator . . . . | | 12 | Fixed and floating points . . . . | | 33 |
| " " reproducer . . . | | 13 | Princ/Theory digital computers . | | 34 |
| " " acctg. machines . | | 14 | Number systems . . . . . . . . . | | 35 |
| Overview of unit-record system | | 15 | Computer logic . . . . . . . . . | | 36 |
| History of data processing . . | | 16 | Programming essentials . . . . . | | 37 |
| Card layout and design . . . . | | 17 | Block diagramming . . . . . . . . | | 38 |
| Forms design . . . . . . . . . | | 18 | Programming systems . . . . . . . | | 39 |
| Procedures development . . . . | | 19 | Central processing unit . . . . . | | 40 |
| Flow charting . . . . . . . . | | 20 | Registers . . . . . . . . . . . . | | 41 |
| Purpose and functions of different languages . . . . | | 21 | Uses of symbolic language . . . . | | 42 |
| Assembly programs and compilers | | 22 | Computer applications . . . . . . | | 43 |
| Macro-generators . . . . . . | | 23 | Princ. of data processing . . . . | | 44 |
| Report generators . . . . . . | | 24 | | | 45 |
| Data scheduling systems . . . | | 25 | | | 46 |
| Monitors and high level lang. | | 26 | | | 47 |
| Anal. of information systems. | | 27 | | | 48 |
| Computer equipment . . . . . | | 28 | | | 49 |
| Coding and condensing data . | | 29 | | | 50 |
| Eval. of auxiliary eqpt. . . | | 30 | | | 51 |

| |
|---|
| 1. Introduction to DP |
| 2. Unit record systems & eqpt. |
| 3. Intro. to systems analysis |
| 4. DP systems<br>= |
| 5. Intro. to digital computers (Comp. theory/logic) |
| 6. Intro. computer programming |
| 7. Advanced programming |
| 8. Programming systems |
| 9. DP applications |
| 0. Field work in DP |
| X. Data processing math |

## B. SKILLS AND KNOWLEDGES APPLIED

| | | |
|---|---|---|
| Operate the key punch . . . . . | | 10 |
| " " sorter . . . . . . | | 11 |
| " " collator . . . . . | | 12 |
| " " reproducer . . . . | | 13 |
| " " acctg. machine . . | | 14 |
| Card layout and design . . . . | | 15 |
| Design forms . . . . . . . . . | | 16 |
| Flow charting . . . . . . . . . | | 17 |
| Work load evaluation . . . . . | | 18 |
| Coding and condensing data . . | | 19 |
| FORTRAN . . . . . . . . . . . . | | 20 |
| COBOL . . . . . . . . . . . . . | | 21 |
| Autocoder . . . . . . . . . . . | | 22 |
| Machine language . . . . . . . | | 23 |
| Block diagramming . . . . . . . | | 24 |
| Mntng. program library . . . . | | 25 |
| Mntng. mag tape library . . . . | | 26 |
| Program instructions . . . . . | | 27 |
| Other languages . . . . . . . . | | 28,9 |

| | | |
|---|---|---|
| Plan and punch program card for key punch | | 30 |
| Wire collator control panel . . | | 31 |
| Wire reproducer panel . . . . . | | 32 |
| Wire acctg. machine panel . . . | | 33 |
| Operate computer console . . . | | 34 |
| Operate card processor . . . . | | 35 |
| Computer applications . . . . . | | 36 |
| Loops and indexing . . . . . . | | 37 |
| Subroutines . . . . . . . . . . | | 38 |
| Input-Output controls . . . . . | | 39 |
| Programming a tape system . . . | | 40 |
| Job timing . . . . . . . . . . | | 41 |
| Program random access device . | | 42 |
| Debug programs . . . . . . . . | | 43 |
| Sort-merge programming . . . . | | 44 |
| ______________ | | 45,6 |
| ______________ | | 47,8 |
| ______________ | | 49,50 |
| ______________ | | 51,2 |

Who runs the students' programs on the computer?

| | | |
|---|---|---|
| Themselves . . . . . . . . . . . . . . | | 1 |
| Person in charge of the computer . . | | 2 |
| Instructor . . . . . . . . . . . . . | | 3 |
| It is sent to a computer center . . . | | 4 |
| It isn't run . . . . . . . . . . . . | | 5 |
| Other ______________ | | |

(53-4)

Who runs programs prepared by the teacher for his own use in teaching a class?

| | | |
|---|---|---|
| Teacher . . . . . . . . . . . . . . . | | 1 |
| Person in charge of the computer . . | | 2 |
| It is sent to a computer center . . | | 3 |
| They aren't run . . . . . . . . . . | | 4 |
| Other ______________ | | |

(54-4)

C. Equipment

| To what degree are operating skills developed? | | | | What eqpt. did you have when the DP instructional program started? What eqpt. has been added since? When? | | | | Skills and Equipment | Cd. No. | How do you provide equipment for students' use? | | | | | | What arrangements do you have for maintenance of eqpt? | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 General Knowledge About 42 | 11 Knowledge re applications 43 | 12 Acquaintanceship (hands on) 44 | 13 Voc'l. Skill 45 | 14-15 Bgng. of Prgm. 46-47-8 No. | 16 Yr. | 17-18 Added 49-51 | 19 52 | | | 20 Gift 53 | 21-25 Purchase (Amt/$) 53-57 | 26-29 Lease (Amt/mo.) 58-61 | 30-33 Rent (Amt/mo.) 62-65 | 34 Use eqpt. in adm. offices 66 | 35 Use eqpt. in bus. downtown 67 | 36-7 On call (Amt/hr) 68-9 | 38-41 Service Contract (Amt/mo.) 70-73 |
| | | | | | | | | Key punch simulator | 3 | | | | | | | | |
| | | | | | | | | Key punch | 3 | | | | | | | | |
| | | | | | | | | Verifier | 4 | | | | | | | | |
| | | | | | | | | Acctg. (tab) machines | 4 | | | | | | | | |
| | | | | | | | | Interpreter | 5 | | | | | | | | |
| | | | | | | | | Collator | 5 | | | | | | | | |
| | | | | | | | | Reproducer | 6 | | | | | | | | |
| | | | | | | | | Sorter | 6 | | | | | | | | |
| | | | | | | | | Computer | 7 | | | | | | | | |
| | | | | | | | | Card processor | 7 | | | | | | | | |
| | | | | | | | | Tape drive | 8 | | | | | | | | |
| | | | | | | | | Data converter | 8 | | | | | | | | |
| | | | | | | | | Random Access Dev. | 9 | | | | | | | | |
| | | | | | | | | Printer | 9 | | | | | | | | |
| | | | | | | | | Programming | 10 | | | | | | | | |

APPENDIX B - 5

Data Processing School Census Survey Questionnaire

UNIVERSITY OF COLORADO NATIONAL SURVEY
INSTRUCTIONAL PROGRAMS IN DATA PROCESSING

ID NO 84038

FOR UNIVERSITY USE ONLY
DO NOT MARK OR WRITE IN THIS AREA

0 1 2 3 4 5 6 7 8 9

USE NO. 2 PENCIL. MAKE YOUR MARKS HEAVY AND BLACK.
ERASE COMPLETELY ANY MARK YOU WISH TO CHANGE.

TYPE OF SCHOOL HS JC VOC

1. INDICATE THE NUMBER OF STUDENTS PRESENTLY ENROLLED IN --
HIGH SCHOOL (GR. 10--12): LESS 299 | 300 599 | 600 999 | 1000 1499 | 1500 UP
JUNIOR COLLEGE / VOCATIONAL: LESS 299 | 300 599 | 600 999 | 1000 4999 | 5000 UP
ADULT EVENING EDUCATION: LESS 299 | 300 599 | 600 999 | 1000 1499 | 1500 UP

2. DOES YOUR SCHOOL PRESENTLY OFFER COURSES IN AUTOMATED DATA PROCESSING? YES NO

3. DO YOU ANTICIPATE THAT YOUR SCHOOL WILL OFFER SUCH COURSES WITHIN THE NEXT THREE YEARS? -- IF YOUR ANSWER TO THIS QUESTION IS "NO", YOU HAVE COMPLETED THIS QUESTIONNAIRE. YES NO

4. WHICH DEPARTMENT(S) HAVE / WILL HAVE RESPONSIBILITY FOR DATA PROCESSING INSTRUCTION AND EQUIPMENT (IF OTHER, INDICATE IN REMARKS)
INSTRUCTIONAL COURSES — BUS MATH SCI ENGR OTHER
EQUIPMENT CONTROL

5. DATA PROCESSING COURSES ARE / WILL BE OFFERED TO --
HIGH SCHOOL STUDENTS, GRADES 10 11 12
POST HIGH SCHOOL STUDENTS
ADULT EVENING CLASSES
DATA PROCESSING COURSES ARE/WILL BE OFFERED AS --
UNIT IN ANOTHER CLASS — SEPARATE SEQUENCE OF CLASSES

6. NUMBER OF STUDENTS ENROLLED IN COURSES COVERING DATA PROCESSING SUBJECTS --
HIGH SCHOOL: 200 100 50 40 20 10 8 4 2 1
POST HIGH SCHOOL: 200 100 80 40 20 10 8 4 2 1
ADULT EVENING CLASSES: 200 100 80 40 20 10 8 4 2 1

7. WHAT AREAS OF STUDY ARE/WILL BE COVERED IN YOUR DATA PROCESSING PROGRAM(S)?

KNOWLEDGES / THEORY
- UNIT RECORD SYSTEM
- INTRODUCTION TO DATA PROCESSING
- DATA PROCESSING APPLICATIONS
- INTRODUCTION TO SYSTEMS
- SYSTEMS ANALYSIS
- MATH (BOOLEAN ALGEBRA, SET THEORY, ETC.)
- NUMBER SYSTEMS (BINARY, OCTAL, ETC.)
- DIGITAL COMPUTER THEORY/LOGIC
- OTHER (NOTE IN REMARKS)

SKILLS — DEGREE OF SKILL: INTRODUCTION/FAMILIARIZATION, VOCATIONAL SKILL, WIRING
- KEY PUNCH/VERIFIER
- SORTER
- REPRODUCER
- INTERPRETER
- COLLATOR
- PAPER TAPE EQUIPMENT
- ACCOUNTING MACHINES (TABULATORS)
- COMPUTER CONSOLE
- COMPUTER PROGRAMS (INDICATE LANGUAGES TAUGHT IN REMARKS)
- OTHER (NOTE IN REMARKS)

8. INDICATE THE NUMBER OF PIECES OF EQUIPMENT YOUR SCHOOL HAS AVAILABLE FOR INSTRUCTIONAL PURPOSES.
- KEY PUNCH: 10 8 4 2 1
- KEY PUNCH SIMULATOR: 10 8 4 2 1
- VERIFIER: 10 8 4 2 1
- SORTER: 10 8 4 2 1
- COLLATOR: 10 8 4 2 1
- INTERPRETER: 10 8 4 2 1
- REPRODUCER: 10 8 4 2 1
- ACCOUNTING MACHINES: 10 8 4 2 1
- PAPER TAPE EQUIPMENT: 10 8 4 2 1
- RANDOM ACCESS DEVICES: 10 8 4 2 1
- COMPUTER: 10 8 4 2 1
- INDICATE MFG. AND MODEL IN REMARKS.

9. INDICATE THE NUMBER OF HIGH SCHOOLS WHICH TEACH DATA PROCESSING AND LIST THEM ON THE BACK OF THIS SHEET.
200 100 80 40 20 10 8 4 2 1

10. INDICATE THE NUMBER OF SCHOOLS WHICH HAVE DATA PROCESSING EQUIPMENT AVAILABLE FOR INSTRUCTIONAL USE.
200 100 80 40 20 10 8 4 2 1

1 2 3 4 5 6 7 8 9 0
1 2 3 4 5 6 7 8 9 0
1 2 3 4 5 6 7 8 9 0
1 2 3 4 5 6 7 8 9 0

REMARKS:

7. KNOWLEDGES: PROGRAM LANGUAGES: 8. COMPUTER MANUFACTURER(S):

SKILLS:

(USE BACK OF SHEET FOR ADDITIONAL REMARKS)

IBM H93878

APPENDIX B - 6

Nonstructured Interview Guide for Management Personnel

Of Manufacturers of Data Processing Equipment (Computers

and Peripheral Equipment)

Nonstructured Interview Guide for Management Personnel

of Manufacturers of Data Processing Equipment (Computers

and Peripheral Equipment)

The nonstructured interview with management personnel of manufacturers of data processing equipment was conducted to cover the following points of information:

I. Developments of data processing equipment and procedures during the next three to ten years.

   a. Hardware
   b. Input/Output
   c. Software

2. Effect of these developments on:

   a. Procedures and systems in business
   b. The following jobs:
      Key punch
      Unit record equipment operators
      Computer console operators
      Programmers
      Systems analysts
   c. Emergence of new jobs in the field
   d. The educational preparations of the people holding the above and other data processing jobs

APPENDIX C

## APPENDIX C - 1

### Data Processing Research Interviewers

Mrs. Caroline J. Beckner
Casey Junior High School
Boulder, Colorado

Mr. John Bell
University of Colorado
Boulder, Colorado

Mr. Anthony S. Dinovelli
Middletown, Connecticut

Mrs. Stuart Dunbar
Brookline High School
Brookline, Massachusetts

Miss Mina M. Johnson
San Francisco State College
San Francisco, California

Mr. Bill Korn
Colorado State University
Fort Collins, Colorado

Miss Doris Leidheisl
Kenosha Technical Institute
Kenosha, Wisconsin

Miss Barbara J. Minnick
University of Tennessee
Knoxville, Tennessee

Mr. Robert R. Mueller
Wichita State University
Wichita, Kansas

Mrs. Joyce D. Mueller
University of Nebraska
Lincoln, Nebraska

Mrs. Juanita J. Waters
Springfield High School
Springfield, Oregon

Mrs. Donna Fae Redinbaugh
University of Nebraska
Lincoln, Nebraska

Miss Virginia C. Williams
St. Cloud State College
St. Cloud, Minnesota

Miss Alice Yetka
Colorado State College
Greeley, Colorado

## APPENDIX C - 2

### Businesses Interviewed

| NAME OF COMPANY | CITY AND STATE | SIC |
|---|---|---|
| **New England Region** | | |
| Aetna Life & Casualty Insurance Co. | Hartford, Conn. | 6300 |
| Connecticut Mutual Life | Hartford, Conn. | 6300 |
| Travelers Insurance Co. | Hartford, Conn. | 6300 |
| Meriden Savings Bank | Meriden, Conn. | 6000 |
| Fabnir Bearing Co. | New Britain, Conn. | 3562 |
| Fenn Manufacturing Co. | New Britain, Conn. | 3591 |
| New Britain Machine Co. | New Britain, Conn. | 3729 |
| Stanley Works | New Britain, Conn. | 2851 |
| Burndy Corp. | Norwalk, Conn. | 3611 |
| DeLeo Brothers, Inc. | Stamford, Conn. | 1794 |
| Colonial Bank & Trust Co. | Waterbury, Conn. | 6000 |
| Society for Savings | West Hartford, Conn. | 6000 |
| Boston Edison Co. | Boston, Mass. | 4911 |
| Boston Gas & Co. | Boston, Mass. | 4922 |
| Carter Rice Storrs | Boston, Mass. | 5096 |
| Christian Science Publishing Co. | Boston, Mass. | 2731 |
| Colonial Provision Co. | Boston, Mass. | 2013 |
| Gilette Safety Razor Co. | Boston, Mass. | 3421 |
| Houghton Mifflin Co. | Boston, Mass. | 2731 |
| Liberty Mutual Fire Insurance | Boston, Mass. | 6300 |
| New England Telephone & Telegraph Co. | Boston, Mass. | 4811 |
| Old Colony Trust Co. | Boston, Mass. | 6000 |
| Savings Bank Life Insurance | Boston, Mass. | 6300 |
| United Shoe Machinery Co. | Boston, Mass. | 3559 |
| The Automobile Legal Association | Brighton, Mass. | 8699 |
| Plymouth County Electric | Cambridge, Mass. | 4911 |
| Carter's Ink Co. | Cambridge, Mass. | 2899 |
| Morse Shoe Inc. | Canton, Mass. | 5039 |
| Norfolk & Dedham Mutual Fire Ins. | Dedham, Mass. | 6300 |
| Champion Lamp Works, Inc. | Lynn, Mass. | 3641 |
| Milton Savings Bank | Milton, Mass. | 6000 |
| William Carter Company | Needham Heights, Mass. | 2321 |
| Lushon Plastics | Newton Highlands, Mass. | 3079 |
| Empire Clothing Company | Salem, Mass. | 5651 |
| B. F. Goodrich Footwear Co. | Watertown, Mass. | 2399 |
| Stanley Home Products, Inc. | Westfield, Mass. | 3981 |
| **Middle Atlantic Region** | | |
| Fedway Associates, Inc. | Jersey City, N.J. | 5095 |
| Lightolier, Inc. | Jersey City, N.J. | 5063 |
| Realtone Electronics Corp. | Jersey City, N.J. | 3651 |
| American Flange & Manufacturing Co. | Linden, N.J. | 3499 |

Appendix C-2 continued

| | | |
|---|---|---|
| Beattie Manufacturing Co. | Little Falls, N.J. | 2271 |
| New Jersey Power & Light | Morristown, N.J. | 4911 |
| Englehard Industry, Inc. | Newark, N.J. | 2819 |
| Federal Pacific Electric Co. | Newark, N.J. | 3622 |
| Howell Electric Motors Co. | Plainfield, N.J. | 3621 |
| Middlesex Water Co. | Woodbridge, N.J. | 4941 |
| | | |
| R. Hoe & Co. | Bronx, N.Y. | 3555 |
| Trunz, Inc. | Brooklyn, N.Y. | 2011 |
| Niagara Machine & Tool Works | Buffalo, N.Y. | 3548 |
| Climax Manufacturing Co. | Castorland, N.Y. | 2651 |
| Mohawk Paper Mills Inc. | Cohoes, N. Y. | 2621 |
| Alcoa Steamship Co. | New York, N.Y. | 4421 |
| Allied Chemical Corp. | New York, N.Y. | 2821 |
| Bowery Savings Bank | New York, N.Y. | 6000 |
| Columbia Gas System, Inc. | New York, N.Y. | 4923 |
| Crompton-Richmond Co. | New York, N.Y. | 6153 |
| Diamond Automation, Inc. | New York, N.Y. | 3551 |
| Dry Dock Savings Bank | New York, N.Y. | 6000 |
| General Cable Co. | New York, N.Y. | 3351 |
| General Cigar Co. | New York, N.Y. | 5094 |
| Givaudan Corp. | New York, N.Y. | 2899 |
| Johns-Manville Sales Corp. | New York, N.Y. | 5098 |
| National Screen Service Corp. | New York, N.Y. | 3861 |
| New York Stock Exchange | New York, N.Y. | 6231 |
| Pan American Airways | New York, N.Y. | 4511 |
| Roamans, Inc. | New York, N.Y. | 5621 |
| Shapiro Paper Co. | New York, N.Y. | 5096 |
| Smith Barney & Co. | New York, N.Y. | 6211 |
| Texas Gulf Sulphur Co. | New York, N.Y. | 1477 |
| Tri Continental Corp. | New York, N.Y. | 6723 |
| Ward Foods, Inc. | New York, N.Y. | 2051 |
| John Wiley Sons, Inc. | New York, N.Y. | 2731 |
| Witco Chemical Co. | New York, N.Y. | 2841 |
| World Journal Tribune, Inc. | New York, N.Y. | 2711 |
| Continental Baking Co. | Rye, N.Y. | 2051 |
| Roosevelt Raceway, Inc. | Westbury, N.Y. | 7948 |
| Fanny Farmer Candy Shops | Rochester, N.Y. | 2071 |
| Marine Midland Trust | Rochester, N.Y. | 6000 |
| Rochester Savings Bank | Rochester, N.Y. | 6000 |
| | | |
| Kawecki Chemical Co. | Boyertown, Pa. | 2819 |
| Paterson Parchment Paper Co. | Bristol, Pa. | 3955 |
| National Forge Co. | Irvine, Pa. | 3312 |
| Educators Mutual Life Insurance | Lancaster, Pa. | 6300 |
| Talon, Inc. | Meadville, Pa. | 3361 |
| Globe Ticket Co. | Philadelphia, Pa. | 2751 |
| Leeds & Northrup Co. | Philadelphia, Pa. | 3611 |

Appendix C-2 continued

| | | |
|---|---|---|
| Pincus, Bernard & Co. | Philadelphia, Pa. | 2013 |
| Publicker Industries, Inc. | Philadelphia, Pa. | 2085 |
| Strawbridge & Clothier | Philadelphia, Pa. | 5311 |
| Wellington Management | Philadelphia, Pa. | 6281 |
| Yarnall-Waring Co. | Philadelphia, Pa. | 3494 |
| American General Life Insurance | Pittsburgh, Pa. | 6300 |
| Equitable Gas Co. | Pittsburgh, Pa. | 2818 |
| Papercraft Corp. | Pittsburgh, Pa. | 2641 |
| Swanee Paper Corp. | Ransom, Pa. | 2621 |
| Miners National Bank | Wilkes-Barre, Pa. | 6000 |

South Atlantic Region

| | | |
|---|---|---|
| Southern Bell Telephone & Telegraph Co. | Coral Gables, Fla. | 4811 |
| Colebrook, Inc. | Hialeah, Fla. | 2253 |
| Computer Service of Florida | Miami, Florida | 7392 |
| First Federal Savings and Loan | Miami, Florida | 6000 |
| Kelly Tractor Co. | Miami, Florida | 5252 |
| American Pioneer Life Insurance | Orlando, Fla. | 6300 |
| Minute Maid Co. | Orlando, Fla. | 2037 |
| Tela-a-Data | Miami, Florida | 7392 |
| Maas Brothers, Inc. | Tampa, Fla. | 5311 |
| Tampa Electric Co. | Tampa, Fla. | 4911 |
| Walter Jim Corp. | Tampa, Fla. | 1511 |
| Times Publishing Co. | St. Petersburg, Fla. | 2711 |
| Shirley of Atlanta, Inc. | Atlanta, Ga. | 2321 |
| Oxford Chemical Corp. | Chamblee, Ga. | 2842 |
| Baltimore Paint Chemical Corp. | Baltimore, Md. | 2851 |
| Churchill, Ltd. | Baltimore, Md. | 5095 |
| Fair Lanes, Inc. | Baltimore, Md. | 7931 |
| Sun Life Insurance Company of America | Baltimore, Md. | 6300 |
| Victor Products, Corp. | Hagerstown, Md. | 3581 |
| Package Products Co. | Charlotte, N.C. | 2752 |
| Central Caroline Bank & Trust | Durham, N.C. | 6000 |
| Broyhill Furniture Industries | Lenoir, N. C. | 2511 |
| Mount Olive Pickle Co. | Mount Olive, N.C. | 2035 |
| Laurel Mills, Inc. | Rutherfordton, N.C. | 2221 |
| Timme Corp. | Wilmington, N.C. | 2211 |
| Keltec Industries, Inc. | Alexandria, Va. | 7391 |
| Lane Co. | Altavista, Va. | 2511 |
| Marion-Harwood Manufacturing Corp. | Marion, Va. | 2322 |
| Sterling Faucet Co. | Morgantown, W. Va. | 3431 |
| Bank of Commerce | Washington, D.C. | 6000 |

Appendix C-2 continued

East South Central Region

| | | |
|---|---|---|
| Birmingham Trust National Bank | Birmingham, Ala. | 6000 |
| Cobbs, Allen & Hall, Inc. | Birmingham, Ala. | 6300 |
| Liberty National Life Insurance Co. | Birmingham, Ala. | 6300 |
| Southern Natural Gas Co. | Birmingham, Ala. | 1381 |
| Walker Drug Co. | Birmingham, Ala. | 5022 |
| | | |
| Belknap Hardware & Manufacturing Co. | Louisville, Ky. | 5072 |
| Thomas Industries | Louisville, Ky. | 3553 |
| | | |
| Spartus, Corp. | Louisville, Miss. | 3871 |
| | | |
| Allen Bros. & O'Hara, Inc. | Memphis, Tenn. | 1511 |
| Cook & Co. | Memphis, Tenn. | 5051 |
| Memphis Light, Gas, & Water Division | Memphis, Tenn. | 4931 |

West South Central Region

| | | |
|---|---|---|
| First Pyramid Life Insurance Co. | Little Rock, Ark. | 6300 |
| | | |
| Louisiana Power & Light | Gretna, La. | 4911 |
| Petroleum Helicopter, Inc. | Lafayette, La. | 4521 |
| F. Strauss & Son, Inc. | Monroe, La. | 5042 |
| American Creosote Works | New Orleans, La. | 2491 |
| Holsum Bakeries Inc. | New Orleans, La. | 2051 |
| Royal Street Corp. | New Orleans, La. | 4832 |
| | | |
| City National Bank & Trust Co. | Oklahoma City, Okla. | 6000 |
| First National Bank of Midwest | Oklahoma City, Okla. | 6000 |
| Western Security Life | Oklahoma City, Okla. | 6152 |
| Jones and Laughlin, Supply Division | Tulsa, Okla. | 3312 |
| Oral Roberts Co. | Tulsa, Okla. | 8661 |
| Sinclair Oil | Tulsa, Okla. | 1311 |
| Skelly Oil | Tulsa, Okla. | 1311 |
| | | |
| Southern Farm Supply Association Inc. | Amarillo, Tex. | 2819 |
| Goodpasture Grain & Mill | Brownfield, Tex. | 5051 |
| Core Labs, Inc. | Dallas, Tex. | 8911 |
| Rauscher Pierce Security Corp. | Dallas, Tex. | 6211 |
| Southwest Wheel & Manufacturing Co. | Dallas, Tex. | 5013 |
| Sun Oil Co. | Dallas, Tex. | 1311 |
| Universal Life & Accident | Dallas, Tex. | 6300 |
| El Paso Natural Gas | El Paso, Tex. | 4922 |
| Hicks-Ponder Co. | El Paso, Tex. | 2321 |
| Newspaper Printing Corp. | El Paso, Tex. | 2751 |
| Popular Department Store | El Paso, Tex. | 5311 |
| Whyburn & Co. | El Paso, Tex. | 6300 |

Appendix C-2 continued

| | | |
|---|---|---|
| First National Bank | Ft. Worth, Tex. | 6000 |
| International Service Life | Ft. Worth, Tex. | 6300 |
| Kimbell Milling Co. | Ft. Worth, Tex. | 4221 |
| Southwestern Petroleum Co. | Ft. Worth, Tex. | 1311 |
| Fish Engineering Corp. | Houston, Tex. | 8911 |
| Houston Chronicle Publishing Co. | Houston, Tex. | 2711 |
| McDonnell Automation Center | Houston, Tex. | 7399 |
| Schlumberger Well Survey | Houston, Tex. | 1382 |
| Tidewater Oil Co. | Houston, Tex. | 1311 |
| Permian Mud Service Inc. | Odessa, Tex. | 4922 |
| H. B. Zachry | San Antonio, Tex. | 1511 |
| National Bank of Commerce | San Antonio, Tex. | 6000 |
| Pearl Brewery | San Antonio, Tex. | 2082 |
| Roegelein Provision Co. | San Antonio, Tex. | 2011 |
| Santa Rosa Medical Center | San Antonio, Tex. | 8011 |
| Texas City National Bank | Texas City, Tex. | 6000 |

West North Central Region

| | | |
|---|---|---|
| Meredith Publishing Co. | Des Moines, Iowa | 2731 |
| Western Mutual Insurance | Des Moines, Iowa | 6300 |
| Maytag | Newton, Iowa | 3633 |
| Boeing Airplane Co. | Wichita, Kan. | 3569 |
| Cessna Air Craft | Wichita, Kan. | 3569 |
| Coleman Co. | Wichita, Kan. | 3567 |
| Garvey, Inc. | Wichita, Kan. | 6711 |
| Rock Island Oil & Refining Co. | Wichita, Kan. | 0139 |
| Commercial National Bank | Kansas City, Kan. | 6000 |
| Minnesota Power & Light | Duluth, Minn. | 4911 |
| Gambles-Scogmore | Minneapolis, Minn. | 5331 |
| Gray Co. | Minneapolis, Minn. | 3585 |
| Investors Diversified Society | Minneapolis, Minn. | 6799 |
| Maico Electronics Inc. | Minneapolis, Minn. | 3842 |
| Ed. Phillips & Sons, Co. | Minneapolis, Minn. | 5095 |
| United Hardware Distributor Co. | Minneapolis, Minn. | 5072 |
| Minnesota Transfer Railway | St. Paul, Minn. | 4013 |
| Paper, Calmenson & Co. | St. Paul, Minn. | 5091 |
| West Publishing Co. | St. Paul, Minn. | 2731 |
| Century Refining Co. | Kansas City, Mo. | 2911 |
| Chemagro Corp. | Kansas City, Mo. | 2873 |
| Old American Insurance Co. | Kansas City, Mo. | 6300 |
| Old Security Life Insurance Co. | Kansas City, Mo. | 6300 |
| Townley Metal & Hardware | Kansas City, Mo. | 5072 |
| Traders National Bank | Kansas City, Mo. | 6000 |
| Asby Corp. | St. Louis, Mo. | 3317 |

Appendix C-2 continued

| | | |
|---|---|---|
| Biltwell Co. | St. Louis, Mo. | 2327 |
| Laclede Steel Co. | St. Louis, Mo. | 3312 |
| Nooter Corp. | St. Louis, Mo. | 3443 |
| Site Oil Company of Missouri | St. Louis, Mo. | 5092 |
| Western Textile Products | St. Louis, Mo. | 2211 |
| J. L. Brandeis & Sons | Omaha, Nebr. | 5311 |
| Hinky Dinky Stores | Omaha, Nebr. | 5411 |
| Commercial Savings & Loan | Omaha, Nebr. | 6000 |
| Glauber Valve Co. | Omaha, Nebr. | 3494 |
| West Central Service Bureau | Omaha, Nebr. | 7392 |

East North Central Region

| | | |
|---|---|---|
| Alter, Harry Co. | Chicago, Ill. | 5077 |
| Cenco Instruments Corp. | Chicago, Ill. | 5086 |
| Follett Corp. | Chicago, Ill. | 2731 |
| McDonnell & Miller, Inc. | Chicago, Ill. | 3494 |
| Mid City National Bank | Chicago, Ill. | 6000 |
| Miehle-Gass-Dexter, Inc. | Chicago, Ill. | 3555 |
| Walter E. Selck & Co. | Chicago, Ill. | 3431 |
| Tempel Steel Co. | Chicago, Ill. | 3461 |
| Verson Allsteel Press Co. | Chicago, Ill. | 3559 |
| William Wrigley, Jr., Co. | Chicago, Ill. | 2073 |
| Alberto-Culver Co. | Melrose Park, Ill. | 2844 |
| Baxter Laboratories | Morton Grove, Ill. | 2834 |
| Peoria & Pekin Union Railway | Peoria, Ill. | 4011 |
| Eclipse Fuel Engineering | Rockford, Ill. | 3433 |
| Zion Industries, Inc. | Zion, Ill. | 2051 |
| Cummins Engine Co. | Columbus, Ind. | 3519 |
| Nibco, Inc. | Elkhart, Ind. | 3494 |
| Balcamp, Inc. | Indianapolis, Ind. | 5013 |
| Central Rubber & Supply | Indianapolis, Ind. | 5089 |
| Economy Finance Corp. | Indianapolis, Ind. | 6145 |
| Midwestern United Life Insurance Co. | Indianapolis, Ind. | 6300 |
| U. S. Corrug-Fibre Box | Indianapolis, Ind. | 2653 |
| Lafayette Life Insurance Co. | Lafayette, Ind. | 6300 |
| Citizens Bank of Michigan | Michigan City, Ind. | 6000 |
| Ford Motor Co. | Dearborn, Mich. | 3711 |
| American Natural Gas Service Co. | Detroit, Mich. | 1311 |
| Bulldog Electric Products | Detroit, Mich. | 3613 |
| Chrysler Corp. | Detroit, Mich. | 3711 |
| Coon-DeVisser Co. | Detroit, Mich. | 5082 |
| J. L. Hudson Co. | Detroit, Mich. | 5311 |
| Parke-Davis & Co. | Detroit, Mich. | 2831 |
| R. L. Polk & Co. | Detroit, Mich. | 7331 |

Appendix C-2 continued

| | | |
|---|---|---|
| Rockwell Standard | Detroit, Mich. | 3714 |
| B. Siegel Co. | Detroit, Mich. | 5621 |
| East Jordon Iron Works | East Jordon, Mich. | 3321 |
| Bissell, Inc. | Grand Rapids, Mich. | 3589 |
| Saginaw Transfer, Co. | Saginaw, Mich. | 4213 |
| Tecumseh Products Co. | Tecumseh, Mich. | 3585 |
| Gar Wood Industries, Inc. | Wayne, Mich. | 3713 |
| | | |
| Alside, Inc. | Akron, Ohio | 3444 |
| RCA Rubber Co. | Akron, Ohio | 3069 |
| Dave Towell, Inc. | Akron, Ohio | 5511 |
| Pecco Products | Bedrod, Ohio | 3722 |
| Seaway Foods | Bedford, Ohio | 5042 |
| Billboard Publishing Co. | Cincinnati, Ohio | 2721 |
| Mack Shirt Corp. | Cincinnati, Ohio | 2321 |
| Addressograph-Multigraph | Cleveland, Ohio | 3579 |
| Anchor Motor Freight, Inc. | Cleveland, Ohio | 4213 |
| Barth Corp. | Cleveland, Ohio | 3548 |
| Glastic Corp. | Cleveland, Ohio | 3079 |
| Grabler Manufacturing Co. | Cleveland, Ohio | 3498 |
| Jay F. Zook, Inc. | Cleveland, Ohio | 6611 |
| Joseph & Feiss Co. | Cleveland, Ohio | 2311 |
| Laub Baking Co. | Cleveland, Ohio | 2051 |
| Lewis Welding & Engineering Corp. | Cleveland, Ohio | 3531 |
| Ohio Crankshaft Co. | Cleveland, Ohio | 3391 |
| Ohio Machine Co. | Cleveland, Ohio | 5082 |
| Warner & Swasey Co. | Cleveland, Ohio | 3541 |
| Zell Co. | Cleveland, Ohio | 5042 |
| Buckeye Steel Castings Co. | Columbus, Ohio | 3323 |
| Columbus Plastic Products, Inc. | Columbus, Ohio | 3079 |
| Nationwide Mutual Insurance Co. | Columbus, Ohio | 6300 |
| North American Equitable Life | Columbus, Ohio | 6300 |
| North Electric Co. | Galion, Ohio | 3661 |
| American Society for Metals | Novelty, Ohio | 2721 |
| Bunting Brass & Bronze Co. | Toledo, Ohio | 3566 |
| Champion Spark Plug Co. | Toledo, Ohio | 3694 |
| DeVilbiss Co. | Toledo, Ohio | 3561 |
| Ohio Citizens Trust Co. | Toledo, Ohio | 6000 |
| Owens-Corning Fiberglass | Toledo, Ohio | 3296 |
| Toledo Scale Corp. | Toledo, Ohio | 3576 |
| Nynes Steel Co. | Youngstown, Ohio | 3441 |
| Standard Slag Co. | Youngstown, Ohio | 3295 |
| | | |
| Albert Trostel & Sons Co. | Milwaukee, Wis. | 3111 |
| First Wisconsin National Bank | Milwaukee, Wis. | 6000 |
| Harley-Davidson Motor Co. | Milwaukee, Wis. | 3751 |
| Lakeside Bridge & Steel Co. | Milwaukee, Wis. | 3443 |
| Northwestern Mutual Life | Milwaukee, Wis. | 6300 |

Appendix C-2 continued

| | | |
|---|---|---|
| Milwaukee Western Bank | Milwaukee, Wis. | 6000 |
| Wisconsin Centrifugal Foundry | Waukesha, Wis. | 3362 |

Mountain Region

| | | |
|---|---|---|
| Apache Railway Co. | Phoenix, Ariz. | 4011 |
| Institute of Financial Planning | Phoenix, Ariz. | 6711 |
| The Valley National Bank | Phoenix, Ariz. | 6000 |
| Western Cotton Products | Phoenix, Ariz. | 4221 |
| Salt River Project | Tempe, Ariz. | 4971 |
| Shamrock Dairy Inc. | Tucson, Ariz. | 5043 |
| Central Bank & Trust Co. | Denver, Colo. | 6000 |
| Frontier Airlines | Denver, Colo. | 4511 |
| Ringsby Truck Lines, Inc. | Denver, Colo. | 4213 |
| Sigman Meat | Denver, Colo. | 2011 |
| Silver Steel Distributor | Denver, Colo. | 5091 |
| Smith-Brooks Printing Co. | Denver, Colo. | 2751 |
| Mountain States Wholesale | Boise, Ida. | 5042 |
| First National Bank of Nevada | Reno, Nev. | 6000 |
| Carlsbad National Bank | Carlsbad, N. Mex. | 6000 |
| Electronic Processing Corp. | Albuquerque, N. Mex. | 7392 |
| Linely Equipment Co. | Albuquerque, N. Mex. | 5999 |
| Shoprite Foods | Albuquerque, N. Mex. | 5411 |
| Kearns Tribune Corp. | Salt Lake City, Utah | 2711 |

Pacific Region

| | | |
|---|---|---|
| Cutter Laboratories Inc. | Berkeley, Cal. | 2831 |
| Giannini Controls Corp. | Duarte, Cal. | 3811 |
| Farmers Merchants Bank | Long Beach, Cal. | 6000 |
| A-1 Kotzin Co. | Los Angeles, Cal. | 2327 |
| Adel Division-General Metals Corp. | Los Angeles, Cal. | 3729 |
| Gallenkamp Stores Co. | Los Angeles, Cal. | 5665 |
| International Industries | Los Angeles, Cal. | 5812 |
| Mandel's of California | Los Angeles, Cal. | 5663 |
| Pierce National Life Insurance Co. | Los Angeles, Cal. | 6300 |
| Rexall Drug & Chemical Co. | Los Angeles, Cal. | 5022 |
| Stratham Instruments Inc. | Los Angeles, Cal. | 3811 |
| Union Bank | Los Angeles, Cal. | 6000 |
| Warner Bros. Pictures Inc. | Los Angeles, Cal. | 7811 |
| Hycon Manufacturing Co. | Monronia, Cal. | 3861 |
| Central Valley National Bank | Oakland, Cal. | 6000 |
| Rhodes Department Store | Oakland, Cal. | 5311 |

Appendix C-2 continued

| | | |
|---|---|---|
| Stolte Inc. | Oakland, Cal. | 1511 |
| World Airways, Inc. | Oakland, Cal. | 4511 |
| Sunkist Growers, Inc. | Ontario, Cal. | 0122 |
| Crystal Cream & Butter Co. | Sacramento, Cal. | 2021 |
| H. S. Crocker Co. | San Bruno, Cal. | 2651 |
| City Transit Systems | San Diego, Cal. | 4151 |
| International Distributor Co. | San Diego, Cal. | 5099 |
| Snowflake Baking Co. | San Diego, Cal. | 2051 |
| U. S. National Bank | San Diego, Cal. | 6000 |
| California Automobile Association | San Francisco, Cal. | 6300 |
| D. N. & E. Walter & Co. | San Francisco, Cal. | 5097 |
| Fibreboard Paper Products | San Francisco, Cal. | 2952 |
| Joseph Magnin Co. | San Francisco, Cal. | 5621 |
| States Steamship Co. | San Francisco, Cal. | 4411 |
| Wells Fargo Bank | San Francisco, Cal. | 6000 |
| Oregon Mutual Insurance | McMinnville, Ore. | 6300 |
| Esco Corp. | Portland, Ore. | 3323 |
| First National Bank of Oregon | Portland, Ore. | 6000 |
| Mail-Well Envelope Co. | Portland, Ore. | 2642 |
| Oregon Bank | Portland, Ore. | 6000 |
| Alaska Steamship Co. | Seattle, Wash. | 4421 |
| Seattle Trust & Savings Bank | Seattle, Wash. | 6000 |
| Montana Phosphate Product | Spokane, Wash. | 1475 |

Appendix C, Table C-3. Distribution of Types of Businesses by Geographic Location and SIC Classification

| Type of Business | Geographic Location | | | | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|---|
| | New England | Middle Atlantic | South Atlantic | East-So. Central | West-So. Central | West-No. Central | East-No. Central | Mountain | Pacific | |
| Agriculture Forestry-Fisheries | | | | | | 1 | | | 1 | 2 |
| Mining-Oil | | 1 | | 1 | 6 | | 1 | | 1 | 10 |
| Contract Construction | 1 | | 1 | 1 | 1 | | | | 1 | 5 |
| Manufacturers | 15 | 33 | 16 | 2 | 9 | 16 | 53 | 3 | 11 | 158 |
| Transportation | | 2 | | | 2 | 1 | 3 | 4 | 4 | 16 |
| Communication | 1 | | 1 | | 1 | | | 1 | | 4 |
| Public Utilities | 3 | 3 | 1 | 1 | 3 | 1 | | | | 12 |
| Wholesalers | 2 | 5 | 1 | 4 | 3 | 5 | 8 | 3 | 4 | 35 |
| Retailers | 1 | 2 | 2 | | 1 | 3 | 3 | 2 | 5 | 19 |
| Banking & Finance | 5 | 9 | 3 | 1 | 7 | 3 | 6 | 4 | 8 | 46 |
| Insurance | 6 | 2 | 2 | 2 | 4 | 3 | 5 | | 3 | 27 |
| Real Estate | | 2 | | | | 2 | 1 | 1 | | 6 |
| Services | 1 | 1 | 3 | | 5 | 1 | | 1 | 1 | 13 |
| Totals | 35 | 60 | 30 | 12 | 42 | 36 | 80 | 19 | 39 | 353 |

## APPENDIX C-4

## HIGH SCHOOLS, VOCATIONAL-TECHNICAL SCHOOLS AND JUNIOR COLLEGES INTERVIEWED*

High Schools

Norwich, Connecticut
Norwich Free Academy

Chicopee, Massachusetts
Chicopee High School

Dracut, Massachusetts
Public Schools

Holliston, Massachusetts
Public Schools

Shrewsbury, Massachusetts
Shrewsbury High School

Raritan, New Jersey
Bridgewater Raritan High School

Ocean Grove, New Jersey
Neptune Township Schools

Princeton, New Jersey
Princeton High School

Springfield, New Jersey
Union County Regional High School

Chester, New Jersey
West Morris Regional High School

Albany, New York
Public Schools

Buffalo, New York
Hutchinson Central Technical High School
East High School

Buffalo, New York (continued)
Bennett High School
South Park High School

Elmsford, New York
Public Schools

Franklin Square, New York
Sewanhaka Schools

Freeport, New York
Freeport High School

Levittown, Long Island, New York
Division Avenue High School

Mamaroneck, New York
Public Schools

Mount Vernon, New York
Mount Vernon High School

New York, New York
Central Community High School, Queens
Martin Van Buren High School, Queens
Maxwell Vocational High School, Brooklyn

Port Washington, New York
Port Washington Public Schools

Rochester, New York
Ben Franklin High School
East High School

Yonkers, New York
High School of Commerce

*Questionnaires from 72 high schools, 32 vocational-technical schools, and 72 junior colleges were usable.

High Schools (continued)

Pittsburgh, Pennsylvania
Allegany Public Schools

Wilkes Barre, Pennsylvania
Meyers High School

Miami, Florida
Miami Central High School

Hagerstown, Maryland
Washington County Schools

Charlotte, North Carolina
Charlotte-Mecklenberg
Public Schools

Fairfax, Virginia
Fairfax County Schools

Louisville, Kentucky
Jefferson County Schools
City Schools

Memphis, Tennessee
City School System

Little Rock, Arkansas
Public Schools

Dallas, Texas
Crozier High School

El Paso, Texas
El Paso Independent School

Fort Worth, Texas
Fort Worth Public Schools

Houston, Texas
Public Schools
Spring Branch High School

Pasadena, Texas
Public Schools

San Antonio, Texas
Northeast Independent School
District

Des Moines, Iowa
Des Moines Public Schools

Wichita, Kansas
Wichita High Schools

Kansas City, Missouri
Public Schools

St. Louis, Missouri
O'Fallon Technical School

Chicago, Illinois
Public Schools

Peoria, Illinois
Public Schools

Rockford, Illinois
Rockford Public Schools

Waukegan, Illinois
Waukegan Township High School

Michigan City, Indiana
Elston Senior High School

Warsaw, Indiana
Warsaw Community High School

Detroit, Michigan
Cass Technical High School

Jackson, Michigan
Public Schools

Pontiac, Michigan
Waterford Public High School

Akron, Ohio
Akron Public Schools

Cincinnati, Ohio
Cincinnati Public Schools

Cleveland, Ohio
Cleveland Public Schools

High Schools (continued)

Columbus, Ohio
Hamilton Local School District

Dayton, Ohio
Patterson Co-op High School

Parma, Ohio
Parma School District

Whitehall, Ohio
Whitehall High School

Phoenix, Arizona
Phoenix Union High School

Tucson, Arizona
Tucson High School

Englewood, Colorado
Englewood High School

Lakewood, Colorado
Jefferson County Public Schools

Reno, Nevada
Reno High School

Albuquerque, New Mexico
Public Schools

Chula Vista, California
Sweetwater Union High School

Sacramento, California
Luther Burbank High School

San Diego, California
San Diego Public Schools

Vocational-Technical Schools

Hartford, Connecticut
Hartford State Technical Institute

Norwalk, Connecticut
Norwalk State Technical Institute

Arlington, Massachusetts
Technical High School

Buffalo, New York
Erie County Technical Institute

Westbury, New York
Nassau County Technical and Trade Training Center

Monroeville, Pennsylvania
Forbes Trail Area Technical School

Philadelphia, Pennsylvania
Dobbins Technical High School
Mastbaum Technical High School

Scranton, Pennsylvania
Scranton Technical School

Miami, Florida
Lindsey-Hopkins Adult Education Center

Tampa, Florida
Brewster Vocational School

Atlanta, Georgia
Hoke Smith Technical School

Clarkston, Georgia
DeKalb Area Technical School

Vocational-Technical Schools (continued)

Marietta, Georgia
Marietta-Cobb County Area Vocational-Technical School

Goldsboro, North Carolina
Wayne Technical Institute

Raleigh, North Carolina
Holding Technical Institute

Bessemer, Alabama
Bessemer State Technical School

Birmingham, Alabama
Wenonah State Technical Trade School

Gretna, Louisiana
Jefferson Parish Vocational Technical School

West Monroe, Louisiana
Quachita Valley Vocational Technical School

Oklahoma City, Oklahoma
Vocational Technical Public Schools

Tulsa, Oklahoma
Area Vocational Technical School

Duluth, Minnesota
Vocational Technical School

Minneapolis, Minnesota
Vocational Education, Minneapolis Public Schools

St. Paul, Minnesota
St. Paul Technical Vocational Institute

Indianapolis, Indiana
Area Vocational Technical Education

South Bend, Indiana
Adult Educational Division of South Bend Community Schools

Columbus, Ohio
Columbus Area Technical School

Perrysburg, Ohio
Pento-County Vocational School and Technical College

Willoughby, Ohio
Chandler Technical School

Waukesha, Wisconsin
Vocational-Technical School

Denver, Colorado
Opportunity School

Seattle, Washington
Edison Technical School

Junior/Community Colleges

Norwalk, Connecticut
Norwalk Community College

New York, New York
Bronx Community College
Brooklyn Community College
Manhattan Community College

Cobleskill, New York
State University of New York Agricultural and Technical College

Farmingdale, Long Island, New York
State University of New York Agricultural and Technical Institute

Junior/Community Colleges (continued)

Rochester, New York
Monroe Community College

Suffolk, New York
Suffolk County Community College

Valhalla, New York
Westchester Community College

Watertown, New York
Jefferson Community College

York, Pennsylvania
York Junior College

Bradenton, Florida
Manatic Junior College

Clearwater, Florida
St. Petersburg Junior College

Ft. Lauderdale, Florida
Broward County Junior College

Miami, Florida
Miami-Date Junior College

Baltimore, Maryland
Baltimore Junior College

Cantonsville, Maryland
Cantonsville Community College

Hagerstown, Maryland
Hagerstown Junior College

Smitland, Maryland
Prince George's Community College

Charlotte, North Carolina
Central Piedmont Community College

Birmingham, Alabama
Jefferson State College

New Orleans, Louisiana
Delgado College

Oklahoma City, Oklahoma
Oklahoma State University Technical Institute

Okmulgee, Oklahoma
Okmulgee Technical Branch of Oklahoma State University

Stillwater, Oklahoma
Oklahoma State Technical

Alvin, Texas
Alvin Junior College

Amarillo, Texas
Amarillo College

Dallas, Texas
El Centro Junior College

Odessa, Texas
Odessa College

Pasadena, Texas
San Jacinto College

San Antonio, Texas
San Antonio College

El Forado, Kansas
Butler County Junior College

Kansas City, Kansas
Kansas City, Kansas Community Junior College

Kansas City, Missouri
Metropolitan Junior College

St. Louis, Missouri
Florissant Community College

Chicago, Illinois
Chicago City College (Loop Campus)

Junior/Community Colleges (continued)

Chicago, Illinois (continued)
  Chicago City College
    (Southeast Campus)
  Chicago City Junior College
    (Wright Campus)

Rockford, Illinois
  Rock Valley Junior College

Dearborn, Michigan
  Henry Ford Community
    Junior College

Grand Rapids, Michigan
  Grand Rapids Junior College

Lansing, Michigan
  Lansing Community College

Livonia, Michigan
  Schoolcraft College

University Center, Michigan
  Delta College

Cleveland, Ohio
  Cuyahoga Community College

Dayton, Ohio
  Sinclair Community College

Toledo, Ohio
  University Community and
    Technical College

Milwaukee, Wisconsin
  Milwaukee Institute of
    Technology

Phoenix, Arizona
  Phoenix College

Alta Loma, California
  Chaffey College

Azusa, California
  Citrus College

Chula Vista, California
  Southwestern College

Compton, California
  Compton College

Costa Mesa, California
  Orange Coast College

El Cajon, California
  Grossmont College

Fullerton, California
  Fullerton Junior College

Glendale, California
  Glendale City College

Hayward, California
  Chabot Junior College

Kentfield, California
  College of Marin

Long Beach, California
  Long Beach City College

Los Altos, California
  Foothill Junior College

Los Angeles, California
  East Los Angeles College
  Los Angeles City College

Norwalk, California
  Cerritos College

Riverside, California
  Riverside City College

San Diego, California
  San Diego Junior College

San Pablo, California
  Contra Costra Junior College

Santa Barbara, California
  Santa Barbara City College

Santa Monica, California
  Santa Monica City College

Junior/Community Colleges (continued)

Van Nuys, California
Los Angeles Valley College

Walnut, California
Mt. San Antonio College

Wilmington, California
Los Angeles Harbor College

Seattle, Washington
Highline Junior College

The following schools returned teacher questionnaires only:

High Schools

Lansing, Michigan
Eastern High School

Columbus, Ohio
Southwestern City Schools

Milwaukee, Wisconsin
Custer High School

Los Angeles, California
Los Angeles Adult Education

San Mateo, California
San Mateo High School

Vocational-Technical Schools

Philadelphia, Pennsylvania
Bok Technical High School

Rock Hill, Missouri
Special School District of St. Louis County

Vocational-Technical Schools (continued)

Cleveland, Ohio
Erie County Technical Institute

Junior/Community Colleges

Concord, California
Diablo Valley College

Los Angeles, California
Los Angeles Trade-Technical College

San Francisco, California
City College of San Francisco

Table C-5. Program Coverage--Titles of Data Processing Courses in Schools

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| INTRODUCTION TO DATA PROCESSING* | | | | |
| Principles of D.P. | | | 3 | 3 |
| Fundamentals of D.P. | 2 | 1 | 2 | 5 |
| D.P. | 6 | | 1 | 7 |
| D.P. Theory | 3 | | | 3 |
| D.P. I | 8 | 1 | 1 | 10 |
| D.P. I & II | 1 | | | 1 |
| D.P. I, II, & IV | 3 | | | 3 |
| Intro. to Business D.P. | | 1 | 4 | 5 |
| Intro. to Automatic D.P. | 2 | | 1 | 3 |
| Intro. to E.D.P. | | | 2 | 2 |
| Intro. to D.P. Systems | | 1 | | 1 |
| Intro. to D.P. I & Lab | | | 1 | 1 |
| Unit Record Equipment I | | 1 | 1 | 2 |
| Unit Record Systems & Equip. | | | 2 | 2 |
| Business D.P. I | 1 | | | 1 |
| Intro. to Computers | | | 1 | 1 |
| Business Machines (Key Punch) | 1 | | | 1 |
| Punched Card Equipment I | | 1 | | 1 |
| IBM Card Punching | | 1 | | 1 |
| Card Punch | 1 | 1 | | 2 |
| Prin. of Unit Record Systems | | 1 | | 1 |
| Prin. of Punched Card Acctg. | | 1 | | 1 |
| Basic Computing | 1 | | | 1 |
| Computer Programming I | 1 | | | 1 |
| Digital Technology Fundamentals | 1 | | | 1 |
| Electronics I | | | 1 | 1 |
| D.P. 11 | | | 1 | 1 |
| D.P. 10 | | | 1 | 1 |
| I A D.P. | 1 | | | 1 |
| D.P. Operations | | 1 | | 1 |
| E.D.P. | 1 | | 2 | 3 |
| Survey of D.P. | | | 1 | 1 |

*Classification used on questionnaire.

Table C-5 (continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Orientation to D.P. | | 1 | | 1 |
| Survey of Auto. D.P. | | | 1 | 1 |
| Prevocational D.P. | 1 | | | 1 |
| Computers & Their Uses | | | 1 | 1 |
| UNIT RECORD SYSTEMS & EQUIPMENT* | | | | |
| Electro-mechanical Machines | | 1 | 5 | 6 |
| Electronic D.P. Machines | | | 2 | 2 |
| Electric Acctg. Machines | 1 | 1 | 2 | 4 |
| Electronic Unit Record Equip. | | | 1 | 1 |
| Electronics II | | | 1 | 1 |
| Unit Record Equipment | 1 | 2 | 6 | 9 |
| Unit Record Machines | 1 | | | 1 |
| Unit Record Wiring | | | 1 | 1 |
| Unit Records I & II | | | 3 | 3 |
| Unit Record Equip. II & III | | 1 | 1 | 2 |
| Unit Record of D.P. | 1 | | | 1 |
| Unit Record Machine Wiring | | | 1 | 1 |
| Unit Record Tabulators | 1 | | | 1 |
| Tab Equipment I & II | | 1 | | 1 |
| Punched Card Equip. II | 2 | | | 2 |
| Punched Card & Basic Wiring II | | 1 | 1 | 2 |
| Basic Machine Wiring & Operations | | | 1 | 1 |
| Functional Wiring Principles | | 2 | 2 | 4 |
| Basic Unit Record Lab | | 1 | | 1 |
| Basic Computer Concepts | | 1 | 1 | 2 |
| Operation & Panel Wiring | | 1 | | 1 |
| Key Punch | 1 | | | 1 |
| Programming & Operating Punch Card Equipment | | | 1 | 1 |
| IBM Punched Card Machines | | 1 | | 1 |
| Principles of IBM Punch Card Acctg. | | | 1 | 1 |
| Intro. to Punched Card Machine Acctg. | | | 2 | 2 |

*Classification used on questionnaire.

Table C-5 (continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Accounting--D.P. Lab | 1 | | | 1 |
| Intro. to Unit Record--Intermediate & Advanced | | | 1 | 1 |
| Computers & Their Use | 1 | | | 1 |
| Data Technology | 1 | | | 1 |
| Principles of D.P. & D.P. Machines | | | 1 | 1 |
| D.P. Machines Operation & Wiring | | | 2 | 2 |
| Systems & Equipment | | 1 | | 1 |
| Business D.P. II | | | 1 | 1 |
| D.P. | | 1 | 2 | 3 |
| D.P. Operations | | 1 | | 1 |
| D.P. Equipment | | | 2 | 2 |
| D.P. Lab | 1 | | | 1 |
| Intro. to D.P. II & Lab | | | 1 | 1 |
| Intro. to D.P. | 2 | | | 2 |
| Pre D.P. | 1 | | | 1 |
| Vocational D.P. I & II | 1 | | | 1 |
| D.P. II | 6 | | | 6 |
| D.P. 11 & 12 | | | 1 | 1 |
| D.P. 66A & 66B | | | 1 | 1 |
| INTRODUCTION TO SYSTEMS ANALYSIS* | | | | |
| Systems Design | | | 1 | 1 |
| Systems Analysis | 1 | 1 | 2 | 4 |
| Systems Analysis & Design | | | 1 | 1 |
| Systems & Procedures | 2 | | 3 | 5 |
| Systems I | 1 | | | 1 |
| Business Systems Design & Development | | 4 | | 4 |
| Business Systems Analysis & Design | | | 1 | 1 |
| Business Systems & Procedures | | 1 | | 1 |
| Business D.P. 2 | | | 1 | 1 |
| Business 26--D.P. Systems | | | 1 | 1 |
| Data Systems Development & Design | | | 6 | 6 |

*Classification used on questionnaire.

Table C-5 (continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Data Systems Development, Design & Fundamentals | 1 | | | 1 |
| D.P. Systems & Application I | | | 1 | 1 |
| D.P. Applications | | | 1 | 1 |
| D.P. III | 1 | 1 | 1 | 3 |
| Unit Record D.P. Applications | | | 1 | 1 |
| Acctg. Machine Operations I | | 1 | | 1 |
| Automated Acctg. Methods & Procedures | | | 1 | 1 |
| Basic Computer Systems | | 1 | | 1 |
| Computer Concepts & Programming | | | 1 | 1 |
| Programming Systems & Techniques | | 1 | | 1 |
| D.P. A | | | 1 | 1 |
| D.P. 12 | | | 1 | 1 |
| DATA PROCESSING SYSTEMS* | | | | |
| Intro. to Programming | | 1 | 2 | 3 |
| Programming Systems | | 1 | | 1 |
| Basic Programming Concepts | | | 1 | 1 |
| Systems & Procedures | | | 3 | 3 |
| Systems Development & Design | | | 3 | 3 |
| Systems Development & Design Application I | 1 | | | 1 |
| Systems II | 1 | | | 1 |
| Systems Analysis & Development | | | 1 | 1 |
| Systems Implementations | | | 1 | 1 |
| Basic Computer Systems | | | 1 | 1 |
| Computer Systems | | 1 | | 1 |
| Computer Systems & Programming | | 1 | | 1 |
| Accounting Systems | | | 1 | 1 |
| Administrative Systems & Procedures | | | 1 | 1 |
| E.D.P. Systems | | | 1 | 1 |
| D.P. Systems & Applications II | | | 1 | 1 |
| General D.P. Systems | | | 1 | 1 |
| Applied Business Systems | | | 1 | 1 |

*Classification used on questionnaire.

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Acctg. Machine Operation II | | | 1 | 1 |
| Management of D.P. Installations | | | 1 | 1 |
| Applications Lab U.R. | | 1 | | 1 |
| COBOL | | | 1 | 1 |
| D.P. | | | 1 | 1 |
| D.P. Fundamentals | | | 1 | 1 |
| D.P. 12 | | | 1 | 1 |
| D.P. 19 | | | 1 | 1 |
| INTRODUCTION TO DIGITAL COMPUTERS (COMPUTER THEORY/LOGIC)* | | | | |
| Basic Computer Concepts | 1 | 1 | 2 | 4 |
| Basic Computing Machines | | | 3 | 3 |
| Basic Computer Technology | | | 1 | 1 |
| Intro. to Computer Programming | 1 | | 1 | 2 |
| Introduction to Programming | | | 1 | 1 |
| Introduction to Computers | | 1 | 1 | 2 |
| Introduction to E.D.P. | | 1 | | 1 |
| Intro. to Electronic Computers | | 1 | | 1 |
| Computer Science | | | 1 | 1 |
| Computer Fundamentals | | 1 | | 1 |
| Digital Computer Theory | | | 1 | 1 |
| Principles of Computer Prog. | | | 1 | 1 |
| Programming I | | 1 | 1 | 2 |
| Computer Programming I | | | 1 | 1 |
| Computer Programming I & II | 1 | | 1 | 2 |
| Computer Programming III | | | 1 | 1 |
| | | | 1 | 1 |
| Adv. Computer Programming | | | 1 | 1 |
| Business Programming | | 1 | | 1 |
| D.P. Machines--UR Prog. | | | 1 | 1 |
| Math 6 Computer & D.P. | | | 1 | 1 |
| Programming (Autocoder) | | 1 | | 1 |
| D.P. 10 | | | 1 | 1 |
| D.P. 13 | | | 1 | 1 |
| D.P. I | 1 | | | 1 |
| D.P. Lab | 1 | | | 1 |
| Vocational D.P. II | | | 1 | 1 |

*Classification used on questionnaire.

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| INTRODUCTION TO COMPUTER PROGRAMMING* | | | | |
| Computer Programming I | 1 | 11 | 14 | 26 |
| Computer Programming III | 1 | | | 1 |
| Computer Programming | 2 | 3 | 4 | 9 |
| Advanced Computer Programming | | | 3 | 3 |
| Computer D.P. Concepts | 2 | | | 2 |
| Prin. of Computer Programming | | | 2 | 2 |
| Programming | | | 5 | 5 |
| Programming I & II | | | 3 | 3 |
| Programming Systems | | | 3 | 3 |
| COBOL Programming | | 1 | 1 | 1 |
| Fortran Programming | 1 | | 3 | 4 |
| Symbolic Programming | | | 1 | 1 |
| Business Programming | | | 1 | 1 |
| Computer Prog. for Business | | | 3 | 3 |
| Prog. Business Computer I | | | 1 | 1 |
| 1401 Programming | | | 1 | 1 |
| Basic 1440 Programming | | | 1 | 1 |
| 1620 Programming | | 1 | | 1 |
| Intro. to Programming Systems | | | 3 | 3 |
| Intro. to Computer Programming | | 1 | | 1 |
| Intro. to Electronic Computers | | | 1 | 1 |
| Electronic Computer Programming | | | 2 | 2 |
| Fundamentals of Computer Prog. | | | 1 | 1 |
| Basic Computer Programming | | | 2 | 2 |
| Computer Operations | | 1 | | 1 |
| Computer Math | 1 | | | 1 |
| Computer Technology | 1 | | | 1 |
| Data Systems I | | 1 | | 1 |
| Vocational D.P. II | | | 1 | 1 |
| D.P. II | | 1 | | 1 |
| D.P. Lab | 1 | | | 1 |
| Business D.P. 23 | | 1 | | 1 |

*Classification used on questionnaire.

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| D.P. 13 | | | 1 | 1 |
| D.P. 17 A | | 1 | | 1 |
| ADVANCED PROGRAMMING* | | | | |
| Computer Programming I | | | 1 | 1 |
| Computer Programming | | | 4 | 4 |
| Computer Programming II | 1 | 1 | 12 | 14 |
| Computer Programming III | | 1 | | 1 |
| Computer Programming I,II,III | | | 1 | 1 |
| Computer Programming II,III | 1 | | 1 | 2 |
| Computer Programming III,IV | 1 | 1 | | 2 |
| Computer Concepts | | | 1 | 1 |
| Computer Compiler Languages | | | 1 | 1 |
| Computer Programming 4B | | | 1 | 1 |
| Computer Programming Scientific & Commercial | | | 1 | 1 |
| Programming Bus. Computer II | | | 1 | 1 |
| Programming Systems | | | 1 | 1 |
| Programming Systems Fortran | | | 1 | 1 |
| Programming (Fortran) | | 1 | | 1 |
| Programming II | | 1 | 2 | 3 |
| Programming III | | | 1 | 1 |
| Scientific Programming | | 1 | 1 | 2 |
| Scientific Programming II | | | 1 | 1 |
| Intermediate Computer Programming | | | 1 | 1 |
| Advanced Programming Systems | | 1 | 1 | 2 |
| Advanced 1440 Programming | | | 2 | 2 |
| Advanced Programming Topics | | | 1 | 1 |
| Advanced Computer Programming | | 1 | 1 | 2 |
| Advanced Computing and Programming Systems | 1 | | | 1 |
| Advanced Prog. System Techniques | | | 1 | 1 |
| Advanced Wiring | | | 1 | 1 |

*Classification used on questionnaire.

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Commercial Programming | | | 1 | 1 |
| Bus. Computer Prog. Applications | | | 1 | 1 |
| Individual D.P. Projects | | | 1 | 1 |
| Systems & Large Projects | | | 1 | 1 |
| Autocoder Computer Programming | 1 | | | 1 |
| COBOL Programs | | | 1 | 1 |
| D.P. Methods | | | 1 | 1 |
| D.P. II | 1 | | | 1 |
| S.P.S. 1401 | | | 1 | 1 |
| D.P. 21,22 | | | 1 | 1 |
| D.P. 17B | | | 1 | 1 |
| D.P. 3 | | 1 | | 1 |
| D.P. Lab | 1 | | | 1 |
| Bus. 83-3 | | | 1 | 1 |
| B.D.P. 25, 27, 51, 52 | | | 1 | 1 |
| B.D.P. 25 (COBOL Prog.) | | | 1 | 1 |
| PROGRAMMING SYSTEMS* | | | | |
| Computer Programming Systems I | | | 1 | 1 |
| Computer Programming II | 1 | 1 | 1 | 3 |
| Computer Programming I, II, III | | | 1 | 1 |
| Computer Programming 1620,1400,360 | | | 1 | 1 |
| Programming Systems I & II | | | 1 | 1 |
| Programming Systems I | 1 | | 1 | 2 |
| Programming Systems II | | 1 | | 1 |
| Programming Systems | | | 1 | 1 |
| Programming III | | | 4 | 4 |
| Programming Linear | | | 1 | 1 |
| Adv. Computer Prog. & Systems | | | 1 | 1 |
| Adv. Computer Programming | | | 4 | 4 |
| Adv. Programming Systems | 1 | | | 1 |
| Adv. Programming Language | | | 1 | 1 |
| Adv. Programming | | | 1 | 1 |
| Adv. Prog. Systems I & II | | | 1 | 1 |

*Classification used on questionnaire.

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Intro. to Scientific Programming | | 1 | | 1 |
| Scientific Programming | | | 1 | 1 |
| Systems & Procedures | | | 1 | 1 |
| Systems Development & Design | | 1 | | 1 |
| Systems Development and Design Applications II | 1 | | | 1 |
| Systems Development & Design I, II | | | 1 | 1 |
| Systems I & II | | 1 | | 1 |
| Information Processing Systems and Their Uses | | | 1 | 1 |
| Business Systems & Procedures | | | 1 | 1 |
| Business D.P. | | | 1 | 1 |
| D.P. Systems | | 1 | | 1 |
| D.P. Lab | 1 | | | 1 |
| D.P. 19B | | | 1 | 1 |
| D.P. 21 & 22 | | | 1 | 1 |
| D.P. 4 | | 1 | | 1 |
| B.D.P. 58 IBM 360 Systems | | | 1 | 1 |
| Executive I.O.C.S. | | 1 | | 1 |
| Introduction to COBOL | | 1 | | 1 |
| DATA PROCESSING APPLICATIONS* | | | | |
| D.P. Applications I | 1 | | | 1 |
| Applications I & II | | 2 | | 2 |
| Computer Applications | | | 2 | 2 |
| Computer Projects | | 1 | 1 | 2 |
| Computer Business Problems | | | 1 | 1 |
| D.P. Applications Lab | | | 1 | 1 |
| Processing Applications | | | 1 | 1 |
| Punched Card Applications | | 1 | | 1 |
| Prog. for Bus. Applications | | | 1 | 1 |
| Bus. Applications for Electronic Computer | | | 1 | 1 |
| Business Computer Programming | | | 1 | 1 |
| Problems in Computer D.P. | | | 1 | 1 |

*Classification used on questionnaire

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| Special Problems in Bus. D.P. | | | 1 | 1 |
| D.P. Problems | | | 1 | 1 |
| Survey of D.P. & Applications | | | 1 | 1 |
| Case Study | | | 1 | 1 |
| Case Study & System Selection | | 1 | | 1 |
| Field Work | | | 1 | 1 |
| Research Project | | 1 | | 1 |
| Internship | | | 1 | 1 |
| Installation Management | | | 1 | 1 |
| Automated Accounting | | | 1 | 1 |
| Programming Monitor Systems | | | 1 | 1 |
| Fortran | | 2 | | 2 |
| Adv. Computer Programming | | | 1 | 1 |
| Adv. Concepts & Systems Analysis | | | 1 | 1 |
| D.P. II | 1 | | | 1 |
| D.P. 17 & 19 | | | 1 | 1 |
| D.P. 22 | | | 1 | 1 |
| D.P. 3 & 4 | | 1 | | 1 |
| FIELD WORK IN DATA PROCESSING* | | | | |
| D.P. Field Project | 1 | 3 | 7 | 11 |
| D.P. Programming Project | | | 1 | 1 |
| Business Research Project | | | 1 | 1 |
| Intro. to Field Project and Adv. Field Project | 1 | | | 1 |
| Computer Project or Field Project | | 1 | | 1 |
| Computer Work Study | | | 1 | 1 |
| On-the-job Training | | 1 | | 1 |
| Work Experience | | | 1 | 1 |
| Cooperative D.P. Internship | | | 1 | 1 |
| Internship | | | 1 | 1 |
| Cooperative Program | 1 | | 3 | 4 |
| D.C.E. | | 1 | | 1 |
| Case Study of System Selection | | 1 | 1 | 2 |
| Admin. Systems & Procedures | | | 1 | 1 |

*Classification used on questionnaire.

Table C-5 (Continued)

| Titles of data processing courses in schools | High School | Voc. Tech. | Junior College | Total |
|---|---|---|---|---|
| D.P. Supervisor | | | 1 | 1 |
| Computer to Decision Making | | | 1 | 1 |
| D.P. 23 | | | 1 | 1 |
| D.P. II | | | 1 | 1 |
| DATA PROCESSING MATHEMATICS* | | | | |
| D.P. Math I, II & III | 1 | 1 | | 2 |
| D.P. Math I & II | | 2 | 1 | 3 |
| Statistics | | 1 | 2 | 3 |
| Computer Math | | | 1 | 1 |
| Mathematics for Computers | | | 2 | 2 |
| Advanced Math | | | 1 | 1 |
| Technical Math | | | 1 | 1 |
| Applied Data Math | | | 1 | 1 |
| Modern Math | | | 1 | 1 |
| Business Math I | | 1 | | 1 |
| Numbering Systems | | 1 | | 1 |
| Intro. to Digital Computers | | | 1 | 1 |
| General Electricity | | 1 | | 1 |
| Math 10 (Algebra for Business with Applications for D.P. Math) | | | 1 | 1 |
| Data Presentation | | | 1 | 1 |
| D.P. Supervision | | | 1 | 1 |
| Math 40 | | | 1 | 1 |
| D.P. 16 | | | 1 | 1 |
| 84 1 & 2 | | | 1 | 1 |
| 85.0 | | | 1 | 1 |
| D.P. II | 1 | | | 1 |

*Classification used on questionnaire.

Appendix C, Table C-6. Skills and Knowledges Applied in High School and Post High School Data Processing Courses

| Skills and Knowledges | Data Processing Courses: Intro. to D.P. HS | Intro. to D.P. PHS | Unit Rec. Sys.-Eqpt. HS | Unit Rec. Sys.-Eqpt. PHS | Intro. to Sys. HS | Intro. to Sys. PHS | D.P. Systems HS | D.P. Systems PHS | Intro.to Dig.Comp. HS | Intro.to Dig.Comp. PHS | Intro.to Comp.Prog. HS | Intro.to Comp.Prog. PHS | Adv. Prog. HS | Adv. Prog. PHS | Prog. Systems HS | Prog. Systems PHS | D.P. Applic. HS | D.P. Applic. PHS | Field Work-D.P. HS | Field Work-D.P. PHS | D.P. Math HS | D.P. Math PHS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oper. key punch | 26 | 25 | 20 | 64 | | 1 | | 2 | 1 | | 5 | 10 | | 3 | | 1 | 17 | 1 | | | | 1 |
| Oper. sorter | 21 | 22 | 20 | 56 | | 1 | | 2 | | | 4 | 7 | | 3 | | 1 | 16 | 2 | | | | 1 |
| Oper. collator | 15 | 17 | 14 | 62 | | 1 | | 2 | | | 3 | 5 | | 2 | | | 14 | 2 | | | | |
| Oper. reproducer | 16 | 16 | 16 | 64 | | 1 | | 2 | | | 3 | 6 | | 3 | | 1 | 15 | 2 | | | | 1 |
| Oper. acctg. machine | 20 | 17 | 20 | 63 | | 3 | | 3 | | 1 | 2 | 6 | | 3 | | 1 | 15 | 4 | | | | 1 |
| Card layout & design | 20 | 27 | 16 | 48 | | 11 | 1 | 8 | 1 | 3 | 6 | 11 | | 3 | | 2 | 17 | 7 | 2 | 1 | | 2 |
| Design forms | 9 | 8 | 14 | 29 | 1 | 21 | | 14 | 1 | 2 | 6 | 11 | | 7 | 1 | 4 | 10 | 8 | 2 | 2 | | 1 |
| Flow charting | 17 | 21 | 10 | 25 | 2 | 14 | | 10 | 4 | 12 | 7 | 36 | | 12 | 1 | 6 | 14 | 9 | 2 | 1 | | 2 |
| Work load evaluation | 4 | 2 | 7 | 15 | 3 | 17 | | 14 | 1 | 3 | 3 | 7 | | 5 | 1 | 4 | 4 | 7 | | 1 | | 2 |
| Coding & condensing | 9 | 20 | 7 | 19 | | 11 | | 10 | 2 | 13 | 8 | 30 | | 11 | 1 | 3 | 11 | 6 | 1 | | | 1 |
| FORTRAN | 2 | | | 1 | | | 1 | | 2 | 4 | 9 | 26 | 3 | 38 | 1 | 12 | 7 | 5 | | | | 1 |
| COBOL | 1 | | 1 | | 1 | | | 1 | | 3 | 5 | 13 | 4 | 36 | 1 | 17 | 5 | 4 | | | | 3 |
| Autocoder | 3 | 3 | 1 | | | 2 | | | 2 | 4 | 3 | 30 | 3 | 25 | 2 | 3 | 5 | 2 | | 3 | | 2 |
| Machine language | 5 | 11 | 3 | | | 3 | | 3 | 4 | 14 | 9 | 62 | | 13 | 1 | 3 | 7 | 3 | | | | |
| Block diagramming | 5 | 17 | 2 | 9 | | 10 | | 10 | 3 | 17 | 8 | 49 | 1 | 12 | 1 | 5 | 7 | 8 | 1 | 1 | | 2 |
| Maintain prog. libr. | | | | | 1 | 1 | | 7 | 1 | 1 | 5 | 15 | | 22 | 2 | 12 | 1 | 3 | | 2 | | 1 |
| Maintain mag. tape libr. | | | | 1 | 1 | 1 | | 4 | 1 | 1 | 2 | 11 | | 14 | 2 | 11 | 1 | 2 | | 3 | | 1 |
| Prog. instructions | 8 | 10 | 2 | 1 | | 1 | | 3 | 4 | 9 | 8 | 52 | | 21 | 1 | 7 | 8 | 1 | | 3 | | 1 |
| Other languages | 1 | | 2 | | | | | 1 | 1 | 1 | 6 | 22 | 3 | 22 | 4 | 13 | 5 | 3 | | 1 | | 1 |
| Plan & punch prog. card | 22 | 28 | 17 | 54 | | 1 | | 2 | 1 | 3 | 5 | 9 | | 2 | 1 | 1 | 16 | 1 | | 1 | | 1 |

Table C-6 (Continued)

| Skills and Knowledges | Data Processing Courses | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D.P. | | Unit Rec. Sys.-Eqpt. | | Intro. to Sys. | | D.P. Systems | | Intro.to Dig.Comp. | | Intro.to Comp.Prog. | | Adv. Prog. | | Prog. Systems | | D.P. Applic. | | Field Work-D.P. | | D.P. Math | |
| | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS |
| Wire collator panel | 10 | 11 | 12 | 60 | | 2 | | 2 | 1 | | 2 | 2 | | | 1 | | 12 | 2 | | | | |
| Wire reproducer panel | 12 | 12 | 14 | 61 | | 2 | | 2 | | | 2 | 2 | | | 1 | | 14 | 3 | | | | |
| Wire acctg. mach. panel | 14 | 13 | 18 | 67 | | 2 | | 2 | 1 | 1 | 1 | 3 | | | 1 | | 13 | 3 | | | | |
| Oper. computer | 5 | 12 | 1 | 2 | | 1 | | 2 | 5 | 17 | 10 | 62 | | 23 | 1 | 7 | 5 | 4 | | 2 | | 1 |
| Oper. card processor | 5 | 6 | 1 | 6 | | 1 | | 1 | 5 | 10 | 7 | 34 | | 16 | 2 | 5 | 4 | 2 | | 2 | | 1 |
| Computer applications | 5 | 4 | 1 | 1 | 2 | 8 | | 10 | 4 | 6 | 9 | 35 | 2 | 14 | 2 | 11 | 6 | 21 | 1 | 4 | | 2 |
| Loops & indexing | 4 | 4 | 2 | | 1 | 2 | | 2 | 4 | 13 | 8 | 56 | 4 | 36 | 1 | 8 | 8 | 7 | | 2 | | |
| Subroutines | 4 | 4 | 1 | | 2 | 1 | | 2 | 4 | 11 | 7 | 52 | 5 | 40 | 2 | 11 | 6 | 7 | | 2 | | 1 |
| Input-output controls | 4 | 4 | 2 | 1 | 1 | 3 | | 4 | 4 | 10 | 8 | 50 | | 33 | 1 | 12 | 6 | 5 | | 2 | | |
| Prog. a tape system | 4 | 1 | | | | 1 | 1 | 2 | 2 | 2 | 3 | 20 | 2 | 31 | 2 | 10 | | 5 | | 2 | | 2 |
| Job timing | 1 | 2 | 3 | 9 | 1 | 8 | | 8 | 1 | 5 | 2 | 17 | 2 | 21 | 2 | 8 | 5 | 5 | | 1 | | 1 |
| Prog. random access dev. | 3 | 1 | | | | | | | 3 | 6 | 4 | 21 | 3 | 45 | 2 | 10 | 1 | 7 | | 4 | | 1 |
| Debug programs | 7 | 7 | 2 | 2 | | 1 | | 2 | 3 | 12 | 9 | 63 | 3 | 38 | 3 | 17 | 8 | 6 | | 3 | | 2 |
| Sort-merge programming | 4 | 1 | 1 | 2 | | 1 | | | 1 | 3 | 2 | 18 | 3 | 38 | 2 | 19 | 7 | 7 | | 1 | | 3 |

Appendix C, Table C-7. Concepts - Discussion and Presentations About

| Concepts | Data Processing Courses | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D.P. | | Unit Rec. Sys.-Eqpt. | | Intro. to Sys. | | D.P. Systems | | Intro.to Dig.Comp. | | Intro.to Comp.Prog. | | Adv. Prog. | | Prog. Systems | | D.P. Applic. | | Field Work-D.P. | | D.P. Math | |
| | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS |
| Functions of key punch | 30 | 57 | 16 | 54 | | | | 1 | 1 | 1 | | 4 | | | | | 14 | | | | | |
| Functions of sorter | 30 | 55 | 16 | 55 | | | | 1 | | | 1 | 1 | | | | | 14 | | | | | |
| Functions of collator | 29 | 52 | 13 | 58 | | | | 1 | 1 | | | 1 | | | | | 15 | | | | | |
| Functions of reproducer | 29 | 50 | 16 | 58 | | | | 1 | | | 1 | 1 | | | | | 14 | | | | | |
| Functions-acctg. machine | 30 | 48 | 17 | 58 | | 2 | | 3 | 1 | | 1 | 1 | | | | | 14 | 1 | | | | |
| Overview-unit rec. sys. | 34 | 59 | 11 | 38 | | 3 | | 1 | 1 | 1 | | 5 | | | | | 12 | 4 | | | | |
| History D.P. | 34 | 76 | 7 | 20 | | | | 2 | 1 | 8 | 3 | 7 | | | | | 13 | | | | | |
| Card layout & design | 29 | 50 | 13 | 41 | 1 | 10 | 1 | 7 | 3 | 4 | 3 | 11 | | | | | 14 | 5 | 2 | 1 | | |
| Forms design | 21 | 26 | 16 | 35 | 2 | 16 | 1 | 13 | | 2 | 5 | 10 | | 2 | 2 | 4 | 14 | 8 | 2 | 1 | | |
| Procedures development | 18 | 22 | 7 | 18 | 2 | 22 | 2 | 17 | 1 | 2 | 3 | 12 | 1 | 3 | 2 | 6 | 10 | 8 | 1 | 1 | | 1 |
| Flow charting | 23 | 40 | 9 | 29 | 4 | 15 | 2 | 9 | 4 | 12 | 7 | 33 | 1 | 5 | 1 | 5 | 12 | 4 | 1 | | | 1 |
| Purp.&func. languages | 14 | 32 | 3 | 4 | 2 | 3 | 1 | 4 | 5 | 16 | 9 | 33 | 1 | 19 | 4 | 9 | 9 | 4 | | | | 1 |
| Assembly prog. & compilers | 8 | 11 | 3 | 2 | 2 | 1 | 1 | 3 | 3 | 11 | 7 | 47 | 2 | 21 | 4 | 9 | 8 | 5 | | | | |
| Macro-generators | 1 | 4 | 1 | 3 | | 2 | | 2 | 3 | 6 | 5 | 26 | 3 | 31 | 4 | 12 | 6 | 6 | | | | |
| Report generators | 1 | 5 | 2 | 2 | | 3 | | 3 | 1 | 8 | 4 | 26 | 2 | 27 | 5 | 14 | 3 | 6 | | 1 | | 1 |
| Data scheduling systems | 5 | 3 | 3 | 3 | 1 | 10 | | 12 | 1 | 2 | 3 | 5 | 3 | 11 | 4 | 11 | 6 | 3 | | 2 | | 3 |
| Monitors& high level lang. | | 2 | 1 | | | 2 | | 1 | 2 | 3 | 4 | 12 | 2 | 39 | 5 | 23 | 5 | 8 | | | | 2 |
| Anal. of info. systems | 5 | 8 | 2 | 2 | 2 | 16 | 1 | 13 | | 1 | 2 | 6 | 2 | 11 | 2 | 12 | 2 | 4 | | 3 | | 1 |
| Computer equipment | 20 | 46 | 3 | 9 | 1 | 4 | 2 | 5 | 5 | 21 | 9 | 30 | 2 | 10 | 1 | 7 | 10 | 3 | | | | 1 |
| Coding & condensing data | 14 | 23 | 7 | 16 | 1 | 11 | 1 | 15 | 5 | 9 | 9 | 32 | 1 | 10 | 1 | 4 | 9 | 7 | 1 | | | |

Table C-7 (Continued)

| Concepts | Data Processing Courses | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Intro. to D.P. | | Unit Rec. Sys.-Eqpt. | | Intro. to Sys. | | D.P. Systems | | Intro.to Dig.Comp. | | Intro.to Comp.Prog. | | Adv. Prog. | | Prog. Systems | | D.P. Applic. | | Field Work-D.P. | | D.P. Math | |
| | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS | HS | PHS |
| Eval. of auxiliary eqpt. | 7 | 18 | 5 | 8 | 2 | 12 | 1 | 16 | 2 | 6 | 4 | 12 | | 4 | 1 | 8 | 6 | 7 | 1 | | | 1 |
| Boolean algebra | 2 | 14 | 2 | | | 1 | 1 | | 2 | 5 | 5 | 9 | 1 | 4 | 1 | 2 | 3 | 1 | | | 5 | 39 |
| Logic | 7 | 17 | 4 | 2 | | 1 | 1 | 1 | 2 | 9 | 5 | 15 | | 7 | 1 | 5 | 8 | 2 | | | 4 | 27 |
| Fixed & floating points | 4 | 9 | 2 | 3 | | 1 | 1 | | 2 | 10 | 4 | 28 | 1 | 18 | 1 | 8 | 9 | 2 | | | 1 | 16 |
| Prin.&theory-dig. comp. | 10 | 36 | 3 | 2 | | 2 | | 3 | 4 | 25 | 6 | 26 | | 4 | 1 | 3 | 8 | 3 | | | | 2 |
| Number systems | 14 | 35 | 4 | 5 | | 2 | | 1 | 2 | 14 | 6 | 17 | | 1 | 1 | 2 | 11 | 1 | | | 3 | 27 |
| Computer logic | 13 | 31 | 3 | 5 | | 4 | | 3 | 4 | 20 | 6 | 36 | | 10 | 1 | 3 | 10 | 2 | | | | 10 |
| Programming essentials | 11 | 22 | 3 | 1 | 1 | 2 | 2 | 5 | 5 | 13 | 10 | 56 | | 19 | 1 | 9 | 8 | 3 | | | | 2 |
| Block diagramming | 15 | 36 | 4 | 11 | 3 | 11 | 1 | 7 | 5 | 14 | 9 | 43 | 1 | 11 | 1 | 8 | 10 | 4 | | | | 1 |
| Programming systems | 8 | 11 | 2 | 2 | | 8 | 1 | 18 | 2 | 9 | 6 | 31 | 2 | 17 | 4 | 20 | 8 | 4 | | 1 | | |
| Central processing unit | 18 | 42 | 3 | 5 | | 1 | | 5 | 5 | 28 | 7 | 29 | 1 | 7 | 1 | 4 | 9 | 2 | | | | 1 |
| Registers | 8 | 25 | 2 | 5 | | 1 | | 3 | 3 | 24 | 7 | 38 | 2 | 12 | 2 | 6 | 7 | 3 | | | | |
| Uses of symbolic lang. | 8 | 22 | 3 | 4 | 2 | 1 | 1 | 3 | 6 | 14 | 8 | 49 | 3 | 14 | 2 | 8 | 8 | 6 | | | | |
| Computer applications | 14 | 26 | 4 | 1 | | 9 | 1 | 14 | 4 | 8 | 7 | 31 | 4 | 19 | 2 | 17 | 9 | 22 | 1 | 6 | | 1 |
| Principles of D.P. | 22 | 70 | 7 | 19 | 1 | 3 | 1 | 3 | 3 | 11 | 5 | 13 | 1 | 5 | 1 | 2 | 11 | 3 | 1 | | 1 | |

Appendix C, Table C-8. Computer Equipment in Total Public Schools

| Equipment | High Schools N = 710 | Post High Schools N = 337 |
|---|---|---|
| Key punch simulator | 1,704 | 546 |
| Key punch | 1,556 | 1,248 |
| Verifier | 289 | 282 |
| Sorter | 545 | 355 |
| Reproducer | 299 | 266 |
| Interpreter | 209 | 222 |
| Collator | 256 | 269 |
| Accounting machine | 480 | 328 |
| Computer | 181 | 265 |

APPENDIX D

TEXTBOOKS USED IN DATA PROCESSING COURSES

| High School | Voc-Tech | Junior College | Text |
|---|---|---|---|
| | X | | Agnew, PRACTICAL BUSINESS ENGLISH FOR COLLEGE, South-Western. |
| | X | | Agnew, OFFICE MACHINES COURSE, South-Western. |
| | | X | Alderson and Shapiro, MARKETING AND THE COMPUTER, Prentice-Hall. |
| X | X | | Anderson, BASIC COMPUTER PROGRAMMING, Appleton-Century Crofts. |
| X | X | X | Arnold and others, INTRODUCTION TO DATA PROCESSING, John Wiley & Sons. |
| X | X | X | Awad, BUSINESS DATA PROCESSING, Prentice-Hall. |
| X | | | Bartee, DIGITAL COMPUTER FUNDAMENTALS, McGraw-Hill. |
| | X | | Beach and Clark, PSYCHOLOGY IN BUSINESS, McGraw-Hill. |
| | X | | Beighey and Borchardt, MATHEMATICS FOR BUSINESS, McGraw-Hill. |
| X | X | | Bell, A MANAGEMENT GUIDE TO ELECTRONIC COMPUTERS, McGraw-Hill. |
| | X | | Bender, HOW TO TALK WELL, McGraw-Hill. |
| | | X | Berkeley and Wainwright, COMPUTERS, THEIR OPERATIONS AND APPLICATIONS, Reinhold. |
| | | X | Borko, COMPUTER APPLICATIONS IN THE BEHAVIORAL SCIENCES, Prentice-Hall. |
| X | | | Boulding and Spivey, LINEAR PROGRAMMING AND THE THEORY OF THE FIRM, Macmillan. |
| | X | | Brandon, MANAGEMENT STANDARDS FOR DATA PROCESSING, D. Van Nostrand. |

| High School | Voc-Tech | Junior College | Text |
|---|---|---|---|
| | | X | Brooks and Iverson, AUTOMATIC DATA PROCESSING, John Wiley & Sons. |
| X | X | | Bux, KEY PUNCH TRAINING COURSE & KIT, South-Western. |
| | X | | Bux, SORTER & TABULATOR TRAINING COURSE & KIT, South-Western. |
| X | X | | Canning, ELECTRONIC DATA PROCESSING FOR BUSINESS AND INDUSTRY, John Wiley & Sons. |
| X | | | Chace, Schniedika, Sherwood, PRINCIPLES OF COST ACCOUNTING, South-Western. |
| X | X | X | Chapin, AN INTRODUCTION TO AUTOMATIC COMPUTERS, D. Van Nostrand. |
| X | | | Corliss, COMPUTERS, Atomic Energy Commission. |
| X | | | Corvine and Abrams, BASIC DATA PROCESSING, Holt, Rinehart & Winston. |
| X | | X | Crowder, THE ARITHMETIC OF COMPUTERS, Doubleday. |
| | X | | Cutler, INTRODUCTION TO COMPUTER PROGRAMMING, Prentice-Hall. |
| X | | | Darnowski, COMPUTERS THEORY AND USES, NEA. |
| | X | X | Data Processing Management Association, AUTOMATIC DATA PROCESSING: PRINCIPLES AND PROCEDURES, Prentice-Hall. |
| X | X | X | Davis, AN INTRODUCTION TO ELECTRONIC COMPUTERS, McGraw-Hill. |
| X | | | Desmonde, COMPUTERS AND THEIR USES, Prentice-Hall. |
| X | | X | Dodes, IBM 1620 PROGRAMMING FOR SCIENCE AND MATH, Hayden. |

| High School | Voc-Tech | Junior College | Text |
|---|---|---|---|
| | X | | Dubois, ESSENTIAL METHODS IN BUSINESS STATISTICS, McGraw-Hill. |
| | X | X | Durestock, WIRING THE 557, 519, 409, William C. Brown. |
| X | X | | Elliott and Wasley, BUSINESS INFORMATION PROCESSING SYSTEMS, Richard D. Irwin. |
| | | X | Fairbanks, SUCCESSFUL OFFICE AUTOMATION, Prentice-Hall. |
| | | X | Finney and Miller, PRINCIPLES OF ACCOUNTING, Prentice-Hall. |
| X | X | X | Fisher and Swindle, COMPUTER PROGRAMMING SYSTEMS, Holt, Rinehart & Winston. |
| | X | | Fletcher and Cashman, INTRODUCTION TO IBM SYSTEMS 1360 PROGRAMMING, Anaheim. |
| | | X | Freeberger and Prager, APPLICATIONS OF DIGITAL COMPUTERS, Ginn & Co. |
| | X | | Fruend and Williams, MODERN BUSINESS STATISTICS, Prentice-Hall. |
| | | X | Gentle, DATA COMMUNICATIONS IN BUSINESS, Publishers Service Co. |
| X | | X | Germain, PROGRAMMING THE IBM 1620, Prentice-Hall. |
| | X | | Gibbs and Webster, GUIDE AND HANDBOOK FOR WRITING, American Book Co. |
| | X | X | Gillie, BINARY ARITHMETIC AND BOOLEAN ALGEBRA, McGraw-Hill. |
| X | | X | Gotlieb and Hume, HIGH SCHOOL DATA PROCESSING, McGraw-Hill. |
| X | | | Grabbe, Ramo and Wooldridge, CONTROL FUNDAMENTALS, VOLUME 1, OF HANDBOOK OF AUTOMATION, John Wiley & Sons. |

| High School | Voc-Tech | Junior College | Text |
|---|---|---|---|
| | | X | Greenberger, COMPUTERS AND THE WORLD OF THE FUTURE, MIT Press. |
| X | X | X | Gregory and Van Horn, AUTOMATIC DATA PROCESSING SYSTEMS, Wadsworth. |
| X | X | X | Gregory and Van Horn, BUSINESS DATA PROCESSING AND PROGRAMMING, Wadsworth. |
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TITLE

**Curricular Implications of Automated Data Processing for Educational Institutions**

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ABSTRACT

The problem was primarily concerned with (1) an analysis of integrated data processing training programs in public education institutions; (2) a study of employees in the integrated data processing programs in selected business offices, as well as a study of needs as expressed by the data processing management personnel of these offices, to determine the common body of knowledge needed for entry into, adjustment to, and promotion patterns for seven major data processing job categories; and (3) the determination of new and projected developments in data processing as forecasted by manufacturers and users of hardware and software and the influence of such developments on future job opportunities and training programs.

Interviews were held in 353 businesses using data processing and the employees of those companies completed questionnaires. Teachers in 176 schools were interviewed to analyze the types of data processing programs being offered in the public high schools and two-year post high schools in the United States. Interviews were held with advance planning executives in computer manufacturing companies to determine what plans were being made for the next three to seven years that would affect education for data processing positions.

Curriculums for the high school and two-year post high school levels were recommended.