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Are the Needs of Industry for Data Processing Programmers Being Adequately Supported by Technical Training Programs in Oklahoma

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ARE THE NEEDS OF INDUSTRY FOR DATA PROCESSING PROGRAMMERS BEING ADEQUATELY SUPPORTED BY TECHNICAL TRAINING PROGRAMS IN OKLAHOMA

A Thesis Submitted to the Graduate Division in Partial Fulfillment of the Requirements for the Degree of Master of Science

By

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Title of Study: ARE THE NEEDS OF INDUSTRY FOR DATA PROCESSING PROGRAMMERS BEING ADEQUATELY MET BY TECHNICAL TRAINING PROGRAMS IN OKLAHOMA.

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Scope and Method of Study: A descriptive study to assess the needs of industry for trained data processing programmers and whether these needs are being met by the Technical Training Program in Oklahoma. Needs of sixty-two industries were studied relative to types of programming languages and types of applications most often used; recommendations as to learning techniques and type of test which should be given to programming students. These needs were compared with what was being taught in the Vocational-Technical Training Programs in Oklahoma.

Findings and Conclusions: The programming language most often used in industry was Cobol; the language most often taught in Vocational-Technical Schools was Assembly. Of the fifteen most used applications in industry, Vocational-Technical Schools use only twelve. Of the thirteen learning techniques thought most important by industry, only three were thought most important by Vocational-Technical Schools. Industry and Vocational-Technical Schools agreed on the type test which should be given. Vocational-Technical Schools should reevaluate their programs to more adequately meet the needs of industry, since these programs are designed to place students directly in industry. Continuous research should be conducted on industry's needs.

ADVISOR'S APPROVAL Fred J. Smith

LIST OF TABLES

CHAPTER I

INTRODUCTION

In 1970 over 40,000 computers were in use in the United States and 1,000 more on order from manufacturers.(3) Every major newspaper had published at least one news article or editorial about computers during 1970.(3) These articles reported how computers function, the speed at which they function, their limitations and how they have, and are continuing to become, a complex part of the business world and social affairs of man.

Computers were thought of as thinking machines or as calculating devices in the past. However, today's businessmen tend to consider computers as an essential element for handling chores, work tasks, or jobs too complicated or involved to accomplish by using manual or non-automated methods. Consequently, cpmputers and computing have become more essential or useful and have involved wide areas of industry, government, and the professions. In addition, technological advances will probably continue to improve computer hardware and techniques far beyond our newest, biggest, and best computers.

Past technological changes have improved computers and computer systems to an extent that educational institutions find it most difficult to keep current. It also seems programmers are finding it difficult to keep proficient in their occupations. Each generation of computers is marked not only by radical differences in the hardware and software systems associated with computing, but also by significant difference in skill patterns of the individuals required to use the machine to

accomplish the work.(2) Based on the changes in the different generations of computers, computer skills must be extensively refurbished every four years.(2)

One of the questions asked is just what is expected from the people who graduate from our colleges and universities these days in relation to the advancement of our computer age. A recent study of the University of Florida of the types of jobs available to graduates of their proposed Computer and Information Science (CIS) Program concluded:

> Scanning the questionnaire responses, one is led to believe that almost every activity requiring intelligence and decision making ability will eventually demand some level of CIS training. The list of activities is hopelessly long for individual discussion in a reasonable report. As examples, however, the raw data from the various employers in Florida is given in the following paragraphs.
>
> The manufacturers state that they want CIS men in inventory and material control, automatic testing and test data processing, price and cost control, performance measurements, forecasting, scheduling, expediting, customer service, business forecasting, market trend analysis, business strategy design, account volume analysis, automatic retain inventory replenishment, conceptual design, circuits and system design, systems modeling and simulation, resource allocation, optimizing cost consideration in quality control, contingency planning, flexible budget planning, variance analysis, performance indicators and decision simulators.
>
> The hospital administrators expect the CIS men to work in medical record storage, retrieval, display and analysis including inward applications, total patient scheduling, logistics, laboratory and dietary control, interpretation of reports, patient care planning, cost accounting and billing, inventory control and preventative maintenance, forecasting of capital needs, daily activity and patient scheduling as integrated parts of a comprehensive communicative, information processing system.
>
> The mayors and city managers expect to use CIS graduates to work on problems of law enforcement, crime prevention and control, defining relationships between various departmental programs, labor management relationships, contract administration, planning of facilities and application analysis, land utilization planning, transportation planning, utilities and finance operations, human resource development, libraries and recreation.

> The financial houses state they will need CIS graduates for work in all fields (data processing, information systems, planning, marketing, sales, treasury). Men will be needed to improve systems to provide management information and controls, electronic transfer of funds, models and simulations of portfolio management, financial accounting and data processing.
>
> The summary feeling one gets on reading these replies is that these executives are anticipating powerful new tools for the management of their activities. They expect to have meaningful, concise, immediately-available information for decision making and control. These men are not so naive as to expect today's technician-programmers to accomplish these goals for them. They will be hiring a new type of information scientist who understands not only the subject business or civic area but also what the computer can do when properly instructed. These people will play critical roles exercising substantial responsibility.[5]

There appears to be a lack of communication between industry and technical training programs relative to what is required of the computer programmer; there is little appreciation for what programming really is today or what industry needs. Little objective research seems to have been done to keep the technical training programs informed of the needs of industry.

Statement of the Problem

The problem was to determine how industry's needs for data processing programmers could be more adequately met by technical training programs in data processing being taught in schools receiving monies from the Oklahoma State Department of Vocational-Technical Education.

More specifically, the problem was delineated in an attempt to answer the following questions:

1. Were there differences in the types of programming languages most often used in industry and those most often taught by the Vocational-Technical Schools in Oklahoma?

2. Were there differences in the types of applications most often used by the instructor for lab problems in Vocational-Technical Schools of Oklahoma and the type of applications most often used in industry?

3. Were there differences in the recommendations by industry as to learning techniques from those used by Vocational-Technical Schools in Oklahoma?

4. Were there differences in the recommendations by industry as to the type test which should be given from those which were given by Vocational-Technical Schools in Oklahoma?

Delimitations of the Problem

The study included the Oklahoma schools which were funded by the State Department of Vocational-Technical Education for their data processing programs, and one hundred thirty-one businesses in the Oklahoma-Texas area which have memberships in Data Processing Management Association.

Limitations of the Problem

The study was limited to those schools which replied to the questionnaire, with a maximum of three requests for information and those industries which responded to the questionnaire, with a maximum of three requests. In addition it was limited to the following languages: (1) Cobol, (2) RPG, (3) Fortran, and (4) Assembly for 3rd generation computers and systems course.

The questionnaire method of gathering data also caried limitations within it, in that the respondents might misinterpret the questions or might not even respond to the questionnaire at all.

Basic Assumptions

It was assumed that questions asked on this survey were valid because they were used on three other surveys.

It was assumed that industry and instructors would have the same interpretation of the questions.

It was assumed that the industrial group selected would represent a valid sample of industry.

It was assumed that the percentage of response and the rating of each item as an educational objective was a valid method of determining priorities of industry, and that the responses by the Vocational-Technical Schools, showing priorities of teachers, would be a valid comparison.

Definition of Terms

Data Processing: An all-inclusive term which refers to the total process of rearranging data from its original form to its final form.

Program: A series of instruction which leads to the solution of the problem. The series includes instructions for moving data from the input area and moving results to output form. When executed, the program must be in machine language form.

Machine Language: All symbolic languages must be converted to instructions which the computer can understand and on which it operates.

Programming Languages: Economic considerations in the manufacture of computers rule out use of our language, and require instead that instructions be spelled out in considerable detail in a coded form. Computer languages have as their objective the direction of the computers' activities as they relate to the computers' applications in problem solving.

There are two types of languages: computer-oriented languages, and problem-oriented languages.

360 Assembly: Basic symbolic language, computer-oriented. This language may also be referred to as Assembly for 3rd generation.

RPG: Report Program Generator is a problem-oriented language. A system of communicating with computers used by business for a quick type of programming.

Cobol: Common-Business Oriented Language, a problem-oriented language, is an English-type programming language used to program business problems.

Fortran: Formula Translator System is a problem-oriented language primarily designed for use in programming problems which are expressed in mathematical-type language.

PL/l: A problem oriented language which is a combination of Cobol and Fortran, and primarily developed to solve problems of both business and scientific communities.

Programmer: One who develops a program or a series of instruction for use by the computer.

Run Book: A book used by the computer operator to guide him through a problem being run on the computer. This book is developed by the programmer at the time the program is written.

Entry Level Job: An employee should be able to produce quicker and in a shorter period of time after employment because he is partially trained in this occupation.

Significance of the Study

The investigator found little or no information directly related to

this study. Consequently, the frequency of a study of this nature needed to be determined. For example, based qn the past, it has been most difficult to keep up with changes in the data processing industry because of new generations of equipment every four years. In addition, if the instructors are to be up-to-date, competent individuals training students for industry, the instructor must be informed of the needs and future needs of industry.

CHAPTER II

RELATED LITERATURE

Much has been written saying industry needs better-trained programmers, and standards should be written so industry would know if they were getting a trained programmer. However, little has been written as to just what type training the programmer should get in schools before he is employed. Perhaps industry is reluctant to state the programmer needs a certain type training because the type of training varies from one industry to another depending on the type of business.

In 1968 a study was made by F. Bangs and M. Hillstead(1) under a contract from the U. S. Department of Health, Education and Welfare Office of Education -- concerning Curricular Implication of Automated Data Processing for Education Institutions. The purpose of the study was 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.(1)

This study pointed out that there would be changes in the data processing field within the next three to five years. It further stated that IBM 360-30 would be used extensively by the majority of companies. More applications would be put on the computer which in turn would require more programmers. More sophisticated use of computer equipment would be made, and a wider use of time sharing and data communications would be used.

Companies would centralize their data-processing operations with more use being made of RPG and PL/1 programming languages. It was felt that more emphasis should be placed on training of system personnel and re-education and upgrading of present employees to keep them current. To make better use of the new third generation equipment, management must revamp their entire systems. (1)

It was felt there was need to improve the Input/Output devices, for a wider use of teleprocessing, and that equipment would decrease in price, thus making it possible for more and more companies to use data processing equipment. (1)

Findings concerning data processing curriculum pointed out that personnel would need to be trained to use the total system approach in business and that education had not been satisfying this need. (1)

Further recommendations were for schools to update the programs currently in existence because they were not meeting the needs in training personnel for many job opportunities in data processing. It also stated that further research is needed in making in-depth analysis of course offerings in data processing. (1)

The study(1) did not make specific recommendations relative to subject matter but did point out that 57 percent of the programmers interviewed felt that their educational backgrounds were adequate and 13 percent of this group stated they were well prepared to be programmers. Almost 30 percent felt they had not been adequately trained for their jobs. In this group, those who had data processing courses before going into the field were better satisfied with their education. It also stated that less than 20 percent of those with data processing training said they

had been inadequately prepared for work in the field while 41 percent without prior training felt this way. (1)

Richard H. Nielson, United Benefit Life, listed the methods used by United to train programmers in an in-house training program. (4) The programmer trainee was put through a three-level course. The first two levels were an introduction to data processing and the third was learning to do a company problem in Cobol. He was given a case study program after he had learned the basics of Cobol. (4)

The case study problem was one of the company's production programs. It contained a narrative description of the problem, record layouts for all input and output files, pages from the field description manual explaining the contents and use of various fields in the records, a list of control totals required, and a copy of the run book. The problem was a file maintenance problem involving the updating of a master file, the preparation of certain special reports, and the creation of transaction records which were inputs to another program. (4)

To check the totals the trainee obtained was a simple matter when the company used the case study in all of its training programs. This provided a valuable tool in evaluating the performance of the trainee. (4)

The trainee was required to define the problem, determine the solution and then devise the best method of arriving at the solution. The trainee not only learned how to program but also became familiar with department procedures for setting up program compilations and test runs. He learned what information was necessary to put on tape labels and what information was required in the run book. He learned the documentation required by the company. (4)

In an article written by J. David Benivati, Xerox Corporation, (2) it was pointed out that Xerox developed a list of skills which would be required by the associate programmer over the next three to eighteen months on a certain job. Xerox then selected from their educational objectives those which would best fulfill these needs. After selection, the objectives were assigned weights, dependent upon two factors: (1) the relative significance of this particular item to the company on a stand-alone basis; and (2) the importance of this item to the development of other skills (interdepending). After being weighted, the objectives' were then sorted according to hierarchy of learning. When this was completed, Xerox was ready to formulate the contents criteria matrix by describing the training activities required for the satisfaction of each objective and the measurement that would be used to assure that their training design worked. The success or failure in the course could be determined by how many points each student accumulated on the weighted matrix rather than how well he statistically performed against his peer group. Through interaction with the candidate sponsor, another 30 percent matrix was developed. Once the student completed the program, he was prepared for the actual job he would be assigned. (2)

Summary

The study by Bangs and Hillstead(l) pointed out that schools should update their programs and teach data processing by systems approach. In the article by Nielson, (4) he indicated United Benefit Life used the case study method to teach their programmers. In the article written by Benivati,(2) he did not state how the actual training was done, but that the students obtained points by completing objectives which were weighted as a means of training. It would be assumed from reading the article that the student worked on a case-study type project to which he would apply these objectives.

CHAPTER III

METHODS AND PROCEDURES

The questionnaire method of research was used to obtain the data for this research study. The questionnaires were sent to industry as well as to vocational-technical schools in Oklahoma.

The questionnaire was developed in the following manner:

1. Some questions were taken from a survey made by the Industrial Economics Research Division, Texas Engineering Experiment Station, Texas A &M University, College Station, Texas, directly entitled "Computer Facilities in Texas." The following questions were used on the questionnaire and were taken from this survey•

   A. Computer Make and Model and Peripherial Section?

   B. Computer application used by the responding organizations?

2. Some questions were taken from a survey made by the Dearborn Public Schools, 1971. The following questions were taken from this survey:

   A. Type of Organization?

   B. Unit Record gear presently in use by the respondent?

   C. Type of personnel employed?

   D. What weaknesses are most frequently detected in your new employees?

   E. Do your programmers personally operate the equipment to compile and/or test their programs?

   F. Where did your employees receive their initial training?

   G. How many new employees have you hired in your data processing

department during the past twelve months, other than key punch personnel?

H. What competency do you think would make the best prospect in data processing employees?

I. If you were seeking computer personnel, other than key punch personnel, where would you look?

3. Some questions were taken from research completed by F. Bangs and Mel M. Hillstead 1) in the Data Processing Learning Teohnique. Other questions in this same section were taken from "Data Processing Manpower Planning System Skills Inventory Questionnaire" by Xerox Corporation.

These questions have been adequately tested through actual research which provided answers which were acceptable and explicable to the investigator's need, so no questionnaires were mailed to a test group. However, the instrument was reviewed by the Research Coordinating Unit of the Oklahoma State Department of ocational and Technical Education, Stillwater, Oklahoma, which suggested some minor changes but felt the survey instrument covered the subject adequately and was in proper format. The questionnaire was assumed valid because of the established validity of the questions by prior research.

Questionnaires were sent to all Vocational-Technical Schools receiving monies from the State Department of Vocational-Technical Education for their data processing programs. Questionnaires were sent to 131 industires in Oklahoma and Texas.

The questionnaire requested the name, address, and phone number of the firm or school replying. The type equipment used by the firm or

school was requested to explain the use of only one language or if several languages could be used but preferred to use only one because it was felt this best fit the applications used. Also requested were the types of programming languages used most frequently and the preparation time for each. This was used to determine the most popular language of the population surveyed. Respondents were then requested to check the types of applications used by putting the percent of time worked on each application in relation to the total time to run their equipment, thus enabling the investigator to determine what applications the student would most likely be confronted with on his first job. This also enabled the investigator to determine the time each school had spent on each type of application and to compare them with the most-used applications in industry. On the last part of the questionnaire, the industries were asked to rate educational objectives to determine which one they felt was the most important, and the Vocational-Technical Schools were to rate the objectives they felt were the most important or the ones on which they have spent the most time.

To encourage a high return from industry, a self-addressed envelope was enclosed with the questionnaire. A follow-up letter was mailed eleven days later to those who did not respond to the first letter with an enclosed self-addressed envelope for the response and another copy of the questionnaire. A third follow up was mailed forty-five days later with a postal card enclosed for their response as to why they did not respond to the first two requests.

To insure that a high return was received from the Vocational-Technical Schools, a hand-written follow up was mailed sixty days after

the first request and had a self-addressed envelope enclosed with the questionnaire.

When the questionnaires were returned, a tabulation was made for each question and the reply. The data was then compared to answer the questions posed in the statement of the problem.

CHAPTER IV

ANALYSIS OF INDUSTRY RESPONSE

Questionnaires were mailed to 131 organizations; nine of these were returned as being either out of business or the companies had contracted for their data processing work. The Texas businesses selected to participate in this study were chosen from a publication of a survey made by Texas A & M. The companies were selected by the type equipment they had in an attempt to obtain a representative sampling of the data processing equipment currently in use. From this publication, eighty-two firms were selected from various cities in Texas, thus assuming a cross section of the population of Texas. In Oklahoma, forty-nine names were selected from the Tulsa, Oklahoma City, and Muskogee telephone directories, plus companies in the local Lawton area known to the investigator.

Returns from Texas represented all the Texas cities selected with a total of fifty-one received or 65 percent of the questionnaires mailed. Returns in Oklahoma represented most of the cities selected with thirty returns being received or 70 percent of the questionnaires mailed, excluding returns from firms no longer in business. The returns received represented 66.3 percent of the total questionnaires mailed, excluding returns from firms no longer in business.

It should be noted that not all questionnaires were completed in their entirety. Sixty-two questionnaires were returned, and nineteen postal cards were returned with the following reasons for not completing the questionnaire:

1 - thought it was too long but was valid.

1 - was unable to find time to complete it; thought it was valid, but too long.

3 - thought it was too long and were unable to find time to complete it.

S - were unable to find time to complete it.

1 - thought it was too long.

1 - thought it was too long; was unable to find time to complete the questionnaire and found the questions confusing and vague as to our facilities.

7 - had other reasons.

Table 1

Type of Organization

In some cases those who responded were involved in more than one type of organization as classified. Respondents were engaged in seventy-five different types of organizations as classified. The organization which had the largest number of returns was, the service organization with 38 percent engaged in providing service to others. There were two types of organizations - education and utilities - which represented 1 percent each of those responding. It should be noted that the one in education was involved only in work for the college and its research facilities, and it did no instruction on the computer. It was, therefore, classified as business.

TABLE I

TYPE OF ORGANIZATION

Distribution	3	Finance	11	Wholesale Trade	2
Transportation	0	Retail Trade	4	Education	1
Government	3	Service	28	Utilities	1
Insurance	3	Research or Eng	3	Manufacturing	10

Table 2

Unit Record Gear Presently in Use

There were 139 pieces of unit record gear in use by the companies who responded with 40 percent of that equipment being sorters and only 7 percent being accounting machines.

TABLE II

UNIT RECORD GEAR PRESENTLY IN USE

Accounting Machine	11	Collator	22	Reproducer	22
Calculating Punch	2	Interpreter	27	Sorter	55
Others					

Table 3

Computers Used By Respondents

Of those who responded, 58 percent had IBM equipment, 18 percent had Honeywell equipment, 6 percent had Univac RCA equipment, 6 percent had Burroughs, 6 percent had NCR equipment and all others accounted for 6 percent of the equipment.

TABLE 11'1

COMPUTERS USED BY RESPONDENTS

Number	Make	Model
5	Burrough	344 to 1700
3	Control Data	200, 6500 and 6600
1	DATA	78
1	EMR	6070
16	Honeywell	115 to 2015
1	IBM	1401
2	IBM	1800
1	IBM	System 3
6	IBM	1130
3	IBM	360/20
2	IBM	360/22
2	IBM	360/25
4	IBM	360/30
12	IBM	360/40
3	IBM	360/50
2	IBM	360/65
6	IBM	370/145
5	IBM	370/155
3	IBM	370/165
5	NCR	315 to Century 200
5	Univac	9200 to Spectra 70
2	Xerox	Sigma 648 and 788

Table 4

Equipment Used With the Computer

There were more tape drives in use than any other piece of equipment with a total of 309 reported, and very close behind were disk units with a total of 300 in use. The third most frequently used were CRT display units with 157 units in use. A total of 108 printers were in use or 18 more printers than CPU. (Central Processing Unit)

TABLE IV

EQUIPMENT USED WITH THE COMPUTER

Tape Drives	309	Card Punch	56
Disk Drive	300	CRT Display Unit	157
Drums	5	Paper Tape Punch Reader	16
Data Cells	1	OSR or OCR	8
Printers	108	Remote Terminal Printers	78
Card Reader	83	Others	46

Table 5

Personnel

The total employed personnel for those who responded was 2,130. Twenty-two percent of those, or 461, were employed as key punch operators, 15 percent, or 316, were employed as system analysts, 12 percent, or 261, were employed as programmer/analysts and 7 percent, or 145, were employed as programmers. This indicates that 34 percent of those employed are in

the area of preparing programs for the system. Sixteen percent of those employed were operators of the computers.

TABLE V

PERSONNEL

Systems Analysts	316	Control Clerks	228
Tab Operators	48	Programmers	145
Key Tape Operators	148	Verifier Operators	71
Programmers/Analysts	261	Computer Operators	345
Key Punch Operators	461	Others	107

Table 6

Weaknesses Most Frequently Dete ted in New Employees

These comments were taken from the returned questionnaires and express the thoughts of the respondent on the question. Comments were very varied as each Data Processing Manager had a different pet peeve about weaknesses in new employees. Therefore compilation of data into groups of measurable responses was not possible.

TABLE VI

WEAKNESSES MOST FREQUENTLY DETECTED IN NEW EMPLOYEES

1. "Over-sold in importance of computers and its place in the business world."

Table 6 (continued)

2. "Too vague or else too highly segmented in their training."
3. "Poor basic knowledge of accounting practices."
4. "Lack of dedication."
5. 'Don't use their heads in decision making."
6. "Willingness to accept sloppy work."
7. "Systems design."
8. "Originality."
9. "They have never been taught good program logic (even ones with many years of programming)."
10. "Programmers lack understanding of basic business accounting principles."
11. "Knowledge of how basic system put together prohibiting tailoring of DOS, OS, etc., to fit our specific requirements."
12. "Too many programmers know only high level language (COBOL, FORTRAN, PL/l) and limit themselves when it comes to a really complicated problem requiring knowledge of ALe and other lower level languages."
13. "General attitude toward business world."
14. "Have a hard time keeping up with the pace of a service company."
15. "No experience in industries we handle."
16. "Lack of experience."
17. "Programmers/Analyst - if hired, must have B.S. degree."
18. "Computer Operators - must be students, who upon graduation, may be offered a programming position."
19. "Poor work habits"
20. "Not willing to give 100 percent effort."

Table 6 (continued)

21. "One-hundred percent accuracy of work to customers."
22. "D.P. fundamentals."
23. "Understanding of solutions to practical problems."
24. "Understanding structure of practical problems."
25. "Lack of overall uompletion of project, including documentation and training."
26. "Lack of understanding of manufacturing systems and controls."
27. "Attitude."
28. "Familiarity with only one computer make or model."
29. "Unwilling to ask questions."
30. "Lack of understanding of business systems."
31. "Weak communications skills."
32. "They do not appreciate the need for documentation."
33. "They minimize the need for desk checking programs and spend too much machine time debugging errors that should have been caught before completion."
34. "They tend to over-sophisticate their programs rather than use simple and direct routines."
35. "Not qualified as per claims."
36. "Schools don't train them up to claims."
37. "Productivity - salary demands inconsistent."
38. "Politeness."
39. "Customer contact relations."
40. "Interestin job. t,l
41. "Aggressiveness."

Table 6 (continued)

42. "Transition from academic to an industrial work environment."
43. "Lack of large computer system experience."
44. "Marketing experience."
45. "Lack of familiarity with our applications."
46. "Inability to apply fundamental training to real problems."
47. "Inability to be self starting; avoidance of original independent thinking."
48. "Tendency to be rigid, inflexible in attitudes and perspective."
49. "Lack of hands-on experience."
50. "Failure to think things thru to conclusion."
51. "Too narrow experience."

Table 7

Do Your Programmers Personally Operate the Equipment To Compile and/or Test Their Programs

Fifty-six percent of those responding indicated the programmers did compile and test their programs, 25 percent did not, and 19 percent only if they had time for them to do it.

TABLE VII

DO YOUR PROGRAMMERS PERSONALLY OPERATE THE EQUIPMENT TO COMPILE AND/OR TEST THEIR PROGRAMS

Yes	No	If Time Permits
34	15	12

Table 8

Programming Languages Used or Taught
in Your Organization

Of the total number of languages recorded, Cobol was used 30 percent of the time; Assembly language was used 26 percent of the time; Fortran was used 18 percent of the time; RPG was used 16 percent of the time, and 10 percent used something else. However, this does not tell the total sto y. Of the 30 percent who said they used Cobol, 58 percent used it more than 50 percent of the time, and of the 26 percent who said they used Assembly only, 19 percent used it more than 50 percent of the time. Of the 18 percent who said they used Fortran, 20 percent said they used it more than 50 percent of the time. Of the 16 percent who said they used RPG, 36 percent said they used it more than 50 percent of the time.

Table 9

Applications

The questionnaire listed seventy-four applications plus a space to list other applications. The respondents were asked to fill out the percent of time they spent on the various applications. Sixty-seven percent of those who responded to the number of applications put the time they spent on each application. The fifteen most responded to applications are listed below with the percent of the total response and the largest response to the amount of time spent on each application. A total of sixty-two questionnaires were returned and this figure is used as a total response.

TABLE VIII

PROGRAMMING LANGUAGES USED OR TAUGHT

IN YOUR ORGANIZATION

Language	Less than 13 percent	More than 12 percent less than 26 percent	More than 25 percent less than 38 percent	More than 37 percent less than 51 percent	More than 50 percent less than 67 percent	More than 66 percent less than 76 percent	More than 75 percent less than 91 percent	More than 90 percent	Total Number
Fortran	8	6	1	4	2	2	1		24
Cobol	7	2	4	4	3	1	9	10	40
Assembly	22	4	2	1	2 2	1	1	3	36
RPG	10	3	0	1	0	3	1	4	22
Others	2	2	1	0	1	0	1	7	14

TABLE IX

APPLICATIONS

Application	Percent of Total Respondents	Percent of Total Respondents Who Gave Percent	Time Spent of the Total Respondents Who Gave Percent
Payroll	71 percent	55 percent	70 percent spent less than 6 percent of time
Accounting General	63 percent	48 percent	53 percent spent less than 6 percent of time
Accounts Receivable	63 percent	44 percent	44 percent spent less than 6 percent of time
General Ledger Acct	55 percent	40 percent	80 percent spent less than 6 percent of time
Accounts Payable	52 percent	34 percent	76 percent spent less than 6 percent of time
Inventory Control	48 percent	35 percent	59 percent spent less than 6 percent of time
Billing and Invoicing	45 percent	28 percent	33 percent spent less than 6 percent of time
Management Info Report	43 percent	32 percent	70 percent spent less than 6 percent of time
Mailing List	42 percent	29 percent	78 percent spent less than 6 percent of time
Personnel Records	40 percent	27 percent	88 percent spent less than 6 percent of time
Financial Statements	40 percent	27 percent	88 percent spent less than 6 percent of time
Sales Analysis	37 percent	26 percent	88 percent spent less than 6 percent of time
Accounting Journal Ent	34 percent	23 percent	92 percent spent less than 6 percent of time
Cost Accounting	32 percent	19 percent	75 percent spent less than 6 percent of time
Fixed Assets Acct	29 percent	22 percent	100 percent spent less than 6 percent of time

Table 9 (continued)

Application	Less Than 6 Percent	More Than 5 Percent Less Than 12 Percent	More Than 11 Percent Less Than 21 Percent	More Than 20 Percent Less Than 31 Percent	More Than 30 Percent Less Than 51 Percent	More Than 50 Percent Less Than 76 Percent	More Than 75 Percent	Total Percent Response	Total Response
Accident Reporting	1	1						2	2
Accounting (Gen.)	16	6	2	4	0	1	1	30	39
Accounting Journal Entry	13	1						14	21
Accounts Payable	16	2	2	0	1			21	32
Accounts Receivable	12	7	3	4	1			27	39
Actuarial Services	2							7	3
Advertising Invoicing	2							2	2
Advertising Scheduling	1							1	1
Agricultural Economic Research	1							1	1
Aircraft Component Control								0	0
Amortization Schedules	9							9	16

Table 9 (continued)

Application	Less Than 6 Percent	More Than 5 Less Than 12 Percent	More Than 11 Less Than 21 Percent	More Than 20 Less Than 31 Percent	More Than 30 Less Than 51 Percent	More Than 50 Less Than 76 Percent	More Than 75 Percent	Total Percent Response	Total Response
Automobile Travel Allowance	1							1	3
Bank Management Information	4	2	0	0	1	1		8	10
Bill of Materials	5	2	1					8	13
Billing and Invoicing	6	6	3	2	1			18	28
Budget Management	8	3						11	21
Cash Control	6							6	13
Commission Accounting	6	1						7	8
Cost Accounting	9	2	0	1				12	19
Charge Account Billing	3	1		1				5	7
Commodities Reporting								0	1
Communication Systems	4	1						5	7
Cost Control	3							3	11
Credit Accounting	4		1					5	7
Customer Accounting	3		2	1				6	12
Data Communication	5	3						8	10
Demand Deposits	0	1	1	2	3	2		9	10

Table 9 (continued)

Application	Less Than 6 Percent	More Than 5 Percent Less Than 12 Percent	More Than 11 Percent Less Than 21 Percent	More Than 20 Percent Less Than 31 Percent	More Than 30 Percent Less Than 51 Percent	More Than 50 Percent Less Than 76 Percent	More Than 75 Percent LeSS	Total Percent Response	Total Response
Depreciation	9							9	16
Disbursements	4							4	6
Dividend Payments	4							4	7
Drafting	2	1						3	5
Engineering Design	5			1	1	1	1	9	14
Expense Allocation	6							6	9
Financial Statements	15	2						17	25
Fixed Assets Acctg.	14							14	18
General Ledger Acctg.	20	2	3					25	34
Group Insurance	2							2	4
Hospital Patient Acctg.			1					1	4
Hospital Patient Information	1							1	5
Hospital Statistics	2							2	6
Installment Loans	4	5	1	1				11	13
Insurance Agents Performance Analysis	5	1	2					8	9

Table 9 (continued)

Application	Less Than 6 Percent	More Than 5 Percent Less Than 12 Percent	More Than 11 Percent Less Than 21 Percent	More Than 20 Percent Less Than 31 Percent	More Than 30 Percent Less Than 51 Percent	More Than 50 Percent Less Than 76 Percent	More Than 75 Percent	Total Percent Response	Total Response
Insurance Premium Accounting	7	3		2			1	13	14
Inventory Control	13	4	4	1				22	30
Labor Analysis	8	1						9	13
Labor Control	3							3	7
Labor-Cost Reports	8							8	14
Linear Programming	3				1			4	7
Mailing List	14	2	1		1			18	26
Management Information Reports	14	4	1	1				20	27
Market Research	4							4	8
Medical Accounting	3		2					3	6
Mortgage Loan Acctg.	2		2					4	6
Motor Vehicle Maintenance Records	6							6	7
Multiple Regression Analysis	3							3	8
Numeric Analysis	3	2						5	8
Order Billing	4	2						6	8

Table 9 (continued)

Application	Less Than 6 Percent	More Than 5 Percent Less Than 12 Percent	More Than 11 Percent Less Than 21 Percent	More Than 20 Percent Less Than 31 Percent	More Than 30 Percent Less Than 51 Percent	More Than 50 Percent Less Than 76 Percent	More Than 75 Percent	Total Percent Response	Total Response
Order Entry	7	1						8	12
Payroll	25	7	4					36	45
Personnel Records	15			1	1			17	25
PERT System	5							5	8
Production Control	4	1	2					7	10
Production Cost Analysis	6							6	11
Production Planning	3							3	9
Production Reporting	3							3	9
Production Scheduling	5							5	9
Sales Accounting	8		1					9	15
Savings Accounts	4	3	3					10	12
Savings and Loan Accounting		2						2	5
Sales Analysis	16	1		1				18	23
Sales Reporting	7			1				8	11
Statistical Analysis	1							1	3
School Records	3	1	1					5	7
Utilities Billing	2							2	2
Others	5	2	4	4	1	3	2	21	22

Table 10

Data Processing Learning Techniques

There were seventy-six items listed plus others under this section. Respondents were to rate how they felt about each item by marking one of the following: Most Important, Highly Important, Important, Of Little Importance, and Of No Importance. The results have been broken down into two categories. The first category was if they felt it was important, highly important or most important; the second category was if they felt it was of little importance or of no importance. The category with the biggest percent of response has been broken into three different groups and listed below.

Percent of Total Response	Most Important	Percent of Total of Category One
100	Basic Concepts	56 percent
96	Computer Applications	42
97	Program Testing	55
91	The Approach (Systems)	46
96	Requirements (Systems)	50
100	Development of the Solution (Systems)	56
93	System Evaluation (Systems)	40
96	System Implementation	49
96	Program Debugging	52
80	Logic	43
94	Effective Listen"ng	52

Percent of Total Response	Highly Important	Percent of Total of Category One
82	*Subroutines	39
80	Programming Random Access Devices	46
69	*Input-Output Control Systems	42
100	Data Control	47
88	System Control	46
95	Finalizing the Systems	49
64	Multiprogramming	41
88	Data File Design	57
94	*Specification Writing	40
86	Flowcharting	51
91	Procedure Writing	40
88	Form Design	46
96	System Planning	42
90	Project Control	46
71	Interpret Core Dump	39
99	Program Analysis for Bus Systems	45
88	Programming Techniques for Improved Performance of Programs	56
86	Test Development Procedures	55
96	Design of Systems Control and Audit Trails	41
96	Documentation Standards	45

Percent of Total Response	- Important	Percent of Total of Category One
59	Assembly Programs and Compilers	48
81	Utility Programs	57
60	Data Scheduling	48
67	Sort-Merges Programming	67
78	Monitors and Supervisory Systems	48
74	Looping and Indexing	43
81	*Subroutines	39
66	Programming a Tape System	39
69	*Input-output Control System	42
63	Multiprocessing	43
68	Card Design	57
96	*Specification Writing	40
66	Decision Table	69
73	Management Information System Design	45
73	Operational Analysis	45
63	Work Measurement	73
62	Work Sampling	74
73	Work Simplification	50
90	System Presentation	42
85	Work Load Evaluation	59
94	Maintaining Program Library	39
65	Maintaining Magnetic Tape Library	43
61	Operating Computer Console	46
67	Job Timing	52

Percent of Total Response	Important	Percent of Total of Category One
71	Card Layout and Design	58
82	Data Scheduling System	49
56	Fixed and Floating Point	61
69	Numbering System	56
72	Computer Logic	43
62	Register	50
62	Cobol Report Writing	45
56	Cobol Sort Verbs	45
65	Binary Search Technique	51
71	Data Communications Concepts	45
54	Document Retrieval and Display Techniques	50
86	Supervisory Training	42
82	I/O Debugging	51

Below are listed the learning techniques which 50 percent or more of those who responded felt were of little or no importance:

Macro Generator

Translators

Macro Programming

Pert

Boolean Algebra

Registered Business Programuner Course and Certificate Information

DOS/TOS Operations Training

Report Generator

Simulators

Time Sharing

Microfilm Information Systems

PROGRAMMING LANGUAGES

Percent of Total Response	Most Important	Percent of Total of Category One
84	Cobol	51
52	*360 Assembly	35
86	Systems Analysis Course	50

Percent of Total Response	Important	Percent of Total of Category One
56	Fortran	44
52	*360 Assembly	35

Of Little or No Importance

RPG PLI

TEST QUESTIONS

Percent of Total Response	Most Important	Percent of Total of Category One
94	Programming Problem or Part of	53

Percent of Total Response	Highly Important	Percent of Total of Category One
66	Essay	35
69	Comb of 97 and 100	38
74	Comb of 98 and 100	

Percent of Total Response	Important	Percent of Total of Category One
62	Multiple Choice	66
76	Completion	46
55	Comb of 96 and 100	62
64	Case Study only	64

Percent of Total Response	Important (continued)	Percent of Total of Category One
59	No Test, Just Lab Problems	52

* Means that this item appears in more than one column.

TABLE X

DATA PROCESSING LEARNING TECHNIQUES

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
I, Basic Concepts	32	13	11	56	100	X	0	0	0		56
2. Assembly Programs and Compilers	6	10	15	31	57	X	19	4	23	43	54
3, Macro-Generators		7	13	20	36		27	9	36	64	56
4. Reports Generators	4	8	16	28	48		22	8	30	52	58
5. Utility Programs	7	12	25	44	80	X	11	0	11	20	55
6. Data Scheduling System	4	13	16	33	62	X	14	6	20	38	53
7. Sort-Merges Programming	6	7	26	39	67	X	13	6	19	33	58
8. Monitors and Supervisory Systems	10	13	21	44	79	X	6	6	12	21	56
9. Computer Applications	22	17	14	53	95	X	3	a	3	5	56

Table 10 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
10.	Looping and Indexing	8	15	17	40	71	X	12	4	16	29	56
11.	Subroutines	10	18	18	46	81	X	10	1	11	19	57
12.	Programming a Tape System	9	11	13	33	65	X	12	6	18	35	51
13.	Macro-Programming	3	12	7	22	41		24	8	32	39	54
14.	Programming Random Access Devices	14	21	11	46	81	X	6	5	11	19	57
15.	Program Testing	31	19	6	56	97	X	1	1	2	3	58
16.	Translators	0	5	11	16	31		20	16	36	69	52
17.	Input-Output Control System	6	16	16	38	67	X	14	5	19	33	57
18.	Simulators	0	5	11	16	31		15	21	36	59	52
19.	The Approach	23	14	13	50	91	X	3	2	5	9	55
20.	Requirements of the System	27	16	11	54	96	X	1	1	2	4	56
21.	Developing the Solution	32	18	7	57	100	X	0	0	0	0	57
22.	Data Controls	22	25	6	53	96	X	2	0	2	4	55
23.	System Controls	22	23	5	50	86	X	6	2	8	14	58
24.	System Evaluation	21	19	13	53	93	X	3	1	4	7	57

Table 10 (Continued)

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 5° Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
25. Finalizing the System	20	30	11	61	95	X	2	1	3	5	64
26. System Implementation	26	17	10	53	96	X	1	1	2	4	56
27. Program Debugging	28	20	6	54	96	X	2	0	2	4	56
28. PERT	0	4	6	10	18		30	15	45	82	55
29. Multiprogramming	7	14	13	34	63	X	10	10	20	37	54
30. Multiprocessing	7	13	15	35	63	X	8	13	21	37	56
31. Time Sharing	3	9	12	24	44		17	13	30	66	54
32. Card Design	0	14	24	38	68	X	12	6	18	32	56
33. Data File Design	15	29	7	51	86	X	7	1	8	14	59
34. Specification Writing	11	21	4	53	96	X	2	0	2	4	55
35. Flow Charting	10	24	13	47	85	X	5	3	8	15	55
36. Decision Tables	1	10	25	36	67	X	12	6	18	33	54
37. Management Information System Design	11	11	18	40	74	X	8	6	14	26	54
38. Operational Analysis	5	17	18	40	73	X	11	4	15	27	55
39. Procedure Writing	11	19	17	47	87	X	5	2	7	13	54
40. Form Design	12	23	15	50	88	X	6	1	7	12	57

Table 10 (Continued)

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	Of Little Importance	Of No Importance	Total	Percent of Total Received	Total Replies
41. Work Measurement	0	9	24	33	61	x	18	3	21	39	54
42. Work Sampling	1	8	25	34	61	x	20	2	22	39	56
43. Work Simplification	6	14	20	40	73	x	14	1	15	27	55
44. System Planning	20	22	11	53	96	x	2	0	2	4	55
45. Project Control	12	23	15	50	91	x	4	1	5	9	55
46. System Presentation	11	18	4	50	89	x	4	2	6	11	56
47. Work Load Evaluation	3	15	26	44	83	x	7	2	9	17	53
48. Maintaining Program Library	12	21	21	54	92	x	4	1	5	8	59
49. Maintaining Magnetic Tape Library	11	9	15	35	64	x	12	8	20	36	55
50. Operating Computer Console	8	11	16	35	61	x	21	1	22	39	57
51. Job Timing	4	12	17	33	63	x	16	3	19	37	52
52. Card Lay Out and Design	5	11	22	38	69	x	15	2	17	31	55
53. Data Scheduling System	8	14	21	43	78	x	10	2	12	22	55
54. Boolean Algebra	1	2	15	18	34		21	14	35	66	53
55. Logic	19	17	8	44	80	x	7	4	11	20	55

Table 10 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
56.	Fixed and Floating Point	4	7	17	28	54	X	12	12	24	46	52
57.	Numbering Systems	7	10	22	39	68	X	12	6	18	32	57
58.	Computer Logic	8	15	17	40	71	X	14	2	16	29	56
59.	Registers	5	12	17	34	61	X	17	5	22	39	56
60.	Cobol Report Writing	7	11	15	33	60	X	9	13	22	40	55
61.	Cobol Sort Verbs	7	9	13	29	54	X	13	12	25	46	54
62.	Binary Search Technique	4	13	18	35	64	X	12	8	20	36	55
63.	Interpret Core Dump	14	15	9	38	69	X	12	5	17	31	55
64.	Data Communications Concepts	10	12	18	40	71	X	9	7	16	29	56
65.	Microfilm Information Systems	2	3	14	19	35		23	13	36	65	55
66.	Document Retrieval and Display Techniques	3	11	14	28	50	X	20	8	28	50	56
67.	Effective Listening	26	8	16	50	94	X	2	1	3	6	53
68.	Supervisory Training	11	17	20	48	87	X	6	1	7	13	55

Table 10 (Continued)

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	Of Little Importance	Of No Importance	Total	Percent of Total Received	Total Replies
69. Registered Business Programmer Course and Certificate Information	2	5	19	26	47		17	12	29	53	55
70. r/o Debugging	7	15	23	45	82	X	8	2	10	18	55
71. DOS/TOS Operations	4	15	6	25	47		13	15	28	53	53
72. Programming Techniques for Improved Performance of Programs	9	27	12	48	87	X	5	2	7	13	55
73. Program Analysis for Business Systems	10	22	17	49	89	X	5	1	6	11	55
74. Test Development Procedures	6	26	15	47	85	X	5	3	8	15	55
75. Design of Systems Control and Audit Trails	19	21	11	51	94	X	1	2	3	6	54
76. Documentation Standards	18	23	10	51	94	X	2	1	3	6	54
77. OTHERS	1	1		2	100		a	0			2
86. Fortran	8	7	12	27	56	X	13	8	21	44	48
87. Cobol	22	15	6	43	84	X	6	2	8	16	51
88. RPG	7	6	12	25	47		15	13	28	53	53

Table 10 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	These Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
89.	360 Assembly	9	8	9	26	52	X	13	11	24	48	50
90.	PL/1	3	3	2	8	21		7	23	30	79	38
	OTHERS .											
95.	Systems Analysis Course	13	11	13	37	80	X	7	2	9	20	46
96.	True and False	1	5	12	18	38		18	12	30	62	48
97.	Multiple Choice	3	7	19	29	62	X	12	6	18	38	47
98.	Completion	8	11	16	35	76	X	7	4	11	24	46
99.	Essay	10	11	10	31	66	X	11	5	16	34	47
100.	Programming Problem or Part of	24	15	6	45	94	X	2	1	3	6	48
101.	Combination of 96 and 100	4	6	16	26	55	X	11	10	21	45	47
102.	Combination of 97 and 100	8	11	10	29	69	X	6	7	13	31	42
103.	Combination of 98 and 100	10	17	5	32	74	X	5	6	11	26	43
104.	Case Study Only	2	8	19	29	64	X	9	7	16	36	45
105.	No Test - Just Lab Problems	5	6	16	27	59	X	8	11	19	41	46
106.	Others	2	1		3	100		0	0			3

Table 11

Source of Employee Training

Twenty-three percent of those who responded indicated their employees received their training on the job. Twenty-two percent indicated employees received their training in a four-year college program. Twenty percent indicated employees received training from a manufacturer's school, and 13 percent indicated employees received their training from a private business school. Eight percent received training from a two-year college associate degree program, 7 percent from high school, and 4 percent from a post-high school with the remaining .3 percent from other sources.

TABLE XI

SOURCE OF EMPLOYEE TRAINING

High School	12
On the Job	42
Private Business Schools	24
Schools Sponsored by Manufacturers of Equipment	36
Post High Schools (Technical Schools)	8
Two-Year College Associate Degree Program	14
Four-Year College Program	39
Other	5

Table 12

New Employees Hired in Past Twelve Months
Other Than Key Punch Personnel
and Projected Requirement for Next Twelve Months

Those who responded indicated they had employed 150 during the past twelve months and indicated they would need 142 new employees in the next twelve months.

TABLE XII

PERSONNEL REQUIREMENT

New Employees Hired in Data Processing Department During Past Twelve Months	150
Projected New Employees Needed in Data Processing Department in Next Twelve Months	142

Table 13

Who Do You Think Would Make
the Best Prospective Data Processing Employee

Eighty-eight percent indicated one who has a minimum of 1-1/2 years of formal data processing training plus 1/2 year of on-the-job training would be the best employee. Twelve percent indicated one who has a minimum of two years of experience with little or no formal data processing training.

TABLE XIII

WHO DO YOU THINK WOULD MAKE

THE BEST PROSPECTIVE DATA PROCESSING EMPLOYEE

One Who Has a Minimum of Two Years of Experience With Little or No Formal Data Processing Training	7
One Who Has a Minimum of 1-1/2 Years of Formal Data Processing Training plus 1/2 Year of On-the-job Training	53
One Who Has No Training or Experience in the Data Processing Field	0

Table 14

If You Were Seeking Computer Personnel
Other Than Key Punch Personnel
Where Would You Look. List First and Second Choice

For first choice, 30 percent of the respondents indicated they would look at the employment agency for experienced personnel; 24 percent indicated personnel within the company would be moved; 22 percent indicated those with four-year college degree, and 11 percent indicated other than those listed, such as other companies.

For second choice in personnel recruitment, 29 percent indicated four-year college degree programs, 25 percent indicated two-year colleges offering associate degree in data processing, and 19 percent indicated they would look at employment agencies.

TABLE XIV

IF YOU WERE SEEKING COMPUTER PERSONNEL
OTHER THAN KEY PUNCH PERSONNEL
WHERE WOULD YOU LOOK

	First Choice	Second Choice
Employment Agency (Experienced Personnel)	17	10
Two-Year College Associate Degree in Data Processing	4	13
Private School of Data Processing	1 -	3
Four-Year College (Degree)	12	15
Post High Tech School in Data Processing	2	3
High School Tech in Data Processing	0	1
Within the Company	13	3
Other	6	4

Table 15

Do You Feel It Is Important That a Student Be Trained On Certain Manufacturing Equipment

Sixty-nine percent of those who responded indicated that it made no difference. Thirty-one percent indicated it would be important and cited as their first choice the following computers: 84 percent preferred IBM, 11 percent preferred Honeywell, and 5 percent preferred NCR. As second choice, 58 percent preferred Univac-RCA, 28 percent preferred IBM and 14 percent preferred Honeywell.

TABLE XV

DO YOU FEEL IT IS IMPORTANT THAT A STUDENT BE TRAINED ON CERTAIN MANUFACTURING EQUIPMENT

Yes	19	No	41

If yes, state manufacturer and model, core size. State second choice.

Make	First Choice	Second Choice
	16	2
Honeywell	2	1
NCR	1	4

Summary

More organizations were engaged in data processing service than any other. It was found that very little unit record equipment was still in use and that IBM was still the most prominent supplier of equipment in the data processing field. There were about as many disk units in operation as there were tape units.

Of the personnel employed in the computer industry, more people were engaged in the process of preparing the programs for the computers than were engaged in key punching or computer operation. There were fifty-one different weaknesses listed of new employees.

In answering the question, "How many firms allowed their programmer-systems people to operate the equipment for program testing and to compile their program?", over half indicated they did. It was also indicated the programming language most frequently used was Cobol and the application for which it was used most was payroll, with accounting generally coming in second.

It was felt that all computer personnel should have a course in Basic Concepts and that a course in Computer Application was very important in data processing learning techniques. It was felt Cobol was the most important language to be taught and that programming problems or part of programs was the best to test a student.

It was indicated most of the present employees received their training on the job. It was also indicated that firms would employ almost as many new personnel in the next twelve months as they did in the past twelve months. They also felt that a new employee would be of most value to them if the person had 1-1/2 years of formal data processing training. Yet, if they

were seeking new employees, they would seek experienced employees from an employment agency. It made little or no difference on which type of equipment new employees were trained, but those who did indicate, listed IBM equipment as their first choice.

CHAPTER V

ANALYSIS OF VOCATIONAL-TECHNICAL SCHOOL RESPONSE

Questionnaires were mailed to thirteen Vocational-Technical Schools receiving monies from the State Department of Vocational-Technical Education to support part of their programs.

Returns were received from nine schools or 69.3 percent of those mailed. It should be pointed out that not all questionnaires returned were completed in their entirety.

Table 16

Type of Organization

All questionnaires returned were from schools who were engaged in data processing education and administrative work for the schools.

TABLE XVI

TYPE OF ORGANIZATION

Distribution	Finance	Wholesale Trade	
Transportation	Retail Trade	Education	9
Government	Service	Utilities	
Insurance	Research or Engineering	Manufacturing	
Others			

had been inadequately prepared for work in the field while 41 percent without prior training felt this way. (1)

Richard H. Nielson, United Benefit Life, listed the methods used by United to train programmers in an in-house training program. (4) The programmer trainee was put through a three-level course. The first two levels were an introduction to data processing and the third was learning to do a company problem in Cobol. He was given a case study program after he had learned the basics of Cobol. (4)

The case study problem was one of the company's production programs. It contained a narrative description of the problem, record layouts for all input and output files, pages from the field description manual explaining the contents and use of various fields in the records, a list of control totals required, and a copy of the run book. The problem was a file maintenance problem involving the updating of a master file, the preparation of certain special reports, and the creation of transaction records which were inputs to another program. (4)

To check the totals the trainee obtained was a simple matter when the company used the case study in all of its training programs. This provided a valuable tool in evaluating the performance of the trainee. (4)

The trainee was required to define the problem, determine the solution and then devise the best method of arriving at the solution. The trainee not only learned how to program but also became familiar with department procedures for setting up program compilations and test runs. He learned what information was necessary to put on tape labels and what information was required in the run book. He learned the documentation required by the company. (4)

Table 18

Computers Used by Respondents

The schools who responded indicated 60 percent of the equipment used were RCA-Univac Computers; 10 percent of the computers were NCR, and 30 percent were IBM.

The RCA-Univac was of the second generation nature with one computer using 20K and the balance all using only 10K. The NCR was a Century 50 and the IBM equipment was one 1620 with 20K, one 360/25 with 24K and a 360/50 with 256K.

TABLE XVIII

COMPUTERS USED BY RESPONDENTS

Number	Make and Model	Memory Size	Percentage
1	RCA 301	20K	10
5	RCA 301	10K	50
1	NCR 100	16K	10
1	IBM 360/25	24K	10
1	IBM 360/50	256K	10
1	IBM 1620	20K	10

Table 19

Equipment Used with the Computer

Eighty-three pieces of equipment were listed as being used with the Computers. Forty-eight percent were tape drives, 11 percent were card readers, 10 percent were card punchers, 5 percent were CRT type display units, 1 percent used paper tape punch readers, and 1 percent were listed as other equipment.

TABLE XIX

EQUIPMENT USED WITH THE COMPUTER

Tape Drives	40	Card Punch	9
Disk Drive	9	CRT Display Unit	4
Drums		Paper Tape Punch Reader	1
Data Cells		OCR or OSR	
Printers	10	Remote Terminal Printers	
Card Readers	9	Others	1

Table 20

Personnel

This survey was not designed to seek the classification of personnel in schools as there were instructors, part-time instructors, part-time employees and students. The following were listed: 3 percent system analysts, 3 percent tab operators, 9 percent programmer analysts, 19 percent key punch operators, 15 percent control clerks, 15 percent programmers, 17 percent computer operators, and 19 percent were classified as other.

TABLE XX

PERSONNEL

Systems Analysts	1	Control Clerks	6
Tab Operators	1	Programmers	6
Key Tape Operators		Verifier Operators	
Programmers/Analysts	4	Computer Operators	7
Key Punch Operators	8	Others	8

Table 21

Weaknesses Most Frequently Detected in New Employees

Only three items were listed but it must be remembered that these were students, and part-time student workers.

TABLE XXI

WEAKNESSES MOST FREQUENTLY DETECTED IN NEW EMPLOYEES

Lack of Judgment
Excessive Ambition
Lack of Experience

Table 22

Do Your Programmers Personally Operate the Equipment to Compile and/or Test Their Programs

Six schools who responded said they allowed their personnel to run the equipment; one school did not allow their personnel to run the equipment.

TABLE XXII

DO YOUR PROGRAMMERS PERSONALLY OPERATE THE EQUIPMENT TO COMPILE AND/OR TEST THEIR PROGRAM

Yes	6	No	1	If Time Permits	7

Table 23

Programming Language Used or Taught in Your Organization

The total number of responses to this section was thirty-seven. Twenty-two percent stated they taught Fortran with 62 percent stating they spent between 12 and 24 percent of their time teaching this language. Twenty-two percent stated they taught Cobol with 38 percent stating they spent between 12 and 24 percent of their time teaching this language and another 38 percent stating they spent between 20 and 36 percent teaching this language. Twenty-four percent of the response stated they taught Assembly Language with 33 percent spending between 12 and 24 percent and 33 percent spending between 25 and 36 percent of their time teaching this language. Twenty-two percent of the 24 percent stated they spent 75 to 89 percent of their time on Assembly Language; 16 percent of the total said they taught RPG with 66 percent of them spending between 12 and 24 percent of their time on this language. Sixteen of the total stated they spent time on other languages with 50 percent of them spending 25 to 31 percent teaching these other languages.

Table 24

Applications

Most schools did not respond to this section as well as anticipated. It was felt by the investigator that schools had never classified their problems as stated yet may teach a part of this type problem. The fifteen most responded to applications are listed as follows:

TABLE XXIII

PROGRAMMING LANGUAGE USED OR TAUGHT IN YOUR ORGANIZATION

Language	Less Than 12 Percent	More Than 12 Percent Less Than 25 Percent	More Than 25 Percent Less Than 37 Percent	More Than 37 Percent Less Than 50 Percent	More Than 50 Percent Less Than 66 Percent	More Than 66 Percent Less Than 75 Percent	More Than 75 Percent Less Than 90 Percent	More Than 90 Percent	Total Number
Fortran	2	5	1						8
Cobol		3	3	1	1				8
Assembly		3	3	1			2		9
RPG	2	4							6
Others	1	2	3						6

Applications Most Responded To	Number of Responses	Percentage of Total Who Gave Percent	Time Spent of Those Who Gave Percent
1. School Records	7	70	40 Percent spent between 30 and 49 percent of their time.
2. Accounting	4	50	100 percent spent between 5 and 10 percent of their time.
3. Sales Accounting	4	50	50 percent spent less than 5 percent of their time. 50 percent spent between 5 and 10 percent of their time.
4. Other	4	100	75 percent spent more than 75 percent of their time.
5. Data Communication	3	33	100 percent spent between 11 and 19 percent of their time.
6. Depreciation	3	33	100 percent spent less than 5 percent of their time.
7. Inventory Control	3	66	100 percent spent less than 5 percent of their time.
8. Payroll	3	33	100 Percent spent between 5 and 10 percent of their time.
9. Accounts Payable	2	50	100 percent spent between 5 and 10 percent of their time.
10. Accounts Receivable	2	50	100 percent spent less than 5 percent of their time.

Applications Most Responded To	Number of Responses	Percentage of Total Who Gave Percent	Time Spent of Those Who Gave Percent
11. Mailing List	2	50	100 percent spent less than 5 percent of their time.
12. Management Information Report	2	50	100 percent spent less than 5 percent of their time.
13. Personnel Reports	2	50	100 percent spent between 5 and 10 percent of their time.
14. Sales Analysis	2	50	100 percent spent between 5 and 10 percent of their time.
15. Statistical Analysis	2		Did not respond as to percent of time spent.

Table 25

Data Processing Learning Techniques

Of those who responded to this section only nine items were rated most important, four sharing most important with highly important or important. Thirty items were listed as highly important with eight items sharing most important and important. Forty-eight items were listed as important with seven items sharing with most important and highly important and four items sharing with little or of no importance.

TABLE XXIV

APPLICATIONS

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent Less Than Percent	Total Percent Response	Total Response
Accident Reporting									1
Accounting (General)		2						2	4
Accounting Journal Entry									1
Accounts Payable		1						1	2
Accounts Receivable		1						1	2
Actuarial Services									
Advertising Invoicing									
Advertising Scheduling									
Agricultural Economic Research									
Aircraft Component Control									

Table 24 (continued)

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent	Total Percent Response	Total Response
Amortization Schedules									1
Automobile Travel Allowance									
Bank Management Information									
Bill of Materials									
Billing and Invoicing	1								1
Budget Management									
Cash Control									
Commission Accounting									
Cost Accounting									
Charge Account Billing									
Commodities Reporting									

Table 24 (continued)

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent	Total Percent Response	Total Response
Communication Systems		1						1	1
Cost Control									
Credit Accounting									
Customer Accounting	1							1	1
Data Communication			1					1	3
Demand Deposits									
Depreciation	1							1	3
Disbursements									1
Dividend Payments									1
Drafting									
Engineering Design									
Expense Allocation	1							1	1

Table 24 (continued)

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent	Total Percent Response	Total Response
Financial Statements	1							1	1
Fixed Assets Accounting									
General Ledger Accounting									
Group Insurance									
Hospital Patient Accounting									
Hospital Patient Information									
Hospital Statistics									
Installment Loans									
Insurance Agents Performance Analysis									
Insurance Premium Accounting									
Inventory Control	2							2	3

Table 24 (continued)

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent	Total Percent Response	Total Response
Labor Analysis									
Labor Control									
Labor Cost Reports									
Linear Programming									
Mailing List	1							1	2
Management Information Reports	1							1	2
Market Research									
Medical Accounting									
Mortgage Loan Accounting									
Motor Vehicle Maintenance Records									
Multiple Regression Analysis									

Table 24 (continued)

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent	Total Percent Response	Total Response
Numeric Analysis									
Order Billing									
Order Entry									
Payroll		1						1	3
Personnel Records		1						1	2
PERT System									
Production Control									
Production Cost Analysis									
Production Planning									
Production Reporting									
Production Scheduling									
Sales Accounting	1	1						2	4

Table 24 (continued)

Application	Less Than 5 Percent	More Than 5 Percent Less Than 11 Percent	More Than 11 Percent Less Than 20 Percent	More Than 20 Percent Less Than 30 Percent	More Than 30 Percent Less Than 50 Percent	More Than 50 Percent Less Than 75 Percent	More Than 75 Percent	Total Percent Response	Total Response
Savings Accounts									
Savings and Loan Accounting									
Sales Analysis		1						1	2
Sales Reporting									
Statistical Analysis									2
School Records		1		2		2		5	7
Utilities Billing					1	7		4	4

Percent Of Total Response	Most Important	Percent of Total of Category 1
100	Basic Concepts	73
100	Computer Applications	*50*
100	*Developing The Solution	38
100	Flowing Charting	44
75	*Management Information System Design	*50*
100	*Registers	33
100	*Cobol Report Writing	33
75	Design of System Control and Audit Control	50
100	Documentation Standards	*50*

Percent Of Total Response	Highly Important	Percent of Total of Category 1
87	Assembly Programs and Compilers	43
89	Report Generators	63
78	Utility Programs	43
67	Monitor and Supervising	67
100	Looping and Indexing	44
100	Subroutines	63
100	*Programming a Tape System	*50*
100	Program Testing	*56*
50	Translators	50
100	Requirements of the Systems	50
100	*Developing the Solutions	38
100	Systems Control	63

Percent Of Total Response	Highly Important (continued).	Percent of Total of Category 1
100	*Finalizing the System	50
100	Program Debugging	50
100	Card Design	44
100	Data File Design	44
100	Specification Writing	67
75	*Work Simplification	50
100	System Planning	77
87	Project Control	57
100	Logic	56
100	Numbering Systems	56
100	Computer Logic	56
100	*Registers	33
100	*Cobol Report Writing	33
87	Cobol Sort Verbs	56
71	Binary Search Techniques	60
62	*DOS/TOS Operations Training	40
100	*Program Techniques for Improved Performance of Programs	38
87	*Test Development Procedures	43

Percent Of Total Response	Important	Percent Of Total Of Category 1
75	Macro Generators	67
78	*Utility Programs	43
100	Data Scheduling	88

Percent Of Total Response	Important (continued).	Percent Of Total Of Category 1
78	Sort Merges Programming	86
100	*Programming a Tape System	50
87	Macro Programming	70
100	Programming Random Access Devices	62
50	*Translators	50
100	Input-Output Control	62
100	The Approach	50
100	Data Control	50
100	System Evaluation	62
100	*Finalizing the System	50
100	System Implementation	75
50	Pert	50
87	Multiprogramming	57
75	Multiprocessing	67
75	Time Sharing	67
87	Decision Tables	71
75	*Management Information System Design	50
63	Operation Analysis	60
100	Procedure Writing	62
100	Form Design	50
57	Work Measurement	100
57	Work Sampling	100
75	*Work Simplification	50
87	System Presentation	57

Percent Of Total Response	Important (continued)	Percent Of Total Of Category 1
75	Work Load Evaluation	67
87	Maintaining Program Library	57
86	Maintaining Magnetic Tape Library	82
88	Operating Computer Console	50
100	Card Layout and Design	62
100	Data Scheduling System	75
56	Boolean Algebra	80
87	Fixed and Floating Point	57
100	*Register	33
100	*Cobol Report Writing	33
100	Interpret Core Dump	50
87	Data Communication Concepts	57
50	*Microfilm Information System	75
62	Documents Retrival and Display Techniques	60
87	Effective Listing	43
62	Supervisory Training	60
50	*Registrar Business Program and Certification Information	50
50	*DOS/TOS Operations Training	40
100	*Program Techniques for Improved Performance of Programs	38
100	Program Analysis for Business Systems	50
87	Test Development Procedures	43

Languages and Systems

Percent Of Total Response	Most Important	Percent Of Total Of Category 1
100	Cobol	89
100	RPG	43
100	360 Assembly	56
80	System Analysis Course	50

Percent Of Total Response	Highly Important	Percent Of Total Of Category 1
67	Fortran	67

Testing of Students

Percent Of Total Response	Most Important	Percent Of Total Of Category 1
100	Program Problem or Part of	62

Percent Of Total Response	Highly Important	Percent Of Total Of Category 1
50	*True and False	75
78	Multiple Choice	57
88	Completion	75
88	Essay	62
57	*Combination of 96 and 100	50
71	Combination of 97 and 100	60
86	Combination of 98 and 100	67

Percent Of Total Response	Important	Percent Of Total Of Category 1
57	*Combination of 96 and 100	50
57	Case Study Only	100

Learning Technique That Was Thought Little Or No Importance

** Translators

Simulator

** Pert

Job Timing

** Microfilm Information System

** Register Business Programming Course and Certification Information

I 0 Debugging

PL 1

* True and False Questions

No Test, Just Lab Problems

Note: Items with * appeared in more than one rating with the same percentage.

TABLE XXV

DATA PROCESSING LEARNING TECHNIQUES

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
1.	Basic Concepts	7	2	a	9	100	X	a	0			9
2.	Assembly Programs and Compilers	2	3	2	7	87	X	1		1	13	8
3.	Macro-Generators		2	4	6	75	X	1	1	2	25	8
4.	Reports Generators		5	3	8	89	X		1	1	11	9
5.	Utility Programs	1	3	3	7	78	X	2		2	22	9
6.	Data Scheduling System		1	7	8	100	X					8
7.	Sort-Merges Programming		1	6	7	78	X	2		2	22	9
8.	Monitors and Supervisory Systems		4	2	6	67	X	2		2	33	8
9.	Computer Applications	4	3	1	8	100	X					8
10.	Looping and Indexing	2	4	3	9	100	X					9
11.	Subroutines	1	5	2	8	100	X					8
12.	Programming a Tape System		4	4	8	100	X					8
13.	Macro-Programming		2	5	7	87	X	1		1	13	8

Table 25 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 5° Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
14.	Programming Random Access Devices	1	2	5	8	100	X					8
15.	Program Testing	2	5	2	9	100	X					9
16.	Translators		2	2	4	50	X	3	1	4	50	8
17.	Input-Output Control System	1	2	5	8	100	X					8
18.	Simulators			3	3	38		3	2	5	62	8
19.	The Approach	1	3	4	8	100	X					8
20.	Requirements of the System	1	4	3	8	100	X					8
21.	Developing the Solution	3	3	2	8	100	X					8
22.	Data Controls	1	3	4	8	100	X					8
23.	System Controls	1	5	2	8	100	X					8
24.	System Evaluation	2	1	5	8	100	X					8
25.	Finalizing the System		4	4	8	100	X					8
26.	System Implementation		2	6	8	100	X					8
27.	Program Debugging	2	4	2	8	100	X					8
28.	PERT			4	4	50	X	2	2	4	50	8

Table 25 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
29.	Multiprogramming	1	2	4	7	87	X		1	1	13	8
30.	Multiprocessing	1	1	4	6	75		1	1	2	25	8
31.	Time Sharing	1	1	4	6	75		1	1	2	25	8
32.	Card Design	2	4	3	9	100						9
33.	Data File Design	2	4	3	9	100						9
34.	Specification Writing		6	3	9	100						9
35.	Flow Charting	4	3	2	9	100						9
36.	Decision Tables		2	5	7	87		1		1	13	8
37.	Management Information System Design	3		3	6	75		1	1	2	25	8
38.	Operational Analysis		2	3	5	63		3		3	37	8
39.	Procedure Writing	1	2	5	8	100						8
40.	Form Design	2	2	4	8	100						8
41.	Work Measurement			4	4	57		3		3	43	7
42.	Work Sampling			4	4	57		3		3	43	7
43.	Work Simplification		3	3	6	75		2		2	25	8
44.	System Planning	1	7	1	9	100						9

Table 25 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
45.	Project Control		4	3	7	87		1		1	13	8
46.	System Presentation		3	4	7	87		1		1	13	8
47.	Work Load Evaluation		2	4	6	75		2		2	25	8
48.	Maintaining Program Library	1	2	4	7	87	X		1	1	13	8
49.	Maintaining Magnetic Tape Library		1	5	6	86	X		1	1	14	7
50.	Operating Computer Console	1	3	4	8	88	X		1	1	12	9
51.	Job Timing							7	1	8	100	8
52.	Card Layout and Design	2	1	5	8	100	X					8
53.	Data Scheduling System	1	1	6	8	100	X					8
54.	Boolean Algebra		1	4	5	56	X	3	1	4	44	9
55.	Logic	1	5	3	9	100	X					9
56.	Fixed and Floating Point		3	4	7	87	X	1		1	13	8
57.	Numbering Systems	1	5	3	9	100	X					9
58.	Computer Logic	2	5	2	9	100	X					9

Table 25 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
59.	Registers	3	3	3	9	100	X					9
60.	Cobol Report Writing	3	3	3	9	100	X					9
61.	Cobol Sort Verbs	1	4	2	7	87	X		1	1	13	8
62.	Binary Search Technique		3	2	5	71	X	1	1	2	29	7
63.	Interpret Core Dump	1	3	4	8	100	X					8
64.	Data Communications Concepts	2	1	4	7	87	X		1	1	13	8
65.	Microfilm Information Systems		1	3	4	50	X	2	2	4	50	8
66.	Document Retrieval and Display Techniques		2	3	5	62	X	1	2	3	38	8
67.	Effective Listening	2	2	3	7	87	X		1	1	13	8
68.	Supervisory Training	1	1	3	5	62	X	2	1	3	38	8
69.	Registered Business Programmer Course and Certificate Information			4	4	50	X	2	2	4	50	8
70.	I/O Debugging		2	1	3	43		2	2	4	57	7
71.	DOS/TOS Operations Training	1	2	2	5	62	X	1	2	3	38	8

Table 25 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	These Above 5° Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
72.	Programming Techniques for Improved Performance of Programs	2	3	3	8	100	X					8
73.	Program Analysis for Business Systems	2	2	4	8	100	X					8
74.	Test Development Procedures	1	3	3	7	87	X	1		1	13	8
75.	Design of Systems Control and Audit Trails	3	1	2	6	75	X	1	1	2	25	8
76.	Documentation Standards	4	2	2	8	100	X					8
77.	OTHERS											
86.	Fortran		4	2	6	67	X	3		3	33	9
87.	Cobol	8	1		9	100	X					9
88.	RPG	3	2	2	7	100	X					7
89.	360 Assembly	5	3	1	9	100	X					9
90.	PL/1		2	1	3	43		1	3	4	57	7
	OTHERS											
95.	Systems Analysis Course	2	1	1	4	80	X		1	1	20	5
96.	True and False		3	1	4	50	X	4		4	50	8

Table 25 (Continued)

	DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Total	Percent of Total Received	Those Above 50 Percent	of Little Importance	of No Importance	Total	Percent of Total Received	Total Replies
97.	Multiple Choice		4	3	7	78	X	2		2	22	9
98.	Completion		6	2	8	88	X	1		1	12	9
99.	Essay	1	5	2	8	88	X		1	1	12	9
100.	Programming Problem or Part Of	5	2	1	8	100	X					8
101.	Combination of 96 and 100		2	2	4	57	X	3		3	43	7
102.	Combination of 97 and 100		3	2	5	71	X	2		2	29	7
103.	Combination of 98 and 100	2	4		6	86	X	1		1	14	7
104.	Case Study Only			4	4	57	X	3		3	43	7
105.	No Test - Just Lab Problems			3	3	43		2	2	4	57	7

Table 26

Where Did Your Employees Receive Their Essential Training

Twenty-seven percent indicated that their employees received their training on the job; 27 percent indicated that training was received in a

two-year college associate degree program; 20 percent trained in schools sponsored by manufacturers of equipment; 7 percent received their training in high schools, and 7 percent received it in post high schools.

TABLE XXVI

WHERE DID YOUR EMPLOYEES RECEIVE THEIR ESSENTIAL TRAINING

High School	1
On the Job	4
Private Business Schools	
Schools Sponsored by Manufacturers of Equipment	3
Post High Schools (Technical Schools)	1
Two-Year College Associate Degree Program	4
Four-Year College Program	2
Other	15

Table 27

New Employees Hired and Projected New Employees

A total of six new employees were hired during the past 12 months and the schools expected to employ two more during the next twelve months.

Table 28

Who Do You Think Would Make the Best Prospective Data Processing Employee"

Of those who responded, 10 percent felt that the person who had 1-1/2

years of formal data processing training and 1/2 years of on-the-job training would make the best prospective data processing employee.

TABLE XXVII

NEW EMPLOYEES HIRED AND PROJECTED NEW EMPLOYEES

New Employees Hired in Data Processing Department Past Twelve Months	6
Projected New Employees Needed in Data Processing Department Next Twelve Months	2

TABLE XXVIII

WHO DO YOU THINK WOULD MAKE THE BEST PROSPECTIVE DATA PROCESSING EMPLOYEE

One Who Has a Minimum of Two Years of Experience With Little or No Formal Data Processing Training	
One Who Has a Minimum of One and One-Half Years of Formal Data Data Processing Training Plus One-Half Year of On-The-Job Training	8
One Who Has No Training or Experience in the Data Processing Field	

Table 29

If You Were Seeking Computer Personnel
Other Than Key Punch Personnel
Where Would You Look

Those who responded to this section: 50 percent indicated they would

seek those with two-year college associate degree in data processing, 37 percent indicated they would seek those with post high tech schools with data processing training and 13 percent indicated they would seek those with four-year college degrees in personnel and employment agency, two-year college associate degree in data processing, private school of data processing shared 20 percent each as second choice.

TABLE XXIX

IF YOU WERE SEEKING COMPUTER PERSONNEL
OTHER THAN KEY PUNCH PERSONNEL
WHERE WOULD YOU LOOK

	First Choice	Second Choice
Employment Agency (Experience Personnel)		1
Two-Year College Associate Degree in Data Processing	4	1
Private School of Data Processing		1
Four-Year College (Degree)	1	2
Post High Tech School of Data Processing	3	
High School Tech in Data Processing		
Within the Company		

Table 30

Do You Feel It Is Important That a Student Be Trained On a Certain Manufacturer's Equipment

Fifty percent indicated they felt it was important and they felt they should have IBM equipment for their first choice and Univac and Honeywell

shared equally for second choice.

TABLE XXX

DO YOU FEEL IT IS IMPORTANT THAT A STUDENT BE TRAINED ON A CERTAIN MANUFACTURER'S EQUIPMENT

Yes	4	No	4

If yes, state manufacturer and model, core size. State second choice.

Make and Model	Core Size	First Choice	Second Choice
IBM 360		X	
IBM 360/370		X	
IBM 360/370		X	
Univac			X
Honeywell			X

Summary

Questionnaires were mailed to thirteen Vocational-Technical Schools with nine schools responding. All schools were engaged in teaching data processing and doing some kind of work for the school system or other school systems.

Fifteen pieces of unit record gear were still in use or were being used in the teaching of data processing. Sixty percent of the computers in use in the schools were second generation RCA-Univac with IBM and NCR making up the balance of the equipment. A total of eighty-three pieces of equipment were being used with the computer with 48 percent being tape drives, 11 percent being disk units, 5 percent CRT-type display units, and the balance of the equipment made up of readers, puncher, paper tape punch units and other equipment.

This survey was not designed to seek the classification of personnel, but it was found that the schools do classify some of the personnel they employ. The two largest classifications were key punch personnel and other, which had 19 percent in each category. Weaknesses most detected in new employees were lack of judgement, excessive ambition, and the lack of experience. Eighty-six percent of those replying indicated they allowed their personnel, which in this case would also include students, to operate the equipment.

In response to the questions as to what programming language was used or taught in the organization, it was found that 22 percent taught Fortran with 62 percent spending between 12 and 24 percent of their time teaching the language. Cobol was taught by 22 percent of those who responded with 38 percent of those spending between 25 and 36 percent of their time

teaching the language. Assembly Language was taught 24 percent of the time with 33 percent spending 12 to 25 percent of the time teaching Assembly and 33 percent spending between 25 and 37 percent of the time teaching Assembly. Thus, Assembly was the language taught most often in the schools which responded to the survey.

The response to the type of application used by the school was limited. It was felt by the investigator that schools did not classify the problems they used. The most frequest response was to school application with 70 percent of those who responded, by giving percent of time, indicating that 40 percent of the 70 percent spent between 30 and 50 percent of the time on this type of application and another 40 percent spent more than 75 percent of their time on this type of application. The application which received the second-most frequent response was accounting with 50 percent of those responding giving the percent of time they spent on the application. They indicated they spent between 5 and 10 percent of their time on this application.

The schools indicated they felt nine items were most important with four of these items sharing equally as highly important. The item that was felt most important was basic concepts, with computer applications and documentative standards sharing equally for second place. There were seven items which they felt had little or no importance.

The schools felt Cobol was the most important language and Fortran was highly important. The schools also felt the best type of test to give was a program or part of one with completion rating highly important as the second-best type of question to give.

Most of the training received by those who worked at the schools was received either on the job or through a two-year associate degree program and 20 percent received their training from a school sponsored by the manufacturer. A total of six new employees had been hired during the past year with a projected need of only two. It was indicated the schools felt the 1-1/2 year's formal training with 1/2 year of on-the-job training was adequate.

If the school was seeking personnel, 50 percent indicated they would seek a person with a two-year associate degree. Fifty percent felt that students and/or employees should be trained on IBM equipment.

CHAPTER VI

COMPARATIVE ANALYSIS

This chapter presents a comparison of the findings of the response of industry to that of the Vocational-Technical Schools.

A comparison was also made of the industry findings to pertinent literature reviewed. Figures were compiled to show the comparison of response from industry and Vocational-Technical Schools.

Questionnaire Responses Compared

The comparison of unit record equipment in industry and in schools was as follows: a greater percentage of accounting machines in schools than in industry, the same percentage of sorters in industry and in the Vocational-Technical Schools, and a lower percentage of other type equipment in use in Vocational-Technical Schools than in industry.

In comparing the computers used most frequently, more computers in use in industry were made by IBM, whereas more computers in use in the Vocational-Technical Schools were made by RCA-Univac. Honeywell brand was the second-most used computer in industry as compared to IBM for the second most used in the Vocational-Technical Schools.

A comparison was made relative to the percentage of the total equipment used by industry and the Vocational-Technical Schools by individual items. Almost an equal number of tape drives and disk drives were used, whereas, in the Vocational-Technical Schools more than four times as many tape units as disk units were in use. Also there were 1.7 times more tape stations in use in the schools than in industry. There were 2.4 times

more disk drives in use in industry than in the Vocational-Technical Schools. The comparison was limited to tape-disk units which represented two types of storage devices requiring different types of programming and yet doing the same thing. All other equipment used with the computer have different uses and most are required, to have an efficient operation with the exception of the CRT-type display unit. The CRT-type display represents a type of on-line information retrieval system which is on the increase, yet 2.8 times more were found in industry than in the Vocational-Technical Schools.

A comparison of personnel in industry relative to that of the Vocational-Technical Schools would serve no functional use since their objectives are different. However, it was interesting to note the percentage of operating-type personnel was very close. It was found that 22 percent of industrial personnel devoted their time to key punching, whereas in the Vocational-Technical Schools it was found to be 19 percent. In the area of computer operation it was found that 16 percent devoted their time to operations as compared to 17 percent in the Vocational-Technical Schools.

In the area of computer use by programmers, it was determined that the Vocational-Technical Schools allow their personnel-student to test and compile their programs 1.5 times more than in industry.

The language used in industry compared to the language taught in Vocational-Technical Schools would seem very important if the school expects to turn out a productive employee. It was found that Fortran was taught 1.2 times more than it was used in industry. In addition, Cobol was used 1.4 times more in industry than it was taught in vocational schools.

Also, Assembly Language was taught almost as much as it was used in industry. RPG was used equally in industry to that taught in the Vocational-Technical Schools. Other languages were taught more than used in industry.

A comparison of application was made by using what industry felt were the fifteen most important. It was found that the application most used in industry was payroll with 71 percent indicating they made use of this application whereas in the Vocational-Technical Schools they used or taught this application only 33 percent of the time. The second-most used application in industry was a General Accounting application which was used by 63 percent of those who responded as compared to 44 percent taught or used by the schools who responded. Twenty-two percent of the Vocational-Technical Schools indicated they taught or used the Accounts Receivable application as compared to 63 percent using this application in industry. No Vocational-Technical Schools indicated they used the General Ledger Accounting application whereas this application was used by 55 percent of those who responded to the survey. The Accounts Payable application was used by 52 percent of those who responded in industry and only 22 percent of the Vocational-Technical Schools. The Billing and Invoicing application was used in industry by 45 percent of those who responded as compared to only 11 percent of the Vocational-Technical Schools. Management and Information Report application was used by 43 percent of those who responded from industry as compared to only 22 percent of the Vocational-Technical Schools. The Mailing List application was used by 42 percent of those who replied in industry as compared to only 22 percent of those in the Vocational-Technical Schools. Forty percent of the

industry responding used the Personnel application as compared to only 22 percent of those in the Vocational-Technical Schools. Financial statement was used by only 11 percent of the Vocational-Technical Schools as compared to 40 percent by the industry respondents. Thirty-seven percent of the industry respondents used the Sales Analysis application as compared to 22 percent of the Vocational-Technical Schools. Eleven percent of the Vocational-Technical Schools used the Accounting Journal Entry application as compared to 34 percent by industry. The Vocational-Technical Schools did not use the Cost Accounting or the Fixed Asset Accounting, whereas this application was used 32 percent and 29 percent, respectively, in industry.

The question with regard to Learning Techniques of Data Processing was really the heart of the entire questionnaire and this is where it was hoped to find what industry thought to be important relative to the knowledge and skills of employees when they are employed.

Importance of each was determined by marking them most important, highly important, important, and little or no importance. A comparative analysis was made on questions rated by a minimum of 50 percent of the respondents by marking it most important, highly important, or important. Industry response was the basis for comparison.

Eleven Learning Techniques were responded to in the most important category by industry, as follows:

1. Basic Concepts
2. Development of the Solution
3. Program Testing
4. Program Debugging

5. Effective Listening
6. Requirements of the System
7. System Implementation
8. The Approach to the System
9. Logic
10. Computer Applications
11. System Evaluation

Responses ranged from 56 percent of those who responded to the most important, highly important and important to the lowest of 40 percent. As a comparison, the Vocational-Technical Schools responded to only three Learning Techniques in this section as most important. They were as follows:

1. Basic Concepts
2. Development of the Solution
3. Computer Applications.

The Vocational-Technical Schools responded to three of these Learning Techniques as highly important:

1. Program Testing
2. Program Debugging
3. Requirements of the System

and five of them as only important:

1. Effective Listening
2. System Implementation
3. Logic
4. The Approach to the System
5. System Evaluation

The Learning Techniques industry responded to which they indicated were highly important are as follows:

1. Data File Design
2. Program Techniques for Improved Performance of Programs
3. Test Development Procedures
4. Flow Charting
5. Finalizing the System
6. Data Control
7. Programming Random Access Devices
8. System Control
9. Form Design
10. Project Control
11. Program Analysis for Business Systems
12. Documentation Standards
13. Input-Output Control
14. Multiprogramming
15. Design of System Control
16. Specification Writing
17. Procedure Writing
18. Subroutines
19. Interpret Core Dump

Vocational-Technical Schools responded to eight of the above Learning Techniques as highly important, which are listed below:

1. Data File Design
2. Program Technique for Improved Performance of Programs
3. Test Development Procedure

4. Finalizing the System
5. Systems Control
6. Project Control
7. Specification Writing
8. Subroutines

Vocational-Tec.hnical Schools responded to three of the nineteen Learning Techniques listed above as most important:

1. Flow charting
2. Documentation Standards
3. Design of Systems Control

Vocational-Technical Schools responded to eight of the nineteen Learning Techniques listed above as only important:

1. Data Control
2. Programming Random Access Devices
3. Form Design
4. Program Analysis for Business Systems
5. Input-Output Control
6. Multiprogramming
7. Procedure Writing
8. Interpret Core Dump

Thirty-seven Learning Techniques were thought to be important by industry compared to only twenty-three thought to be important by Vocational-Technical Schools. Vocational-Technical Schools thought twelve of these thirty-seven Learning Techniques to be highly important and two of little or no importance.

The questions regarding what type of languages should be taught as

well as a systems analysis course were important. Industrial respondents indicated they thought it most important that Cobol and a systems analysis course should be taught, and they divided their responses on the Assembly course with an equal percentage of response with the important category. The Vocational-Technical Schools were in agreement with industry and in all three courses gave an equal or larger percent response than industry did. However, the Vocational-Technical Schools thought Assembly to be most important.

Industry did not feel any of the language courses were highly important, whereas the Vocational-Technical Schools gave the most response to Fortran. Industry gave the most response to Fortran under the important category. This would indicate Vocational-Technical Schools did not believe it was too important to teach Fortran, and industry thought it even less important to teach Fortran.

It should be noted that Vocational-Technical Schools thought RPG to be most important. The need for such a course would vary depending on the computers in the area of the schools.

Vocational-Technical Schools', response to the type test which should be given was certainly in agreement with that of industry as they both thought the most important type test was programming problems or part of problems. The Vocational-Technical Schools' response was greater than industry.

Industry thought three other types of tests were highly important whereas the Vocational-Technical Schools thought these three and four more were highly important. In all cases, the percentage of response by Vocational-Technical Schools was greater than that of industry.

Industry respondents listed five they thought were important types of testing. Of these five, the Vocational-Technical Schools thought only two of them important with two of the remaining three to be highly important and one to be of little or no importance.

The question, "Is it important that students should be trained on a certain manufacturer's equipment?" was asked. Sixty-nine percent of industry respondents indicated it made no difference as to the type of equipment they were trained on, whereas 31 percent indicated it was important. The Vocational-Technical Schools were split fifty-fifty on the question. The respondents in industry who indicated "yes" were asked to state what manufacturer's equipment they felt the student should be trained on as a first and second choice. Eighty-four percent of industry's respondents indicated it should be IBM as first choice and 58 percent indicated Univac as their second choice as compared to the Vocational-Technical Schools, which also indicated IBM as first choice, with a fifty-fifty split for Honeywell and Univac as second choice.

In Chapter II three particular studies or authors were described as being worthy of comment. The three most noteworthy studies are discussed with relation to the findings of this investigator.

F. Bangs and M. Hillstead Study(l)

The study stated the IBM 360-30 would be used extensively by the majority of companies. We found only four IBM 360-30 in use by respondents of this study, whereas we found twelve IBM 360-40 or just 10K larger than they predicted. We did not find a widespread use of time sharing, yet it does appear to be growing. RPG and PL/l programming languages did not grow as was expected, but it is noteworthy that PL/l never did get off

the ground and RPG is used by the smaller computer systems. The need for more emphasis on training of system personnel was borne out by this study.

Findings comparing data processing curriculum have pointed out that the student should be trained in the total system approach and the schools are still not satisfying this need.

The investigator would agree with this study as the result of his study, that an in-depth analysis of course offerings in data processing still needs to be made.

Richard H. Neilson - United Benefit Life Article (4)

This article indicated United Benefit Life puts their employees through a two-level introduction course followed by a case study of a company's production program. It further pointed out the case study would be worked in Cobol. The research study backed this up on an industry-wide basis as introduction to data processing was listed as one of the most important Learning Techniques, Application was listed as one of the most important Learning Techniques and Cobol was the programming language that was used most of the time and was most important as far as Learning Techniques.

The company used the student's program (case study) to evaluate his performance. Industry felt this was not the most important means of testing the student, but thought it was an important means of testing his performance. The Vocational-Technical Schools felt the same way.

J. David Benivati, Xerox Corporation(2)

In the article by Mr. Benivati, he pointed out that lists of objectives should be sorted according to hierarchy of learning. The

investigator's study has sorted into three groups what industry thought was most important, highly important and important. This should be a guide to developing a curriculum for the schools according to how industry sorted out these objectives.

Summary

A comparison of industry's desires or their needs versus Vocational-Technical Schools' desires or needs would indicate that if the schools are going to meet the needs of industry, they will have to update their equipment and develop some application-type problems to be used in the classroom which will more nearly represent the fifteen most used applications in industry.

The schools should review their teaching techniques to see if they are meeting the desires, thinking and needs of industry.

To meet the needs of industry, it would appear from the comparison that more emphasis should be placed on the programming language of Cobol and more emphasis on Systems Courses.

CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The primary purpose of this study was to investigate the following research questions:

1. Were there differences in the types of programming languages most often used in industry and those most often taught by the Vocational-Technical Schools in Oklahoma?
2. Were there differences in the types of applications most often used by the instructor for lab problems in Vocational-Technical Schools of Oklahoma and the type of applications most often used in industry?
3. Were there differences in the recommendations by industry as to learning techniques from those used by Vocational-Technical Schools in Oklahoma?
4. Were there differences in the recommendations by industry as to the type test which should be given than those which were given by Vocational-Technical Schools in Oklahoma?

This chapter is concerned with summarizing the findings, drawing conclusions from these findings and making recommendations based on these conclusions.

Summary

The following is a brief summary of the findings:

1. The programming language most often used by industry could be identified. The programming language most often taught by the Vocational-Technical Schools could be identified. The investigator

found that Cobol was most used in industry and that Assembly Language was most often taught in Vocational-Technical Schools in Oklahoma.

2. The fifteen most important applications used by industry could be identified whereas the fifteen most important applications used as lab problems could not be precisely identified. Of the fifteen which were felt most important by industry, only twelve were used or taught as the most important by the Vocational-Technical Schools of Oklahoma.
3. Industry's responses to what they thought most important in Learning Techniques were very clearly defined; the importance placed by Vocational-Technical Schools of Oklahoma were quite different from those of industry. The investigator found a very definite difference of opinion in this area.
4. The investigator found that industry was in agreement with Vocational-Technical Schools of Oklahoma on the type test which should be given programming students.

Conclusion

Data processing as it is known today is young in relation to many other professions. It was only a short time ago that the computers were large and only a few companies had them. In 1964 data processing advanced greatly with the development of the third generation equipment by IBM's announcement of the 360 series of computers. Today many of these computers are still in operation and the 360 is the basis for today's education in the computer field.

There is more standardization today of languages and more refinement in their uses, and an attempt to develop a language to bridge the gap between the scientific field and business data processing. As of this date, no generally accepted language has been developed to fill this need. Therefore, several languages are in use in the data processing field. Education should try to meet the needs of industry by teaching the language which most industries in the area use.

Today's type of data processing organization is quite different from that of a very few years ago because of the cost of maintaining an installation. As long as business growth was rapid, no one looked at the cost of data processing, but when the growth slowed down, businesses looked for ways to cut the cost of their own operations. As a result, many firms went into the service business to help cut their costs. This would seem to indicate our students must be able to understand and develop programs for a wide variety of businesses and also be able to communicate with a wide variety of people other than those in the organization where they are employed.

Unit record gear was the basis of today's computer industry and much of the same logic used in the unit record equipment is used in today's computers. But, due to the speed of today's computer, most of the unit record equipment is being phased out or has been phased out. This study supports this because only 8 percent of the unit record equipment is of an accounting nature. This should indicate to education that any money spent on this type of education or equipment would be a waste of the taxpayer's dollar.

This survey was not designed to make a survey of equipment but to determine the type of equipment the student might expect to find and to what extent this should affect what is to be taught. Differences in various types of equipment require different programming. Some information on the most popular equipment must be included so the student will be at least aware of some of the differences.

What type equipment is used with the CPU is of great importance to education. If Vocational-Technical Schools teach only the use of tape systems in their programs, the student will be placed at a great disadvantage if he must program a disk system. As the survey pointed out, there are about as many disk systems as tapes and of course disks hold many more bytes of information than tapes. The survey pointed out that some installations have both disks and tapes in their organization. The survey indicated that 16 percent operated on a strictly disk system and 10 percent operated on a strictly tape system. Therefore, this indicates strong consideration must be given to programming of both disk and tape systems in our educational institutions. The survey pointed out there were 157 CRT units. This would also indicate that education must give some consideration to programming of a CRT unit or terminal devices.

An analysis of the survey indicates that over 1/3 of the jobs in data processing are in the area of program preparation, 22 percent of the jobs are in the keypunch area and 16 percent of the jobs are in operation of the computer. Then the question arises: "What kind of training should education offer to meet the needs in these areas?"

The investigator believes that with a further look at the jobs

available, education might train some students to meet the needs in other areas if they did not fit in the three categories as listed.

Just where does operation of the computer fit in the education of the student? Does the student need to learn to compile and test the program problems given to him? Will he be asked to do this on the job? The survey indicates that over 75 percent of the 'nstallations have their programmers compile and test their programs. Then education should certainly consider this when the student is taught data processing.

There are many programming languages which can be taught and the question is: which language does industry use most? Most people who are familiar with computers are aware that some computers use a basic language--- or on the other hand most with a certain amount of core will use a common language. The companies who make computers certainly will push the language that is basic to the computer which they sell because the customer is locked into that computer should he decide to upgrade his computer. But it would appear to the investigator that if the core was large enough they should program in a language which would work on any computer so that programs could be transferred in the event the company changes computers. What effect does this have on education and what languages should be taught? The investigator believes the survey pointed out that Cobol was the language most used and used a larger percent of the time than any other language. Many of our larger colleges and universities push Fortran as the main language because they are emphasizing mathematics and Fortran is certainly the language to use in mathematics. Yet, the survey pointed out that only 18 percent of industries use Fortran and that only 22 percent of the 18 percent use it more than 50 percent of the time. Thus, if education spends

semester after semester only teaching Fortran and our problems are all directed in this area, education has deprived the student of much of the knowledge he should have been taught. Cobol is preferred by business and the investigator believes if the student is interested in programming he must be well grounded in Cobol, and Fortran should not be the common language taught in any college or university unless all students will work only in the scientific area.

Education must determine what type problems to give the students. Educators all agree there must be some basic problems the student must learn. Yet, if educators continue with these same problems which the investigator calls two plus two problems, the student has been cheated. Therefore, some in-depth problems must be programmed by the student. In the survey, fifteen computer applications were selected from seventy-four to determine which problems are used the most so educators can select from these fifteen to develop a problem in-depth around these applications.

Education should determine just what should be taught to best train the student to meet the needs of industry. Educators need to know where to place the emphasis in programming. The investigator believes this section on Learning Techniques has pointed out what industry feels is important. Educators should be able to take this list and use it as a guide to place more emphasis on these items as well as to expand or add courses which will improve instruction. By the same token, this can be used to de-emphasize some of the items we now teach. The whole point of technical education is to prepare the student for work.

Programming languages and systems courses, as pointed out earlier,

is the basis of the student's instruction. Therefore, education should teach the student the languages which industry feels the programmer should know when he is employed. The language most often used was Cobol and it is pointed out that the respondents feel Cobol is the most important language to be taught. The 360 Assembly fell with equal importance in both the most important and important categories. Fortran was thought to be only important. The investigator feels the student should know Fortran but that Cobol should be the common language base for instruction in colleges and universities. The investigator feels that emphasis should be put on the other languages based on local needs.

Testing in an educational institution is the basis on which educators evaluate the student's performance. Just how should the student be evaluated seems important to the investigator. He feels the survey pointed out by the comments added to the survey that the student must be able to express himself in some form of communication, therefore the essay question appeared in the highly important category. The other type test which appeared in the most important was programming problems or parts of problems, which means to the investigator, can the student really do the job. More response was made to this question than any question by those who responded to this section.

History is the basis from which we project the future. It is important to know where the people now employed received their training to help determine where education emphasis has been placed in the past, and also where would the employer look for new employees. When we put these two together we find out that most of the employees have been trained on the job in the past and that if the company should seek new employees they

would seek experienced personnel from an employment agency. This would indicate the companies no longer want to stand the expense of training employees in the future. Second most important indicated their employees had training in a four-year college program, yet the second choice where they would seek new employees would be from within the company. This would indicate if they couldn't find experienced personnel they would train from within the company, thereby cutting the expense of training personnel. A help to this problem could be training in a two-year program at a local college at night.

The economy of this country is down and companies are looking for ways to cut expenses and one way is to keep employees at a minimum. Even though the employment of data processing personnel has hot moved at a fast rate the past twelve months, it appears they expect to employ about the same number in the next twelve months. This indicates education should continue to train at about the same rate as in the past twelve months.

Who does make the best prospective data processing personnel is an important question to education. For educational programs to be justified and of value, students must be employed. This survey indicates 1-1/2 years of formal data processing training with 1/2 year of experience would best fill the bill. The formal training can be met without any problem, but 1/2 year of experience is certainly a problem without the help of industry. Education must seek industry's help by asking them to take students on, even if it is on a no-pay basis, and train them in the way that would be of help when they take a job. A program where the student might

be paid is almost ruled out with the federal regulations and the minimum wage and hour law. Insurance laws add to the problem. But somehow the student must have some experience to be employable and the only place he will obtain training is industry. Industry help is needed to accomplish this part of the educational program.

Where would you seek new personnel poses some problems to education and the spending of educational dollars. The second choice of those who responded indicated they would first seek four-year degree personnel, and two-year degree personnel second, and employment agency for experienced personnel third. Then the question arises "Where should the education dollar be spent"? Each year we spend money in high schools and post high school programs; yet based on this survey, the respondent is not interested in people from these programs. Vocational-technical program money is to be spent on programs on the non-degree type programs. By working with industry in on-the-job training programs we could meet industry needs for personnel with the two-year associate degree programs. The question still remains "Should vocational-technical money be spent on high school and post high school programs or should this money be funneled into improvements of the two-year programs"? The investigator feels education must ask the question: "At what point do we overeducate computer personnel?" This question will not be easy to answer. Overeducation creates unrest of personnel in all occupations. The investigator feels undereducation causes as much unrest because the employee does not feel comfortable in doing his job.

When education wants to upgrade their equipment they must ask "What

equipment should I seek?" In considering computers, the question is the same. Should the school acquire equipment which is most found in industry or will some other equipment do the job and result in saving the taxpayer's dollar and lower the cost of the program? This survey indicated by over 68 percent that there was no difference in which equipment was used as long as the student learned the basic requirements. The investigator feels even though one manufacturer's equipment was not specified, it should be of equal value to that found in industry most of the time.

Recommendations

1. An extensive survey should be made nationwide under the direction of trained researchers to determine where educational dollars should be spent in data processing and what type training a student should have.

2. In our educational programs much more emphasis should be placed on training students to become programmer analysts rather than a programmer or a systems analyst.

3. More emphasis should be placed on training in Cobol language with a course at least one year in length. Fortran should be de-emphasized in most programs.

4. Indepth problems should be developed in the fifteen listed applications so the student will be familiar with these types of problems.

5. More emphasis should be placed in our systems course with the study of problems from industry. An agreement should be worked out with industry to allow students to work with systems analysts as part of their training.

6. More emphasis should be put on program debugging, computer applications and program testing.

7. A course in logic and effective listening should be required of all data processing students.

8. All other data processing learning techniques should be studied to see that they are being covered and the right amount of emphasis is placed on each.

9. Education should compare its present methods of testing and see how they compare to the importance as listed in the survey.

10. Education should make an all out effort to obtain an agreement with industry whereby they will train students on a part-time basis to enable the student to gain some experience. Consideration should be given to paying part of the cost incurred in industry to meet these needs.

11. A complete evaluation of expenditures for data processing programs should be undertaken. More emphasis should be placed in the associate degree program and less in high achool and post high school programs except in training keypunch operators.

12. When updating of computer is considered, a certain manufacturer's equipment is not essential for training but the similarity of equipment and equipment attachments should meet those most found in industry.

APPENDIX

Dale I. Sare
Phone 1-405-355-3361
Box 582
Lawton, Oklahoma 73501

June 15, 1972

Director of Data Processing

Gentlemen:

As a data processing teacher educator, I am extremely iriterested in the constant improvement of the instruction and problems used in labs so we can meet the needs of industry for data processing personnel.

I realize that you are a busy executive, but it is my hope that you will find the subject of this study to be of sufficient merit to warrant your attention.

The purposes of this questionnaire are (1) to determine what language is being used the most in industry and what percent of time the Vocational-Technical Schools spend on each language; (2) to determine what type of applications are most used in industry and what type of applications are being used in the labs in the Vocational-Technical Schools; (3) to determine what teaching objectives industry feels are important and what type of objectives we are using in the Vocational-Technical Schools; (4) what types of jobs the student will likely find the most frequently in industry; (5) what weaknesses are more frequently detected in new employees (6) what kind of educational experience a student should have while attending school; (7) where you would seek new employees. When the questionnaires are returned, we will then compare them to see if we are meeting the needs of industry. The format has been designed so that it can be filled out almost as rapidly as it can be read.

In order to insure a valid study, it is necessary that a large percentage of the questionnaires be returned. A stamped, self-addressed envelope is enclosed for your convenience. The information gained from this study can be used to upgrade present programs in the Vocational-Technical Schools in Oklahoma. It could be used as a guide to set up new programs or to put more emphasis on one course and less on others. Please respond and return the questionnaire as soon as possible.

To protect the privacy of your 0plnlons, company names will not be used in any of the summary statements. Answers will be kept confidential: only the statistics of the study will be used.

This study is being completed this summer in connection with a master's thesis at Kansas State College of Pittsburg.

Thank you very much.

Sincerely,

Dale I. Sare
Director of Data Processing
Cameron College
Lawton, Oklahoma 73501

Please direct all replies to:
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Dale I. Sare

Phone 1-405-355-3361

Box 582

Lawton, Oklahoma 73501

June 15, 1972

Dear Colleague,

As a data processing teacher educator, I am extremely interested in the constant improvement of the instruction and problems used in labs so we can meet the needs of industry for data processing personnel.

I realize you are a busy educator, but it is my hope that you will find the subject of this study to be of sufficient merit to warrant your attention.

The purposes of this questionnaire are (1) to determine what language is being used the most in industry and what percent of time the Vocational-Technical Schools spend on each language; (2) to determine what type of applications are most used in industry and what type of applications are being used in the labs in the Vocational-Technical Schools; (3) to determine what teaching objectives industry feels are important and what type of objectives we are using in the Vocational-Technical Schools; (4) what types of jobs the student will likely find the most frequently in industry; (5) what weaknesses are more frequently detected in new employees (6) what kind of educational experience a student should have while attending school; (7) where you would seek new employees. When the questionnaires are returned, we will then compare them to see if we are meeting the needs of industry. The format has been designed so that it can be filled out almost as rapidly as it can be read.

In order to insure a valid study, it is necessary that a large percentage of the questionnaires be returned. A stamped, self-addressed envelope is enclosed for your convenience. The information gained from this study can be used to upgrade the programs we now teach in the Vocational-Technical Schools in Oklahoma. It could be used as a guide to set up new programs or to put more emphasis on one course and less on others. Please respond and return the questionnaire as soon as possible.

To protect the privacy of your 0plnlons, school names will not be used in any of the summary statements. Answers will be kept confidential: only the statistics of the study will be used.

This study is being completed this summer in connection with a master's thesis at Kansas State College of Pittsburg.

Thank you very much.

Sincerely,

Please send all replies to:
Dale I. Sare (Kansas State College)
103 E. Williams Apt. 1
Pittsburg, Kansas 66762

Dale I. Sare
Director of Data Processing
Cameron College
Lawton, Oklahoma 73501

QUESTIONNAIRE

Dale I. Sare
Director of Data Processing
Cameron College
Lawton, Oklahoma
73501

Would you like a copy of this study when it is completed. YES NO

Name of Firm or Organization _____

Mailing Address _____

City State Zip Phone

Person In Charge of Computer Facilities Title

TYPE OF ORGANIZATION

___Distribution _____Insurance _____SerVice _____Education _____Manf.
_____Transportation ___Finance _____Research or Eng _____Utilities
_____Government _____Retail Trade _____ Wholesale Trade _____Other

UNIT RECORD GEAR PRESENTLY IN USE

Present number of units	Model	Present number in units	Model	Other
____Accounting Machine	___	_____Interpreter	_____	_____
_____Calculating Punch	_____	_____Reproducer	_____	_____
_____Collator	_____	_____Sorter	_____	_____

Computer Make and Model

Memory Size _____ _____Bytes _____Words

Quantity	Type	Quantity	Type	Quantity	Type
_____	Tape Drive	_____	Printer	_____	Paper Tape Punch Reader
_____	Disk Drive	_____	Card Reader	_____	OSR OR OCR
____	Drum	_____	Card Punch	_____	Remote Terminal Printer
_____	Data Cell	_____	CRT Display Unit	_____	Other: _____

If more than one computer, please list on separate sheet.

PERSONNEL: (Please indicate approximate numbers)

___Systems Analysts _____Programmers/Analysts _____Programmers . Computer Operators
___Tab Operators ___Key Punch Operators _____Verifier OperaLors
__Key Tape Operators Control Clerks ____Others

What weaknesses are most frequently detected in your new employees?

A. _____
B. _____
C. _____
D. _____

Do your programmers personally operate the equipment to compile and/or test their programs?

YES NO IF TIME PERMITS ONLY

Programming Languages used or taught in your organization. Please give per cent of total time each of the following languages are used or taught.

70

1. ForTran		4. RPG		7.	
2. Cobol		5. Other		8.	
3. Assembly		6.		9.	

Industry: Please check the following applications which pertain to your present computer operations by putting the per cent of total time they take in your operation.

Schools: Please put the per cent of time spent on the different type of problems as classfied.

1. Accident Reporting
2. Accounting (gen.)
3. Accounting Journal Entry
4. Accounts Payable
5. Accounts Receivable
6. Actuarial Services
7. Advertising Invoicing
8. Advertising Scheduling
9. Agricultural Economic Research
10. Aircraft Component Control
11. Amortization Schedules
12. Automobile Travel Allowance
13. Bank Management Information
14. Bill of Materials
15. Billing and Invoicing
16. Budget Management
17. Cash Control
18. Commission Acctg.
19. Cost Accounting
20. Charge Acct. Billing
21. Commodities Reporting
22. Communication Systems
23. Cost Control
24. Credit Accounting
25. Customer Accounting
26. Data Communication
27. Demand Deposits
28. Depreciation
29. Disbursements
30. Dividend Payments
31. Drafting
32. Engineering Design
33. Expense Allocation
34. Financial Statements
35. Fixed Assets Acctg.
36. General Ledger Accounting
37. Group Insurance
38. Hospital Patient Accounting
39. Hospital Patient Information
40. Hospital Statistics
41. Installment Loans
42. Insurance Agents Performance Analysis
43. Insurance Premium Accounting
44. Inventory Control
45. Labor Analysis
46. Labor Control
47. Labor Cost Reports
48. Linear Programming
49. Mailing list
50. Management Information Reports
51. Market Research
52. Medical Acctg.
53. Mortgage Loan Acctg.
54. Motor Vehicle Maintenance Records
55. Multiple Regression Analysis
56. Numeric Analysis
57. Order Billing
58. Order Entry
59. Payroll
60. Personnel Records
61. PERT System
62. Production Control
63. Production Cost Analysis
64. Production Planning
65. Production Reporting
66. Production Scheduling
67. Sales Accounting
68. Savings Accounts
69. Saving and Loan Accounting
70. Sales Analysis
71. Sales Reporting
72. Statistical Analysis
73. School Records
74. Utilities Billing

Should you do other types of works, please list them below.

75.
76.
77.
78.
79.
80.

Data Processing Learning Techniques

DIRECTIONS: Please circle the number which best reflects the value or importance which you place upon EACH of the following techniques.

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Of little Import	Of no Importance
1. Basic Concepts	4	3	2	1	0
2. Assembly programs and Compilers	4	3	2	1	0
3. Macro-Generators	4	3	2	1	0
4. Reports Generators	4	3	2	1	0
5. Utility Programs	4	3	2	1	0
6. Data Scheduling System	4	3	2	1	0
7. Sort-Merges Programming	4	3	2	1	0
8. Monitors and Supervisory Systems	4	3	2	1	0
9. Computer applications	4	3	2	1	0
10. Looping and Indexing	4	3	2	1	0
11. Subroutines	4	3	2	1	0
12. Programming a tape System	4	3	2	1	0
13. Macro-Programming	4	3	2	1	0
14. Programming Random Access Devices	4	3	2	1	0
15. Program Testing	4	3	2	1	0
16. Translators	4	3	2	1	0
17. Input-Output Control System	4	3	2	1	0
18. Simulators	4	3	2	1	0
Systems 19-26					
19. The Approach	4	3	2	1	0
20. Requirements of the System	4	3	2	1	0
21. Developing the Solution	4	3	2	1	0
22. Data Controls	4	3	2	1	0
23. System Controls	4	3	2	1	0
24. System Evaluation	4	3	2	1	0
25. Finalizing the System	4	3	2	1	0
26. System Implementation	4	3	2	1	0
27. Program, Debugging	4	3	2	1	0

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	Of Little Import	Of no Importance
28. PERT	4	3	2	1	0
29. Multiprogrammning ,	4	3	2	1	0
30. Multiprocessing	4	3	2	1	0
31. Time Sharing	4	3	2	1	0
32. Card Design	4	3	2	1	0
33. Data File Design	4	3	2	1	0
34. Specification Writing	4	3	2	1	0
35. Flow Charting	4	3	2	1	0
36. Decision Tables	4	3	2	1	0
37. Management Information System Design	4	3	2	1	0
38. Operational Analysis	4	3	2	1	0
39. Proc-edure Writing	4	3	2	1	0
40. Form Design	4	3	2	1	0
41. Work Measurement	4	3	2	1	0
42. Work Samp1ing	4	3	2	1	0
43. Work Simplification	4	3	2	1	0
44. System Planning	4	3	2	1	0
45. Proj ect Control	4	3	2	1	0
46. System Presntation	4	3	2	1	0
47. Work Load Evaluation	4	3	2	1	0
48. Maintaining Program Library	4	3	2	1	0
49. Maintaining Magnetic Tape Library	4	3	2	1	0
50. Operating Computer console	4	3	2	1	0
51. Job Timing	4	3	2	1	0
52. Card Lay Out and Design	4	3	2	1	0
53. Data Scheduling System	4	3	2	1	0
54. Boolean Algebra	4	3	2	1	0
55. Logic	4	3	2	1	0
56. Fixed and Floating Point	4	3	2	1	0

DIRECTIONS: Please circle the number which best reflects the value or importance which you place upon EACH of the following techniques.

DATA PROCESSING LEARNING TECHNIQUES	Most Important	Highly Important	Important	of Little Importance	of No Importance
57. Numbering Systems	4	3	2	1	a
58. Computer Logic	4	3	2	1	0
59. Registers	4	3	2	1	0
60. Cobol Report Writing	4	3	2	1	0
61. Cobol Sort Verbs	4	3	2.	1	0
62. Binary Search Technique	4	3	2	1	0
63. Interpert Core Dump	4	3	2	1	0
64. Data Communications Concepts	4	3	2	1	0
65. Microfilm Information systems	4	3	2,	1	0
66. Document Retrieval and Display Techniques	4	3	2	1	a
670 Effective Listening	4	3	2	1	a
68. Supervisory Training	4	3	2,	1	0
69. Registered Busiriess Programmer course and Certificate Information	4	3	2	1	0
70. I/O Debugging	4	3	2	1	0
71. DOS/TOS Operations Training	4	3	2	1	0
72. Programming Techniques for Improved Performance of Programs	4	3	2	1	0
73. Program Analysis for Business Systems	4	3	2	1	0
74. Test Development Procedures	4	3	2	1	0
75. Design of Systems Control and Audit Trails	4	3	2	1	0
76. Documentation Standards	4	3	2	1	0
OTHERS					
77. _____	4	3	2	1	0
78. _____	4	3	2	1	a
79. _____	4	3	2	1	0
80. _____	4	3	2	1	0
81. _____	4	3	2	1	0
82. _____	4	3	2	1	0
83. _____	4	3	2	1	0
84. _____	4	3	2	1	0
85. _____	4	3	2	1	0
PROGRAMMING LANGUAGES					
86. ForTran	4	3	2	1	0
87. Cobol	4	3	2	1	0
88. RPG	4	3	2	1	0
89. 360 Assembly	4	3	2	1	0
90. PL/1	4	3	2	1	0
OTHERS					
91. _____	4	3	2	1	0
92. _____	4	3	2	1	0
93. _____	4	3	2	1	a
94. _____	4	3	2	1	0
95. Systems Analysis Course	4	3	2	1	0
METHODS OF TESTING DATA PROCESSING STUDENTS					
96. True and False	4	3	2	1	0
97. Multiple Choice	4	3	2	1	0
98. Completion	4	3	2	1	0
99. Essay	4	3	2	1	0
100. Prograruning Problem or Part of	4	3	2	1	0
101: Combination of 96 & 100	4	3	2	1	0
102. Combination of 97 & 100	4	3	2	1	0
103. Combination of 98 & 100	4	3	2	1	0
104. Case Study Only	4	3	2	1	0
105. No Test-Just lab problems	4	3	2	1	0
106. _____	4	3	2	1	0

Where did your employees receive their initial training?

_____ High School
On the Job
Private Business Schools
Schools sponsored by Manfacturers of Equipment Company _
Other _____

_____Post High Schools (Technical Schools)
2 year college associate degree program
4 year college program

How many new employees have you hired in your data processing department during the past 12 months, other than key punch personnel? _____ Projected next 12 months? _____

Who do you think would make the best prospective data processing employees?

(Please check one)

_____ 1. One who has a minimum of two years of experience with little or no formal data processing training.

_____ 2. One who has a minimum of 1½ years of formal data processing training plus ½ year of on-the-job training.

_____ 3. One who has no training or experience in the data processing field.

If you were seeking computer personnel, other than key punch personnel, where would you look? Place a 1 for first choice and a 2 for second cheice.

_____ Employment agency (experienced personnel)
_____ 2 year college associate degree in DP
_____ Private Schools of DP
_____ Other

_____ 4 year college (degree)
_____ Post High Tech School DP
_____ High School Tech in DP
_____ Within the Company

Do you feel it is important that a student be trained on a certain mfg. equipment?

_____YES _____NO

If yes, state mfg. and model, core size _ _____ _____ K

SECOND CHOICE (another Mfg.) _____ _____ _____K

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE.

Answers will be kept confidential; only the statistics of the study will be reported.

Remarks:

Dale I. Sare

Phone 1·405·355·3361

Box 582

Lawton, Oklahoma 73501

June 26, 1972

Director of Data Processing

Gentlemen:

On June 15, 1972, a survey instrument requesting your opinion regarding what should be taught and the kind of lab problems that should be used in Vocational-Technical Schools was forwarded to you. At this date I have not received this information from you.

Please find enclosed, another copy of the instrument for your use. I would appreciate your completion and return of the instrument at your earliest convenience.

If you have completed and returned the original instrument, please disregard this request and accept my sincere thanks for your cooperation.

Sincerely,

Dale I. Sare
Director of Data Processing
Cameron College
Lawton, Oklahoma

P.S. Please return the questionnaire to Dale I. Sare
Kansas State College
103 E. Williams, Apt. #1
Pittsburg, Kansas 66762

August 9, 1972

In reply to the questionnaire:

I will complete and mail today.

I thought it was too long.

I thought it had no relationship to the subject and was invalid.

I was unable to find the time to complete it.

I thought it was valid but too long.

The questionnaire was confusing and vague.

Other reasons

BIBLIOGRAPHY

BIBLIOGRAPHY

(1) Bangs, F. Kendrick and Hillstead, Mildred C., "Curricular Implications of Automated Data Processing for Educational Institutions." Final Report, Office of Education, Department of Health, Education and Welfare. Washington, D. C., September, 1968.

(2) Benenati, J. David. "A Technique for the Identification, Design, Implementation and Measurement of Relevant Data Processing Training Activities." Presentation delivered at the Edutronics Users Forum in Chicago, Illinois, January 29, 1970.

(3) Brightman, Richard W. "The Computer and the Junior Colleg : Curriculum," American Association of Junior Colleg s, Washington, D. C., 1970.

(4) Nielsen, Richard H. "Training and Retraining of EDP Paonn " Best's Review, Life Addition, January, 1969, page 75.

(5) A Proposal for the Establishment of an Undergraduate Inter-College Department of Computer and Information Screen at the University of Florida (Gainsville, Florida: University of Florida, March, 1971), 2.