ANDREWS, WILLIAM C. A Survey of Data Processing Education in Industry and Government in Piedmont North Carolina. (1970)
Directed by: Dr. Lawrence Sorohan. pp. 109

The purpose of this survey is to determine the training source and number of people actually trained in various types of data processing skills in Piedmont North Carolina. Major skill areas covered in the survey are (1) unit record training; (2) basic computer concepts; (3) basic programming; (4) systems analysis and design; (5) managerial training for programmers and analysts; and (6) orientation for non-computer executives.

In addition, information is available as to course attendance in the Piedmont area, course selection factors, and the effects of separate pricing on DP education. Respondents from the four counties making up the Piedmont Standard Metropolitan Statistical Area were mailed a questionnaire covering the major points mentioned above. Their replies are related to user size per major area surveyed.

Prior to separate pricing policies, many users were dependent on their vendor/supplier for training. The majority of respondents now indicate that they will turn to software firms and university/colleges for their training.

The small user is less likely to be able to provide the same type and quality of training to his data processing personnel as the medium user or large user. Cost is the major consideration.

Respondents consider the prestige and capability of the organization conducting the training as a prime consideration for course selection and total cost as a secondary factor.

A SURVEY OF DATA PROCESSING EDUCATION IN INDUSTRY AND GOVERNMENT IN PIEDMONT NORTH CAROLINA

by

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Approved by

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PART I

CHAPTER I

INTRODUCTION

As the nation slips, slides, and stumbles into the 1970's there is great concern and uncertainty about the direction and distance that lies ahead. On one hand, there is the pall of social, environmental, philosophical and inflationary problems that at times seems bent on smothering all hopes for a brighter tomorrow. On the other, is the eloquent testimony of past technological and economic progress made possible by the free enterprise system, promising a future of accomplishments that taxes all but the most vivid of imaginations.

At the heart of such accomplishments lies the massive capability and future potential of electronic data processing. A devil to some, an angel to many, the computer is now deeply involved in all parts of our human existance.

Since the development of the ENIAC (Electronic Numerical Integrater and Calculator) in 1945, the computer and data processing as a whole has grown at a fantastic rate. The following examples denote this growth:

> "In ten years the speed of the computer has increased by a factor of 1000:1, costs for computation have gone down by a factor of

100:1, memory capacity has gone up by 1000:1."

"In 1970, approximately 65,000 computer systems will have been installed in the U. S. representing an investment of about $25 million."

"By 1973, the annual shipment of computers and related equipment in the U. S. will reach $9 - $10 billion and represent about 12 percent of total new plant and equipment investment."[1]

In 1959, a Greensboro, North Carolina based organization installed its first computer - an IBM-650. By 1969, ten years later, the same company had over 45 computers in over 35 locations. Its annual budget for data processing was well over $15 million, of which less than one-half was for hardware and peripherals. The major portion of expenditures in this budget was for people.

As the use of data processing equipment has grown, the requirement for qualified personnel to program, analyze and manage the data processing systems has grown at an ever greater rate. According to Dr. G. Truman Hunter of IBM, "There were about a half million people working in the computer industry in 1967. It is estimated that

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[1] Murdick, R. G. & Ross, Joel E., "The Need For Systems Education", Journal of Systems Management, July 1969, (Volume 20, Number 7, Issue 99), pp. 8 - 12.

125,000 were operators while 375,000 were programmers, analysts and managers." By 1975, according to one projection he sites, "450,000 operators and 1.5 million programmers, analysts and managers will be needed."[2]

Others have projected similar requirements for qualified data processing personnel.

> "A conservative estimate of the number of personnel required in 1970 includes: 190,000 systems analysts, 222,000 programmers, and 85,000 data processing managers."[3]
>
> ". . . There may well be more than 100,000 computers installed by 1975. There are approximately 150,000 - 200,000 programmers and analysts today. On the assumption that, for the average 1975 installation, there will be a systems manager and two systems analysts, and a programming manager and six programmers, we will need a total of 1 million analysts and programmers by 1975 - or roughly five to six times as many as we have today. Where will they come from?"[4]

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[2] _____, "The Supersonic Seventies", Business Automation, January 1970, (Volume 17, Number 1), pp. 44-65.

[3] Murdick & Ross; op. cit.

[4] Davis, Sidney, "A Flexible Concept For Recruiting Data Processing Personnel For The 1970's", Computers and Automation, September 1968, (Volume 17, Number 9), p. 22.

"Complicating the difficulties in devising programs is a growing shortage of programmers. At least 100,000 men and women are now busy giving instructions to the nations computers, but another 50,000 such jobs are going begging. Computer makers are producing the equipment faster than the industry can train such specialists."[5]

Some efforts are being made by organizations to expand and improve data processing education in order to produce the required people, but their steps are small compared to the large needs of the industry. Table 1 provides an example of the scope of company-conducted computer courses. "Data processing, which fewer than 10 years ago was viewed by many individuals as a pure service function, has taken on many new dimensions and has evolved into one of mankind's most significant management and control tools. The premise is simple - data processing cannot and will not attain its full potential without capable and well-qualified professionals and good management."[6]

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[5]"The Supersonic Seventies", op. cit.

[6]Gillis, Warren K., "Personnel Requirements in Data Processing"' Computers and Automation, September 1968, (Volume 17, Number 9), pp. 24-26.

TABLE 1

COMPANY-CONDUCTED COMPUTER COURSES BY SIZE OF COMPANY

QUESTION: "Does your company conduct any computer courses for its staff?"

		Size of Company		
	Total %	Large %	Medium %	Small %
Yes	38.5	63.2	23.3	12.7
No	56.6	33.3	73.6	79.0
Not Stated	4.9	3.5	3.1	8.3
Total Base	100.0	100.0	100.0	100.0
	(634)	(288)	(163)	(181)

(Source - "Management & the Computer", Dow Jones & Company, 1969)

CHAPTER II

Design Of The Survey

Section I - Significance Of The Survey

The requirement for data processing personnel, both nationally and in North Carolina, is expanding at a rate much faster than people are currently being trained to fill the jobs being created. This thesis will discuss the current methods, procedures and requirements in data processing education of government and industry in the Piedmont North Carolina, and comment as the future trends in this area. The data produced herein should be most useful to educators planning curriculums in data processing or managerial training as well as educational departments of industry in planning data processing or managerial training programs. Due to the size and general demography of area covered in this survey, it is this writer's opinion that the following information would be relatable with few exceptions to the rest of the South-Atlantic United States.

The designation of Piedmont North Carolina as a Standard Metropolitan Statistical Area (S.M.S.A.) encompassing the counties of Forsyth, Guilford, Randolph and Yadkin was set by the U. S. Bureau of Budget in 1967. (See Appendix A for details of the S. M. S. A. Designation.) (For the remainder of this study, this area will be

referred to as "the Piedmont.") The Piedmont has been characterized by rapid industrial and population growth and in 1968 ranked 59th in the United States in population, 58th in number of households, 57th in retail sales, and 56th in effective buying income.[7] The Piedmont S. M. S. A. is the largest in North Carolina in population, income, and manufacturing growth. Tables 2, 3, 4, and 5 picture population and economic growth in the Piedmont.

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[7] _____, Greensboro's Growing Market, Greensboro Chamber of Commerce, Research Division, Greensboro, North Carolina, 1969.

TABLE 2

MANUFACTURING GROWTH IN PIEDMONT NORTH CAROLINA: 1954 and 1963
IN THOUSANDS OF DOLLARS

1954

County	Number Establishments	Value Added
Forsyth	187	$ 303,756
Guilford	509	169,106
Randolph	200	51,826
Yadkin	39	692
TOTAL	935	$ 525,380

1963

Forsyth	209	645,275
Guilford	627	417,311
Randolph	200	102,506
Yadkin	33	1,917
TOTAL	1,069	$1,167,009

(Source - U. S. Census of Manufacturers - Area Statistics: Volume III, 1954, 1963, U. S. Bureau of Census.)

TABLE 3

POPULATION GROWTH IN PIEDMONT NORTH CAROLINA: 1950, 1960 and 1968

County	1950	1960	1968
Forsyth	146,135	189,428	219,500
Guilford	191,057	246,520	281,900
Randolph	50,804	61,497	71,900
Yadkin	22,133	22,804	24,500
Total	410,129	520,149	597,800

(Source - North Carolina Department of Conservation and Development; Population of Counties and Minor Civil Divisions; January 1962.)

(Source - "Management Survey of Buying Power"; Sales Management; June, 1969.)

TABLE 4

POPULATION PROJECTIONS FOR PIEDMONT NORTH CAROLINA: 1970 and 1980

County	1970	1980
Forsyth	241,292	315,205
Guilford	313,600	407,024
Randolph	72,286	84,535
Yadkin	23,009	22,761
TOTAL	650,187	829,525

(Source - North Carolina Department of Health; Net Migration By Color, Sex and Age for North Carolina; 1950-1960.)

TABLE 5

PIEDMONT NORTH CAROLINA LABOR FORCE BREAKDOWN: 1968

Type	County			
	Forsyth	Guilford	Randolph	Yadkin
Manufacturing	39,830	54,740	17,760	730
Construction	4,600	7,470	940	140
Transportation	7,950	5,880	520	40
Trade	14,480	26,160	2,490	540
Finance/Insurance	3,680	7,350	410	40
Service	10,030	15,250	1,580	360
Government	10,290	15,800	1,950	810
All Other Employment	10,170	17,720	4,130	2,980

(Source: North Carolina Work Force Estimates, 1969. Employment Security Commission.

A corresponding increase in data processing personnel in the Piedmont can be traced in Tables 6 and 7.

TABLE 6

AMOUNT OF DP JOB GROWTH IN THE PIEDMONT NORTH CAROLINA: 1966-1972

Job Description	1966		1969		1972	
	Total	%	Total	%	Total	%
Data Entry Operators	325	39.6	503	37.5	611	34.7
Unit Record/Computer Operators	199	24.3	290	21.6	343	19.5
Programmers/Analysts	127	15.5	259	19.3	426	24.2
Supervisors	97	11.8	164	12.2	216	12.3
Other*	72	8.8	125	9.3	164	9.3
	820		1,341		1,760	

*(Control clerks, etc.)

(Source - "A Study on the Data Processing Technical Curriculums in the North Carolina Community College System", N. C. State University; 1969)

TABLE 7

PERCENT OF DATA PROCESSING JOB INCREASE

IN THE PIEDMONT NORTH CAROLINA: 1966-1972

Job Description	1966-1969 % Increase	1969-1972 (Projected) % Increase
Data Entry Operators	54.2	21.5
Unit Record/Computer Operators	45.7	18.3
Programmers/Analysts	103.9	64.5
Supervisors	69.1	31.7
Others*	73.6	31.2

(*Control clerks, etc.)

(Source - "A Study on the Data Processing Technical Curriculums in the North Carolina Community College System", N. C. State University: 1969)

Here again, the largest growth, both actual and projected is the area of programmers and analysts. The depicted growth of unit record/computer operators is somewhat misleading since both categories have been computed together. The requirement for unit record personnel is decreasing as the equipment is replaced by computers and computer operators. Table 8 provides an overall view of change in data processing employment in North Carolina.

TABLE 8

DATA PROCESSING EMPLOYMENT CHANGE,

PIEDMONT NORTH CAROLINA: 1966-1969

Job Description	% Change 1966-1969
Data Entry Operators	+57%
Unit Record Operators	- 7%
Computer Operators	+97%
Programmers	+73%
Systems Analysts	+150%
Supervisors	+67%
Other*	+95%

(*Control clerks, etc.)

(Source - "A Study on the Data Processing Technical Curriculums in the North Carolina Community College System", N. C. State University: 1969)

Section II - A Review of Related Work

The continuing growth of job requirements in North Carolina has caused the community college system in the state to expand its training curriculum to include a variety of data processing training. This curriculum was not centrally developed but organized on the basis of local area advisory group recommendations.

In May 1969, the Department of Industrial and Technical Education, North Carolina State University, submitted a study on the data processing technical curriculums offered in the North Carolina Community College Systems to Dr. I. E. Ready, Director of North Carolina Community Colleges.[8] The study, done by Dr. William A. McIntosh, Department of Industrial and Technical Education, endeavored to analyze data for three areas:

1. Definition of the employment market in North Carolina for data processing personnel, and the role of the community college system in training employees for this market.

2. Development of a curriculum in accord with 1 above to meet student and industrial needs.

3. Determine equipment and other instructional requirements to complement findings in 1 and 2.

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[8] McIntosh, William A.; "A Study On The Data Processing Technical Curriculums Offered In The North Carolina Community College Systems"; North Carolina State University, Department of Industrial and Technical Education; Raleigh, North Carolina; May 1969.

Dr. McIntosh mailed questionaires to over 800 organizations in the Greensboro/High Point/Winston-Salem areas and the Charlotte/Mecklenburg area covering number of people employed, types of languages and equipment, etc. (See Appendix C for a sample of Dr. McIntosh's questionnaire.) Major recommendations of the study were:

1. The North Carolina Community College System has, by and large, been successful in producing graduates of the two-year technical curriculum who perform well in the industrial environment.
2. For the foreseeable future, the demand for quality graduates exceeds the current capability of the system (when such capability is related to the number of existing and potential employment positions.)
3. Data processing programs in the secondary schools and universities do not compete with the two-year program of the Community College System. Each serves the employment market at different skill levels.
4. Effective articulation between the various educational levels offering data processing training is restricted and in some cases completely lacking.

(Note: Only conclusions related to curriculum are presented here.)

A breakdown of the questions in Dr. McIntosh's questionnaire was accomplished by the Research Department, Greensboro Chamber of

Commerce for the Piedmont Area and Greensboro. These findings are included as Appendixes D and E.

Section III - The Questionnaire and Method of Data Collection

In order to provide additional information to organizations currently conducting or contemplating data processing education programs, a series of questions was developed on the training sources in use in industry and government in Piedmont North Carolina.

The questionnaire for this survey was designed to cover the following eight points:

1. The desirability of unit record training for analysts and programmers.

2. The need for knowledge of more than one programming language and how persons are trained in basic computer concepts and basic programming.

3. How persons are trained in the concepts of systems analysis and design.

4. Managerial education, covering the familiarization of non-data processing management in basic computer concepts and training of data processing personnel in managerial techniques.

5. Amount of data processing training in the Piedmont North Carolina (other than in-house training).

6. Criteria used in course selection by data processing managers.

7. The effects of "unbundling"* on an organizations's data processing education program.

The questions were not grouped but followed one another in the general sequence indicated above. The questionnaire itself was divided into three major parts: (1) A cover letter explaining the reason for the survey and identifying the sender, (2) A list of definitions of terms used in the questionnaire, (3) The actual list of questions. (See Appendix F for an example of the questionnaire.) Identifying data as to the name, organization, address, telephone number and job position of the respondent was requested at the first of the questionnaire as Question Number One.

Subject organizations for the survey were selected from the respondents of the N. C. State study who indicated that they possessed data processing capability and were located in the Piedmont area. Certain information on the subject organization such as hardware size, number of people, etc. was already available from the N. C. State study. Appendix G provides a detailed list of organizations making up the original mailing of this survey.

Prior to the bulk mailing of the questionnaire, it was submitted to the data processing managers of two organizations not included in the survey population. Based on their answers and comments, certain minor revisions were affected. The questionnaire was reproduced in quantity and mailed on January 14, 1969. A self-addressed, stamped envelope was included with the mailing, as an aid in returning the questionnaire.

* Separate pricing of services.

A data matrix was designed on which to record data from returned questionnaires. In addition to a detailed breakout of the questions, the matrix provided space for identification of the respondent organization according to type of industry, location by county, and size of computer system. (Appendix H provides an example of the Data Recording Matrix.)

CHAPTER III

Definition of Terms

Since its inception, the field of data processing has become encumbered with a multitude of special words and symbols - a jargon, which to the uninitiated, makes communication most difficult. This chapter will provide definitions for the less frequently or less well known terms that might be encountered in this study. The majority of definitions are from Sippl's Computer Dictionary and Handbook.[9]

Assembly Language: A machine-oriented language for programming which belongs to an assembly program or system.

Compiler Language: A high-level language such as COmmon Business Oriented Language (COBOL) or FORmula TRANslation (FORTRAN); usually written in an "English-like" manner.

Data Processing: The preparation of source media which contain data or basic elements of information, and the handling of such data according to precise rules of procedure to accomplish such operations as classifying, sorting, calculating, summarizing, and recording.

Machine Operator: The person who manipulates the computer controls, places information media into the input devices, removes the output and performs other related functions.

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[9] Sippl, Charles J; Computer Dictionary and Handbook: Howard Sams and Company, Inc.; (New York); 1966.

Programmer: One who prepares programs for a computer. A person who prepares problem-solving procedures and flow charts and who may also write and debug routines.

Systems Analyst: An individual who is skilled and trained to define problems and to analyze, develop and express solutions, especially algorithms that may be resolved and implemented by a computer.

Unbundling: The separate pricing of services previously charged under one cost; started by IBM in January, 1970.

Unit Record Equipment: Equipment using punched cards as input - includes data punches, tabulating machines, collators, etc.

User size: A designation designed for this survey to provide a breakdown of computer users by the size of computer installation.

Example: A small user - a computer center using a small scale computer such as an IBM-1130 or IBM/360 Model 20. Also includes unit record equipment users.

A medium user - a computer center using a medium scale computer such as an IBM/360 30 or 40, or RCA Spectra 70/35.

A large user - a computer center using either one large scale computer such as an IBM/360 50 or 65, or a center having multiple computers on site.

PART II

CHAPTER IV

A General Analysis of the Results of the Survey

Of the 65 questionnaires originally mailed, data from 51 are included in this study. Forty-four questionnaires were actually returned by mail while data for an additional seven was obtained by telephone interview. Three other questionnaires were returned but were not used due to some discrepancy in answering. Four other questionnaires were returned too late to be included. The data used in the survey represents 78% of the total number of questionnaires originally mailed out. Detailed information on the 51 respondents as to industry, equipment size, and county location is shown in Tables 9 and 10.

General observations on the data collected are:

(a) The majority of respondents felt that detailed unit record training is unnecessary for programmers and systems analysts.

(b) In general, programmers should be skilled in more than one language and, in most organizations, be required to program in more than one language. The training of persons in basic computer concepts has been accomplished in a great number of organizations by programmed instruction courses administered by in-house sources rather than by formal classroom training. (The questionnaire did not inquire into the detailed methods of training; however, this data was supplied by many

respondents.)

(c) Organizations have been very dependant on the vendor/ supplier for programmer training but have trained most of their systems analysts in-house through on-the-job training programs.

TABLE 9

NUMBER OF RESPONDENTS BY INDUSTRY,

COUNTY LOCATION, AND EQUIPMENT SIZE

Industry	County	User Size	No. Respondants
Textiles	Guilford	Large	2
		Medium	1
		Small	1
	Randolph	Medium	1
Apparel	Guilford	Large	1
		Medium	1
		Small	1
	Forsyth	Medium	1
Food Products	Guilford	Small	3
Tobacco	Guilford	Small	1
	Forsyth	Large	1
Retail	Guilford	Small	2
		Medium	1
General Manufacturing	Forsyth	Small	1
	Guilford	Medium	1
	Randolph	Small	1
Education	Forsyth	Small	1
	Guilford	Small	2
Insurance	Guilford	Large	1
		Medium	1
		Small	1
Electronics	Forsyth	Large	1
	Guilford	Large	1
	Randolph	Small	1
Services	Forsyth	Medium	1
	Guilford	Small	2
Transportation	Forsyth	Medium	1

TABLE 9 (Continued)

NUMBER OF RESPONDENTS BY INDUSTRY,

COUNTY LOCATION, AND EQUIPMENT SIZE

Industry	County	User Size	No. Respondents
Finance	Forsyth	Medium	1
	Guilford	Medium	1
		Small	2
Communication	Guilford	Small	2
	Yadkin	Small	1
Furniture	Guilford	Small	2
Government	Forsyth	Small	2
	Guilford	Small	2
Metals	Guilford	Small	1
Wholesale	Forsyth	Small	2
Clay Products	Guilford	Small	1
Miscellaneous	Guilford	Small	1

TABLE 10

NUMBER OF RESPONDENTS BY LOCATION

County	No. Respondents
Forsyth	12
Guilford	35
Randolph	3
Yadkin	1
Total	51

(e) Fewer than one-half of the respondents provide in-house training programs in managerial techniques for their data processing personnel, while even fewer send their personnel to managerial training programs conducted by outside organizations. Orientation for non-data processing executives is provided by a greater percentage of the respondents, with the majority of that training provided by in-house programs.

(f) The only courses given in the Piedmont that the respondents have sent people to have been provided by vendor/suppliers. Indications are, however, that if appropriate data processing courses were available in the Piedmont, they would be subscribed to by data processing users in the area.

(g) The prestige and capability of the organization giving the course was ranked as most important by the greater percentage of the respondents, with cost as a second most important consideration.

(h) The separate pricing of educational services, along with other services, by some vendor/suppliers are of great concern to many users, especially those having small installations. Almost all of the respondents involved with "unbundling" vendors indicate that they will be "more selective" in choosing courses and in planning the educational development of their personnel.

These major areas are discussed in more detail in the following chapters:

CHAPTER V

Unit Record Training

As previously mentioned in Part I, Chapter II, the requirement for unit record operators is on the decline. They are being replaced by computer operators as unit record equipment is replaced by computers. Of the number of organizations responding to the N. C. State questionnaire, 34 percent have unit record installations. Approximately 50 percent of these organizations plan to upgrade to a computer installation within the next two years.[10]

TABLE 11

NUMBER OF COMPANIES USING UNIT RECORD EQUIPMENT IN PIEDMONT NORTH CAROLINA: 1966 - 1972*

1966		1969		1972	
No. Firms	No. Pieces Equipment	No. Firms	No. Pieces Equipment	No. Firms	No. Pieces Equipment
49	407	54	424	45	338

% change 1966-69	% change 1969-72
+4.2%	-20.3%

(Source - "A Study on the Data Processing Technical Curriculum in the North Carolina Community College System"; N. C. State University; 1969)

*Projected

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[10] McIntosh; op. cit.

The decrease in unit record users is directly related to the lack of need for programmers and analysts to know unit record equipment wiring principles.

Many training courses in basic data processing concepts have stressed unit record wiring principles as a basis of learning processing techniques and capabilities. (See Appendix J for a partial listing of data processing courses taught by some colleges and universities in the Piedmont.) As more organizations move to computer installations, data processing managers feel that the requirement for knowledge of unit record wiring principles for programmers and analysts has lessened considerably. Programmers and analysts should be familiar with the capabilities of the equipment, however. Of the 51 respondents, 43, or 84%, indicated negative to both parts of Question Two of the questionnaire. Several of the reasons given by the remaining 16% of the respondents who felt that such training was necessary are:

> "It is less complicated, yet it orients a person into programming techniques, therefore a person can become a more efficient programmer more rapidly."
>
> "Some knowledge is necessary since I feel it is helpful to know the capabilities of the tools at your disposal."
>
> "Must know the capabilities of the equipment, but need not be an expert at wiring."
>
> "Gives a basic knowledge of data processing at a small scale. You walk before you run."

Table 12 provides a breakout of respondents to Question Two by Small, Medium and Large users.

TABLE 12

THE REQUIREMENT FOR A DETAILED KNOWLEDGE OF UNIT RECORD WIRING PROCEDURES - RESPONDENTS BY USER SIZE

	SMALL USER	MEDIUM USER	LARGE USER
YES	5	2	0
NO	28*	9*	7

* Respondents answered No or Yes to both parts of the questions in all but three cases. In these instances, all three answered yes for the systems analyst and indicated that there was a need for him to be familiar with the equipment capabilities but not necessary for him to be able to perform detailed wiring tasks.

CHAPTER VI

Basic Computer Training

Section I - Programming Languages

Questions Three through Six related to the training of persons in basic computer concepts, basic programming and language use.

Questions Three and Four were related to the need for training in more than one programming language. The N. C. State Survey showed a trend toward the use of compiler, or high level languages as opposed to the use of assembler or symbolic languages. (Supportive data can be found in the results of Question Four, Appendix D.)[11]

In response to Question Three, 91 percent of the respondents, or 47 of the 51, answered Yes, they felt that a programmer should be skilled in more than one programming language. No explanation was given by the four respondents answering No.

In response to Question Four, 76 percent or 39 of the 51, indicated that a programmer would be required to program on more than one language if assigned to their organization. The majority of respondents answering NO (88 percent) are small users and have limited machine capability (usually a limitation of one language).

---

[11] McIntosh; op. cit.

Section II - Basic Computer Concepts and Programming

In reply to part one of Question Five (How does your organization train new persons in basic computer concepts?), most organizations, especially the smaller users, were very dependant on the vendor/supplier for their training in basic computer concepts. As mentioned earlier, some of the hardware manufacturers make available programmed instruction courses in both basic computer concepts and several programming languages. These courses are usually provided at little or no cost to the user. (See Appendix K for an example of the type of courses provided by the International Business Machines Corporation and the related prices.) Although not specifically defined in all cases, it can be concluded that a high percentage of such training by vendor/suppliers indicated in Table 13 is by programmed instruction, especially where basic computer concepts is concerned.

There has been no use of software firms or private schools for training in basic computer concepts or basic programming, although one respondent indicated a use of a university/college course. No reason was given for the lack of utilization of other areas of training, but several suppositions can be advanced. Since there is a great amount of training supplied by vendors/suppliers at no cost (Depending on separate pricing policies - see Chapter X for a further discussion of this area.), many organizations tend to discount the (relatively) high prices of software firms and universities in a training program.

In addition, university courses are usually of too long a duration, whereas an organization can produce a productive trainee in a much shorter time using programmed instruction or regular classroom methods of a continuous nature.

TABLE 13

NUMBER OF ORGANIZATIONS PROVIDING TRAINING IN BASIC COMPUTER CONCEPTS BY USER SIZE AND TRAINING SOURCE

Training Source	USER SIZE SMALL	MEDIUM.	LARGE
In-House	10	7	6
Vendor/Supplier	27	10	2
Software Firm	-	-	-
University/College	-	-	-
Private School	-	-	-
Other	-	-	-
TOTAL	37	17	8

Note: Figures indicate the number of organizations providing any portion of training of 50% or over from one source. Since some respondents used more than one source, this results in a greater total than the base 51.

TABLE 14

NUMBER OF ORGANIZATIONS PROVIDING TRAINING IN BASIC PROGRAMMING BY USER SIZE AND TRAINING SOURCE

Training Source	USER SIZE		
	SMALL	MEDIUM	LARGE
In-House	8	5	6
Vendor/Supplier	31	12	4
Software Firm	-	-	-
University/College	-	-	-
Private School	-	-	-
Other	-	-	-
TOTAL	39	17	10

Note: Figures indicate the number of organizations providing any portion of training of 50% or over from one source. Since some respondents used more than one source, this results in a greater total than the base 51.

Question Six requested a breakdown of the number of people trained in 1968, 1969, and 1970 (projected) by different methods. Table 15 provides this data on a total basis while Table 16 relates number trained to the size of user.

At first glance, these figures seem to be in contradiction with those of Tables 13 and 14 which show a predominance of training being carried out by vendor/suppliers. This surface discrepancy can be

TABLE 15

NUMBER OF PERSONS TRAINED IN BASIC COMPUTER CONCEPTS AND PROGRAMMING BY TYPE OF TRAINING SOURCE: 1968-1970 (PROJECTED)

Training Source	1968	1969	1970 (Projected)
In-House	93	111	128
Vendor/Supplier	54	65	53
Software Firm	-	-	5
University/College	-	-	1
Private School	-	-	-
Other	-	-	-
TOTAL	147	176	187

realized by the data in Table 16, which shows the relationship of number of persons trained to the size of the user. There is a definite increase in number of people from 1968 to 1970, but a lesser reliance on projected use of vendor/suppliers in 1970. The use of a software firm and a university/college is projected from one large user.

These figures should not be construed to mean that all 510 persons trained actually remained in the Piedmont, since several organizations provide in-house training for divisions of their company located outside the Piedmont. Data on number of persons from outside the Piedmont who were trained locally is not available, but would be estimated to be a fairly small percentage, since such training is carried out by a very few large organizations.

TABLE 16

RELATIONSHIP OF NUMBER OF TRAINEES TO USER SIZE:

1968-1970 (PROJECTED) (BASIC COMPUTER CONCEPTS AND BASIC PROGRAMMING)

User Size	Base	1968	1969	1970 Projected)
Small User	33	61	67	62
Medium User	11	37	53	53
Large User	7	49	56	72
TOTAL	51	147	176	187

CHAPTER VII

Systems Analysis and Design

The number of persons available in any data processing organization to perform the jobs of systems analysis and design have always been in short supply. Improved performance with computer hardware has sometimes been bottlenecked because of this shortage, especially in the smaller company. The small user is unlikely to be able to pay the high salaries normally commanded by persons with several years experience in the systems field. This has meant, in many cases, that projects were either not done at all, or were worked on by persons with limited skill and experience, sometimes producing less than optimum results.

The requirement for persons adequately trained in the concepts of systems analysis and design is enormous. One report of the Federal Government estimates that by 1970, more than 500,000 persons will need initial or updated training in systems analysis or related subject matter. (This estimate includes subject matter specialists and related occupations needing some training in systems analysis and design.)[12]

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[12] U. S. Office of Education; "The Relationship of ADP Training Curriculum and Methodology In the Federal Government"; AEDS MONITOR; July 1967; Volume 4, Number 12); pp. 12-13.

Questions Seven and Eight were concerned with the number and method of training of persons in the techniques of systems analysis and design. A large majority of the organizations making up the survey indicated that they provided in-house training for systems analysts. According to some additional comments added to the questionnaire, this is not a formal training program in some of the organizations, but a type of "on-the-job-training", usually of a programmer who is assigned additional duties in this area. Table 17 provides a breakout of training in systems analysis and design by training source.

TABLE 17

NUMBER OF ORGANIZATIONS PROVIDING TRAINING IN SYSTEMS ANALYSIS AND DESIGN BY TRAINING SOURCE

Training Source	Number of Organizations
In-House	26
Vendor/Supplier	16
Software Firm	8
University/College	-
Private School	-
Other	-
TOTAL	46

Note 1: Eleven respondents, all small users, indicated that they provide no systems analysis training at all.

Note 2: Figures indicate the number of organizations providing any portion of training of 50% or over from one source. Since some respondents used more than one source, this results in a greater total than the base 51.

Question Eight asked the respondent to indicate the number of persons in his organization trained in systems analysis and design in 1968, 1969, and 1970 (projected). Table 18 shows the number of persons so trained in those years.

TABLE 18

NUMBER OF PERSONS TRAINED IN SYSTEMS ANALYSIS AND DESIGN BY USER SIZE: 1968-1970 (PROJECTED)

	Base	1968	1969	1970 (Projected)
Small User	22	18	28	31
Medium User	11	8	12	14
Large User	7	46	57	31
Total	40	72	97	107

Note: Eleven respondents, all small users, indicated that they provide no systems analysis training at all.

These figures should not be construed to mean that a total of 186 persons were trained in systems analysis and design in the Piedmont and remained, there, since several organizations have provided in-house training programs for company personnel outside the area. No data as to the exact number of persons trained from outside the Piedmont is not available, but it is expected to be a very low percentage, since such training is carried out by a very few large organizations.

The figures in Tables 17 and 18 point up the already established trend of personnel growth in the data processing field. The training and growth, in the majority of cases, is among the large user.

It is interesting to note that organizations rely significantly on the support of software firms to supplement their training in systems analysis and design. As in other types of training previously mentioned, no use is made of the private school in systems training.

CHAPTER VIII

Managerial Training

Section I - Managerial Training for Data Processing Personnel

As in any other department of the organization, programmers and systems analysts must be acquainted with the basic managerial techniques and problems often encountered in supervisory situations. Many companies stress technical training but seem to forget that the technician might someday become a manager, and unless grounded in managerial practices, will be more non-productive and disruptive to the organization than the newest trainee in the department.

Question Nine on the survey asked if training in managerial techniques was provided by the organization to its programmers and systems analysts, whether through in-house training programs or by outside sources. No effort was made to distinguish the type of outside training source.

Forty-three percent of the respondents, or 22 of the 51, do not provide any type of training in managerial techniques for their programmers or analysts. Of these 22 organizations, 18 were small users and four were medium users. All large users provided some type of managerial training with five of the seven making up the survey using both in-house and outside sources. Thirty percent of all respondents replied that they used both in-house and outside sources.

Table 19 is a breakout of type of training by user size and training source.

TABLE 19

MANAGERIAL TRAINING FOR PROGRAMMERS AND SYSTEMS ANALYSTS

RELATED TO USER SIZE AND TRAINING SOURCE

		IN-HOUSE		OUTSIDE	
User Size	Base	Yes	No	Yes	No
Small User	33	7	26	10	23
Medium User	11	5	6	3	8
Large User	7	5	2	5	2
TOTAL	51	17	34	18	33

Section II - Orientation for Non-data Processing Executives

"The objective of managerial training can be stated in a word: behavioral - changing the manager's behavior to the extent that he both appreciates the potential of the computer and the problems of computer personnel, and has learned to use the computer to solve his problems."[13]

In a survey conducted by Case and Company, management consultants, 865 top-level funtional executives from 655 companies indicated:

Major dissatisfaction (40%) with achieving the original goals of their first computer installation, even though over 80 percent of the companies had had computers for five years or more.

Greater dissatisfaction (45%) with the scope of their present computer efforts.

Almost universal agreement (73%) that their company had failed to utilize the computers capabilities.[14]

Executives cited two major reasons for the lack of success in computer information systems - first, a lack of qualified data processing personnel, including the computer manufacturers sales and systems

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[13] Ross, Joel E., "Data Processing Training for Managers: Objective and Curriculum Content; Computers and Automation; September 1968; (Volume 17, Number 9): pp. 16-19.

[14] Barnett, John H.; "Non-Computer Executives and the Computer"; Journal of Systems Management; December 1969, (Volume 20, Number 12, Issue 104); pp. 14-21.

staff, and, second, a lack of top management involvement in computer projects. The two reasons could be classified as two symptoms of one problem - a knowledge gap.[15]

McKinsey and Company researchers arrived at a similar conclusion in a recent study conducted by that organization. "One of the prime reasons . . . for the computer dilemma is the abdication by management of its control to staff specialists - good technicians who have neither the operational experience to know the jobs that need doing nor the authority to get them done right. Only managers can manage the computer in the best interest of the business."[16]

Many companies are trying to fill this void in managerial educational development by providing basic orientations in computer concepts for their non-computer executives. Semi-technical in nature, these courses usually cover the broad concepts of hardware/software operation and try to give the executive the capability to communicate with data processing oriented personnel.

Question Ten of the survey asked respondents to relate orientation of non-data processing managers to basic computer concepts by the source of training. Of the 51 respondents, 16 percent, or eight, answered that they provided no orientation in concepts for their management. Seven of the eight were small users.

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[15] Barnnet; op. cit.

[16] _____, Unlocking the Computer's Profit Potential; McKinsey and Company, Research Department; (New York); 1968; p. 38.

For the remaining 64 percent, or 43 of the 51, Table 20 provides a breakout relating to user size.

TABLE 20

SOURCE OF MANAGEMENT ORIENTATION RELATED TO USER SIZE BY TRAINING SOURCE

	USER SIZE		
Training Source	SMALL	MEDIUM	LARGE
In-House	21	8	8
Vendor/Supplier	16	3	2
Software Firm	-	3	3
University/College	-	1	-
Private School	-	-	-
Other	-	-	-
TOTAL	37	15	13

Note: Figures indicate the number of organizations providing any portion of training of 50% or over from one source. Since some respondents used more than one source, this results in a greater total than the base 51.

These figures show a fairly low dependence on the vendor/supplier for orientation courses, with most organizations preferring to use in-house training programs instead. Table 21 provides similar information from a nationwide survey to training by management position.

TABLE 21

COMPUTER TRAINING BY RESPONDENTS POSITION - DOW-JONES SURVEY

Question: "Have you attended any courses on computers?"

	RESPONDENT'S POSITION			
	TOTAL	TOP MANAGEMENT	SENIOR MANAGEMENT	OTHER COMPANY TITLES
	%	%	%	%
Yes	63.9	50.8	63.2	72.2
No	32.3	40.6	35.3	25.9
Not Stated	3.3	8.6	1.5	1.9
Total Base	100.0 (634)	100.0 (128)	100.0 (204)	100.0 (259)
Question: "If yes, who gave them?"				
Computer Manufacturer	73.8	73.8	82.2	70.1
College or University	33.1	24.6	22.5	42.8
Own Company	25.7	12.3	18.6	34.8
Management Organization	21.1	12.3	22.5	21.9
Other Outside Organization	15.6	15.4	14.0	17.1
Not Stated	0.5	1.5	-	1.5
Total Base	100.0* (405)	100.0* (65)	100.0* (129)	100.0* (187)

*Adds to more than 100.0% because some respondents gave multiple answers.

(Source - "Management and the Computer"; Dow-Jones and Company; 1969.

CHAPTER IX

Data Processing Education in the Piedmont

Section I - Types of Courses and Course Availability

Questions Eleven and Twelve of the survey were concerned with the topic of data processing education in the Piedmont area, and to what extent training might be utilized if appropriate courses were available.

The only data processing courses attended by data processing personnel (other than in-house courses) were technical training sessions sponsored by a vendor/supplier. (In all but one case, the vendor, IBM, was providing training in some phase of basic programming or advanced software techniques.)

Table 22 relates the number of persons attending these technical training courses in the Piedmont to the user size for 1968 and 1969.

TABLE 22

NUMBER OF PERSONS RECEIVING DATA PROCESSING TRAINING THE PIEDMONT FROM OUTSIDE SOURCES - 1968 AND 1969

User Size	1968	1969
Small User	17	19
Medium User	6	8
Large User	10	9
TOTAL	33	36

Question Twelve asked the respondent to indicate which organizations in the Piedmont area conducting data processing courses he would send his data processing personnel to, assuming that appropriate courses were available (other than in-house programs). Table 23 relates this selection to user size.

TABLE 23

PREFERENCE OF ORGANIZATIONS IN THE PIEDMONT AREA IN SELECTING APPROPRIATE DATA PROCESSING TRAINING, IF AVAILABLE, BY TRAINING SOURCE

	USER SIZE		
Training Source	SMALL %	MEDIUM %	LARGE %
Vendor/Supplier	22.2	18.7	11.7
Software Firm	28.3	38.0	46.3
University/College	39.5	41.2	32.0
Private School	0.0	2.1	0.0
Total	100.0	100.0	100.0

The percentage of respondents selecting a university/college does not correspond with the number of persons actually trained in data processing by that source. One supposition is that organizations are unaware of the existing programs of universities and colleges in the Piedmont. (See Appendix J for a partial list of DP courses offered by universities/colleges in the area.)

Section II - Manager's Criteria for Course Selection

In order to determine if there were any special considerations made by data processing managers when selecting a training course for their people, Question Thirteen asked the respondent to rank five criteria for each of five types courses. The numbers one through five were used, with one representing the most important and five the least important. Tables 24 through 28 show the ranking by each course of study related to user size.

For all five courses, the majority of respondents considered the prestige and capability of the organization conducting the course to be the prime factor in course selection. Cost of the training was the factor ranked as second by most respondents. The duration of a course, its location and the time given were ranked a major factor of consideration in only a few instances, mostly by the smaller users. Otherwise, these three criteria were overall considered to be of lesser importance than the prestige/capability factor and cost.

TABLE 24

RANKING OF BASIC COMPUTER CONCEPTS BY SELECTION FACTORS

USER SIZE	RANKING	PRESTIGE AND CAPABILITY OF GROUP GIVING COURSE	TOTAL COST	TRAINING LOCATION	DATE TIME	DURATION OF COURSE
		%	%	%	%	%
SMALL	1	73.3	20.0	6.7	0.0	0.0
	2	13.3	40.0	20.0	13.3	6.7
	3	0.0	6.7	33.3	26.7	33.3
	4	6.7	13.3	26.7	20.0	33.3
	5	6.7	20.0	13.3	40.0	20.0
MEDIUM	1	63.6	36.4	0.0	0.0	0.0
	2	18.2	54.6	9.0	0.0	9.0
	3	0.0	0.0	45.5	45.5	9.0
	4	9.0	0.0	18.2	45.5	27.3
	5	9.2	9.0	27.3	9.0	45.5
LARGE	1	71.4	28.6	0.0	0.0	0.0
	2	28.6	57.1	0.0	14.3	0.0
	3	0.0	0.0	57.1	28.6	14.3
	4	0.0	0.0	28.6	42.8	28.6
	5	0.0	14.3	14.3	14.3	57.1

TABLE 25

RANKING OF ASSEMBLY LANGUAGE PROGRAMMING BY SELECTION FACTORS

USER SIZE	RANKING	PRESTIGE AND CAPABILITY OF GROUP GIVING COURSE	TOTAL COST	TRAINING LOCATION	DATE TIME	DURATION OF COURSE
		%	%	%	%	%
SMALL	1	73.3	20.0	6.7	0.0	0.0
	2	20.0	40.0	20.0	6.7	13.3
	3	0.0	20.0	33.3	6.7	40.0
	4	0.0	6.7	13.3	46.6	33.4
	5	6.7	13.3	26.7	40.0	13.3
MEDIUM	1	72.7	27.3	0.0	0.0	0.0
	2	9.1	54.5	18.2	0.0	18.2
	3	0.0	0.0	36.4	0.0	63.6
	4	0.0	0.0	9.0	91.0	0.0
	5	18.2	18.2	36.4	9.0	18.2
LARGE	1	100.0	0.0	0.0	0.0	0.0
	2	0.0	71.4	0.0	28.6	0.0
	3	0.0	14.3	57.1	14.3	14.3
	4	0.0	0.0	14.3	42.8	42.9
	5	0.0	14.3	28.6	14.3	42.8

TABLE 26

RANKING OF COMPILER LANGUAGE PROGRAMMING BY SELECTION FACTORS

USER SIZE	RANKING	PRESTIGE AND CAPABILITY OF GROUP GIVING COURSE	TOTAL COST	TRAINING LOCATION	DATE TIME	DURATION OF COURSE
		%	%	%	%	%
SMALL	1	73.3	20.0	6.7	0.0	0.0
	2	26.7	40.0	20.0	0.0	13.3
	3	0.0	20.0	33.3	13.3	33.3
	4	0.0	6.7	13.3	46.7	33.3
	5	0.0	13.3	26.7	40.0	20.0
MEDIUM	1	63.6	27.3	9.1	0.0	0.0
	2	18.2	54.5	18.2	0.0	9.1
	3	0.0	9.1	36.3	27.3	27.3
	4	9.1	0.0	9.1	54.5	27.3
	5	9.1	9.1	27.3	18.2	36.3
LARGE	1	85.7	0.0	14.3	0.0	0.0
	2	14.3	57.1	0.0	28.6	0.0
	3	0.0	28.6	42.8	14.3	14.3
	4	0.0	0.0	14.3	57.1	28.6
	5	0.0	14.3	28.6	0.0	57.1

TABLE 27

RANKING OF SYSTEMS ANALYSIS AND DESIGN BY SELECTION FACTORS

USER SIZE	RANKING	PRESTIGE AND CAPABILITY OF GROUP GIVING COURSE	TOTAL COST	TRAINING LOCATION	DATE TIME	DURATION OF COURSE
		%	%	%	%	%
SMALL	1	60.0	13.3	6.7	13.3	6.7
	2	20.0	26.7	26.7	13.3	13.3
	3	6.7	26.7	20.0	13.3	33.3
	4	6.7	20.0	13.3	40.0	20.0
	5	6.7	13.3	33.3	20.0	26.7
MEDIUM	1	54.5	27.3	9.1	0.0	9.1
	2	18.2	45.4	18.2	0.0	18.2
	3	9.1	9.1	36.3	27.3	18.2
	4	9.1	9.1	9.1	54.5	18.2
	5	9.1	9.1	27.3	18.2	36.3
LARGE	1	71.4	14.3	14.3	0.0	0.0
	2	14.3	57.1	14.3	14.3	0.0
	3	0.0	14.3	42.8	14.3	28.6
	4	14.3	0.0	14.3	57.1	14.3
	5	0.0	14.3	14.3	14.3	57.1

TABLE 28

RANKING FOR MANAGEMENT ORIENTATION TO

DATA PROCESSING CONCEPTS BY SELECTION FACTORS

USER SIZE	RANKING	PRESTIGE AND CAPABILITY OF GROUP GIVING COURSE	TOTAL COST	TRAINING LOCATION	DATE TIME	DURATION OF COURSE
		%	%	%	%	%
SMALL	1	80.0	13.3	0.0	6.7	0.0
	2	20.0	40.0	6.7	13.3	20.0
	3	0.0	13.3	40.0	13.3	33.3
	4	0.0	20.0	20.0	40.0	20.0
	5	0.0	13.3	33.3	26.7	26.7
MEDIUM	1	63.6	18.2	18.2	0.0	0.0
	2	0.0	45.4	18.2	0.0	36.3
	3	0.0	36.3	18.2	36.3	18.2
	4	0.0	0.0	27.3	45.4	27.3
	5	36.3	0.0	18.2	18.2	18.2
LARGE	1	100.0	0.0	0.0	0.0	0.0
	2	0.0	71.4	0.0	28.6	0.0
	3	0.0	14.3	57.1	14.3	14.3
	4	0.0	0.0	42.8	57.1	0.0
	5	0.0	14.3	0.0	0.0	85.7

CHAPTER X

The Effects of "Unbundling" on Data Processing Education

On June 23, 1969, the International Business Machines Corporation announced a new pricing policy that was to have extensive effects throughout the data processing industry. The policy stated that on January 1, 1970, certain systems engineering activities, most customer education courses, and many future computer programs would be offered for a charge. Previously, such data processing support was provided without separate charge.[17]

Although expected for some time because of legal activities pending against IBM from several other organizations, including the United States Justice Department, the policy nevertheless caused both users and other suppliers to pause and take a hard look at the computer industry.

The International Business Machines Corporation has dominated the computer market for many years, currently supplying in the neighborhood of 70 percent of the computers manufactured in the United States.[18] Their pricing umbrella has, in the past, enabled other companies - manufacturers, lessors, etc. - to compete to the degree that IBM's grip on the marketplace could never be seriously challenged.

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[17] Watson, Thomas J., Jr.; Annual Report; International Business Machines Corporation; Poughkeepsie, New York; January 27, 1970; p. 6.

[18] _____; "Monthly Computer Census"; Computers and Automation; January 1970; (Volume 19, Number 1); pp. 66-69.

The industry's No. 1 manufacturer has set the pricing pace, and because of its better than 70 percent share of the market has, in effect, established de facto pricing standards.[19]

Since IBM's announcement, some manufacturers have followed "No. 1's" lead and also announced separate pricing policy (e.g. - NCR, Xerox Data Systems, Control Data Corporation), while others have maintained a package price for all services (e.g. - RCA, Honeywell). Although IBM has cut the price of hardware by about three percent, the additional costs of separate pricing (including other unbundling manufacturers) make for a price increase to the user of from 15 to 30 percent.

Since the separate pricing of education courses were a major portion of the new policies, Question Fourteen of the survey asked users if the unbundling would effect their educational programs. Sixty-eight percent of the respondents felt that separate pricing would have a very definite effect on their training operations and were not sure what steps they would take to alleviate the situation. Table 29 provides a breakout by user size.

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[19] Drattell, Alan; "Unbundling - The User Will Pay for the Works"; **Business Automation**; August 1969; (Volume 16, Number 8); pp. 37-41.

TABLE 29

THE EFFECTS OF UNBUNDLING ON DATA PROCESSING EDUCATION PROGRAMS BY USER SIZE

USER SIZE	WILL EFFECT DATA PROCESSING EDUCATION PROGRAMS
Small	76.6%
Medium	55.6%
Large	85.7%

Some comments on this question supplied by respondents are as follows:

"More expensive" - University User

"We will tend to train our own personnel more than in the past to eliminate schooling costs and improve efforts to develop systems analysts from within the company. Also develop personnel for the operation of OS systems design."
- Manufacturer

"Will require more in-house training."
- Government Agency

"We will go almost exclusively with independent training companies and are also planning a video tape program combined with our in-house program."
- Apparel Firm

"We will use sources such as software firms and universities in addition to vendor courses."
- Textile Company

"Since vendors will be engaged in competition with all other educational facilities, the resultant education possibly could be of higher quality."
- Tobacco Processor

"We have a small budget and our education will suffer because of unbundling."
- School System

"We will rely more on in-house training for two reasons:
1. The quality of manufacturer's instruction does not justify the price. (Too many unqualified instructors and "shallow" courses along with too much selling of the product.)
2. We purchased, rather than leased, our system, and do not feel that the manufacturer has met its commitments made before the unbundling."
- Sales Organization

George J. Ravazzolo, a former IBM'er and now president of Advanced Systems, Inc., Mt. Prospect, Ill., a firm which provides education courses for data processing users, said,

"Unbundling has forced us all to grow up, develop our own people and learn how to take care of ourselves. He sees the following happening, for example, to those data processing operations which have not established an education plan:

1. They will go to management and request a budget increase without the facts to substantiate that request because that requires a plan. And, if their management is any good, it will become very upset with them . . .

2. Some data processing operations will ignore budgeting for education and will eventually be forced to go over budget. This again is going to upset their management.

3. Some data processing managers will ignore the problem and will eventually face the deterioration of the quality of their personnel. And with deteriorating personnel comes attrition when people start realizing that they are personally not being developed by that company."[20]

The actual effects of separate pricing will probably not be felt by the user until later in 1970. By that time, organizations should be in a position to evaluate their position in relation to data processing education. (See Appendix K for a partial list of IBM education courses and their related prices.)

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[20] "The Supersonic Seventies"; op. cit.

PART IV

CHAPTER XI

Summary And Conclusions

Section I - Summary

A summary of the major points of the questionnaire and subsequent analysis of the related data are as follows:

1. Unit Record Training - A knowledge of detailed unit record wiring principles is unnecessary for persons receiving training in basic data processing concepts and subsequent entry into a working level of programmer or systems analyst. There is a marked decline in the use of unit record equipment installations as a sole data processing entity. The accounting machines are being replaced by small scale computers and the remainder of the unit record equipment is being used as peripheral support of the main computer operation (sorters, interpreters, etc.) Detailed wiring practices and procedures should be confined to persons who will be acting as equipment operators - computer or unit record.

2. Basic Computer Training - A great amount of training in both basic computer concepts and computer programming has been accomplished by vendor/suppliers as part of their "total package" to users. Much of the basic computer concepts training has been by programmed instructions material. The knowledge of multiple high-level

or compiler languages by programmers is necessary in a majority of companies currently using computer systems. COBOL (COmmon Business Oriented Language) and FORTRAN (FORmula TRANslation) are the most common languages in use by organizations possessing third generation hardware. PL/1, or IBM compiler language combining the concepts of COBOL and FORTRAN is available at a limited number of installations. Users of second generation hardware are usually dependent on a symbolic type programming for processing. The majority of users, especially the medium and large users, indicate that a programmer in their company would be required to program in more than one language.

3. Systems Analysis And Design Training - There is a limited number of organizations providing training in system analysis and design through formal classroom programs. These are mostly large and medium users. The smaller users indicate that they depend a great deal on on-the-job training for development of systems analysts. There is less dependence on a vendor/supplier for systems analysis and design training and more use of software firms and other outside sources. The requirement for persons skilled in these techniques is steadily increasing and does not appear to lessen in the near future.

4. Management Training - The area of management training was discussed in two parts: one dealing with the training of programmers and systems analysts in the concepts and techniques of general management and the other questioning if orientation in computer concepts was provided to non-computer executives. Less than 50 percent of responding organizations provide any type of managerial training for

their programmers or analysts, either on an in-house basis or from outside sources. A greater number provide some type of orientation for their non-computer executives in basic computer concepts. Small users are more unlikely to provide training in either area than medium or large users.

5. Course Selection In The Piedmont - There have been no training courses in the Piedmont area used by respondents other than a few provided by vendor/suppliers. (This does not refer to in-house programs.) These vendor/supplier courses have been highly technical in nature, generally covering some type of hardware operation or sophisticated programming technique such as "Operating Systems", "Systems Generation", "Teleprocessing", etc. All such courses were either conducted at vendor/supplier offices in Greensboro or Winston-Salem. Respondents indicate, however, that if appropriate data processing training was offered in the Piedmont area by either a software firm or university/college that it would probably be subscribed to. This opinion was prevalent from all user sizes.

6. Selection Criteria - All respondents ranked the prestige and capability of the organization conducting the training as a prime factor in the selection of data processing education programs from outside sources. The cost of such a program was generally ranked as the second most important factor. The duration of the course was ranked as least significant by the respondents; however, larger users ranked this factor lower more often than small users. The time/date and training locations were not considered as major or minor factors, but rather lesser considerations than cost by most respondents.

7. "Unbundling" - Of the users who are affected by the separate pricing policies of a vendor/supplier, almost all reported that they expect some difficulty in the development or continuation of a data processing education program. The only users who were not so concerned were the large users who provided an in-depth training program and those users not currently effected by separate pricing. Many respondents indicated that they would be more critical of vendor/supplier programs and would tend to rely more heavily on software firms and universities for training. The small user seems to be more concerned with the problem of "unbundled" education programs than the medium or large user, primarily from a cost/budget standpoint.

Section II - Conclusions

Data processing education in the Piedmont North Carolina, as well as the rest of the South-Atlantic geographic area is undergoing dramatic change. Whereas in the past, a data processing manager could call his vendor/supplier marketing representative and schedule a course for his personnel at no charge, today he is more often faced with the problem of how much does the course cost and what does his budget look like. The continued growth of computer installation and the related need for skilled professional personnel has made data processing training one of the major growth industries of the area. The following conclusions relate to the specific summary points covered in Section I of this chapter:

1. Unit Record Training - Organizations currently providing detailed wiring training as part of their general program in basic data processing concepts should consider the elimination of such training and the substitution of a section on the capabilities of unit record equipment in its place. Programmers, and especially systems analysts, should be aware of the capabilities of the equipment from a \peripheral standpoint, however, since they may be required to use such facilities in relation to their systems development.

It would appear to be a waste to continue detailed training in this area to anyone other than an entry level equipment operator for two reasons:

(a) If the course is conducted by a university/college or private school, it is doubtful that the student will ever be required to put the knowledge to use unless he is in an entry-level situation as described above. His or her time could be better utilized in other subject matter.

(b) If the person is in the position of a programmer or systems analyst, it is a waste of that persons time and ability (as well as salary) to require him or her to perform such mundane tasks as unit record panel wiring. This task should be left to an operator.

2. Basic Computer Training - Training in basic computer concepts and programming has been frequently accomplished by the use of programmed instruction materials supplied by a vendor/supplier. It is this writer's observation that in most cases the student is given the materials, put in a corner of the room out of the way, and told, "If you have any questions, ask someone". Too many times that "someone" is not specified or is to busy to be bothered by a trainee. The results are a person going on the job with a semi-skilled knowledge of the language he is supposed to be using. Organizations should consider the expansion of training in basic computer concepts and programming from pure programmed instruction and formal classroom sessions to the more advanced individual training methods involving interactive remote computing and video tape segments woven into an individualized instruction concept. One large user in the Piedmont is experimenting with this approach as a result of a program proposed by

this writer to them in 1969. There are indications that other users are interested in the possibilities of such training.

3. Systems Analysis and Design Training - Organizations must make an effort to provide a formal training program for the concepts of system analysis and design. This program can be in conjunction with or supplemented by on-the-job training but should never be replaced only by OJT. The small user especially should become aware of the long term advantages of a good grounding in basic systems principles as opposed to short term considerations of budget and time. Data processing managers should also become more aware of the fact that there is more to systems analysis and design than the pure mechanization of an application. The ramifications of introduction of a change into the organization can be far-reaching if not properly handled. A well-trained systems analyst knows how to approach this problem.

The lack of training programs for systems analysis and design in the Piedmont area should be alleviated by projected training programs to be provided by some software firms in the area. In addition the university system, as well as the community colleges, should consider the addition of such a program to their curriculums.

4. Management Training - The programmers and systems analysts with potential and ability will be advanced into managerial positions as time passes. User organizations of all sizes must provide training programs for these people in all phases of management. Such programs should be more thorough than the standard supervisor's orientation commonly provided by the personnel department of the organization.

The managers of information systems development will be breaking down the traditional organizational boundaries as their systems become more sophisticated. Only a good grounding in management philosophy at the programmer and analyst level will prevent chaos. Such training is necessary if an organization expects to provide a continuity in its supervisory and managerial development and promotion.

As we move into the 1970's, the computer is losing its glamor as a "black box" and top management is beginning to realize that control through proper information manipulation is a requirement for organizational management. The non-computer executive - the purchasing officer, the personnel man, etc. - should have a basic knowledge of the abilities and capacity of the computer tool at his disposal. His education should not stop here, however. Technology is expanding at an ever-increasing rate. It is the responsibility of the user organization to keep their non-computer executives aware of the "state-of-the-art" and changes to their "information tool". Such continued orientation is necessary if managerial expects to continue its optimization of management information systems.

5. Course Selection In The Piedmont - A definite opportunity exists in the Piedmont Area for more data processing education courses conducted by organizations other than the vendor/supplier. Industry and government should be made aware of the curriculums available from the universities and community colleges as well as specialized training offered by software firms in the area. Since the prestige

and capability of the organization conducting the training is one of the main considerations of a company in selecting data processing courses, it would appear that the universities and community colleges would be in an excellent position to begin expanding a real working dialogue with industry and government. The current concept of classroom presentation by the university (3 days a week, or one night a week, etc.) will have to be revised, however, if they expect to serve the needs of the business world to any extent. The universities should consider the possibility of all-day seminars in specific subject areas, to be presented on campus.

Although the departure from traditional education methods would be radical, its rewards (both monetary and status) would be great.

Although not a major part of the survey, this writer feels that the following observations on private business schools is revelant to the overall concept of data processing education in the Piedmont Area.

Due to the prior laxity of practices of private business schools, industry does not rely on these organizations to provide any company-sponsored data processing courses. Most of the computer school or private business school graduates do not have either the quality or quantity of experience that industry requires. Many companies will not accept graduates from private schools at anything but a computer operator level even though the individuals have been trained in programming concepts.[21]

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[21] _____; "EDP: Nice Work If You Can Get It"; Business Automation; March, 1969; (Volume 16, Number 3), p. 41.

One of the major problems facing the private school is that of reputation. More than 700 private schools throughout the United States specializing in EDP training have sprung up in the past 12 years. The number changes regularly as new ones enter the field and operators of others, whose only goal is to make a fast buck, move on to other exploitable areas. In their wake are graduates no closer to jobs in data processing than they were before spending their time and money for relatively worthless certificates of graduation.[22]

Industry itself, including manufacturers of equipment and users, have been increasing their commitment to training, especially since IBM's unbundling announcement implemented on January 1, 1970. In addition to initial training in a particular field or specific subject in data processing, retraining is a critical problem affecting the industry because of the rapid changes in technology. Dr. Hunter, of IBM, said;

> "There are many evidences that the high school or college graduate cannot possibly expect to exist for all of his working life on only the education he received at the point where he stopped his formal education. Rather, people in business will continue getting education, much of which will be provided either formally or informally through job-oriented training. Therefore, I believe any company which is going to install a management information system, should plan on an extensive commitment to education. This may occur on its own premises or it may involve sending people back to school for brief periods of time. Everyone should understand that the hardware is no better than the education and ability of the people who put it to work. If they are not given an opportunity to move up in their education and application,

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22 "The Supersonic Seventies"; op. cit.

then the performance of the system will show it."[23]

A statement by J. R. Bradburn, Executive Vice President of RCA provides an appropriate conclusion to this paper. "The computer education gap is a deep chasm. I consider it one of the key negating factors in the overall growth of the computer business. Ours, in the last analysis, is a people-dependent industry, limited not by technology or our ability to master economic production techniques, but rather by the number of competent individuals available both to manufacturers and users to implement computer information systems."[24]

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[23]Hunter, op. cit.

[24]Bradburn, J. R.; "Where is the Computer Industry Heading?"; Computers and Automation; January, 1970; (Volume 19, Number 1) p. 10.

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APPENDIX A

DESIGNATION OF A STANDARD METROPOLITAN STATISTICAL AREA

The Bureau of the Budget first issued definitions for metropolitan areas in 1949. The primary objective in establishing standard definitions was to make it possible for all Federal agencies to utilize the same boundaries in publishing statistical data useful for analysing metropolitan problems.

The general concept of a metropolitan area is one of an integrated economic and social unit with a recognized large population nucleus. Each standard metropolitan statistical area (SMSA) contains at least one central city with at least 50,000 inhabitants or more. The SMSA includes the county of such a central city and adjacent counties that are found to be metropolitan in character and economically and socially integrated with the county of the central city.

Area boundaries have been redifined from time to time because of population changes that have taken place since the inception of the concept of SMSA's.

On July 1, 1967, the Bureau of the Budget created the Greensboro-Winston-Salem-High Point standard metropolitan statistical area, which includes Forsyth, Guilford, Randolph and Yadkin counties. Previously, Guilford County and Forsyth County had been two separate SMSA's.

Source - THE CAROLINAS' MAJOR MARKET; Research Division, Greensboro Chamber of Commerce; 1969.

APPENDIX B

DESCRIPTION OF COUNTIES

FORSYTH

Forsyth, covering 424 square miles, is the third most populous county in North Carolina. An estimated 148,500 people were located in the county's largest city, Winston-Salem, in 1968. Some of the county's products are machinery, foodstuffs, furniture, various tobacco products and textiles. Winston-Salem College, Salem College, and Wake Forest University as well as a technical school are located in the county.

GUILFORD

Guilford ranks second in North Carolina in population, first in manufacturing employment, and second in value added by manufacture. Covering 651 square miles, its two main urban areas are Greensboro and High Point, with an estimated 1969 population of 149,077 and 75,324 respectively. Its noted products include textiles, furniture, food, machinery, metal fabrication, tobacco, chemicals, and paper, with textiles ranking first and furniture second. Strategically located, its role as a center for distribution and offices complexes will undoubtedly continue. The University of North Carolina at Greensboro,

North Carolina, Agricultural and Technical State University, Bennett College, Greensboro College, Guilford College, with both its main campus and downtown campus in Greensboro, and High Point College as well as the Guilford Technical Institute are found in Guilford County.

RANDOLPH

Randolph is a large Central Piedmont county of 801 square miles. Asheboro, its largest town, had an estimated 1968 population of 12,100. It is very industrialized with textiles being its most important product.

YADKIN

Covering 335 square miles, agriculture is the economic highlight with tobacco the most important crop in Yadkin County. In 1968, 1644 people were estimated to be living in Yadkinville.

Source - THE CAROLINAS' MAJOR MARKET; Research Division, Greensboro Chamber of Commerce; 1969.

APPENDIX C

QUESTIONNAIRE FROM NORTH CAROLINA STATE SURVEY

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR LOCAL DATA PROCESSING FACILITY

1. The following questionnaire was completed by:

_____
(name and title)

_____
(company)

_____
(address, including city and zip code)

_____
(telephone number) (date)

2. Number of employees:

Job Description	Number of employees as of January 1st 1966	1969	1972 est.
Data entry operators			
Unit record machine operators			
Computer operators			
Programmers			
Systems Analysts			
Supervisory personnel			
Other (please define):			

Note: If one individual fits more than one job category, include him once - in the highest job category.

3. What was the previous EDP job, or EDP training, of those people employed as of January 1, 1969, immediately prior to their present positions? Please write the number of people who:

	Received EDP Training At:					
Job Description	High School	Two Year post high school	College or university	Private EDP training school other than computer mfr.	Your Company sponsored training course	Computer mfr. sponsored training course
Data entry operators						
Unit record machine operators						
Computer operators						
Programmers						
Systems analysts						
Supervisory personnel						
Other (please define)						

4. Please indicate the languages that you use or plan to use:

Type of Language	1966	1969	1972 est.
Fortran			
COBOL			
Algol			
PL/I			
Symbolic			

5. Do you feel that "hands on experience" is essential for training individuals for job entry levels for the following job categories:

Job Description	Yes	No
Data entry operators		
Unit record machine operators		
Computer operators		
Programmers		
Systems analysts		
Supervisory personnel		
Other (please define)		

6. Type of data processing equipment in your data processing installation.

Equipment	Number of pieces of equipment as of January 1. 1966	1969	1972 est.
a. Unit record			
b. Computer equipment:			
1. Magnetic tape			
2. Magnetic disk			
3. Remote terminals			
4. On-line facilities			
5. Memory core size			
c. Other (please define)			

7. Place an H for Heavy, M for Medium, and L for Light before each of the areas of study listed below. This will indicate the amount of training you think should be applied in each area.

_____Key punch	_____Operating systems
_____Verifier	_____Tape systems
_____Sorter	_____Magnetic drum systems
_____Reproducer	_____Magnetic disk systems
_____Collator	_____Card systems
_____Accounting machine	_____Programming
_____Interpreter	_____Systems design
_____Calculator	_____Computer operation
_____Board wiring	_____Block diagramming
_____Card handling	_____Data flow in computer
_____Operation	_____SPS
_____Flow charting	_____COBOL
_____Procedure planning	_____Autocoder, easycoder, etc.
_____On-the-job training	_____Fortran
	_____On-the-job training
	_____Other (Please specify)
	_____ _____

8. Would your organization be willing to sell computer time to other businesses in this area?

_____Yes _____No

9. Indicate percent of the number of employees in your computer center in the following categories who received training in North Carolina:

Job Description	% trained in North Carolina
Data entry operators	_____
Unit record machine operators	_____
Computer operators	_____
Programmers	_____
Systems analysts	_____
Supervisory personnel	_____
Other (please define)	_____
_____	_____
_____	_____
_____	_____

10. Indicate the extent to which you have experienced difficulty in staffing your computer center:

Little difficulty _____

Moderate difficulty _____

Great difficulty _____

11. What additional educational facilities do you feel are needed in your area to ease the program of staffing and operating a data processing center?

_____
_____
_____
_____
_____
_____
_____

12. Additional comments:

_____
_____
_____
_____
_____

DEFINITION OF TERMS USED IN QUESTIONNAIRE

Data entry operators: Include key punch verifier, data inscriber or encoder operator personnel.

Programmer: Coders.

Systems analysts: Include programmers who perform the analyst functions.

Supervisory personnel: Include directors, systems analysts, programming and operating personnel in management positions.

Other supporting personnel: Include other employees in positions not described above and please define below.

_____

_____

_____

_____

_____

Please return this questionnaire to: William A. McIntosh
Dept. of Industrial and Technical Education
N. C. State University
111-B Tompkins Hall
Raleigh, North Carolina
Telephone: 755-2241

APPENDIX D

ALL FIRMS IN PIEDMONT AREA WITH EDP EQUIPMENT - 70 RESPONDENTS

2. Number of Employees

Job description	1966 Total No.	1966 % of total	1969 Total No.	1969 % of total	1972 Total No.	1972 % of total
Data entry operators	325	39.6	503	37.5	611	34.7
Unit record machine operators and Computer operators	199	24.3	290	21.6	343	19.5
Programmers and systems analysts	127	15.5	259	19.3	126	24.2
Supervisory personnel	97	11.8	164	12.2	216	12.3
Other	72	8.8	125	9.3	164	9.3
Total	820		1341		1760	

Job description	% increase 1966-69	% increase 1969-72
Data entry operators	54.2	21.5
Unit record machine operators and Computer operators	45.7	18.3
Programmers and systems analysts	103.9	64.5
Supervisory personnel	69.1	31.7
Other	73.6	31.2
Total	63.5	31.2

Average Number of Employees	1966	1969	1972
Total firms responding	53	69	66
Average number employees	15.5	19.4	26.7
No. firms with no employees	17	1	2
No. firms who could not estimate	0	0	2

Notes

Only 24 firms reported "other", i.e., secretaries, clerks, etc.
Jefferson Standard will decrease their EDP staff by 10 people from 1969 to 1972.
Dunning Industries will eliminate their staff in 1972.
Forsyth County will employ 2 less people in 1972 than 69.
Western Electric in Burlington will employ 2 less people in 1972 than 1969. In addition, Western Electric did not report no. of systems analysts and programmers since they report to the development department.

ALL FIRMS IN AREA WITH EDP EQUIPMENT - 70 RESPONDENTS

3. What was the previous EDP job, or EDP training, of those people employed as of January 1, 1969, immediately prior to their present positions?

Job Description	High School	2 year post high school	College or University	Private EDP train. sch.	Your company train. course	Comp. mfr. train. cour.	Total
Total Number							
Data entry op.	223	0	5	65	145	45	483
URMO & CO	76	16	8	47	111	40	298
Prog. & Sys. An.	46	13	63	27	66	139	354
Sup. Personnel	17	4	41	14	53	64	193
Other	20	2	2	2	56	1	83
Total	382	35	119	155	431	289	1411
Percent People Trained by Job Description							
Data entry op.	46.2	0	1.0	13.4	30.0	9.3	100.0
URMO & CO	25.2	5.4	2.7	15.8	37.2	13.4	100.0
Prog. & Sys. Ana.	13.0	3.7	17.8	7.6	18.6	39.3	100.0
Sup. Personnel	8.8	2.1	21.2	7.2	27.5	33.2	100.0
Other	24.1	2.4	2.4	2.4	67.5	1.2	100.0
Percent People trained by Place of Training							
Data entry op.	58.4	0	4.2	41.9	33.6	15.3	34.2
URMO & CO	19.9	45.7	6.7	30.3	25.8	13.8	21.1
Prog. & Sys. An.	12.0	37.1	52.9	17.4	15.3	48.1	25.1
Sup. Personnel	4.4	11.4	34.4	9.0	12.3	22.1	13.7
Other	5.2	5.7	1.7	1.3	13.0	.3	5.9

Notes:

No. firms with same no. employees as people trained: 41
No. firms with more employees than people trained: 9
No. firms with less employees than people trained: 18
No. firms who did not respond to this question: 2

ALL FIRMS IN AREA WITH EDP EQUIPMENT - 70 RESPONSES

4. Please indicate the languages that you use or plan to use.

Language	1966 No.	1966 % of total	1969 No.	1969 % of total	1972 No.	1972 % of total
Fortran	7	15.6	19	18.1	27	20.4
Cobol	9	20.0	32	30.5	43	32.6
Algol	1	2.2	1	1.0	2	1.5
PL/1	1	2.2	6	5.7	25	18.9
Symbolic	20	44.4	24	22.9	19	14.4
Other:	7	15.6	23	21.9	16	12.1
ALP	0		1		1	
Assembler	0		2		2	
Autocoder	4		2		1	
Board Wiring	1		1		1	
Machine	1		1		1	
Neat/3	0		1		0	
PAL	0		1		1	
RPG	1		13		8	
Univac BAL	0		1		1	
Total	45		105		132	
No Response	40		7		5	
Language Unknown to Firm	0		0		3	

Language	% increase 1966-69	% increase 1969-72
Fortran	171.4	42.1
Cobol	255.6	34.4
Algol	0	100.0
PL/1	500.0	316.6
Symbolic	20.0	-20.8
Other	228.6	-30.4
Total	133.3	25.7

Notes:

Dunning Industries will have no EDP employees in 1972, but will use Cobol language.

Carolina By-Products will have employees in 1972, but no language.

Klopman Mills had 24 employees in 1966 but indicate no language or equipment in 1966.

ALL FIRMS IN AREA WITH EDP EQUIPMENT - 70 RESPONDENTS

5. Do you feel that "hands on experience" is essential for training individuals for job entry levels for the following job categories:

Job Description	YES			NO			Total
	No.	% yes	% total	No.	% no.	% total	No.
Data entry operators	62	18.0	88.6	8	12.1	11.4	70
Unit RMC	60	17.4	89.6	7	10.6	10.4	67
Computer operators	63	18.3	96.9	2	3.0	3.1	65
Programmers	48	14.0	76.2	15	22.7	23.8	63
Systems analysts	47	13.7	73.4	17	25.8	26.6	64
Supervisory Personnel	56	16.2	83.6	11	16.7	16.4	67
Other:	8	2.3	57.1	6	9.1	42.9	14
Librarian	1			0			
Salesman	1			0			
Clerks/Secretaries	1			3			
Control clerks	1			2			
Total	344		83.9	66		16.1	410

ALL FIRMS IN AREA WITH EDP EQUIPMENT - 70 RESPONDENTS

6. Type of data processing equipment in your data processing installation:

Equipment	1966 No. firms	1966 Pieces equip.	1969 No. firms	1969 Pieces equip.	1972 No. firms	1972 Pieces equip.
Unit record	49	407	54	424	45	338
Magnetic Tape	17	74	32	174	40	235
Magnetic Disk	17	39	38	131	53	288
Remote terminals	3	4	15	34	30	169
On-line facilities	6	8	14	27	22	85
Other	3	4	9	20	6	28

Memory Core Size:	No. firms	% total	No. firms	% total	No. firms	% total
Small	48	94.1	56	82.4	38	58.5
Medium	2	3.9	7	10.2	16	24.6
Large	1	2.0	5	7.4	11	16.9
Total	51		68		65	

Equipment	% change 1966-69	% change 1969-72
Unit record	+4.2	-20.3
Magnetic Tape	+135.1	+35.1
Magnetic Disk	+235.8	+119.8
Remote terminals	+750.0	+397.0
On-line facilities	+237.5	+214.8

No equipment reported 19

ALL FIRMS IN AREA WITH EDP EQUIPMENT - 70 RESPONDENTS

6. Array of Memory Core Size

Size Equipment	No. Pieces Equipment 1966	1969	1972
4	4	3	0
8	9	12	1
12	3	8	2
14	0	0	1
16	6	6	9
19	0	1	0
20	2	2	1
24	0	1	3
32	2	14	13
40	1	1	1
49	0	0	1
64	2	5	7
65	0	3	2
96	0	2	0
128	2	1	4
132	0	0	2
133	0	0	1
161	0	1	0
256	0	1	2
264	0	0	1
276	0	1	1
300	0	0	1
462	0	0	4
512	0	2	2
600	0	0	1
1500K	0	0	1
4000	0	1	0
8000	0	0	1
unknown	0	0	3
Total	33	65	65

Other: Type Equipment			
Optical scanner	0	0	2
Fastrand Drum	0	1	1
Drum 168K	0	1	1
Paper Tape	0	1	0
Computer card	0	5	7
Mohawk Data Encoders	0	8	15
IBM 6400	1	0	0
Magnetic Drum	1	1	0
Magnetic Doc. Read.	2	3	2

ALL FIRMS IN AREA WITH EDP EQUIPMENT - 70 RESPONSES

8. Would your organization be willing to sell computer time to other businesses in the area?

Size Equipment	Yes No.	Yes % yes	Yes % total	No No.	No % no	No % total	Total
Small	25	80.6	47.2	28	80.0	52.8	53
Medium	3	9.7	37.5	5	14.3	62.5	8
Large	3	9.7	60.0	2	5.7	40.0	5
Total	31			35			66

10. Indicate the extent to which you have experienced difficulty in staffing your computer center:

Size Equipment	Little difficulty No.	Little difficulty % little dif.	Moderate difficulty No.	Moderate difficulty % mod. diff.	Great diff. No.	Great diff. % great
Small	17	73.9	27	81.8	11	91.7
Medium	5	21.7	3	9.1	0	-
Large	1	4.3	3	9.1	1	8.3
		% total		% total		% total
Total	23	33.8	33	48.5	12	17.6

APPENDIX E

GREENSBORO - 28 RESPONDENTS WITH EDP EQUIPMENT

2. Number of Employees

Job Description	1966 Total No.	1966 % of total	1969 Total No.	1969 % of total	1972 Total No.	1972 % of Total
Data entry operators	111	32.3	173	35.6	237	35.5
Unit record machine op. and Computer op.	88	25.6	109	22.4	133	19.9
Programmers and systems analysts	65	18.9	103	21.2	161	24.1
Supervisory personnel	44	12.8	66	13.6	97	14.5
Other	36	10.5	35	7.2	40	6.0
Total	344		486		668	

Average Number of Employees	1966	1969	1972
Total firms responding	22	28	27
Average number employees	15.6	17.3	24.7
No. firms with no employees	6	0	1

Notes

18 firms did not report "other", i.e., secretaries, clerks, etc.
Jefferson Standard will decrease their DP staff by 10 people from 1969 to 1972.
Dunning Industries will eliminate their staff in 1972.

GREENSBORO - 28 RESPONDENTS WITH EDP EQUIPMENT

3. What was the previous EDP job, or EDP training, of those people employed as of January 1, 1969, immediately prior to their present positions?

Job Desc.	High School	2 year post high school	College or university	Private EDP training sch.	Your Company train. course	Computer mfr. train.course	Total
			Total Number				
Data entry op.	57	0	4	37	64	30	192
URMO & CO	22	4	6	24	67	20	143
Prog. & Sys. An.	23	3	25	10	49	60	170
Sup. Personnel	8	1	15	5	33	22	84
Other	6	2	0	1	27	1	37
Total	116	10	50	77	240	133	626
			Percent People trained by Job Description				
Data entry op.	29.7	0	2.1	19.3	33.3	15.6	100.0
URMO & CO	15.4	2.8	4.2	16.8	46.8	14.0	100.0
Prog. & Sys. An.	13.5	1.8	14.7	5.9	28.8	35.3	100.0
Sup. Personnel	9.5	1.2	17.8	6.0	39.3	26.2	100.0
Other	16.2	5.4	0	2.7	73.0	2.7	100.0
			Percent People trained by Place of Training				
Data entry op.	49.1	0	8.0	48.0	26.7	22.6	30.7
URMO & CO	19.0	40.0	12.0	31.2	27.9	15.0	22.8
Prog. & Sys. A,	19.8	30.0	50.0	13.0	20.4	45.1	27.2
Sup. Personnel	6.9	10.0	30.0	6.5	13.8	16.5	13.4
Other	5.2	20.0	0	1.3	11.2	.8	5.9

Notes

No. firms with same no. employees as people trained: 17

No. firms with more employees than people trained: 3
No. firms with less employees than people trained: 8

GREENSBORO - 28 RESPONDENTS WITH EDP EQUIPMENT

4. Please indicate the languages that you use or plan to use:

Language	1966 No.	1966 % of total	1969 No.	1969 % of total	1972 No.	1972 % of total
Fortran	3	13.0	10	18.5	12	20.3
Cobol	4	17.4	16	29.6	19	32.2
Algol	1	4.3	1	1.8	2	3.4
PL/1	0	0.0	3	5.6	9	15.2
Symbolic	12	52.2	13	24.1	9	15.2
Other:	3	13.0	11	20.4	8	13.6
Autocoder	2		2		1	
RPG	0		4		3	
ALP	0		1		1	
Assembler	0		2		2	
Autocoder	0		2		1	
Board Wiring	1		1		1	
Total	23		54		59	
No Response	12		1		1	

Notes
Dunning Industries will have no EDP employees in 1972, but will use Cobol language.
Carolina By-Products will have employees in 1972, but no language.

5. Do you feel that "hands on experience" is essential for training individuals for job entry levels for the following job categories:

Job Description	Yes No.	Yes % yes	Yes % total	No No.	No % no	No % total	Total No.
Data entry operators	24	17.1	85.7	4	12.9	14.3	28
Unit RMC	24	17.1	88.9	3	9.7	11.1	27
Computer Operators	27	19.3	100.0	0	0	0	27
Programmers	21	15.0	80.8	5	16.1	19.2	26
Systems Analysts	19	13.6	67.8	9	29.0	32.1	28
Supervisory Personnel	21	15.0	80.8	5	16.1	19.2	26
Other:	4	2.8	44.4	5	16.1	55.6	9
Librarian	1			0			
Salesman	1			0			
Clerks/Secretaries	1			3			
Control Clerks	1			2			
Total	140		81.9	31		18.1	171

GREENSBORO - 28 RESPONDENTS WITH EDP EQUIPMENT

6. Type of data processing equipment in your data processing installation:

Equipment	1966		1969		1972	
	No. firms	Pieces equip.	No. firms	Pieces equip.	No. firms	Pieces equip.
Unit record	21	149	22	136	19	113
Magnetic Tape	7	33	15	68	18	98
Magnetic Disk	9	22	18	50	23	119
Remote terminals	1	2	4	10	10	102
On-line facilities	2	4	5	9	8	42
Memory Core Size:						
Small	20		23		17	
Medium	1		1		3	
Large	1		4		6	
Total	22	14	28	26	26	26
% small	90.9		82.1		65.4	
% medium	4.5		3.6		11.5	
% large	4.5		14.3		23.1	
Other	3	4	5	9	2	4

GREENSBORO - 28 RESPONDENTS WITH EDP EQUIPMENT

8. Would your organization be willing to sell computer time to other businesses in the area?

Size Equipment	Yes			No			Total
	No.	% yes	% total	No.	% no	% total	
Small	11	73.3	47.8	12	92.3	52.2	23
Medium	1	6.7	100.0	0	0	0	1
Large	3	20.0	75.0	1	7.7	25.0	4
Total	15			13			28

10. Indicate the extent to which you have experienced difficulty in staffing your computer center:

Size Equipment	Little difficulty		Moderate difficulty		Great diff.	
	No.	% little dif.	No.	% mod. diff.	No.	% great
Small	9	81.8	7	77.8	7	87.5
Medium	1	9.1	0	-	0	-
Large	1	9.1	2	22.2	1	12.5
		% total		% total		% total
Total	11	39.3	9	32.1	8	28.6

Notes

Range for Greensboro firms of employment by size equipment:

Small	1-16 employees
Medium	17-24 employees
Large	25-79 employees

APPENDIX F

COVER LETTER, DEFINITION OF TERMS, AND QUESTIONNAIRE

January, 1970

Dear Sir:

As part of the requirements of the Master's Degree program at the University of North Carolina - Greensboro, I am conducting a survey of data processing education currently being carried out in the Piedmont North Carolina.

The main purpose of the survey is to make data available to the educational community in the Piedmont as to thoughts and trends of industry as far as their data processing training activities are concerned.

Initial information for this survey was taken from data gathered by Dr. William McIntosh, North Carolina State University, in 1969. Since your organization participated in that initial survey, your continued assistance would be appreciated.

A stamped self-addressed envelope is enclosed for your convenience in returning the questionnaire.

Thank you again for your cooperation and assistance in this survey.

Very truly yours,

William C. Andrews

William C. Andrews
2004 Donegal Court
Greensboro, N. C.
27406

(919) 299-2927

DEFINITION OF TERMS USED IN QUESTIONNAIRE

Vendor/Supplier	-	IBM, Honeywell, RCA, etc.
Software Firm	-	Computer Sciences, Brandon Applied Systems, etc.
University/College	-	University of North Carolina, Guilford Technical Institute, etc.
Private Business Schools	-	N. C. School of Automation, King's Business College, ECPI, etc.
Piedmont North Carolina	-	The counties of Guilford, Forsyth, Randolph, and Yadkin.

Please Return This Questionnaire To:

William C. Andrews
2004 Donegal Court
Greensboro, N. C.
27406

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT

DATA PROCESSING EDUCATION IN YOUR COMPANY

1. This questionnaire was completed by:

_____

(Name and Title)

_____

(Company)

_____

(Address, including city and zip code)

_____

(Telephone Number) (Date)

2. Do you feel that a knowledge of unit record equipment wiring principles is necessary for a programmer? (YES___) (NO___)
A systems analyst? (YES___) (NO___)
If yes, please explain:

_____

_____

_____

3. Do you think a programmer should be skilled in more than one programming language? (YES___) (NO___)

4. Would a programmer in your company have the opportunity to program in more than one language? (YES___) (NO___)

5. How does your company train new personnel in basic computer concepts and basic programming? (If more than one source, please indicate approximate percentage.)

	BASIC CONCEPTS	PROGRAMMING
In-house training program		
Vendor/Supplier courses		
Software firm courses		
University/college courses		
Private business schools		
Other (Specify)		
_____		
_____		

6. How many people from your company were trained in basic computer concepts and basic programming in the years indicated? (Company sponsored/funded courses)

	1968	1969	1970 (Proj.)
In-house training program			
Vendor/Supplier courses			
Software firm courses			
University/college courses			
Private business schools			
Other (Specify)			
_____			
_____			

7. How does your company train personnel in the techniques of systems analysis and design? (If more than one source, please indicate approximate percentage.)

In-house training program _____

Vendor/Supplier courses _____

Software firm courses _____

University/college courses _____

Private business schools _____

Other (Specify) _____

_____

_____

8. How many people from your company were trained in the techniques of systems analysis and design in the years indicated? (Company sponsored/funded courses)

	1968	1969	1970 (Proj)
In-house training program			
Vendor/Supplier courses			
Software firm courses			
University/college courses			
Private business schools			
Other (Specify)			

_____

_____

9. Does your company provide any in-house training programs for programmers or systems analysts in managerial techniques? (YES___) (NO___) Do you use outside sources in place of in-house training in managerial techniques? (YES___) (NO___)

10. How does your company provide an orientation in basic data processing concepts for its non-data processing managers?

In-house training program _____

Vendor/Supplier courses _____

Software firm courses _____

University/college courses _____

Private business schools _____

Other (specify) _____

_____

_____

11. How many of the training courses (other than in-house courses) attended by your programmers and systems analysts were in the Piedmont North Carolina area? (Please specify by course and location.)

1968	1969
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

12. Assuming that appropriate courses were offered in the Piedmont North Carolina area, would your company send programmers and systems analysts to them if they were conducted by:

A vendor/Supplier _____

A Software firm _____

A college or university _____

A private business school _____

13. Which would be the deciding factor in selecting a training course in the data processing field? Please rank 1 (most significant) through 5 (least significant).

	Prestige & Capability of organization giving course	Total Cost	Training Location	Date/ Time	Duration of course
Basic Computer concepts					
Programming (Assembly Languages)					
Programming (Compiler languages)					
Systems analysis and design					
Management Orientation to data processing					

14. Do you feel that unbundling (separate pricing) of educational services by many Vendor/Suppliers will have an effect on the training of your data processing personnel? (YES___) (NO___)

Please explain_____

_____

_____

_____

_____

APPENDIX G

SURVEY POPULATION

Cone Mills Corporation
2150 Yancyville Street
Greensboro 27405

Thomasville Furniture Ind.
Thomasville 27360

Guilford Mills, Inc.
P. O. Drawer U-4
Greensboro 27402

Vulcan Materials Company
P. O.Box 7506
Winston-Salem 27102

Jefferson Standard Life Ins.
Jefferson Building
Greensboro 27401

Acme-McCrary Corporation
North Street
Asheboro 27203

Hanes Corporation
P. O. Box 1413
Winston-Salem 27102

Central Carolina Grocers, Inc.
P. O. Box 687
Kernersville 27284

Bowman Gray School of Medicine
Winston-Salem 27102

E. C. P. I.
Suite 1015 Wachovia Building
Greensboro 27402

Carolina By-Products, Inc.
Randolph Avenue
Greensboro 27406

Lorillard Corporation
2525 E. Market Street
Greensboro 27420

Jewel Box Stores, Inc.
1200 N. Eugene Street
Greensboro 27402

Greensboro Public Schools
712 N. Eugene Street
Greensboro 27401½

Industrial Truck Sales & Service
P. O. Box 3174
Greensboro 27402

Western Electric Company
Wachovia Building (DAD)
Greensboro 27402

University of N. C. - Greensboro
1000 Spring Garden Street
Greensboro 27403

City of Greensboro
Drawer W-2
Greensboro 27402

Forsyth County
Government Center
Winston-Salem 27102

Greensboro News Company
200 N. Davie Street
Greensboro 27420

Jefferson-Carolina Corporation
P. O. Box E-1
Greensboro 27402

Life Assurance Co. of Carolina
630 N. Main St.
High Point 27260

Carolina Steel Corporation
South Elm Street
Greensboro 27406

Alma Desk Company
P. O. Box 271
High Point 27260

Klopman Mills, Inc.
Asheboro 27203

Joseph Ruzicka, Inc.
P. O. Box 21568
Greensboro 27420

R. J. Ryenolds Tobacco Company
Winston-Salem 27101

A & T. State University
312 N. Dudley Street
Greensboro 27401

Pilot Life Insurance Company
Sedgefield 27407

Computer Servicenters, Inc.
1020 W. Wendover Avenue
Greensboro 27405

Guilford County
County Courthouse
Greensboro 27420

Yadkin Valley Telephone Corp.
Yadkinville 27055

North Carolina National Bank
315 W. Lindsey Street
Greensboro 27401

Winston-Salem State College
Winston-Salem 27102

Dillard Paper Company
2751 Patterson Avenue
Greensboro 27403

Sears, Roebuck & Company
2600 Lawndale Drive
Greensboro 27402

Western Electric Company
3300 Lexington Road, S. E.
Winston-Salem 27102

Home Federal Savings & Loan
North Greene Street
Greensboro 27402

Greensboro Coca-Cola Company
High Point Road
Greensboro 17403

Computer Centers of N. C.
P. O. Box 1705
High Point 27260

Wachovia Bank & Trust
P. O. Box 3099
Winston-Salem 27102

Gate City Savings & Loan
108 S. Greene St.
Greensboro 27401

Burlington Industries, Inc.
P. O. Drawer 21207
Greensboro 27410

J. P. Stevens & Company, Inc.
W. Market Street
Greensboro 27403

Blue Bell, Inc.
335 Church Street
Greensboro 27405

Indian Head Hosiery Company
P. O. Box 1910
High Point 27260

Gilbarco, Inc.
West Friendly Avenue
Greensboro 27407

Pomona Corporation
Winston-Salem Road
Greensboro 27407

Hafo Distributers, Inc.
P. O. Box 4757
Winston-Salem 27101

N. C. School of Automation
618 W. Friendly Avenue
Greensboro 27403

Piedmont Aviation, Inc.
Smith Reynolds Airport
Winston-Salem 27102

Founders Furniture Company
Pleasant Garden 27313

Reliance Universal, Inc.
P. O. Box 846
High Point 27260

City of Winston-Salem
P. O. Box 2511
Winston-Salem 27102

Wachovia Services, Inc.
Wachovia Building
Winston-Salem 27102

Guilford Dairy Association
West Market Street
Greensboro 27403

Adams Millis Corporation
300 English Street
High Point 27260

Burlington Management Services Corp.
Wachovia Building
Greensboro 27420

DAN-2921 (5-51)

	INDUSTRY TYPE	SIZE	LOC	2a	2b	3	4	5a	5b	6a	6b	6c	7	8a	8b	8c	9a
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APPENDIX J

SAMPLE LISTING OF DATA PROCESSING COURSES IN COLLEGES AND UNIVERSITIES IN THE PIEDMONT

University of North Carolina - Greensboro

Department of Business Education and Secretarial Administration

No. 334. PRINCIPLES OF AUTOMATIC DATA PROCESSING (4:3:2)

Programming, wiring and operation of unit record equipment. Card design, keypunching, sorting, collating, and the preparation of reports. Introduction to flowcharts and systems design. Not open to freshmen (Page 115 - 1969-70 Catalog).

No. 335. FORTRAN PROGRAMMING (3:3) Development of the FORTRAN language as a tool for solving scientific, statistical, and other mathematical related problems on modern digital computers. The course will cover expressions in FORTRAN, algebraic statements containing arithmetic functions and exponentiation, problem logic and input/output record description. Prerequisite: A basic knowledge of algebra. (Page 116 - 1969-70 Catalog).

No. 535. ELECTRONIC DATA PROCESSING I (3:3) An introduction to basic computer concepts. The development of understanding in the programming of the 1401 computer at the machine language level. (Page 118 - 1969-70 Catalog).

No. 536. ELECTRONIC DATA PROCESSING II (4:3:2) An introduction to processors and compilors. Use of Autocoder, FORTRAN, COBOL languages

with emphasis on developing initial programming skill. (Page 118 - 1969-70 Catalog).

No. 634. ADP FOR BUSINESS TEACHERS (4:3:2) (Listed in Graduate Catalog).

A & T State University - Greensboro

School of English, Department of Business

No. 412. ELECTRONIC AND AUTOMATIC DATA PROCESSING FOR BUSINESS 3 (3-0) Fundamentals of Business data processing. The use of electronic computers and automatic machines in the area of accounting, economics, management, marketing, and general business. The equipment and facilities of the Guidance Center Laboratory are utilized in the course. (Page 208 1968 Catalog).

School of English, Department of Mathematics

No. 301. INTRODUCTION TO THE PROCEDURES OF DIGITAL COMPUTERS 3(3-0) Flowcharts, machine language, e.g. FORTRAN, preparation of cards and tapes, number systems, typical programs for solution on standard computers. Mathematical essentials for computer programming; e.g. approximation methods, error functions, iteration schemes, and numerical solutions of equations (Page 223 - 1968 Catalog).

High Point College - High Point

Department of Business Administration & Economics

BA 352. FUNDAMENTALS OF DATA PROCESSING (3 hours) A presentation of the broad concepts of data processing and computer problems. Emphasis is

placed upon the theory and philosophy of application rather than on the mechanics of the various systems. (Page 84 - 1969 Catalog).

Department of Mathematics

Computer Science 211. INTRODUCTION TO COMPUTER PROGRAMMING (3 hours) An introduction to digital computers, programming and the PL/1 language. This course is suitable for the general student. (Page 116 - 1969 Catalog).

Computer Science 231. FORTRAN PROGRAMMING (3 hours) An introduction course in computer programming in the FORTRAN language. (Page 116 - 1969 Catalog).

Guilford College

Department of Business Economics

No. 125. DATA PROCESSING I (3 hours) Data processing fundamentals, equipment, programming, systems, the basic data flow, machine processable data and data organization as related to electronic equipment. A typical data processing installation is provided by the college for laboratory work. (Page 85 - 1969 Catalog).

No. 126. DATA PROCESSING II (3 hours) This course orients the student to the basic principles of keypunching, verifyer, alphabetic punching and production punching. Additional equipment to be used includes sorters and collators. (Page 85 - 1969 Catalog).

Department of Management

No. 420. COMPUTER SCIENCE (3 hours) Principles of computer operation, structure, programming, application of computer techniques to accounting and business problems, study of auxiliary equipment for electronic data

processing. (Page 115 - 1969 Catalog).

Department of Mathematics

No. 331. DIGITAL COMPUTERS (3 hours) Components of computers, areas of application, programming, problem solving, and systems. (Page 124 - 1969 Catalog).

Wake Forest University - Winston-Salem

Department of Mathematics

No. 225. THEORY AND APPLICATION OF THE DIGITAL COMPUTER I. Basic theory and application of computers. Intensive study and laboratory training in coding and programming using FORTRAN. (Page 125 - 1969-70 Catalog).

No. 226. THEORY AND APPLICATION OF THE DIGITAL COMPUTER II. A continuation of M225, including PL/1, SPS and basic machine language. (Page 125 - 1969-70 Catalog).

No. 355. NUMERICAL ANALYSIS. A computer-oriented study of various analytical and numerical methods. (Page 126 - 1969-70 Catalog).

APPENDIX K

LIST OF SELECTED IBM EDUCATION COURSES AND RELATED PRICES

F3601	Fundamentals of Programming	$ 140.00
D3601	System/360 System Design and Analysis	360.00
D3602	System/360 Communications system design and Analysis	560.00
H3660	System/360 OS Workshop	1500.00
H3668	System/360 OS System Planning	1175.00
K3663	System/360 OS BTAM Coding	425.00
H1800	1800 TSX System Training	900.00
W9870	System Science Education - Part 1	3500.00
W9872	System Science Education - Part 2	2500.00

Source - (Data Processing Education Course Price List; International Business Machines Corporation; October 1969)