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Trends and patterns in computer usage: A survey study of business and industry for the purpose of determining content for the computer science program in the community college

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TRENDS AND PATTERNS IN COMPUTER USAGE: A SURVEY STUDY OF BUSINESS AND INDUSTRY FOR THE PURPOSE OF DETERMINING CONTENT FOR THE COMPUTER SCIENCE PROGRAM IN THE COMMUNITY COLLEGE

By

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TRENDS AND PATTERNS IN COMPUTER USAGE: A SURVEY STUDY OF BUSINESS AND INDUSTRY FOR THE PURPOSE OF DETERMINING CONTENT FOR THE COMPUTER SCIENCE PROGRAM IN THE COMMUNITY COLLEGE (May, 1990) Abstract of a doctoral dissertation, University of Miami, Coral Gables, Florida. Chairman: Dr. E. John Kleinert

The Study

The purpose of the study was to determine characteristics of the data-processing business community and to determine what patterns and central themes are emerging concerning computer usage. This information was to be used to develop curriculum content for data-processing education.

The data consisted of (1) reporting on languages, hardware, operating systems, and software utilized by the data-processing business community; (2) information from the data processing business community related to where and at what level the data processing graduate is being employed; and (3) projections of future computer-related skills which will be needed for student employment. Data from a search of the literature for the trends and patterns of computer usage was included.

Design

The study design consisted of developing a

questionnaire instrument for obtaining information from the data-processing business community; gathering data by submitting the questionnaire to the business community; searching current periodicals for the future themes and patterns applicable to the computer science area; and analyzing the data from both the questionnaire and the periodical search.

Findings

The findings indicated emerging computer usage areas; current trends involving the integration and usage of applications software, systems software and language packages; and changes taking place regarding the nature of data processing hardware.

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TABLE OF CONTENTS

Chapter		Page
I.	INTRODUCTION	1
	Background	1
	Need for the Study	2
	Curriculum Considerations	3
	Statement of the Problem	5
	Purpose of the Study	5
	Study Design	7
	Definitions	7
	Significance of the Study	9
	Summary and Overview	10
II.	REVIEW OF THE LITERATURE	11
	Introduction	11
	Curriculum Models	12
	An Operational Curriculum	17
	Conceptualizing the Curriculum Planning Process	19
	A Model with Technological Domains	21
	The Mega Model, a Model for Planned Change	23
	Needs Assessment Model	29
	Summary of Curriculum Planning Models	30
III.	DESIGN METHODOLOGY	32
	Introduction	32
	The Survey Study	32
	Instrumentation	32
	Background	33
	The Plan for Making and Administering the Instrument	33
	Data Gathering Techniques	35
	Analyzing the Instrument Response Data	36
	Creating the Database	36
	Processing Methods	37
	Procedures used for analysis of the data from the heading section	37
	Analyzing the responses to the questions	39
	Programs used for processing data	41
	Resources Used for Determining Trends and Patterns	43
	Data Source	43

The Database 46
Processing the Database 46
Summary 47

IV. FINDINGS OF THE STUDY 48

Background 48
Results 49
Language Usage 50
Hardware 53
Operating Systems 53
Software 55
Employment of Data Processing Students 57
Work Experience 61
Usage Areas Emerging in the Future 63
Applications Software, Systems Software, and Languages, Current Trends 68
Data Processing Hardware 70
Summary 71

V. SUMMARY OF THE STUDY 73

Rationale 73
Purpose 73
Data 73
Design 74
Developing the Instrument 75
Submission of the Instrument 75
Search of Current Periodicals 75
Analysis of Data 76
Summary of Findings 76
Conclusions: Trends Indicated by the Study 78
Recommendations 79
Training Recommendations for the Practitioner 79
Replication of the Study 80

REFERENCES 81

ANNOTATED BIBLIOGRAPHY 86

APPENDIX

A Glossary of Terms 120

B Programs Used for Data Processing 125

C Information of File Construction/Processing 129

D Questionnaire form 144

LIST OF TABLES

Table		Page
4.1	Language Usage	51
4.2	Hardware	52
4.3	Operating Systems	54
4.4	Software Packages	56
4.5	Skills Desired for Entry Level Employment	58
4.6	Job Categories Students have been Hired in	60
4.7	Work Experience/Work Study	62
4.8	Job Areas Emerging in Future from Survey	64
4.9	Job Areas Emerging in Future from Articles	66
4.10	Job areas Emerging in Future from Articles	67

CHAPTER I

INTRODUCTION

Background

During the last forty years society has been significantly influenced by the development of an electronic data processing device known as the computer. Business corporations, government agencies, and other organizations depend on computers to process data and make information available for use in decision making. Computers are responsible, to a large extent, for the standard of living typical in the United States today. As the costs of computer equipment continue to decrease, computers will become an even more integral part of daily life (Mandell, 1982).

The Computer Revolution may be more sweeping than the Industrial Revolution. The effects of the computer are seen now in spectacular ways: in the graphics it produces; in its use in industrial planning; and in its effects on transportation, money, paperwork, commerce, and in the creation of the computer professions (Williams, 1982).

The two year computer science program in the

community college is designed to train individuals for the computer professions. Due to the rapid progress in design and development within the computer industry, the computer science curriculum must be constantly revised.

Need for the Study

This study is directed to the curriculum planner in the community college computer science area. The objective of the computer science program is to prepare the graduate for computer related employment. The need for conducting this research was evidenced by figures indicating a state of declining enrollment in computer related courses and by reports indicating the inability of students to find work related to that which they have studied.

Constant change is taking place in computerized data processing. Many books written about this area were outdated before they were published. The main source of up-to-date information is current periodicals (or other written materials) which reflect innovation and subsequent utilization which lead to present and future trends of employment information. Also necessary for baseline data is the present computer employment picture. This information comes from descriptive data of the present computer industry.

Curriculum Considerations

Curriculum innovations down through the ages have come chiefly from theological and political demands. Only occasionally was innovation or change the result of systematic inquiry. However in the past 50 years or so, attempts at basing proposed curriculum improvements on evidence have increased (Foshay, 1957)

An early theoretical position was taken by Bobbitt (1918) that curriculum should be centered around training for occupational efficiency. Other positions such as those advanced by the Commission of the Reorganization of Secondary Education were the Seven Cardinal Principles dealing with education for citizenship, education for physical efficiency, and education for social intercommunications (Foshay, 1957).

More recently, Johnson (1977) expressed a definition of curriculum and instruction as a directive force for the theory builder. He distinguished among curriculum, the source of curriculum, and the relation of curriculum to instruction. Johnson (1977) stated curriculum was the output of a curriculum development system. Curriculum resulted from cultural content which is ordered and selected. He also stated cultural content must be selected within particular domains (such as vocational and general education).

Walker (1974) expressed his theory of curriculum development as five questions. They are: What are the significant features of a given curriculum? What are the personal and social consequences of a given curriculum feature? What accounts for stability and change in curriculum? What accounts for people's judgments of the merit or worth of various curriculum features? What sorts of curriculum features ought to be included in a curriculum intended for a given purpose in a given situation?

Walker's questions reflect his theory that the curriculum is a practical field of study and is expected to make a difference in the logical framework of the learning process.

The theory relating to the development and improving of a technical curriculum is that content must be viewed as providing responsive instruction determined by job and/or task analysis. The techniques and the objectives which are responsive contribute directly to students finding and keeping jobs (McNeil, 1984).

The need for a "future implications dimension" for curriculum was stated by McNeil (1984) and Bhola (1980). The basic curriculum design must be based on a careful appraisal of future developments in society (Dodge, 1987).

Statement of the Problem

The problem this study addressed was the need for continuing information accumulation to determine the trends and patterns in business usage of the computer (examples: artificial intelligence related to business and industry; computer assisted design and manufacturing; and, interactive video training). This research included an analysis of this information to determine what computer related skills (such as computer languages or software) were required by these business community usages.

Purpose of the Study

The major purpose of this study was to provide course content information to the Business Data Processing program in the community college. This course content information was to come from two sources. One source was the prospective employers of the program graduates. The other source was a survey of the recently written literature to obtain timely information related to computer usage.

The purposes of this study were:

1) To determine what patterns and central themes exist within the field of computer usage and the implications these patterns and themes have for the computer science

program in the community college.

A) What languages, hardware, operating systems, and software should the student who completes the Associate of Science data processing degree have mastered to enhance employment prospects in the present data processing environment?

B) Where and at what data processing level (job type) is the data processing graduate employable?

C) What are the current desires and expectations of the potential employer of the data processing graduate concerning "work experience" and "on the job training?"

2) To determine the changing and emerging patterns and themes for future consideration for the computer science education program in the community college system.

A) What are the emerging computer usage areas, and what skills will be needed to meet the demands of these specializations?

B) What are the current trends involving integration and usage of applications software, systems software, and language packages?

C) What changes are taking place regarding the nature of data processing hardware?

Study Design

The design of the study consisted of researching present and future computer usage, design, and implementations.

The methodologies employed by this study were: (1) searching the literature for information indicating the trends for present and future computer usage; (2) developing a questionnaire; (3) obtaining data by submission of the questionnaire to business and industry; and 4) analyzing these data for training areas and related information.

Definitions

The following terms are used throughout the study in relation to topics, specific items, and categories of the questionnaire. Saylor and Alexander's (1966) curriculum and curriculum planning definitions were utilized.

1. Business data processing program--two year program offered in the community college leading to a degree which will enable the student to achieve employment.
2. Computer science program or computer science--used in place of "business data processing" by some authors but represents the same program.
3. Computer professions--all jobs related to the use of computers.
4. Work experience--time spent in a computer profession

at the entry level.

5. Curriculum--encompasses all learning opportunities provided by the community college. Curriculum is frequently used in the context of this study to refer to the technical curriculum with emphasis on the use of computers.

6. Curriculum plan--the advance arrangement of learning opportunities for a particular population of learners to achieve goals. Concerning this study the goal is computer related employment.

7. Technical curriculum--learning experiences based on mastery of technical skills directed toward attaining a job in the related technical area.

8. Vocational curriculum--used interchangeably with technical curriculum but also includes job training leading to employment.

9. Needs assessment technique--a procedure to uncover local deficiencies and trends to contribute to the decisions necessary in curriculum planning.

10. "The community" or "business and industry" labels--the organizations, businesses, service industries, or any group for profit or non profit, in the surrounding urban area.

11. "Software, hardware, operating systems" and other computer related terminology can be found in the glossary

included in Appendix A.

Significance of the Study

This study is significant for the following reasons:

1) The study indicates to the curriculum planner the languages, software, operating systems, and other computer-related areas which need to be incorporated into the curriculum.

2) The study provides data for continuing descriptive research for this constantly changing curriculum area. Included in the study was the programming software developed to expedite data processing. These guidelines, dealing with data gathering techniques and the processing methods, will need to be replicated or this study will not be usable as baseline data for the continuance of research in this area.

3) Business, industry and service areas provide current information regarding employment opportunities. Employment opportunities are related to the data processing shops needs, the types of equipment they are using, and projections of developing employment opportunities.

4) The business and industry computer users, by participating in the construction of the instrument and responding to the instrument, were partners in the curriculum planning process which is to produce the

computer graduate which they are expected to employ.

Summary and Overview

Chapter I presented an overview of the study. This overview addressed the problem, and the method of solving the problem, of providing information to the curriculum planner applicable to a rapidly growing, changing curriculum area.

Included in this discussion were the purpose and intent of the study, the design of the study, definitions of terms, and the significance of the study.

The following four chapters were organized as follows: review of the literature relevant to the study is presented in Chapter II; the design and methodology was detailed in Chapter III; the findings were presented in Chapter IV; and Chapter V detailed the conclusions and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of this chapter is to review different technical curriculum models. The organization of this chapter consists of six parts. The first part labeled "Curriculum Models" addresses the relevance of the technical curriculum. Included in this section are suggested methods of determining curriculum content. The second part describes a fully operational technical curriculum model developed by the United States Armed Forces. The third part, "Conceptualizing the Curriculum Planning Process," compares curriculum planning processes. The fourth part, "A Model for Technical Domains," states how domains when related to specific subject areas suggest activities for curriculum planning. The "Mega Model," the fifth part, is included because not only is it an extremely comprehensive model but it was used to plan and implement a post secondary vocational and adult education program. The innovation diffusion dimension of the Configuration(C) Theory of the mega model contains strategies for the development of the technical curriculum. The sixth part, "The Needs Assessment

Models," parallels the design of the study. The concept of needs assessment or needs analysis was contained in all the models developing the technical curriculum.

Curriculum Models

The dynamic nature of the vocational, technical, and occupational curriculum raises the critical question, "What is the basic direction that curriculum development should take?" (Finch and Crunkilton, 1984, p.16). They go on to tell us that, traditionally, curricula developed have been somewhat haphazard, with little consideration given to a continuous developmental process in this vital area. The curriculum content soon became outdated if steps were not taken to prevent complacency. The resultant static nature of curricula lost the dynamic aspect of the subject material. A curriculum area can only succeed if it is relevant. Curriculum relevance enables the students to experience success in the work world for which they have been prepared (Finch and Crunkilton, 1984).

The relevance of content has to become the main issue when curriculum planning takes place. The need for curriculum models for development of this relevance was stated by Goodlad (1975) when he argued that curriculum planning was primarily trial and error. Many curriculum procedures followed were without basis. Goodlad's assumptions and statements were verified twelve years

later by Brown (1987).

Brown (1987) surveyed the extent to which instructional curriculum was meeting the needs of undergraduate students in undergraduate technical programs. He concluded that, "based on informal data collected over the last few years, we have big problems" (p. 52). Lack of a curriculum model or systematic approach to curriculum development was the typical method found. He characterized "unsystematic curriculum design and no needs analysis" as "deadly sins" (p. 52).

Brown (1987) described what typically happened in curriculum design in the technical area is a group of professors gather and design curriculum. Each tried to include his or her special interest. If any outside information was used, it usually involved looking at some other schools' curricula to see what they were doing. "What is exactly 'not' done is to base the curriculum on an analysis of the knowledge and skills needed for the jobs the graduates are likely to get" (p. 53).

Curriculum model use and definition was explained by Hunkins (1980). He said using a model for systematic curriculum development was a means of conceptualizing curriculum and dealing with major tasks implicit in curriculum planning. The model selected should stress procedures but, hopefully, not induce an over-reliance on

"means-end" thinking. The model should be a process for facilitating the systematic generation of the curriculum program.

Hunkins (1980) suggested a curriculum planning model with seven major stages. The stages were: (1) curriculum conceptualization and legitimization; (2) curriculum diagnosis; (3) curriculum development content selection; (4) curriculum development experience selection; (5) curriculum implementation; (6) curriculum evaluation; and (7) curriculum maintenance.

The first stage requires a needs analysis, a determination of the audience for the curriculum, the raising of philosophical and conceptual questions, determining the curriculum design, and creating a master management plan. The second stage, diagnosis, requires translating the needs into causes and solutions, and generating objectives. The third, developing the content, requires selecting a concept of knowledge content, determining criteria for selection, selecting content, and organizing content. The fourth stage, experience selection, requires a selecting conception of experience, a selecting conception of instruction, determining criteria for selection, relating experiences to educational environments, and melding of curriculum components to curriculum thus creating a curriculum plan. The fifth stage, implementation, requires pilot testing,

monitoring the system, keeping communication channels open, and final implementation. The sixth stage, evaluation, requires formative and summative evaluations. The seventh stage, maintenance, requires managing the curriculum system and managing the support systems.

Bhola (1982), the originator of the mega model referred to later in this review, stated that no study on curriculum when innovation or change was the major part of the curriculum development task, was complete unless an "acceptance of change" model was included. He suggested the Bennis, Benne and Chin (1969) model. Bennis, Benne and Chin (1969) described a model aimed primarily at the concept of changing attitudes, values, behaviors, and beliefs.

Bennis, Benne and Chin (1969) stated the model was somewhat related to the concepts of Kurt Lewin. The name they called the model was "Unfreezing-Changing-Refreezing" (p. 98). The "Unfreezing" stage was to create motivation to change, to experience a lack of conformity or experience disconformation, and experience a presence of something which was not right.

The second stage, was the changing step. It consisted of developing new responses based upon information based on cognitive redefinition through [a] identification (information from a single source), and [b]

scanning (information from multiple sources.) "Refreezing" was to stabilize and integrate the changes.

Present in this model was methodology needed to deal with an existent commitment to previous behavior. The elimination of the feeling that previous behavior or attitudes or curriculum content, were wrong or inadequate was to occur. If change was to occur, therefore, it must be proceeded by an alteration of the present state of equilibrium which supports the present behavior but allows for voluntary adjustment. The involvement of those affected by the change, as well as those desiring the change, must be in the change process.

Foster (1982) also addressed the problem of individuals not wanting to give up the old ways. The old technology was ingrained in the system, whether it was a school's curriculum or a business, a tremendous effort was made to prove the old technology holds more promise than the new technology. He referred to this as the "sailing-ship phenomenon" (p. 30). The sailing-ship builders knew they had a problem when steam-ships were introduced. So the builders tried to design more efficient sailing-ships. At first the builders succeeded because early steam-ships were in the developmental stage. Many of the early steam ships exploded and sunk. As time progressed the more advanced technology prevailed.

Adherence to the old technology ironically can work

to the benefit of the user of the old technology for things out of date get cheaper and easily obtainable. The resultant situation, due to this thinking, is that technology is funded and supported which is outdated. (Foster, 1982).

An Operational Curriculum Model

Finch and Crunkilton (1984) presented the curriculum planning efforts of the armed forces as an example of a simple systematic approach to curriculum design aimed at the technical area. The success rate when using these learning activities was very high. When reviewing these techniques, an important factor is that the armed forces' students differed from ordinary students, and the military learning environment differed from the community college learning environment.

During the 1960s and the 1970s the various armed services sought to develop a model for establishing instructional procedures for the purpose of systematizing the instructional design process. A process of devising curriculum for training emerged from these efforts which was referred to as "Instructional systems development" or written simply as ISD. These ISDs had a major impact on managers, instructors, and students involved in military technical training. ISD essentially consists of five phases: analyze, design, develop, implement, and control.

All five phases were characterized by the following:

1. Rigorous derivation of training requirements from job requirements. Training requirements should maximize the combined effectiveness of the training and nontraining components of the total operational system.

2. Selection of instructional strategies to maximize efficiency of training.

3. Iterative trial and revision of instruction during development until training objectives are met (p. 30).

The analysis of the task included the identification and verification of the duties and tasks as described in the military occupational specialty, known in the armed forces as the MOS. The instructional setting was taken into consideration when the tasks were analyzed. The design phase emphasized the developing and sequencing of objectives and identifying student entry behaviors. The terminal learning objectives stated precisely what it was the learner was to learn and what performances the learner will exhibit to show the learning has been mastered.

The development phase focuses on objectives as they relate to sound learning procedures. In terms of general learning guidelines the following were presented:

Inform the learners of the objectives.

Provide for active response.

Provide for guidance and prompts.

Provide for feedback.

During the implementation phase, the entire plan was developed and the logistics for learning were prepared. Instruction in its best possible form was provided to the students.

The final phase of control was one of evaluation. Quality control was a part of every phase, but in this phase, the evaluation was of a more global nature and the effects, the output, the ultimate results, were evaluated to determine what changes, if any, were to be made. The system was in a constant state of evolution.

A drawback to these ISDs was the large number of staff necessary to complete the process. Teams of over a hundred persons were needed to work on individual ISDs (Finch and Crunkilton, 1984).

Conceptualizing Curriculum Planning Process

Conceptualizing the curriculum planning process was demonstrated by Gay (1980). Her work included four models, each with a unique perspective toward curriculum planning. These curriculum planning process models were: the academic model, the experimental model, the pragmatic model, and the technical model. The model of more

interest to this study is the technical model, but to place it in perspective the other models need explanation.

The academic model utilized scholarly logic as the basis for the process of curriculum development. Giving direction was the inherent structure of the discipline or disciplines relating to and shaping curriculum content. Curriculum planning was perceived as "transcending idiosyncrasies of particular situations" (p. 124). This model was dependent on theoretical considerations as perceived by the curriculum planners.

The experimental model contrasts with the academic model in that it was oriented toward activities and the learner. Persons plus process-oriented objectives were emphasized. Direction was toward learning and the learner, as a member of the social order.

The pragmatic model stresses planning in the local context. Present sociopolitical factors, in the environment of the learner, dictated that planning must be a localized process. It was not to be imposed from outside the local school setting.

The technical model was based on the perception that learning itself was a "system." The system "can be reduced to its constituent parts; it occurs in certain systematic and predictable ways; and its efficiency and effectiveness can be improved through good control or 'management' principles" (p. 128).

Components of this model were: making a needs assessment, specifying objectives, selecting content that aligns with objectives, and establishing concrete evaluation measures (Gay, 1980).

The use of any one of the Gay's models or a combination of two or more of the models, was possible. The tendency would be for the curriculum planner to align the planned curriculum revision with only one of Gay's models.

A Model with Technological Domains

Technological domains were proposed by Rummler (1987) as a framework for a model for organizing and updating the content of curriculum dealing with the areas deemed "professional" or those relating to professions.

The model consisted of the following: needs analyzed; intervention(s) selected; intervention(s) designed and developed consisting of repertoire changed, new behavior, and environment changed; intervention implementation; and evaluation. Each step was developed from the proceeding step. The interventions were from the needs analysis; design was developed from the identification of the interventions.

Underlying this model was the opportunity to identify technology domains relevant to stated objectives of improved performance/effectiveness of individuals. Each

technology domain must show the sub-component make up by job/task analysis, behavioral analysis, and analysis of other pertinent elements.

Domains to be identified were: needs analysis; instructional design and development; performance engineering; and evaluation. After identification of the domains, subject areas relevant to the domains or potentially relevant to the domains, were to be related to the technology area, and the theory, if theory was relevant, supporting the activities involved in the domain.

As an example, Rummler (1987) cited the following to demonstrate relationships which were relevant from one domain to another: 'Left brain-right brain' research is potentially important to learning theory and learner physiology, which in turn has importance for various components of instructional design. This is then incorporated into the repertoire of the individual" (p. 40).

A simpler approach to deciding what should be taught in the vocational and training areas was expressed by McNeil (1984) in his model. The model does not deal with justifying change or with behaviors which inhibit change; rather it qconsists of two parts: determining occupational targets, and determining the objectives for training

programs or courses.

Determining occupational targets consists of planners trying to coordinate programs that develop vocational skills with programs aimed at job placement. A job market analysis, a program review, and an assessment of curriculum resources must be coordinated with the priorities of the local, state, and national business communities.

Determining the objectives for training programs and courses requires job descriptions and task analysis procedures. The task identification process occurs through interviews, questionnaires, reports of critical incidents, and hardware analysis. The report of critical incidents includes records of work assignments which were carried out very effectively or very ineffectively.

McNeil (1984) stated that the weakness of the model was the preparation for jobs as they have been or as they are in the present. The model did not deal with what the jobs might be or should be as determined by future considerations. The criticism was that the model "is associated with 'presentism' " (p. 107).

The Mega Model, a Model for Planned Change

The search for models for planned curricular change would not be complete without the presentation of Bhola's mega model (1982). The model has eight segments within

it. The complexity of this model is due to the inclusion of social phenomena, the interacting and overlapping of social situations, economic change, technical change, policy change, and cultural relativities.

The eight sub models are:

1) The grammar of artifactual action.

2) An elaboration of the means x ends calculus of cultural action.

3) An "ideology to technology" chain.

4) A model for cultural action as elite initiatives in affiliation/exclusion.

5) A model for policy design.

6) A model for the understanding of power.

7) A dialectical model of needs negotiation.

8) A configuration theory of innovation diffusion or the CLER model.

Although the main interest for planning change in education is model eight, the other models are of interest to better understand the mega model.

The "grammar of artifactual action" model centers around artifactual action. Artifactual action was any social action organized by a means and ends relationship. Artifactual action may vary from ideological invention through policy making to the design of interventions. This action may involve teaching, consulting, counseling, family planning, administering, development,

modernization, and many other areas.

Important to the artifactual action is the grammar, which is asserted in this model to be one generic grammar with three levels. These three levels or processes of dynamic interrelation are: ordering/relating; expecting/typifying; and experiencing/correcting. These three processes in this model are the basic elements of the practice of innovation and planned change (Bhola, 1978).

The "means/ends" model deals with the artifactual action as it involved a means/ends relationship. The adaptation of a particular means to preferred ends will always occur. This model examined this relationship (Bhola, 1980).

The "ideology to technology" chain linked ideology with policy, planning, change, evaluation, methodology of change and evaluation, and finally, with techniques and tactics. The particular teaching strategy employed or the evaluation tactic chosen, must be congruent with the overall methodology (Bhola, 1979b, p.7).

The "cultural action and elite role" model Bhola (1980) explained as one which puts the roles of the elite and the masses in complementary positions -- ones which assume artifactual action within the appropriate perspective. Resulting from this model was the focus on the behavior

of the authorized elite, which leads into the model of "policy design." Policy making works in two directions: governing policy that undertakes to set new directions for society, and institutional policy that seeks to harness the society's resources to enable it to move into these new directions.

The "dialectical model of needs negotiation" provided perspective on participatory planning of change in relation to needs as defined on a planning change agenda. The "felt needs" of the community and the "user-definitions" of problems were instrumental in the negotiation process as needs were determined by the elite and fashioned into new, ideologically determined needs (Bhola, 1979a).

The "configurational(C) theory of innovation diffusion" and planned change model is referred to as the CLER model. The term CLER was an acronym for "configurational relationships", "linkages", "environments", and "resources." The "innovation", as in innovation diffusion, was defined by Bhola (1980) as "the new concept or new attitude, a new technology or new part of an existing technology, a new tool or piece of a new technology with accompanying skills and organization of work, a set of cultural values, or a new mode or style of living and working. This innovation is to be introduced to an individual, group, institution, or culture that had

not incorporated it functionally previously" (p. 14).

Diffusion was defined as the process involving information use, social interaction, and behavioral change, through the incorporation of innovation into the social order. The network of configurational relationships which included individuals, groups, institutions, and cultures were in a state of total diffusion when innovations voluntarily were sought and incorporated into the social system (Bhola, 1980)

Bhola (1980) stated linkages(L) were "the mutual stance between innovator and adopters being able to receive or reject information and/or influence from each other" (p. 21). Linkages fell into the categories of: linkages between and linkages within, formal and informal linkages, linkages dormant, and linkages to be severed for purposes of eliminating and isolating resistance to change.

The environment(E) was the physical, social, and intellectual condition which impinge upon configuration. The resources(R) were related to the environment for one enables the other to exist. Basically, the resources were the aid and support needed in the environment.

The CLER model was used for conceptualizing strategies for the use of learning resources in the community education curriculum. Planning for change was

not the main element addressed by the model. Innovation and diffusion were primarily emphasized (Bhola, 1981a).

Bhola (1981b) described the use of the mega model for the planning and implementation of a vocational and adult education program. The CLER model was the primary contributor to the use of the mega model.

When using the CLER model, Botha (1980) stated:

> Synergetic manipulation of the CLER need not, however, mean the manipulation of all four variables. There will be situations where only one or more (but not all four) variables will need to be optimized. There will be situations where all four may need to be optimized, but only one or more (not all four) are amenable to the change agent's control (p. 26).

Models which contributed to Bhola's work were: Rogers and Shoemaker's (1971) stages of adoption model with related conceptualization of the characteristics of innovators, innovations, and adopters; the social interaction model, the problem-solver model, and the linkage model as developed by Havelock (1971); the proactive/inactive change model of Zaltman, Florio, and Sikorski (1977); and the intermediate technology model by Schumacher (1973).

Needs Assessment Model

McNeil (1984) included four steps in his needs assessment model. They were: formulating a set of tentative goals statements, assigning priority to different goals, determining the acceptability of learner performance in each of the preferred goals, and translating high priority goals to plans.

Dodge's (1987) plans for needs assessment specifically defined behaviors whereas McNeil (1984) was less specific. Dodge (1987) proposed five steps for a needs assessment. They were:

1) Get management backing. Make sure there is cooperations on this level because without the support of management, the task will become most difficult if not impossible.

2) Meet with the people who can help you form an agenda. Who are the experts, who wants what, who can clarify the goals or objectives of the content area? answer these questions and build on the information.

3) Decide whether your assessment is about something already taking place or about something which will be happening in the future, or a combination of the two.

4) Go to where the jobs are performed. Use survey forms, questionnaires, and discussions.

5) Develop task charts, format what it is you want to know. Ask yourself these questions to clarify the information received. Divide into task, sub-task, required equipment, and related documents.

Dodge (1987) saw these needs assessment techniques as the only way of determining technical curriculum content.

Summary of Curriculum Planning Models

The process emerging from the literature incorporates three elements: needs assessment, interview, and a search for future implications.

Needs assessment was suggested by Gay (1980), McNeil (1984), and Dodge (1987). The concept of a task analysis (related to entry level employment) which would be a part of the needs assessment and included on the instrument, was suggested by Hunkins (1980), Finch and Crunkilton (1984), and Rummler (1987).

The interview technique, though implicit in any needs assessment, was called for directly by McNeil (1984) when dealing with task identification, Benne, Bennis and Chin (1969) who stated it was needed to relate innovation to the curriculum development, and Dodge (1987).

The need for the "future implications dimension" in the study was found in McNeil (1984) in his search for "presentism" and in his "Futuristic model" (p. 97). Dodge (1987) indicated that implications for the future

were necessary but he did not offer a solution for dealing with the problem of finding future implications. "Innovative diffusion" as described by Bhola (1980) required the "future" to define "innovation," but the "future" was more like "tomorrow" due to his concept of the area of concern evolving slowly, rather then an extremely dynamic area with consideration for events coming in the future years.

CHAPTER III

DESIGN METHODOLOGY

Introduction

Chapter III is divided into two parts: the survey study and resources used for determining the trends and patterns of computer usage.

The first part explains the methodology used for gathering the computer usage data from business and industry. The narrative consists of explaining the development of the questionnaire, the administration of the questionnaire, and the analyzing of the data contained in the administered questionnaire.

The second part describes the procedures used to determine the trends and patterns of computer usage from sources other than the questionnaire instrument.

Part One: The Survey Study

Instrumentation

The purpose of this section is to explain how the instrument was utilized. This section consists of the plan for developing the instrument, the implementation of the plan, and the data gathering techniques.

Background

The origination of the this research study was in a meeting at Miami Dade Community College convened by the college wide coordinator of the occupational areas. Agreement was reached that it was quite likely that the computer science curriculum was outdated and no longer meeting the needs of the computer industry.

The suggestion was made that a study should be carried out to ascertain what the present state of the computer industry is and what the trends and patterns for future usage are. The group agreed. It was agreed that a plan was to be deverleloped for procuring the data which was to incolude any committees needed to help carry out the plan. Support was pledged and the meeting was adjourned.

The Plan for Making and Administering the Instrument

The following plan was submitted for approval. Construction and administration of the instrument was to be guided by the following steps:

A) Form a committee consisting of a professor from each campus (three in all) to construct the instrument. These professors would represent the professorial staff college-wide.

B) Every data processing professor (all 18) was to write down what questions addressing information

areas the professor thought should be on the instrument and give this information to the professor representing his/her campus.

C) These questions were to be brought to the committee and from this information an instrument was to be constructed. The instrument was not to exceed two pages, and to include both forced-choice and open-ended questions.

D) The instrument was then to be taken back to each campus and revised by the professors there. This process was to be repeated until agreement was reached.

E) The department chairpersons were to approve the instrument and sign off for each campus.

F) The instrument was to be submitted to the college advisory board (which consists of people from computer related business and industry) for approval and possible revision. Part of this process was to have them each respond to the instrument to test the instrument.

G) The instrument was to be submitted to the members of the Data Processing Management Association during one of their monthly meetings, therefore, it had to be approved by the DPMA board of directors and a date set for submission. The DPMA Board of

Directors had indicated before the submission of this plan that they would consent to the submission of the instrument to their organization if the instrument was presented at the board meeting for approval. They also were to respond to the instrument to test it.

The plan was reviewed by committee and approved. The research committee consisted of three professors. The committee met on eight consecutive Fridays. The plan was followed and the instrument was developed. Within two weeks all the department chairpersons had approved it. It was submitted to the Business Data Processing Advisory Committee on June 14, 1988. The committee, consisting of ten members, approved the instrument. Two weeks later, the instrument was approved for distribution to the DPMA by their board of directors.

A copy of the instrument is in Appendix D.

Data Gathering Technique

The administration of the instrument was to the Data Processing Managers Association membership attending The November 10, 1988 monthly meeting. Every member present answered the instrument, thus yielding 67 instruments. Those members absent (20) were contacted by phone and mailed the form for the completion and return of the instrument. This follow up raised the total to 97

responses.

Twenty respondents were interviewed to clarify their answers and in some cases to get more information about suggestions or comments made on the form. These interviews were structured to parallel the content of the instrument. Results of the interviews were reported and added to the needs assessment information.

Analyzing Instrument Response Data

The explanation of the process of analysis which was applied to the data from the instrument falls into three categories. They are the the creation of the database, processing methods, and programs used for processing data.

Recording the information from the instrument and creating the database in a well-thought-out prescribed manner was the key to effective processing.

Creating the Database

The database consisted of 97 records. Each record represented the responses to one instrument (therefore 97 records indicated 97 instruments were processed.)

Each record, which was composed of the answers from all the questions on the instrument, contained a maximum of 36 fields. Each field was to contain the response to a question on the instrument.

The first seven fields of each record were positional. The first field was always the name of the person filling out the questionnaire. The company name was put in the second field. The service area was in the third field, the number of employees was in the fourth field and the number of data processing employees was placed in the fifth field. The position in the company of the respondent was placed in the sixth field, and the "yes" or "no" indicating the respondent was involved in the hiring process, was placed in the last remaining positional field.

The remaining fields, indicating the answers to the actual questions, were entered with code characters at the beginning of the field. Answers to questions marked "N/A" were skipped. Therefore each record contained the first seven fields plus the remaining fields which were the coded answers to the questions. The code consisted of the number or letter which preceded the question on the form. Each completed instrument became a record in the database. Detailed specifications used in the database are included in Appendix C.

Processing Methods

Procedures used for analysis of data from the heading section. The first part of the analysis of the data was the analysis of the information in the heading section of the instrument. This information indicated types of

businesses having data processing shops and the size of the data processing shops. This related to the extent potential jobs exist for the students to whom this study was directed. The information in the heading section established the credibility of the respondents by listing the characteristics of the respondents and the employment areas (business, industry, medical, education and other areas) they represented. Analysis was based on arranging in alphabetical order, grouping, and where meaningful, numeric values. Statistical representation of data (such as percent answering related to shop sizes) was used where applicable.

The first step in processing this heading information took the form of multiple sorting. The respondents names were sorted into alphabetical order. Included with the printout of these names were the company name, the service area, and the job title.

The second sort was alphabetically by company name. This listing indicated which companies were represented in this study. If more than one employee of any given company responded, which was the case with the larger companies, the company name was repeated in this listing. These multiple forms returned from one company were processed so that the answers given were grouped together and only one set of answers represented that company. The answers were accompanied by the size of the data

processing shop. Also included in this listing were the names of the individuals responding, the service areas, and the sizes of both the employee force and the data processing shop.

The third sort was alphabetical by service area. This indicated which areas were represented in this study and to what extent (how many instruments were returned) each service area was represented. Also listed with the service area were the company name, the company work force, the data processing shop size, the representative responding, and the title of the respondent.

A fourth sort was made on company size. This sort was repeated using the data processing shop size. The purpose of this sort was to rank the companies responding as potential employers using the data concerning employment.

Ratios were calculated pertaining to data processing jobs and employee work force in the different employment areas. This information could be used to project data processing employment.

Analyzing the responses to the questions. The processing of the responses to the questions was complicated by the different formats used for the question answers. Data which could be easily quantified, such as the "yes" and "no" answers and other forced choice answers limited to predetermined options, were analyzed by using

frequency counts. Answers which required words, groups of words, or sentences were categorized by ncontent analysis and presented in the resultant categories. To give further meaning to responses, the instruments were grouped according to some desired variable (or sequence of variables such as respondents with "mainframes" using "COBOL"). These groups of questionnaires were processed for differences between the overall responses and the group responses.

The first processing run included all the questionnaires received (as opposed to later runs which included only questionnaires containing selected variables or topics). This processing run dealt with questions with answers which could be represented by frequency distributions. Responses which fell into the "yes" and "no" category were reported as to frequency of each answer. The answer to questions such as #2: "What type of computer hardware do you use?" was broken down into how many "mainframes", "mini's" and "micros" were reported to be in use. The types of hardware, also indicated in the responses to this question, were also reported in the frequency distribution format keying on the manufacturer (such as how much IBM mainframe equipment is out there.)

Other questions, such as #s 3 and 4, which required responses dealing with names of languages or software, were also reported on the basis of the frequency of the

each given language, or software package being named.

This first run of the database created an overall picture of the (easily) quantified data. The second run of the database was to print out all the answers which consisted of sentences or phrases which would not lend themselves to quantifying. Question #9, dealing with areas emerging in the future for study and employment, was an example of this type of question.

Once the first and second runs were completed, then, analysis was repeated on the basis of selected variables. The number of employees, the number of data processing employees, service areas (such as banking or education), individuals involved in hiring, and mainframe shops were examples. Multiple variable processing was also done. An example was the service areas (such as banking), processed with the variable "mainframe", processed with data from individuals involved in the hiring process.

Programs used for processing data. The programs used for processing the data were written in the language BASIC and run on MS DOS 3. All the programs utilized for processing data in the study were written especially for this study. Appendix C contains all the programs as well as a detailed discussion as to how the programs were constructed and used.

Programs used were comparative sort programs. To

speed up processing, a partitioned sort model was integrated (as the first step) into the sort program. The sort programs were written so that any and all fields could be key fields (any answer or group of answers to any question could become a variable to sort on). Statistical programs were also written. Copies of them can also be found in Appendix B.

Commercial software packages which have a sort potential could have been used but were not because they are quite lengthy and time consuming. The more popular database program dBase III requires 250,000 bytes of RAM memory and at the time the database is constructed, all key fields must be designated. The SORT utility in MS DOS 3, could be used. It requires a microcomputer which has the ability to support MS DOS 3. The primary problem in using the DOS SORT is that it does not allow processing to be integrated within the sort procedure.

The sort program was used to sort into alphabetical order the file containing the 270+ references which composed the bibliography, to create the file of topics in alphabetical order, and to sort the variables in the heading section of the questionnaire. Also this program was modified to sort question responses and create groups for comparative processing.

Part Two: Resources Used for Determining Trends and Patterns

The reviewing of recently published material concerning computer usage and analyzing the content of this material were the procedures used to obtain the information which indicated the trends and patterns of computer usage.

Data Source

The main source of information was found to be periodicals, both magazines and newspapers. Some references were found in books, but generally the information contained in books was outdated due to the time lapse required between the writing of the book and the final publication.

In order to obtain a cross section of information, the list of magazines, which would form a reference section in a small library, was used as source material. These periodicals included popular reading, periodicals representing geographical locations, periodicals representing trade and industry, and scholarly periodicals published by scientific groups and universities.

To limit the time period so that only the most recent issues would be taken into consideration, the May, June, July, and August issues were researched. This time period presented a picture of what was happening in the rapidly

changing computer area during this fixed time frame.

Determination of the content of the articles in the four issues of the 270 periodicals was a major problem because the periodical subject reference section of the library, which was computerized, was of little use. Only the most obvious of article titles (those containing the word "computer" or a very obvious computer related word) were listed in the subject/keyword/topic database. Therefore, the table of contents of each periodical had to be examined and articles which might have any computer implications scanned for possible use in the research study. One of the articles found in the research dealt with this very problem (Ciarcia, 1988).

The criteria used for selection of articles with computer implications were: 1) subject matter or theme of the article was contemporary; 2) the subject matter or theme of the article had future implications; 3) the subject matter or theme of the article had implications for present or future computer usage which related to employment: and 4) the subject matter or theme of the article had implication related to the growth or "health" of the computer industry. The basic criterion for the selection of articles which incorporated the above stated criteria was that the subject matter or theme of the article must relate to the purposes of the study as stated in Chapter I.

The periodicals averaged about twelve articles in each individual table of contents. Over 12,000 article titles were reviewed. Articles which had the potential of meeting one or more of the criteria were turned to and scanned.

About 230 articles were found which were significant to this research project. Each article which was selected required a written summary. Also the subject or theme of the article was analyzed and represented by a single word (or a short group of words). Many articles had overlapping subjects or topics therefore these articles contained more than one subject or topic. An example was an article on computer usage in the health area which also contained information about interactive video training and a health care database. All three of these descriptive words or phrases, health, interactive video training, and database, became the keywords which represented the health related article and were entered into the database for processing. The written summary served two purposes, one was to reference the importance of the keywords or topics found in the article, and the other to retain a summary so that a narrative could be written indicating the trends and patterns the keywords and topics represented.

The Database

The data from the articles consisted of keywords or topics recorded from each article. The articles with their respective keyword/topic data composed the database. All articles, keywords, and topics were represented by numbers for ease of processing. When articles contained more than one keyword or topic, the keywords or topics which were thought to be more important were listed first in the grouping sequence.

Processing the Database. Processing the database containing the articles and the keyword phrases representing the articles consisted of determining if keyword phrases were actually part of other keyword phrases or subsets of other keyword phrases. An example of this process was the following keyword analysis: "interactive video training" was found in five references; "education" was found in 17 references; and "handicapped" was found in three references. The choice of "education" as the set keyword was relatively easy because the interactive video training references and the handicapped references were also found in the education references. Other keywords such as "music" were more difficult to categorize because the four references contained in music had to be split between the keywords "education" and art. To make these decisions, it was necessary to have readily available the individual summaries written on each

referenced article.

From the 92 keywords, 24 categories emerged. These categories were further processed as to their importance reflecting the trends and patterns in computer usage. The detailed analysis is contained in Chapter IV. An in- depth technical explanation of the analysis is contained in Appendix C.

An annotated bibliography containing the articles found which relate to the 24 categories is on page 86.

Summary

This chapter explained how the research was conducted, how the data were gathered, and how the data were processed.

One point stressed in this chapter was that after data are gathered, the data must be recorded (put in a database) in a way which enables almost unlimited processing opportunity. Perhaps after multiple processing runs, unanticipated information of importance emerges. Sachs (1988) emphasized this point regarding the search of a database for the presence of important information.

CHAPTER IV

FINDINGS OF THE STUDY

This chapter reports the findings of the study. The findings are presented in a sequence which parallels the order of the questions stated in the purpose of the study. This chapter begins with a brief background section which reviews the research questions.

Background

The twofold purpose of the study was to determine the present characteristics of the data-processing business community and to determine what patterns and central themes are emerging within the field of computer usage.

The major purposes of this study were:

1) To determine what patterns and central themes exist within the field of computer usage and the implications these patterns and themes have for the computer science program in the community college.

   A) What languages, hardware, operating systems, and software should the student who completes the Associate of Science data-processing degree have mastered to enhance employment prospects in the

present data-processing environment?

B) Where and at what data-processing level (job type) is the data processing graduate employable?

C) What are the current desires and expectations of the potential employer of the data processing graduate concerning "work experience" and "on the job training."

2) To determine the changing and emerging patterns and themes for future consideration for the computer science education program in the community college system.

A) What are the emerging computer usage areas, and what skills will be needed to meet the demands of these specializations?

B) What are the current trends involving integration and usage of applications software, systems software, and language packages?

C) What changes are taking place regarding the nature of data-processing hardware?

Results

This section is divided into sub-sections. Each sub-section begins with the question from the "Purpose of the Study" which is then answered. The sub-titles report the data answering the individual parts of the question.

What Languages, Hardware, Operating Systems, and Software Should the Student who Completes the Associate of Science Data Processing Degree have Mastered to Enhance his Employment Prospects in the Present Data Processing Environment?

Language Usage

Language usage reported in Table 4.1 indicated that 52% of the questionnaire respondents used the programming language COBOL. COBOL usage was indicated to be mainly in the mainframe environment. RPG, with 20% usage, was the dominant language in the minicomputer area. BASIC (16%) was the language of choice in the microcomputer area. Assembler and JCL, which are mainframe languages, were the only other languages which rivaled COBOL in the mainframe area. Pascal and RPG were used mainly in the minicomputer area. The language C, with a 9% usage rate, was the only rival to BASIC in the microcomputer area. Fortran, which is the oldest of all the languages, appeared to be seldom used.

Data from Table 4.1 regarding shop size indicate the number of individuals working in the data-processing shops which reported the use of the language in column one. Since the bigger shops generally use more than one language, and the shop sizes figure is reported for both languages, the shop size as job indicators are not

Table 4.1

Language Usage: Based on Responses of Businesses Surveyed

Total Sample n=87		Responses from Lang. Users n=71			
Language	% of total sample	% of lang. users in sample	Shop size	Ratio of hardware usage: mnf.	mini	micro
COBOL	52	63	2006	xxx	xx	x
RPG II & III	20	24	1221	x	xxx	
Basic (Vbasic)	16	20	899	x	x	xxx
Assembler	11	14	805	xxx		
Pascal	9	10	508		xxx	xx
C	9	10	392		x	xxx
JCL	5	6	203	xx		
Fortran	2	3	45	x	x	

The 1st col.: language name; 2nd col.:% total response; 3rd col.: % based on the 81% of response indicating the use of a programming language; 4th col.: shop size indicating number of employees in shops reporting the use of this language; cols. 5,6 & 7 (mnf.-- mainframe; mini -- minicomputer; micro -- microcomputer) indicate a ratio of hardware usage graphically displayed.

additive. Nevertheless, the job numbers represented by shop size indicate a pattern of the number of employees in the specific data-processing environment where the languages were used.

Relationships between the number of employees as indicated by the shop size and the usage rate can be

Table 4.2

Hardware in Use by Businesses Surveyed

The first number in each cell is the number of responses. The second number in the cell is the percentage these responses are of the total responses for the category (the category totals were: mainframe n=40; minicomputer n=49; micro n=59, manufacturers with one response generally were not reported). The third number is the percentage the responses are of the total responses to hardware usage (n=77).

Mfg.	Mainframe			Minicomputer			Microcomputer		
IBM	30	75%	38%	23	47%	30%	44	75%	57%
UNISYS	5	12%	6.5%				2	3%	2.5%
Hewlett Packard	2	5%	2.5%	4	8%	5%			
[Minicomputers only] Digital (PDP & VAX)				10	20%	13%			
WANG				6	12%	8%			
[Microcomputer only] AT&T							4	7%	5%
Altos							4	7%	5%
Apple McInt.							1	1.6%	1%

Out of the total 87 questionnaires, 77 reported hardware usage. The remaining ten, due to the nature of their business (such as sales or consulting) marked this item "N/A".

made. An example is the job environment of BASIC with a shop size of 1399 and a 16% usage rate, compared to C, which has about 9% usage rate with a shop size of 392. The usage indicator is a two-to-one ratio, yet the job opportunity or shop size indicator is four to one.

Hardware

Table 4.2 displays the hardware usage as reported by the total number of respondents. Many users have more than one type of hardware so the figures given in the cells are generally not additive. The figures represent a usage pattern. By taking information in the table and comparing it with other figures in the table, certain inferences can be drawn. Examples of the inferences are: IBM dominates the mainframe and microcomputer areas; Apple has little prominence in the business environment; and no manufacturer dominates the minicomputer market.

Operating Systems

Operating systems were found to be extremely important to the career data processing individual. Table 4.2 indicated a predominance of IBM equipment in the mainframe area, therefore IBM would be expected to predominate operating systems' usage. Table 4.3 contains operating systems information indicated by the questionnaire study. Table 4.6 indicates 40% of students hired were hired in the operations area.

The two IBM operating systems, MVS and MVS/XA, have shop sizes of 1414 and 985, and a 42% share (33%+9%) of all computer operating systems which included those operating systems used on the minicomputers and microcomputers. The minicomputer operating systems, UNIX and PICK, have a combined usage rate about equal to the

IBM VM, VS, and VSE minicomputer operating systems (Table 4.3).

Table 4.3

Operating Systems in Use by Businesses Surveyed

Total=87, Operating systems responses=64

Operating System	% of total	% of reported OS	Shop size	Ratio of hardware use mnf.	mini	micro
MVS (IBM)	25	33	1414	xxx		
MVS/XA (IBM)	7	9	985	xxx		
VM, VS, VSE (IBM)	8	11	442		xxx	
UNIX (AT&T)	11	19	307		xxx	
PICK	7	9	113		xxx	
VMS (Digital)	4	5	96		xxx	
WANG	2	3	34		xxx	
MS/DOS, PC/DOS (IBM compatible)	30	41	812			xxx

The 1st col.: Operating system; 2nd col.: % total response; 3rd col.: % based on the 74% of response indicating the use of an operating system; 4th col.: jobs in shops using this operating system; cols. 5,6 & 7 indicate hardware usage: mnf -- mainframe; mini -- minicomputer; micro -- microcomputer.

On the microcomputer level, the microsoft operating system used by IBM was the predominant system. The IBM compatible operating systems for the microcomputer, are included in the microsoft operating system category. Respondents reported 41% used the MS/DOS systems in their data processing shops (Table 4.3). The Apple McIntosh

was the only microcomputer reported that did not support this system (Table 4.2).

Software

The more successful software packages have been directed to the market relating to both spreadsheets and secretarial skills. data-processing students wishing to obtain entry level positions can benefit from the mastery of these software packages (Table 4.5).

Software which varies from the spreadsheet or secretarial skills theme is CICS from IBM. CICS requires a knowledge of COBOL as a prerequisite for usage. Use of the software package CICS was indicated by 21% of the data-processing shops. The total shop size of the CICS user was 1639 (Table 4.4).

Table 4.4 indicates Lotus, a spreadsheet program with a 65% usage rate, was the leading software package. The word processing packages were ranked second and fourth in Table 4.4 with a combined usage rate of 56%. Wordstar, the oldest word processing software, was reported to have the highest usage rate (33%). The database package, dBase, had a reported usage rate of 24% (Table 4.4). Display Writer, a dedicated IBM package for the mainframe, had a usage rate of 6% (Table 4.4).

Table 4.4

Software Packages Used by Businesses Surveyed

Total=87, Software users=77

Software name	% of total	% of soft. users	Shop size	Ratio of hardware use mnf.	mini	micro
Lotus	65	75	2290		xxx	xxx
Wordstar	33	38	1259		xxx	xxx
dBase II&III	24	27	682		xx	xxx
Wordperfect	23	26	691		xx	xxx
CICS	21	23	1639	xxx		
CustPack	8	9	133		x	xxx
Display Writer	6	6.5	223	xxx	x	x
Multimate	6	6.5	215		x	xxx
Symphony	6	6.5	130		xx	xxx

The 1st col.: Software name; 2nd col.: % total response; 3rd col.: % based on the 88% of response indicating the use of software packages; 4th col.: jobs in shops using this software; cols. 5,6 & 7 indicate hardware application usage.

Also of interest was the mention of other software packages. The following list includes the name and the number of times mentioned: MS Word (5); Mumps (1); Pace (1); Framework (1); Volkwriter (1); SAS (1); CAD (1); Pagemaker (2); Qcalc (1); Wordmark (1); Foxbase (2); IMS (2); MICSS (1); XYwriter (3); Clipper (1); Easytrieve (2); Prowriter (1); Windows (1); Excel (3); All-in-1 (1); Revelation (2); Realword (1); Presto (1); and three graphics packages.

Where and at what Data Processing Level (Job Type) is the Data Processing Graduate Employable?

Employment of Data Processing Students

Two questions were asked concerning the employment of students by the respondents. The questions were "In what job categories have students been hired?" and "What skills are desired for entry level data-processing jobs?" The data from these questions are contained in Table 4.5, and Table 4.6.

Skills in the programming area were desired for employment by 36% of the respondents. Usage of software had a 21% response. Skills concerning operations or operating systems had a 17% response. No language emerged as the best although COBOL, JCL, and RPG were the top choices. Programming skills, without mentioning any specific language, was reported by 13% of the total respondents (Table 4.5).

Twenty-one percent of the respondents reported software mastery to be a desired skill. Software usage had no clear favorite package although word processing led the field. Lotus, CICS, and CAD were mentioned (Table 4.5).

The biggest single area required was operations or knowledge of operating systems. General characteristics

Table 4.5

Skills Desired by the Industry for Entry Level Data Processing Employees
n=53

Response	# of responses	% of	Shop size	Ratio of hardware use mnf.	mini	micro
Programming -- as a skill	7	13	245	xxx	xx	x
COBOL	4	7.5	184	xxx	xx	
JCL	3	5.6	180	xxx		
RPG II & III	3	5.6	126	x	xxx	
Fortran	1	1.8	8		x	
C	1	1.8	8			xxx
Totals for programming	19	36	751			
Software use -- as a skill	4	7.5	79		x	xxx
Word Proc.	2	3.7	40		x	xxx
Data entry	2	3.7	18		x	xxx
Lotus	1	1.8	35		xxx	
CICS	1	1.8	25	xxx		
CAD	1	1.8	8		xxx	
Totals for software	11	21	205			
Operations	9	17	205	xxx	xxx	
Edu/Degree	8	15	397	xxx	xxx	xx
DP exp. & Trng	6	11	131	xxx	xxx	
Intell., logic, Motivation	12	23	432	xxx	xxx	xx
Computer lit.	3	5.6	73		xx	xx
Acct., Bus.	2	3.7	85		xx	x
Tech. skills	2	3.7	74		xx	x

The 1st col.: Response; 2nd col.: number of responses; 3rd col.: % based on the 53 responses; 4th col.; shop size and cols. 5,6 & 7 indicate hardware usage.

such as education, intelligence, logic, and motivation were also included in the responses (Table 4.5).

Job categories within which students have been hired are displayed in Table 4.6. Five categories were mentioned by 47 respondents. The categories were: programming, operations, technicians, data entry, and graphics. Programming, with 53% of the responses and a shop size of 1443, was the leader. Operations was second with 40%, and a shop size of 712. Although the difference between programming and operations is only 13%, the shop size for programming was over double that for operations (Table 4.6).

The middle part of Table 4.6 indicated where students have found employment. Banking was the primary employment area. Consulting was second after banking in the employment areas. Although consulting may very well fit into banking or any industry, it was presented as a separate area due to the respondents answers. Telephone calls to respondents indicated that most consulting was on a generalists level. Consultants, although preferring to work in certain categories of business or industry, generally worked with operations problems where demand existed, usually setting up systems and maintaining them.

Table 4.6 contains the names of employers who have hired student graduates.

Table 4.6

Job Categories in Which Students Have Been hired, and Agencies Hiring Them

Based on the response of the questionnaires
n=47

Job area	# of responses	% of	Shop size	Ratio of hardware use mnf.	mini	micro
Programming	25	53	1443	xxx	xxx	x
Operations	19	40	712	xxx	xxx	xx
Technician	2	4	64		x	x
Data entry	2	4	47		x	x
Graphics	1	2	8			x
Types of hiring agencies						
Banking	11	23	570	xxx	xxx	x
Consulting	6	13	170	xxx	xxx	x
Insurance	5	11	288	xxx	xxx	x
Medical	5	11	144	xxx	xxx	x
Individual employers						
Dade Board of Instruction			+100	xxx	xxx	xxx
Ryder Trk. Rental			+100	xxx	xxx	xxx
Florida Power and Light			+100	xxx		x

The 1st col.: Job area; 2nd col.: number of responses; 3rd col.: % based on those responding that they had hired students; 4th col.: shop size of respondents; cols. 5,6 & 7 indicate hardware usage.

What are the Current Desires and Expectations of the Potential Employer of the Data Processing Graduate Concerning "work experience" and "on the job training."

Work Experience

The current desires and expectations of potential employers of the data-processing graduate concerning "work experience" and "on-the-job training" are in Table 4.7.

There were 72 respondents to this question, 48 of those responding reported hiring data processing graduates. The requirement of work experience was reported by 29 respondents. Only 26 of the 29 respondents indicated the type of work experience desired. Operations experience led programming by the number of responses in the work experience category. When shop sizes were examined, the data indicated that the bigger shops desired programming as the work experience skill. The operations oriented shop had a shop size of 497 and the programming oriented shop size was 938 (Table 4.7).

The 48 respondents reported that only 11 participate in a work study program. Although the ratio was about one-to_three of respondents reporting participation and non-participation in work experience programs, the shop sizes of respondents reporting participation indicated about 40% of the jobs were in shops which participated in

Table 4.7

Desirability of Work Experience/Work Study, According to Businesses Surveyed

n=87

Category	# of responses	% of total	% of item responses	Shop size
Hires AS data processing graduates			**Responses: n=72**	
Yes	48	55	67	2891
No	24	27.5	33	332
Requires work experience			**Responses: n=48**	
Yes	29	33	60	1548
No	19	22	39.5	1126
Types of work experiences			**Responses: n=26**	
Operations	15	17	58	497
Programming	11	13	42	938
Participates in work study program			**Responses: n=48**	
Yes	11	13	23	1114
No	37	43	77	1592
Work/study equal practical experience			**Responses: n=61**	
Yes	58	67	95	2256
No	3	3	5	150
Work experience a degree requirement			**Responses: n=27**	
Yes	26	30	96	295
No	1	1	4	100

The 1st col.: Categories and answers; 2nd col.: number of responses; % based on n=87; 3rd col.: based on the number of responses in the category: 4th col.: shops size represented by the respondents.

work experience programs [.41=1114/2706 (2706=1114+1592), Table 4.7]. Concerning the question of whether or not work study was to be equated with practical experience, 95% of those responding to this item indicated that work study would be equated with practical experience. The shop size represented by this group was 2256. The number of responses to the question of whether or not work study should be a degree requirement totaled only 27. Of those responding, 26 felt that work study should be a degree requirement (Table 4.7).

What are the Emerging Computer Usage Areas, and What Skills will be Needed to Meet the Demands of these Specializations?

Usage Areas Emerging in the Future

The question of what job areas or usage areas are emerging in the future was dealt with both by inquiring of the data processing professional and surveying the literature. The response from the questionnaire study is reported first.

The question concerning those job areas which are emerging was answered by 48 respondents. Mastery of database technology led the responses with 19% agreement that this was an emerging skill area. The concept of mastery of 4th generation languages had a response rate of 16%.

Networking and telecommunications were mentioned as

future skills areas. Emphasis on microcomputer experience received a 10% response. Personal computer experience, operating systems, and graphics all were at a 10% response level (Table 4.8).

Tables 4.9 and 4.10 contain the data from the content analysis of 243 articles. The data in Table 4.8 compare favorable with data from Tables 4.9 and Tables 4.10.

Table 4.8

Predicted Job Areas Emerging in The Future
Based Questionnaires Responses
n=48

Job areas	# of responses.	% of	Shop size
Database	9	19	398
4th gen. lng.	8	16	275
Network/telecom	8	16	184
PC experience	5	10	292
Oper.sys/oper.	5	10	118
Graphics	5	10	115
CICS	3	6	174
Exp.Sys/Art.Int	3	6	99
Computerized business pgms.	2	4	72
Voice actuation	1	2	10
Work Station	1	2	12

The 1st col.: Emerging job areas; 2nd col.: number of responses; 3rd col.: % based on the 48 responses; 4th col.: shop size.

The predominant theme in the literature was the expanded usage of microcomputers. This was rated fourth by the questionnaire respondents in Table 4.8 with a 10% response. This is a close relationship to the 16% frequency rate in Table 4.9. The upgrading of microcomputers to become workstations or emulate the processing of the minicomputer were future predictions. Thirty-eight articles dealt with the future use and operations of the microcomputers. Job opportunities in the microcomputer area were indicated as being the main thrust of these articles. Secondly, research and development skills, requiring a more sophisticated background in areas such as engineering or mathematics, was predicted as a necessity for future computer employment. The mastery of database software and understanding database concepts was projected to be the third most important development. Business-related usage of computers was the theme of 27 articles. Combining business skills with computer skills was suggested by these articles. Graphics, mentioned in 20 articles, was projected to be a fast-developing area. These articles indicated that advances in microcomputer hardware, with extended memory and faster processing, opens the graphics area to smaller shops with less sophisticated equipment. Usage areas in the natural sciences, astronomy, weather

reporting, and geological area, were indicated to be emerging for individuals with computer knowledge. Again knowledge of these sciences, as well as the workings of the computer, will be necessary.

Education with the accessibility to massive databases is opening up new fields for data-processing. Interactive video training was indicated to be a growing computer related methodology in education (Table 4.9).

Table 4.9

Job Areas Emerging in the Future: Based on an Content Analysis of the Articles n=243

Job areas (relating to)	# of art.	% of total.art
PC operations/usage	38	16
Res & Dev.	34	14
Database	31	13
Business usage	27	11
Graphics	20	8
Natural Environment	18	7
Education	17	7
Artificial Intelligence (4th.gen.lng.&.expt.systems)	12	5
Medical	9	4
Military	8	3

The 1st col.: Emerging job areas; 2nd col.: number of articles; 3rd col.: % based on the 243 articles.

Artificial intelligence, robotics, and voice actuation were of little importance as rated by both the questionnaire respondents (Table 4.8) and the information in Tables 4.9 and 4.10.

Contradictory data were found concerning the networking area. Table 4.8 shows this area to be one of the more important areas, yet the literature barely mentions it (Table 4.10).

Table 4.10

Job Areas Emerging in the Future
Based on an Item Analysis of Articles
n=243

Job areas (relating to)	# of art.	% of total.art
Crime	6	2.5
Robotics	4	1.6
Music	4	1.6
Workstations	4	1.6
Voice processing	3	1.2
Information industry	3	1.2
FBI	2	.8
Networking	2	.8
Cosmetics	1	.4

The 1st col.: Emerging job areas; 2nd col.: number of articles; 3rd col.: % based on the 243 articles.

Content of the articles is presented in an annotated bibliography.

What are the Current Trends Involving Integration and Usage of Applications Software, Systems Software, and Language Packages?

Applications Software, Systems Software, and Languages, Current Trends

Data from industry indicated that the software in place which was most used was the Lotus spreadsheet program. The usage percentage of 65% (Table 4.4) is double the rate of individual word processing packages. When the word processing packages (Wordstar and Word Perfect) were treated as a single category, the percentage 56% (Table 4.4, Wordstar: 33% plus Word Perfect: 23%) indicated word processing could be ranked second among software packages. The database program, dBase, was represented with 24% (Table 4.4) as a weak third.

The trend for the future as shown on Table 4.7, which represented data from the industry, indicated that database packages will move to top priority. Agreement was found in the literature confirming this data. Database was a prime topic for the future in 31 of the 243 articles reviewed. Database was third overall in the topic analysis of the articles (Table 4.9).

The trend in the usage of systems software (operating systems) can be seen in Table 4.3 and Table 4.9. Table

4.3 established present industry use of the mainframe operating systems (IBM's MVS and MVS/XA). Indications of a 32% usage of these two systems (Table 4.3) lead all other operating systems. Shop sizes using these systems, were large at 2399 (Table 4.3).

The literature indicated that the personal computer operating systems were the systems of the future (38 articles, Table 4.9). Personal computer operating systems were only two percentage points below the combined value of the mainframe operating systems (Table 4.3). In Table 4.7, personal computer experience ranked fourth as an emerging future skill.

The overall trend toward learning operating systems was indicated in Table 4.5 where operations was the single biggest response to the question "Skills desired for the entry level employee?" The trend of wanting operating systems people was also reflected in Table 4.7 which indicated that the leading type of work experience given students was operations (response rate of those responding to this question was 58%, Table 4.7).

The current usage of language packages was indicated to be most commonly the use of COBOL on the mainframe, RPG on the minicomputer, and BASIC on the microcomputer (Table 4.1). The response from industry indicated that the languages of the future were the fourth generation languages (Table 4.7). Twelve articles in the literature

pointed to this as a future job area (Table 4.9).

What Changes are Taking Place Regarding the Nature of Data Processing Hardware?

Data Processing Hardware

The numbers representing shop sizes indicated a dominance in the mainframe area (Table 4.1, shop size 2806). The literature indicated, just as it did for software packages and operating systems, that the personal computer level of data-processing was the growth area of the future (Table 4.9). The progress in the development of the personal computer which perhaps can be better described as a stand alone desktop computer, has advanced to a point where, with the high speed chips and extended memory, these computers are to become the workstations of the future.

The hardware trend of continuing usage of the mainframe and minicomputer is shown in Table 4.1, Table 4.2, and Table 4.3. Database, business usage, graphics, education, artificial intelligence and the other categories can be integrated into the leading topic, personal computer operations and usage (Table 4.9). The microcomputer was the main user of the nine software packages represented there (Table 4.4).

Summary

The languages which dominate the data-processing area presently were reported to be COBOL, RPG, and BASIC. The pattern of the future appeared to be 4th generation languages.

The operating systems which dominate the data processing environment were reported to be the IBM mainframe operating systems. The IBM minicomputer operating systems account for one half of all minicomputer operating systems usage. The IBM operating system for the microcomputer has the majority of the microcomputer operating system market. The future pattern was indicated to be growth of the microcomputer area.

The software which was indicated to be dominating the market was Lotus. Word processing was a close second, with database third. The speculation was that database will dominate the software market. Networking packages will also increase in popularity.

The employment of data processing students was divided into the programming and operations areas. Employers predominantly wanted the graduate to have work experience. They indicated they would like to see work study as part of the degree requirement. The majority (95%) agreed to accept work study experiences as work experience.

The skills the future data-processing graduate will need were indicated to be: programming COBOL, RPG, BASIC, and 4th generation languages such as LISP; mastery of the operation systems from mainframes to microcomputers; knowledge of word processing and database software; knowledge of the particular business or industrial area in which the data processing is to be accomplished; knowledge of networking or software related to networking; and experience.

CHAPTER V

SUMMARY OF THE STUDY

Rationale

The computer science curriculum is a developing technical area requiring continuing sources of information to update content. The source of this computer related information is comprised of the members of the data-processing business community who are expected to employ students receiving technical training.

A requirement of this process is information which enables the curriculum planner to take into account the the trends and patterns of future development in this technical area.

Purpose

The purpose of the study was to determine characteristics of the data-processing business community and to determine what patterns and central themes are emerging concerning computer usage.

Data

The data consisted of the following:

1. Languages, hardware, operating systems, and software utilized by the data processing business

community.

2. Information from the data processing business community related to where and at what level the data processing graduate is being employed.

3. Projections of future computer-related skills which will be needed for student employment.

Data indicated (1) emerging computer usage areas; (2) current trends involving the integration and usage of applications software; systems software and language packages; and (3) changes taking place regarding the nature of data processing hardware.

Design

The study design consisted of the following:

1. Developing a questionnaire instrument for obtaining information from the data-processing business community.

2. Gathering data by submitting the questionnaire to the business community.

3. Searching current periodicals for the future themes and patterns applicable to the computer science area.

4. Analyzing the data from both the questionnaire and the periodical search.

Developing the Instrument

The instrument was created by 18 community college data-processing professors. A committee representing the professors was established to supervise the construction of the instrument. When content agreement was achieved, the instrument was submitted to and approved by the three chairmen of the data-processing departments on the three community college campuses.

The instrument was submitted to and approved by the Data Processing Advisory Board which consisted of individuals from computer related business and industry appointed by the community college to oversee the computer science curriculum. The instrument was submitted to and approved by the Data Processing Management Association board of directors.

Submission of the Instrument

The instrument was submitted to the Data Processing Management Association membership. All 97 active members of the DPMA completed a questionnaire. Fifteen questionnaire respondents were personally interviewed. Eighty-seven different businesses and industries were represented by the completion of one or more questionnaire forms.

Search of Current Periodicals

A search for computer related articles from the May,

June, July, and August issues of 270 periodicals was made. Two hundred forty-three articles were found. The articles' content was classified into topics, followed by a topic analysis. The topic analysis resulted in 24 main topic areas.

Analysis of Data

The information from both the questionnaire data collected and the articles was entered into a database for analysis. The analysis took the form of frequency counts (generally reported as percentages), specific employment information, and graphic illustrations. Results were reported in table form for ease of interpretation.

Summary of Findings

1. The programming languages COBOL, RPG, and BASIC dominated respectively the mainframe, minicomputer, and microcomputer programming areas. The language pattern relating to future expectations indicated the emerging importance of 4th generation languages.

2. The operating systems used in the data-processing environment were the IBM systems. The IBM operating systems were the systems used in the mainframe and microcomputer areas. The IBM minicomputer operating system's usage rate was close to being equal to all competitive operating systems' usage rates combined. The

growth pattern of operating systems' usage was indicated to be in the microcomputer area. The development of the small stand-alone desktop computer into a super-efficient workstation rivaling the minicomputer, was projected.

3. The software package which had the largest share of the software market was Lotus (a spreadsheet package). Word processing software had a usage rate which ranked second to Lotus. Database software had a usage rate which ranked third. Data indicated that database systems will dominate the software market in the future. Networking packages' usage rate will also increase.

4. The employment of data processing students was in both programming and operations areas. Employers wanted the graduate to have work experience. Employers indicated they would like to see work study as part of the degree requirement. A majority of employers agreed to accept work study experiences as the equivalent of work experience.

5. The skills the future data processing graduate will need were indicated to be: programming COBOL, RPG, BASIC, and 4th generation languages such as LISP; mastery of the operation systems from mainframes to microcomputers; knowledge of word processing and database software; knowledge of the particular business or industrial area in which the data processing is to be accomplished; knowledge of networking or software related

to networking; and work experience.

Conclusions: Trends Indicated by the Study

The following conclusions concerning the future of the data processing area were indicated by the data:

1. Microcomputers are becoming more powerful and will be developed into work stations with the power equal to the minicomputer.

2. The microcomputer/work station concept will enable graphics and many design software packages to be accessible to smaller shops and also the data processing student.

3. Computer assisted manufacturing, computer assisted design, and computer assisted engineering will to be the software packages of the future.

4. Modeling, wire frame and solid, will be used in computer assisted design areas.

5. Development and use of expert systems will be dependent upon 4th generation languages.

6. Networking and telecommunications are areas which will be integrated into the curriculum.

7. Interactive video training in the computer assisted education area is replacing all other traditional software instructional packages.

8. Database will be used in all information-intense areas.

9. Use of CICS software with COBOL in the interactive data processing environment will be the standard operating procedure in the COBOL mainframe shop.

10. Voice actuation processing will be developed to the point where keyboards will become unnecessary.

Recommendations

Training Recommendations for the Practitioner

The following recommendations for curriculum planners are indicated by this study:

1. Make the programming area the main emphasis of the instructional program.

2. Make the operations area (knowledge of operating systems) the secondary area of concern.

3. Make a computer-related work study program a permanent part of the computer science curriculum.

4. Emphasis the mainframe languages for purposes of increasing employment prospects.

5. Offer the students the opportunity to master certain software packages to enhance employment prospects.

6. Integrate the knowledge of banking or finance into the computer science curriculum.

7. Make all language courses include database skills (utilizing that language to learn database) as part of course content.

8. Give main emphasis in operating systems coursework to operating systems which deal with multiprogramming, and virtual storage capabilities.

9. Language skills to be taught are COBOL for the mainframe, RPG for the minicomputer, and BASIC for the microcomputer.

10. Direst hardware acquisition considerations to the IBM-manufactured (or equivalent equipment) mainframe, minicomputer, and microcomputer. The minicomputer area may include the Digital Equipment Company's equipment.

11. Software packages for students to master are Lotus, Wordstar, Word Perfect, and dBase.

12. In planning curriculum, people should follow this design (of this study.)

Recommendations for Future Research

This study should be the first in a series of studies which have the purpose of obtaining information for the continuing development of the computer science curriculum.

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Walker, D., Schaffarzick, J. Comparing curriculum. Review of Educational Research, 44, No. 1, 1974.

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ANNOTATED BIBLIOGRAPHY

Introduction

This search of the literature reported in the annotated bibliography form is to examine the future prospects of computer usage areas. Implications or any facts about any particular industry, are meaningless without some information as to the health and vitality of the industry in question. Therefore information relating to these barometric factors as well as factors of historical significance, factors of competitive forces, and factors of long term research and development, are included.

The topic headings are presented in alphabetical order.

Artificial Intelligence

Bulkeley, William M. Selling software that's hard to describe: Lotus' Agenda poses problems in marketing. The Wall Street Journal, July 11, 1988, 69(188), p.19. (a).

Lotus introduced a primitive artificial intelligence package and had difficulty marketing it.

Carr, Clay. Making the human-computer marriage work. Training and Development Journal, May 1988, 42(5), 65-74.

The future use of database technology will be the factor for a successful marriage of the computer and the human. The use of artificial intelligence systems will make this technology possible.

Cetron, Marvin. Into the 21st century. Futurist, July/Aug 1988, 22(4), 29-40.

Predictions of what is coming in the 21st century.

Hawkins, William J. Artificial results. Popular Science, August 1988, 233(2), p.14. (b).

Artificial intelligence packages using LISP are being developed by Apple and Texas Instrument.

Holloway, C., Hand, H. Who's running the store, anyway? Artificial intelligence. Business Horizons, March-April 1988, 31(2), 70-6.

Artificial intelligence programs could be used to run the country.

Kozlov, Alex. Aristotle in the fast lane. Discover, July 1988, 9(7), 75-9.

A researcher working with artificial intelligence at Yale University created artificial intelligence programs to take the place of travel agents, stockbrokers, and insurance agents.

Rice, Patrick. Survival of the fittest. Tech Exec, June 1988, 30-9.

Businesses, especially banking, must computerize or they are lost. The expert systems used require the artificial intelligence element to assist in decision making.

Shepard, Susan J. Sophisticated expert. PC Tech Journal, July 1988, 6(7), 106-119.

PC-Plus, an expert system developed by Texas Instrument, has the database procedures built into the operating system and uses a LISP editor.

Sullivan, Daniel M. Allaying fear of new technology. USA Today (the mag.), July 1988, vol. 117, no. 2518, 72-4.

A natural language technology has been developed which with a database and AI technology can answer questions.

Weston, Frederick C. Computer integrated manufacturing systems: Fact or fantasy. Business Horizons, July-August 1988, 31(4), 64-8.

The wave of the future is computer integrated manufacturing. CIM integrates robotics, CAD, and CAM into artificial intelligence systems.

Yeager, Judy. Programs: Algorithms, languages, and translators. News/34-38, July 1988, 126-141.

The trend in languages is toward "applications generators." The fourth generation artificial intelligence languages meet these goals.

Aviation

Carroll, James R. Air traffic growth outpaces safety system, Study finds. Detroit Free Press, July 28, 1988, p.7a.

The air traffic control system needs to be immediately updated.

IBM wins bid to upgrade air traffic control system. Detroit Free Press, July 27,1988, p.6b.

IBM was awarded a 3.55 billion dollar renovation contract for the air traffic control network.

Ott, James. Regional airline association shown yield management system. Aviation Week and Space Technology, June 1988, 128(26), p. 72.

Control Data Corp. developed a $200,000 computer based information system for the regional commuter airline.

Shifrin, Carole A. FAA completes transition to host computer system. Aviation Week and Space Technology, June 1988, 128(26), p.83.

The FAA spent $12 billion for a modernization plan to update the present computer system.

Business/Industry

Bamber, greg J. Management strategy and new technology in retail distribution: A comparative study, Journal of Management Studies, May 1988, 25(3), 197-215.

The largest food distribution center in Australia is completely computerized.

Banks, Howard. What's ahead for business? Forbes, July 25, 1988, 142(2), p.31.

Almost all sections of the U.S. industry, from high-tech chip makers to rust belt sections, are taking part in a splurge of capital investment.

Birnbaum, Jesse. Dialing for dollars. Money, July 1988, 17(7), 89-93.

Banking institutions have integrated computers into their banking systems so that customers can pay bills, make deposits, or perform banking tasks from their homes or offices.

Brown, Merrill. The channels achievers. Channels, 8(6), June 1988, 33-61.

An analysis of the data from the communications database.

Bulkeley, William M. Special systems make compiling less traumatic for top executives. The Wall Street Journal, June 20, 1988, 69(174), p.15. (b).

Top executives need to learn the use of the desktop computer to tap into the information generated by their company.

Coble, Karen. Computers cater exact hog rations. Successful Farming, May 1988, p.52.

The computer can be used to help agribusiness by controlling the environment and feed management to raise hogs more profitably.

Dean, Edwin., Kunze, Kent. Recent changes in growth of U.S. multifactor productivity. Monthly Labor Review, May 1988, 111(5), 14-9.

The multifactor productivity index reports growth in the U.S. economy.

Foley, Mary Jo., Levitt, Don. Unix:What users are saying. Datamation, Oct. 1, 1987, 33(19), 97-108.

The Unix operating system has freed business and industry from single vendor's constraints. The programming environment plus the multiuser capabilities make Unix an ideal system.

Grieves, Robert. The power of two years. Forbes, July 11, 1988, 142(1), p.114.

Burroughs acquired Sperry for 4.8 billion dollars and named it Unisys. The success of the Unisys venture which had revenue of 9.7 billion in the second year was attributed to the guiding strategy which was to serve the needs of the computer industry where they found them, not to sell hardware.

Hillrick, John. We're being pushed out of the picture. USA Today, July 14, 1988, p.2b. (d).

The electronics area employs 2.6 million people. If the trend to do business with Japan continues, these jobs may be lost.

Lederer, Albert L. Information systems planning: Top management takes control. Business Horizons, May-June 1988, 31(3), 73-8.

The use of computer information accessible to top management can change the way decisions are made.

Luck-Nunke, Bonnie. Easing your company into the computer age. Personnel Administrator, June 1988, 33(6), 190-1.

Computerizing the human resources function of a company is inevitable because the company must increase production and quantify functions.

Spirig, John E. Software: buy it right. Personnel Journal, June 1988, 67(6), 50-9.

Software is available for the human resources functions including payroll management.

Computer Aided Design, Manufacturing, and Engineering

Gantz, John. PC-Based color prepress. Computer Graphics World, May 1988, 11(5), 25-6. (a).

Color proofs of pages can be done on the microcomputer.

Gantz, John. Solid modeling Computer Graphics World, June 1988, 11(6), p.25. (b).

Solid modeling is the animated 3-d model on the screen. Previously wireframe modeling was the only possibility due to the constraints on memory and speed. With the advent of the 32-bit chip and expanded memory, solid frame modeling is feasible.

Lewyn, Mark. Price wars rock workstation firms. USA Today, July 19, 1988, p.3b.

Workstations used for CAD, CADD, and CAE were the fastest growing segment of the computer market.

Lockwood, Russ. The many faces of the 386. Personal Computing, July 1988, 12(7), 90-6.

The 80386 chips are speeding things up for the CAD operating systems.

Pardon, David. Computer-aided Steinlager. Yachts and Yachting, May 27, 1988, p.52.

The Apple PC with a CADD program was used for yacht design.

Putka, Gary. Apollo to post 2nd-quarter loss in the big reversal. The Wall Street Journal, July 8, 1988, 69(187), p.4.

Sales were depressed because orders were less than expected from Europe. The present market for the Apollo workstation as a CAD tool is increasing.

Ross, Steven. AutoCad version 9.0. Architectural Record, May 1988, 159-161.

Costs necessary to utilize this software are comparatively low.

Stubbe, Gordon Lee. Computers: Three dimensional modeling with PCs. Architectural record, May 1988, p. 157.

The computer generated three dimensional model is required of architects if they are to keep pace with their complex and changing profession.

Computer Chips

Byrne, Erin K. et al. Design of monomeric arsinogallane and chemical conversion to gallium arsenide. Science, July 15, 1988, 241, 332-4.

Chip research on making faster chips.

Cole, Tim. Programming hypercubes. Popular Mechanics, June 1988, 165(7), p.14. (b).

The worlds fastest hypercube has been developed by the Sandia National Labs. The hypercube is made possible by the use of 1024 microcomputer CPU chips.

Gilder, George. Who caused the D-Ram crisis. Forbes, July 25. 1988, 142(2), 70-1.

The end to Japanese supremacy is not the protectionist moves like the Semiconductor Trade Agreement, it is the production of high quality product.

Hillkirk, John. Computer makers in crisis. USA Today, July 7, 1988, p.1. (b).

The price of computer chips has jumped 300% in one year. Memory chips. have a 25% price increase. In 1988, one billion chips were produced. This figure did not meet the demand.

Lockwood, Russ. The many faces of 386. Personal Computing, July 1988, 12(7), 90-6.

The 80386 chips are speeding things up for the operating systems which use them.

Miller, Michael W. Hybrid chip solves incompatibility problem. The Wall Street Journal, July 19,1988, 69(194), p.27. (b).

The Texas Instrument research department has found a way to create a faster chip which will translate electrical signals into laser light.

Petersen, Ivars. Striping a molecule to gallium arsenide. Science News, July 16, 1988, 134(3), p.38.

Manufacturing problems for the high speed chips have been solved.

Sieling, Mark S. Semiconductor productivity gains linked to multiple innovations. Monthly Labor Review, May 1988, 111(5), 27-31.

Innovative thinking has lead to the growth of the semiconductor industry in the U.S.

Siwolop, Sana. These computers hear you loud and clear. Business Week, July 4, 1988, No. 3059, 109-10.

The 20 million instructions per second RICS chip is being used to convert PC's to work stations.

Crime

Esterow, Milton. Confessions of an art cop. Artnews, May 1988, 87(5), 143-7.

Prominent art is stolen, openly displayed for years and finally recognized. Art crime is the second largest international crime area. The solution is to create a computer database system to process and keep track of artwork. This information should be accessible to anyone with a modem.

Gwyne, Peter. Science and technology against crime. The World and I. June 1988, 164-9.

Computer based photograph improvement can help in solving crimes.

Kimsey, Judy. Museum cataloging. Computer Graphics World, May 1988, 11(5), 25-6.

Visitors will be able to use a computer based catalog to bring up the images of a painting or sculpture. It will enable individuals to zoom in on important details, compare works of different artists, and even change the look by altering shading. This will also help prevent theft of art objects for they can be easily identified.

Lickson, Charles P. The ever-present employee computer crime problem. Tech Exec, June 1988, 47-8.

Computer crime is costing business and industry hundreds of millions of dollars annually. When caught, the employees are seldom prosecuted.

Paulson, Morton C. Keeping the right records. Changing Times, 42(6), June 1988, 47-50. (a).

Individuals need to keep their own records to verify the computer generated records kept by business, industry, and government agencies.

Paulson, Morton C. Someone's got a file on you. Changing Times, 42(7), July 1988, 41-6. (b).

Extensive files are being kept on individuals concerning credit, health, income, habits, lifestyle, and almost any area possible. Records kept by agencies both governmental and private have been found to be inaccurate.

Peck, Keenan. High-tech house arrest. The Progressive, July 1988, 52(7), 26-9.

Electronic monitoring of the criminal under house arrest is used in over 100 jurisdictions eliminating the need for jail space.

Sacks, Jeffery J. A cluster of unexplained deaths in a nursing home in Florida. American Journal of Health. July 1988, 78(7), 806-8.

Shifrin, Carole A. FAA completes transition to host computer system. Aviation Week and Space technology, June 1988, 128(26), p.83.

The FAA has $12 billion for a modernization plan to update the present computer system to track suspect aircraft worldwide.

Database

Burgi, Michael. Database. Channels, 8(6), June 1988, 82-7.

This article reports information from the massive communications database concerning advertising, network ratings, cable television ratings, and information about buying and selling television or radio stations.

Evans, Brenda. The status of black males in America: a database search. American Psychologist, May 1988, 43(5), 401-2.

The searching of databases of information is

becoming a problem because databases are becoming more complex. The searching for information requires a search strategy.

Gay, Verne. Arbitron joins rivals. Advertising Age, June 1988, 59(27), p.112.

Control Data Corp. plans to install 18,000 television scanners in homes across the country and hook these scanners to a central computer. The information will accurately report television usage.

Gray, Geri. A clinical database for advanced cancer patients. Cancer Nursing, 11(2), 1988, 77-83.

A database was created and analyzed to produce a comprehensive study of 1,103 cancer patients.

Khana, Gurcharan S. On electronic communication for anthropologists. Current Anthropology, April 1988, 29(2), p.112.

Anthropologists are not aware of who is doing what and where. A massive database is proposed to indicate to the profession where and what everyone is doing. Also information as to projects in the planning stage would be included.

Miller, Holly G. Connected for success. Online Today, June 1988, 14-19.

The massive database CompuServe is available to the PC owner with a modem.

Miller, Michael W. Portable PC is used as notepad. The Wall Street Journal, July 12, 1988, 69(189), p.31. (d).

Linus Technologies Inc. has a portable computer which allows the user to write on the glass screen with a stylus. The machine than converts the writing into typed text.

Miller, Michael W. Software to improve database searches. The Wall Street Journal, July 12, 1988, 69(189), p.31. (e).

A database search can be made more efficient with software management programs.

Muller, Joann. Knight-Ridder plans to buy data company. Detroit Free Press, July 12,1988, p.4c.

The Dialog Information Services division of Lockheed Corp. was purchased by Knight Ridder for 353 million dollars. Dialog brings Knight Ridder 155 million references and 320 databases with 92,000 subscribers in 86 countries.

O'Malley, Christopher. Personal information manager. Personal Computing, July 1988, 12(7), 125-8.

The personal information manager, PIM, uses low level artificial intelligence to help the business man organize his activities and enter them into a database.

Paulson, Morton C. Keeping the right records. Changing Times, 42(6), June 1988, 47-50. (a).

Individuals need to keep their own records to verify the computer generated records kept by business, industry, and government agencies.

Paulson, Morton C. Someone's got a file on you. Changing Times, 42(7), July 1988, 41-6. (b).

Extensive files are being kept on individuals concerning credit, health, income, habits, lifestyle, and almost any area possible. Records kept by agencies both governmental and private have been found to be inaccurate.

Smith, Lani W. Microcomputer bases bibliographic search. Nursing Outlook, Mar/Apr 1988, 37(2), 125-7.

Approximately 250,000 articles are published yearly in the health science area. The database required to process this information requires a management system.

Tellow, Karin. Computer aided planning moves to compact disc and creates more opportunities for designers. Interiors, June 1988, 147(11), p.39.

Compact discs are being used for 2-dimensional CADD programs creating massive storage capabilities for the database required for graphic usage.

Environment

Astronomy

Berry, Richard. Thinking telescopes. Astronomy, Aug 1988, 16(8), 42-6.

The new generation of telescopes is the automated photoelectric telescope. Computer operated, they record and observe endlessly.

Brocius, Daniel. A hands-off approach. Earth Science, Spring 1988, 41(1), 25-7.

An Automatic Photoelectric Telescope is being operated by the Smithsonian's Fred Laurence Whipple Observatory.

Prentice, Gary S. Do-it-yourself image processing. Sky and Telescope, Aug 1988, 76(2), 142-6.

Do-it-yourself image processing of images related to astronomical research can extract much information from hard-won picture images.

Ecology

Gurtz, M. E. Development of a research management system. Research data management in the Ecological Sciences, University of South Carolina, 1986, No.16, 26-39.

The computer based research management system is replacing all other systems.

Halfpenny, J. Climate calendars. Bioscience, June 1988, 38(6), 399-405.

Computer graphics reveal weather patterns in large databases that are useful to ecologists. Previously most data was presented in terms of statistics. Graphics enable the ecologist to comprehend massive amounts of information.

Michener, W. K. Data management and long term ecological research. Research data management in the Ecological Sciences, University of South Carolina, 1986, No.16, 1-8.

Computer data management has revolutionized the ecological sciences.

Resser, P. G. Overview of research date management. Research data management in the Ecological Sciences, University of South Carolina, 1986, No.16, 9-22.

Various research data management systems are explained.

Stafford, S. G. Data management procedures in the Ecological Sciences. Research data management in the Ecological Sciences, University of South Carolina, 1986, No.16, 93-114.

Data management procedures in the ecological sciences area are computer based.

Weather

Griffin, Kelley. New equipment will pinpoint severe weather. Detroit Free Press, August 3, 1988, 158(88), p.7c.

Two out of every three severe weather warnings are wrong. The computer with high powered radar can be used to correct this problem.

Hawkins, William J. Electronic newsfront: weather. Popular Science, August 1988, 233(2), 14-5. (a).

The PC computer can be converted to a home meteorological center.

Hawkins, William J. PC predictions. Popular Science, August 1988, 233(2), p.14. (c).

Weather watching with the PC has become possible.

Kierein, Tom. The hi-tech world of TV weathercasting. Weatherwise, June 1988, 41(2), 150-4.

Computer graphics are used for the background display on the television weather show.

Wenning, Carl J. Earth satellite forecasting. Sky and Telescope, July 1988, 76(1), 70-1.

A PC can be used to predict the orbits of satellites and when they will appear overhead.

Graphics

Ayala, Susan. Legal-graphics firms spread as lawyers use more visual aids to make their cases, The Wall Street Journal, July 21, 1988, 69(196), p.17.

The use of computer graphics in the court room gives significant advantages to lawyers.

Berney, Karen. Graphics come of age. Nation's Business, June 1987, 75(6), 53-5.

No-fuss software and affordable hardware for the PC create high quality graphics. Slides, charts, overhead transparencies, and other visuals can be easily made.

Cavuote, James. Electronic publishing. Computer Graphics World, June 1988, 11(6), 83-4.

Desktop publishing was a phenomenon of 1986-1987. This helped redirect the PC market so as to avoid a slump. Desktop publishing has focused interest on laser printers, color output systems, larger screen displays, high resolution screens, and enhanced graphics software.

Gantz, John. PC-Based color prepress. Computer Graphics World, May 1988, 11(5), 25-6. (a).

Color proofs of pages can be done on the microcomputer.

Gantz, John. Solid modeling Computer Graphics World, June 1988, 11(6), p.25. (b).

Solid modeling is the animated 3-d model on the screen. Previously wire frame modeling was the only possibility due to the constraints on memory and speed. With the advent of the 32-bit chip and expanded memory, solid frame modeling is possible.

Halfpenny, J. Climate calendars. Bioscience, June 1988, 38(6), 399-405.

Computer graphics reveal weather patterns in large databases that are useful to ecologists. Previously most data was presented in terms of

statistics. Graphics enable the ecologist to comprehend massive amounts of information.

Henderson, John. Analysis of kinetic data with a spreadsheet program. Journal of Chemical Education. June 1988, 65(6), p.150.

Commercial spreadsheet programs provide chemists with a powerful tool for performing calculations on data sets and seeing the results graphically displayed.

Hawkins, William J. Electronic newsfront: weather. Popular Science, August 1988, 233(2), 14-5. (a).

The PC computer can be converted to a home meteorological center with a full graphics output.

Ticer, Scott. Digital Communication Associates Inc. unusual trail to high tech's big business. Business Week, July 4, 1988, No. 3059, p. 104.

Digital is promoting a line of PC to mainframe connections. The future thrust is to develop networks that enable the PC user to have work station capabilities allowing for the use of graphics or CADD.

Travis, Mike. Image processing goes color. Computer Graphics World, June 1988, 11(6), 87-9.

True color is a rarity in the computer graphics area. Only with the most expensive system is true color approximated.

Information

Cetron, Marvin. Into the 21st century. Futurist, July/Aug 1988, 22(4), 29-40.

Predictions of what is coming in the 21st century emphasize the concept of the "Information Age."

Buckley, Chris. Counting the cost of ISDN. Datamation, Oct. 1, 1987, 33(19), 26-30.

The costs of implementing Integrated Services Digital Network are substantial in both money and inconvenience. The value of equipment made obsolete by the new system may exceed any benefits.

Duncanson, Jay., Chew, Joe. The ultimate link. Byte, July 1988, 13(7), 278-286.

Integrated Services Digital Network (ISDN) is the technology that integrates digitized voice and data. This applies not only to computer data but to fax and video transmission.

Hillkirk, John. Commuting by computer. USA Today, July 15, 1988, p.7b. (a).

A five employee business is run from 1700 miles away by use of telecommunications. The use of computers with modems enables individuals to use the home as a workplace.

Seghers, Frances. Three billion-a-year information industry. Business Week, July 4, 1988, No. 3059, p. 104.

The information industry is valued at 3 billion dollar. A major part of this industry is the repackaging and selling of public information.

International

Hudson, Richard L. Computer companies struggle to cope with cooler market in West Germany. The Wall Street Journal, July 21, 1988, 69(196), p.12.

The European market for computers has cooled down.

Miller, Michael W. IBM continues consolidation drive with shake-up of marketing operations. The Wall Street Journal, July 19,1988, 69(194), p.2. (c).

IBM is consolidating the marketing divisions both domestic and foreign.

Tonsmeire, Arthur Jr., Lager, Robert. The economy of Honduras. Caribbean Today, 2(3), 1987, 8-9.

AID gave Honduras 147.5 million to examine weaknesses in economic growth. The computer run massive database will be created and maintained by the Foundation of Commercial Investigation and Development.

Japan

Forester, Tom. The materials revolution. Futurist, July/Aug 1988, 22(4), 21-5.

The Japanese, realizing the importance of new materials development, funded a 400 million dollar program for testing, research, and development.

Greene, Bob. Computers, toilets have japan talking. Detroit Free Press, August 4, 1988, 158(89), p.15b.

The move away from the technology related fields in Japan may signal the demise of the technology related culture there.

Hillkirk, John. Fujitsu vice president bridges culture gap. USA Today, July 15, 1988, p.2b. (c).

A subsidiary of Fujitsu, Japan's number one computer maker, has been opened in Silicon Valley.

Hillrick, John. We're being pushed out of the picture. USA Today, July 14, 1988, p.2b. (d).

The electronics area employs 2.6 million people. If the trend to do business with Japan continues, these jobs may be lost.

Moy, Joyanna. An analysis of unemployment and other labor market indicators. Monthly Labor Review, April 1988, 111(4), 39-50.

The Japanese unemployment picture is percentage-wise increasing over U.S. unemployment.

Price, Robert M. Superconductors propel technology. Vital Speeches, May 1, 1988, 54(14), 435-8.

Although the U.S. leads in the development of the supercomputer, Japan is close behind.

Suzaki, Takahiro. A hollow future for Japan. Futurist, May/June 1988, 22(3), p.33.

Predicts an exit of young able technologically inclined workers from Japan. This will deprive Japan of creativity and vitality which will ultimately lead to Japan's downfall.

Wood, Robert C. Japan's economic mess. National Review, July 8, 1988, 40(13), 39-40.

The Japanese government shows little interest in improving the standard of living in Japan. There is money aplenty but no way to spend it to improve living conditions around the major work areas.

Jobs

Bailey, Julie. Jobs for women in the nineties, MS, July 1988, 17(1), 74-9.

Women will find more opportunity to work in the home with the advent of the home computer and the modem.

Elmer-Dewitt, Phillip. Wowing'em with wizardry. Time, July 18, 1988, 132(3), p.57.

Computer technicians were kept busy at the Democratic convention by 250 computers used to deliver information with a crude artificial intelligence system.

Lupo, Nunzio. Fast Track at GM. Detroit Free Press, August 7, 1988, 158(92), p.1c.

The track to top management is through the technical areas rather than sales and marketing.

McCandles, Holloway. The 10 worst careers for women. Working Women, July 1988, 65-6.

Word processing or data entry are the second "worst" career for women.

Michelli, Robin. Home is where the office is. Money, July 1988, 17(7), 69-79.

Marketing strategies are for the computer in the home to be an extension of the workplace rather than a toy.

Siverd, Bonnie Extra Cash. Working Women, July 1988, 98-101.

The second income from word processing, data entry, and programming can be very good for the home bound women.

Slutsker, Gary. Charles Wang and his thundering nerds. Forbes, July 11, 1988, 142(1), 118-24.

Wang's Computer Associates International, Inc. employees 4500 people in 22 countries. Wang had revenue of 709 million dollars. Wang is always looking for new software and has a work force of 1000 constantly updating old software. Wang is always hiring.

Medical

Boling, Rick. New-age malaise. Equinox, Mar/Apr 1988, 38, p.33.

A new sickness is appearing. It concerns computer users. It is called technostress. The symptoms are obvious. The person becomes a mechanical extension of the computer.

Galloway, Joseph L. et al. Ask the computer. U.S. News and World Report, July 25, 1988, 105(4), p.9.

The U.S. government is installing 52,000 computers in pharmacies to monitor the 32 million medicare beneficiaries.

Keuch, Nancy. Computer consultant: animated learning. American Journal of Nursing, July 1988, 88(7), p.102.

Interactive video training programs have been used successfully for the critically ill nursing program. The programs are usually run on IBM PCs.

Smith, Lani W. Microcomputer bases bibliographic search. Nursing Outlook, Mar/Apr 1988, 37(2), 125-7.

Approximately 250,000 articles are published yearly in the health science area. The database required to process this information requires a management system.

Travis, Mike. Image processing goes color. Computer Graphics World, June 1988, 11(6), 87-9.

True color is a rarity in the computer graphics area. Only with the most expensive system is true color approximated. The application of the color output to medicine for diagnosis is significant.

Music

Diliburto, John. Klaus Schulze: Synthesizer universe. Down Beat, July 1988, 55(7), 26-8.

The computer based synthesizer was the key to the making of the complex structures used by a classical pianist.

Evans, Brian. Factual arts: Combining music, math, and art. Futurist, May/June 1988, 22(3), 29-32.

With the help of a computer, music and video can be derived from mathematical equations.

Woodard, Josef. The Herbie Hancock interview. Down Beat, June 1988, 55(6), 16-9.

The computer is an important part of the creative process involved in making music.

Research and Development

Bell, Nancy. FY1989 Budget: familiar themes for R & D. Biosciences, May 1988, 38(5), 323-6.

The research and development budget is broken down into categories. The agencies which are involved in computer related technology are listed.

Crawford, Mark. Superconductors: Is Japan ahead. Science, July 8, 1988, 241, 152-3.

Japan may pull ahead of the U.S. in the race for marketing high-temperature superconductors.

Forester, Tom. The materials revolution. Futurist, July/Aug 1988, 22(4), 21-5.

The Japanese, realizing the importance of new materials development, funded a 400 million dollar program for testing, research, and development.

Garwin Richard L. A strategic defense initiative: a maginot line in space. The Center Magazines, 20(6), Nov/Dec 1987, 45-53.

A breakdown of the SDI budget showing the money which is to be spent upon this computer controlled system.

Graves, Samuel B. Institutional ownership and corporate R & D in the computer industry. The Academy of Management, June 1988, 31(2), 417-27.

The institutional ownership of technology related firms is a problem because of the desire for short term profits rather than a commitment to research and development.

Neuman, Stephanie. Arms, aid and the superpower. Foreign Affairs, Summer 1988, 66(5), 1044-66.

The sale of arms by the superpowers requires technical training. The demand for the high tech training is increasing.

Landau, Ralph. U.S. Economic growth. Scientific American, June 1988, 258(6), 44-52.

The U.S. economy, if it is to be saved, must improve workers skills, support research and development, and invest in technological areas.

Ouchi, William G. et al. The logic of joint research and development. California Management Review, Spring 1988, 30(3), 9-33.

The Japanese government participates in joint research and development in the technical areas more efficiently than the U.S. government does.

Revenue

Carroll, Paul B. Big computer companies are expected to post robust nets for latest quarter. The Wall Street Journal, July 11, 1988, 69(188), p.8.

The big computer companies are predicted to report increased earnings.

Chase, Marilyn. Advanced micro earnings surged in the 2nd quarter. The Wall Street Journal, July 13, 1988, 69(190), p.4. (a).

Sales of the more advanced microcomputers surged to 439 million dollars.

Chase, Marilyn. Intel profit nearly tripled in the quarter, indicating competitive gap is growing. The Wall Street Journal, July 13, 1988, 69(190), p.4. (b).

Intel's profits are up with revenue of 726 million dollars.

Miller, James P. Apple's profit up 71% in 3rd quarter. The Wall Street Journal, July 19,1988, 69(194), p.32.

Apple's profits are up.

Pepper, Jon. Voice mail keeps you in touch. Nation's Business, June 1988, 76(6), 54-5.

Voice mail, a computer-linked system to send, receive, store, and retrieve phone messages, is increasing in usage. Estimated revenues from voice mail marketing is 400 million dollars.

Sutton, Pamela. NCR profits rise. USA Today, July 19, 1988, p.1b.

Worldwide orders slipped but domestic sales increased.

Ticer, Scott. Digital Communication Associates Inc. unusual trail to high tech's big business. Business Week, July 4, 1988, No. 3059, p. 104.

Digital is promoting a line of PC to mainframe connections. The future thrust is to develop networks that enable the PC user to have work station capabilities. Revenues of 250 million were reported for this fiscal year.

Robotics

Cole, Tim. NASA's mighty robot riveter. Popular Mechanics, July 1988, 165(7), 17-8. (a).

The 33 foot high robot riveter was used by NASA to assemble space equipment.

Makey, R. H., Sharplin, .A. D. Does technology create unemployment. USA Today(the mag.), vol. 116, no. 2516, 24-8.

Technology, especially robotics, will replace workers overpaid in routine jobs. The auto industry is paying over twenty dollars an hour to labor which requires only a few hours to master job skills.

Stock Market Crash

Arbel, Avner. The smart crash of October 19th, Harvard Business Review, May-June 1988, 66(3), 124-36.

Details the use of the computer in trading on the stock exchange. Defines arbitrage trading as done with the computer.

Kates, Anne. Tech stocks terrorize summer rally. USA Today, July 22, 1988, p.1b.

High tech stock rallied when the market went down.

Olson, Walter. What didn't cause the crash. Fortune, July 4, 1988, 118(1), 140-1.

Computer-driven portfolio hedging did not cause the stock market to crash.

Voice

Elmer-Dewitt, Phillip. Wowing'em with wizardry. Time, July 18, 1988, 132(3), p.57.

The Democratic convention used 250 computers to deliver information with a crude artificial intelligence network which used voice input.

Parham, Charles. Computers that talk. Classroom Computer Learning, Mar. 1988, 8(6), 26-31.

Computer software which talks is becoming available to the teacher.

Pepper, Jon. Voice mail keeps you in touch. Nation's Business, June 1988, 76(6), 54-5.

Voice mail, a computer-linked system to send, receive, store, and retrieve phone messages, is increasing in usage.

Siwolop, Sana. These computers hear you loud and clear. Business Week, July 4, 1988, No. 3059, 109-10.

Voice response computers have been developed. This system does not require user's voice recognition training.

Sullivan, Daniel M. Allaying fear of new technology. USA Today (the mag.), July 1988, vol. 117, no. 2518, 72-4.

A natural language technology has been developed which with a database and AI technology can answer voice-input questions.

Wages

Lochhead, Carolyn. A shifting U.S. work force for a changing U.S. economy. Insight, Feb 1987, 3(5), 36-8.

The background of the entering worker consists of skills which are usually in a few non-technical areas. The entering worker is receiving a low pay ($7000 to $9000). This is due to the service orientation of most entry level jobs which are traditionally low paying.

Makey, R. H., Sharplin, A. D. Does technology create unemployment. USA Today(the mag.), vol. 116, no. 2516, 24-8.

Technology has the capability of producing a higher standard of living but workers in low-level skill jobs will not benefit.

Zimmerman, Gregory. The economics of S/3x talent. Tech Exec, June 1988, 3-9.

Salary information on the high tech employee was gathered by a survey.

APPENDIX A

Glossary of Terms

Glossary

Assembler -- a programming language one level above machine language, also referred to as Assembly. Assembler is machine dependent which means it will only run on the type of machine for which it was designed. Usually programmed only on the mainframe.

BASIC -- a language used mainly on the microcomputer and minicomputers. BASIC is an acronym for Beginners All-purpose Symbolic Instructional Coding. Differs from other programming languages due to the fact it compiles line by line therefore the compiler generates only one error statement and it stops compiling.

C -- a programming language developed for the microcomputer.

CICS -- a software package developed by IBM to allow interactive file processing. CICS is used with COBOL for file processing.

COBOL -- COBOL is an acronym stands for common business oriented language, it is generally used on the mainframe.

Custpack -- a software package which incorporates other software packages as desired by the consumer when the computer is purchased. (The packages usually include word processing, a spreadsheet program, and/or a business program.

Database -- a system of creating and updating files where all files are written into one master file. Developed primarily for the mainframe.

dBase -- a commercially produced version of the database concept usually applied to a microcomputer or minicomputer.

DEC -- Digital Equipment Company, a prominent minicomputer manufacturer.

Display Writer -- a word processing software package put out by IBM for the mainframe environment and later adapted to be used on the microcomputer.

DOS -- an acronym for disk operating system. Used primarily on the microcomputer and minicomputer.

Expert system -- a task oriented software package (generally using a fourth generation programming language) which projects future models. Normally used in business and industry to contribute to long term planning.

Fourth generation language -- languages which have the capability to self program. Artificial intelligence is directly related to these languages.

Fortran -- an acronym for formula translation. One of the first machine independent languages. Primarily used for mathematical purposes.

IBM -- International Business Machines.

JCL -- an acronym for job control language. JCL is an operations language which sets up the computer to work with the programming language of choice. Also it is used to control file input/output and file structure.

LISP -- a fourth generation programming language which emulates the logical sequencing of information.

Lotus -- a spreadsheet program mainly marketed for the microcomputer.

Mainframe -- a category name used to describe the top of the line computer. A mainframe is the most powerful and efficient computer. Although workstations can duplicate many of the features of the mainframe, the workstation is one terminal with a single user, the mainframe can support one thousand such terminals and duplicate the power of the workstation on each terminal.

Microcomputer -- a stand-alone computer which works for a single user and becomes dedicated to the task the user is using it for. Can not do multiprogramming.

Minicomputer -- a smaller version of the mainframe which can do many of the programming tasks of a mainframe. Will probably support only fifty or a hundred terminals.

Multimate -- a software package used primarily for networking.

MS/DOS -- an acronym for Microsoft disk operating system. Designed by Microsoft Corporation for use on the microcomputer.

MVS (MVS/XA) -- multiprogramming virtual storage operating system for the mainframe. Developed by IBM to fully utilize the central processing unit's capabilities. The MVS/XA is an update, the XA stand for extended architecture.

Network(ing) -- to have more than one computer online so that computers can interchange information and processing capabilities.

PICK -- an operating system developed mainly for the minicomputer.

OP -- an acronym for operating system. The operating system is a software package which contains the instructions for the computer to function.

Operating systems -- same as OP.

Operations -- the branch of computer utilization which deals with the physical running of the machine which is the computer. Usually related only to minicomputer and mainframe environments. The programming language JCL is integrated into the operations area.

PC/DOS -- the same as MS/DOS only generally used to refer to the MS/DOS system used on the IBM personal computer.

PDP -- the name of the minicomputer marketed by Digital Corporation. The PDP series was called the eleven series. The name of the computer was usually designated as PDP 11/ something.

Pascal -- a programming language thought to be an improvement over BASIC, named after the early (1623-1662) French mathematician Blaise Pascal.

RPG -- acronym for report program generator. A relatively easy programming language to learn which will output reports from complex data files.

Symphony -- a software package which combined database and spreadsheet software.

UNIX -- an operating system designed for the minicomputer. Thought by many experts to be the operating system of the future for minicomputers.

VAX -- a high powered minicomputer put out by Digital.

VBASIC -- a version of BASIC which will run on the mainframe.

VM, VS, VSE -- the letters stand for "virtual," "storage" and "multiprogramming." Three operating systems designed for the minicomputer by IBM.

VMS -- virtual memory system from Digital Equipment Company (DEC).

Voice actuation -- a software system which reacts to the sound of a person's voice.

WANG -- a software company name which is the name of the founder of the company.

Word processing -- a term applied to the use of the computer as a very powerful typewriters.

Wordperfect -- a word processing software package.

Wordstar -- the first widely used word processing software package (marketed in 1980).

Work station -- a stand-alone single user computer (about the size of a microcomputer) which has the power of a minicomputer or a mainframe, but only in narrowly defined aspects of processing. Usually used in the design or graphics areas. It may be networked to other computers.

APPENDIX B

Programs Used for Data Processing

A Program to Divide the File into Fields Contained on each Record

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10 REM PRINT OUT FIELDS
20 DIM B(100),B$(40)
30 OPEN "I",1,"b:QUESTFL"
40 IF EOF(1) THEN CLOSE #1: GOTO 160
50 LINE INPUT#1,A$
60      FOR A=1 TO 40
70  B(A)=INSTR((B(A-1)+1),A$,","):IF B(A)=0 THEN A=41 ELSE
C =A
80      NEXT:REM remove the REM in 90 to print out B(A)
90 REM  FOR A=1 TO C:PRINT B(A);" ";:NEXT A
100 PRINT
110 FOR A=1 TO C
120 B$(A)=MID$(A$,(B(A-1)+1),((B(A)-(B(A-1))))-1)
130 NEXT A
140 GOSUB 180
150 GOTO 40
160 PRINT "XXXXXXXXXXX":CLOSE:END
170 REM
180 REM PRINT OUT FIELDS
190 FOR AZ=1 TO 40
200 PRINT B$(AZ);:IF B$(AZ)="" GOTO 220
210 NEXT AZ
220 PRINT
230 RETURN
```

A Program to Print Out Specified Fields

```
5 REM PRINT ALL RECORDS WITH OVER FIVE DP EMPLOYEES
10 DIM B(100),B$(40)
20 OPEN "I",1,"b:QUESTFL"
30 IF EOF(1) THEN CLOSE #1: GOTO 130
40 LINE INPUT#1,A$
50      FOR A=1 TO 40
60  B(A)=INSTR((B(A-1)+1),A$,","):IF B(A)=0 THEN A=41 ELSE
C =A
70      NEXT
80 PRINT
90 FOR A=1 TO C
100 B$(A)=MID$(A$,(B(A-1)+1),((B(A)-(B(A-1))))-1)
110 NEXT A
115 GOSUB 200
120 GOTO 30
130 PRINT  "XXXXXXXXXXX":CLOSE:END
140 PRINT B(A):PRINT A:STOP
200 REM PRINT OUT FIELDS
210 FOR AZ=1 TO 40
220 IF VAL(B$(5)) ) 5 THEN PRINT B$(AZ);" ";:IF  B$(AZ)=""
GOTO 240
230 NEXT AZ
240 PRINT
250 RETURN
```

A Program for Processing Fields

```
10  REM  TO ADD EMP FOR LANG (OR ANYTHING) USE 140--CHANGE
THE MID LAST CHAR TO = AMT OF CHARS AFTER =SIGN.
20 REM ALSO USE FOR FIELDS -- SPECIFY 3A OR 3a FOR  fields
STARTING WITH 3A (OR 3a)
30 REM WRITE FILE FOR software w/numbers  NAME IS MAKEFIL2
40 DIM B(100),B$(40)
50 OPEN "I",1,"b:QUESbas2"
60 OPEN "O",2,"xxxxxxxx":REM SUPPLY YOUR OWN FILE NAME
70 IF EOF(1) THEN CLOSE #1: GOTO 230
80 S$=A$
90 LINE INPUT#1,A$
100     FOR A=1 TO 40
110 B(A)=INSTR((B(A-1)+1),A$,","):IF B(A)=0 THEN A=41 ELSE
C =A
120     NEXT:REM remove the REM in 130-140 to print B(A)
130 REM  FOR A=1 TO C:PRINT B(A);" ";:NEXT A
140 REM PRINT
150 FOR A=1 TO C
160 B$(A)=MID$(A$,(B(A-1)+1),((B(A)-(B(A-1))))-1)
170 IF A < 8 GOTO 200
180 IF MID$(B$(A),1,1)="1" THEN LPRINT
B$(A);TAB(30)B$(5):C1=C1+1
190 IF A= 11 THEN A = C+1
200 NEXT A:LPRINT:LPRINT
210 IF A = C+1 THEN  PRINT B$(1)
220 GOTO 70
230 PRINT "TOTAL RECORDS IN FILE " C1:CLOSE:END
```

APPENDIX C

Information on File Construction and Processing

Organization of the Data

The data from the articles consisted of keywords or topics (when the expression keyword is used henceforth, it includes topics or any words representing the articles.) Keywords were recorded from the articles in their order of importance. The importance of each keyword was a value judgment made by the researcher at the time the article was read. The first keyword recorded in the database representing the article was designated by placement, the most important, the placement of the second, third and fourth following keywords indicated a diminishing importance. The database was constructed so that any keyword, combination of keywords, article titles, or author's name could be accessed in any way that might be desired. An example might be that the researcher might wish to evaluate contents of articles by looking at the the first two keywords of every article.

The database consisted of four files which had an interactive processing capability. The files were two index files, the reference file (the bibliography) and one data file. The first index file contained all the reference materials with the index being the assigned

number of each piece of reference material. The rule followed was that materials were numbered by the database in alphabetical ascending order. Titles starting with "A" were assigned the smaller numbers. The 92 keywords found in the research were also numbered alphabetically in ascending order.

The data file contained both the reference material which was represented by a number, and the keywords, also represented by a number, contained in each piece of reference material.

Therefore, the data file contained 230+ records. Each record contained the reference material name represented by a number, and the numbers representing the keywords found in that reference. The average reference material piece contained four keywords. (Descriptive information on the database which falls into the category "Findings" is presented in chapter four.)

Databases were created by using the non-document mode of the word processing program Wordstar. Any word processing package could be used or simply the MS DOS EDIT mode would be adequate.

Processing the Database for Writing the Narrative

The first processing step was to determine and record the titles of the written documents which contained each

keyword. Since the titles were all represented by numbers, each keyword would be followed by numbers representing the document title in which the keyword was found. The first few records of the file to be searched appeared as follows:

```
      FILE
Record#1
      1*-26-34-24-25-19
Record#2
      2*-26-19
Record#3
      3*-26-19-81
Record#4
      4*-19-81-11
Record#5
      5*-37-19-10-58-72
```

The first record (1*-26-34-24-25-19) begins with a one which represents a title of a written document. In this instance the one represents the article by Paulson (1988). The numbers following the one (26-34-24-25-19) represent keywords. The 26 represents "Database," the 34 represents "Federal Bureau of Investigation Computer Division", the 24 represents "Crime", the 25 represents "computer related database errors", and 19 represents "detailed computer usage."

The data was processed into meaningful information by searching each record by keyword. A computer program was written which searched by keyword every record in the database. The program took the alphabetically first

keyword and searched the file for the existence of this keyword. When it found the keyword, the program recorded the article the keyword was found in and continued the search until all 230 articles were searched. Then the program proceeded to do the same with the alphabetically second keyword. This was repeated until all keywords were used. The result was a 92 record file with the records containing all the reference material numbers in which each one of the 92 keywords was found. (A copy of the computer program used is in this appendix.) The resultant file appeared as follows:

```
FILE
Record#1
   Artificial intelligence-(69)-(71)-(100)-(125)-(  )+
Record#2
   Astronomy-(43)-(65)-(70)-(86)-(  )+
```

The keyword is listed, in the first record the keyword is "Artificial intelligence" and the numbers following the keyword are the written documents referenced by number. The number 69 from the first record represents Bulkeley (1988), the 43 in the second record represents Berry (1988).

The resultant keyword file was further processed to determine which of the 92 keywords were actually subsets of other keywords. For the purposes of careful evaluation of the data, each keyword had to be weighed individually for significance. Which keywords were subsets of which

other keywords, and which keyword was the categorical keyword with the other keywords as part of a subset, was a decision which frequently required reviewing the narrative written about the reference piece which contained the keyword. The keyword which was found more often in the reference materials, was generally also found to be the keyword designating the set, with the other related keywords becoming the subset keywords. An example was the following keyword analysis (from the file): Interactive video training was found in five references; Education was found in 17 references; Handicapped was found in three references. The choice of education as the set keyword was relatively easy because the interactive video training references and the handicapped references were also found in the education references. Other keywords such as music were more difficult because the four references contained in music had to be split between the keywords education and art. Therefore, to make these decisions, it is necessary to have readily available the individual summaries written on each reference piece.

Of the 92 keywords, 24 categories emerged as reflecting the trends and patterns in computer usage. The detailed analysis and the rationale for the analysis are contained in chapter four.

Analyzing Instrument Response Data

The explanation of the process of analysis which was applied to the data from the instrument falls into two categories. One is the creation of the database, the other is the processing of the responses.

Creating the Database

Recording the information from the instrument and creating the database in a well thought out prescribed manner is the key to processing. The actual data entry could be accomplished by many methods, such as with the EDIT function which is standard in some form on all computers, or with a word processing software package. The word processing software package is recommended because this type of software has a full screen editor and incorporates many variations of "search" and "replace" commands. The EDIT feature, although it incorporates some of the advantages of the word processing package, is basically a single line editor and more difficult to use.

The software package Wordstar was used to create the databases used in this research. The non-document mode

was used for all file creation.

The database consisted of approximately 100 records. Each record represented the responses to one instrument (therefore 100 records indicated 100 instruments were processed.) The record size was limited to 256 characters (with the last character position containing the end of record label.) The 256 character (or byte) record is the default value for Microsoft disk operating systems when using sequential files.

Each record, which was composed of the answers from all the questions on the instrument, contained a maximum of 36 fields. Each field was to contain the response to a question on the instrument. Although there were 46 response areas on the instrument, the most any respondent could fill in were 36 due to the mutually exclusive nature of certain answers (such as if the answer to a question was "yes" than the follow-up questions to "no" wouldn't be applicable.) All fields were variable length with a comma used to indicate the end of the field. Although fixed length fields are used in most commercial database software, the variable length field is a much better utilization of the space of the record. The variable length is determined by the amount of characters needed for each data entry into any particular field.

The first seven fields of each record were positional.

The first field was always the name of the person filling out the questionnaire. The format for this position was to have the last name first with one space separating the last name from the first name. This format of the name field enabled the names to be sorted without designating the first name as a secondary key field. All following fields were separated with a comma. The company name was put in the second field. The service area was in the third field, the number of employees was in the fourth field and the number of data processing employees was placed in the fifth field. The position in the company of the respondent was placed in the sixth field, and the "yes" or "no" as if the respondent was involved in the hiring process was placed in the last remaining positional field.

The remaining fields, indicating the answers to the actual questions, were entered with code characters at the beginning of the field. Answers to questions marked "N/A" were skipped. Therefore each record contained the first seven fields plus the remaining fields which were the coded answers to the questions. The code consisted of the number or letter which preceded the question on the form. The question number was followed by the response to the question. For example, if there were a question 15 with a response of "yes", it was recorded as "15y" or if the response was a word such as "COBOL" then the response was recorded as "15COBOL". If two words were part of the

response such as the response to question 15 being "COBOL,FORTRAN", the response was recorded as "15COBOL.FORTRAN" with the period separating each word. If the response was two words but the two or more words were actually one answer, then the period was not used to separate the fields (for example the written answer containing three answers "very little,COBOL,FORTRAN" would be recorded as "15very little.COBOL.FORTRAN"). Questions with multiple parts, such as question three, were coded as "3A", "3B", and "3C". The following portion of the database indicates how the recording was done:

Manney Bill,W.A.Taylor Co.,Importing/marketing,100,5,Adm,n,
1y,1Ay 1-2yrs exp prog,2Mini Honeywell.micro,4Pick,
5FoxBase.Revelation.Lotus.DW3.Wordstar.Graph Master,6y,6An,
6By,6Cy,7y,7By,8Strong bus skills,11n,11BShop size too
small,13y,13An

Kantt Cherry,Credomatic of Fl.,Credit Card Processing,12,
7,Systems Analyst,n,1n,2mini.IBM S/2,3RPG III,5Wordstar.
DBase III Plus.Lotus,6Cy,7y,7by,11n,12y,13y

Lawrence Maria,American Bankers,Insurance,1000,150,Systems
Analyst,n,1y,1adepends upon individual,2Mainframe.Amdahl.mini
.Hewlett Packard.micro.AT&T.IBM,3aCOBOL,Assembler,3bCOBOL,
4MVS,5LOTUS.DBL.ORACLE,6y,6By,7y,7Dy,10good prog,11n,13y

The above example consists of three records. The records pictured rap around so that they appear to be on three or more lines. In the actual file the formatting was 256 characters across, all on a single line.

The Sort Program

The key program used was a sort program. This program is unique in that it sorts using the total record as the key field (the field which is to control the sort). The space occupied by this program in RAM memory is 1505 bytes. This program utilizes the disk as secondary storage so that large files can be sorted on computers with RAM memory less than the file size. Other methods of sorting could be used, but they were not due to the following reasons. Software packages which have the sort potential are quite lengthy and time consuming. The more popular database program dBase III requires 250,000 bytes of RAM memory and the key fields must be designated. Sorting with packages of this type, requires predetermined sort fields, fixed field lengths, and a fixed amount of fields in the record. This determination must be made when the file is created. The SORT utility in MS DOS 3, could be used. Again this utility requires the key field designations, and requires a microcomputer which has the ability to support MS DOS 3. The biggest draw back in using the DOS SORT is that it does not allow processing to be integrated within the sort procedure.

The sort program was used to sort into alphabetical order the file containing the 200+ references which composed the bibliography, to create the file of topics in alphabetical order, and to sort the variables in the heading section of the questionnaire. Also this program was modified to sort question responses for ease of processing.

The sort program follows:

```
10 OPEN "O",2,"B:DATABAS1"
20  DIM N$(27,100),B(27),FLN$(27):REM 27'S EXCEED 26,  100-
    MOST FOR ONE LETTER
30 OPEN "I",1,"B:DB1"
40 IF EOF(1) THEN CLOSE #1: GOTO 120
50 LINE INPUT#1,A$
60 PRINT A$
70 IF A$="ZZZZ" THEN CLOSE #1: GOTO 120
80 A=ASC(A$)-64
90 B(A)=B(A)+1
100 N$(A,B(A))=A$
110 GOTO 40
120 PRINT "FIRST SORT FINISHED"
130 FOR C = 1 TO 26
140 IF N$(C,1)="" THEN 210
150 C$=CHR$(C+64)
160 OPEN "O",1,"STFL"+C$:N=N+1:FLN$(N) = "STFL"+C$
170   FOR D = 1 TO 100
180     IF    N$(C,D)    =""   THEN    200    ELSE    PRINT
        N$(C,D):WRITE#1,N$(C,D)
190   NEXT D
200 CLOSE#1
210 NEXT C
220 PRINT "END"
230 REM SORT
240 DIM  N1$(100):REM BIGGEST AMOUNT OF LETTER FILE
250 S = 0
260 S=S+1:IF FLN$(S)="" THEN 470
270 OPEN "I",1,FLN$(S)
280 IF EOF(1) THEN 320
290 L=L+1:LINE INPUT#1, N$
300 N1$(L)=N$
```

```
310 GOTO 280
320 N=B(ASC(MID$(N$,2,1))-64)
330 PRINT N
340 FOR I= 1 TO N-1
350   FOR J=I+1 TO N
360     IF N1$(I))N1$(J) THEN SWAP  N1$(I),N1$(J)
370   NEXT J
380 NEXT I
390 CLOSE#1
400 OPEN "O",1,FLN$(S)
410  FOR M=1 TO B(ASC(RIGHT$(FLN$(S),1))-64)
420   WRITE#1,N1$(M)
430   WRITE#2,N1$(M)
440 PRINT N1$(M)
450  NEXT M
460 CLOSE#1:L=0:GOTO 260
470 PRINT "AT 470"
480 KILL "STFL*.*"
490 CLOSE#2
500 PRINT "END":END
```

This program is here presented in a simple form for the purpose of understanding the logic. The execution time of this program can be cut by 95% by eliminating all the PRINT statements, putting as many statements as possible on one line number (the program could probably concentrate into fifteen statements.) All the NEXT statements could have the variables removed, or when two NEXT statements are together, the two variables (retained for purposes of clarity) could be placed after one NEXT statement (NEXT A,B) or NEXT:NEXT could be used.

The sort logic of this program is based on a double sort format. The first sort partitions the file to be sorted into twenty-six parts. All the records beginning with "A" are in the first partition, those beginning with "B" are in the second partition and so forth. The eight

statements from line number 40 to 110 partition the file and place the partitioned results in RAM memory in an array.

Lines 130 to 200 write these arrays on the disk (or place them in secondary storage.) These arrays would have been integrated into the previous step (lines 40 to 110) if the file partitions were to large for RAM memory. Storage on a secondary device frees RAM memory for calling processing modules at this point in the program. This sort program is a base program to be used for sorting only. It has the capability of having processing subroutines used, CHAINING, or the CALL commands inserted. Memory if not erased (when CHAINING), will have to be erased with the CLEAR function (due to limitations on RAM) and therefore the arrays containing the partitions of the file will be lost.

Modules added check for errors, such as the absence of numeric fields where they should be, the absence of capital letters or lower case letters where required, the presence of code characters not in the code, and others. Also totals or other counts could be made during the sort for purposes of verification, to control processing, or simply to record totals.

Sorting also is a searching procedure in that it puts all the records or fields together. If equipment types are of interest, sorting of the file not only puts equipment

types in alphabetical order, but by putting in alphabetical order, puts all the IBM equipment together, all the AT&T equipment together, and all other equipment types together. Since the file is partitioned and can be accessed by partition, searching for IBM equipment will take the processing procedure immediately to the "I" partition and search this small part of the file.

The above discussion of the SORT program is an example of the programs written for the study and the explanations of these programs.

APPENDIX D

Questionnare

QUESTIONNAIRE

Name_____Company name_____

Service area (banking, manufacturing, etc.) _____

Number of employees ____ Number of Data Processing employees ___

Your position in company _____

Are you directly involved in the hiring process? _____

Instructions:

Please answer only those questions applicable to your particular company. Questions not applicable should be marked "N/A".

1. Has your company hired individuals who have graduated with an Associate degree in Data Processing/Computer Science

____Yes ___No

IF YES

A. Do you require work experience ( )Yes ( ) No
Describe the type of experience and length of experience if relevant.

B. What job category (ex. operations, programming, etc.)?

IF NO

Why not? Do you have suggestions for Miami-Dade Community College?

2. What computer hardware do you use in your company/organization (type of mainframe, mini and/or micro)?

3. Which programming languages are used?

Mainframe _____

Mini _____

Micro _____

4. Which operating systems?

5. Which software packages are used (ex. WordStar, Lotus, CICS, etc.)?

6. Does your installation use networking? ( ) Yes ( ) No
If yes, what type(s)? ( ) micro to micro;
( ) micro to mainframe/mini; ( ) mainframe/mini to mainframe/mini.

7. Does your installation have telecommunications needs?
( ) Yes ( ) No;
If yes, what type(s)? ( ) via satellite; ( ) via telephone lines; ( ) via fiber optical; ( ) via common carrier
( ) other _____

8. Which specific skills do you look for in entry level DP employees?

9. Do you see job areas emerging in the future which should be integrated into the Miami-Dade Community College program?

10. If you have knowledge of Miami-Dade Community College graduates who have been hired, list briefly their strengths and weaknesses.

11. Does your company participate in a work/study program?
( ) Yes ( ) No
IF YES
What type of jobs or tasks does your company usually assign the student?

IF NO
Is there a reason why your company would or would not participate?

12. Do you consider the time spent in a work/study program as practical experience?

13. Do you think students should have practical exposure as a non paid/low paid apprentice in data processing as part of the degree requirement? ( ) Yes ( ) No

IF YES
Would you be willing to participate in this program?

14. Any further comments?

(End of instrument)

VITA

Lawrence White was born in Chicago, Illinois on December 24th, 1936. He received his elementary and secondary education in Zion, Illinois. In 1959 he received an A.B. degree from Florida Southern College in Lakeland, Florida. In 1966 he was awarded a Master of Educational Research degree from University of Miami.

From 1960 until 1965 he taught in the Dade County Public School system. He went on leave in 1965 for three years to pursue graduate work at the University of Miami. Upon returning to the school system, he was promoted to an administrative position. His assignment was to oversee program evaluation for the vocational, industrial, technical, and adult education programs.

In 1980 he was employed by Miami Dade Community College as a professor in the computer science area.

In 1967 he was admitted to the Graduate School of University of Miami, where he was awarded a Ph.D. in May 1990.

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