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ANALYSIS, CLASSIFICATION, AND SYNTHESIS OF RESEARCH FINDINGS AND THOUGHT PERTAINING TO BUSINESS DATA PROCESSING EDUCATION FROM 1971 TO 1976

presented by

JOHN FREDERICK SCHRAGE

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Business Education

Robert Poland
Major professor

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ANALYSIS, CLASSIFICATION, AND SYNTHESIS OF RESEARCH FINDINGS AND THOUGHT PERTAINING TO BUSINESS DATA PROCESSING EDUCATION FROM 1971 TO 1976

By

John Frederick Schrage

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
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ABSTRACT

ANALYSIS, CLASSIFICATION, AND SYNTHESIS OF RESEARCH FINDINGS AND THOUGHT PERTAINING TO BUSINESS DATA PROCESSING EDUCATION FROM 1971 TO 1976

By

John Frederick Schrage

The problem was to provide a state-of-the-arts document on business data processing education from 1971 to 1976. Teaching implications were shown based on research findings and thought which were classified into the categories of history and status, curriculum implications, course content, materials and equipment, teaching methods, and occupational information.

The sources of data, from a master list of sixty-seven research reports and 555 non-research publications, were analyzed and synthesized into the above six categories. Research reports were abstracted to consolidate findings and recommendations. Key words and bibliographic references were recorded on cards for computer analysis. From the tabulation of data, the history and status category contained the most references with the teaching methods area containing the least sources.

The history of business data processing was traced to the stone age with its future leading to the use of the small computer systems. "Curriculum '68", from the Association for Computing Machinery, and

Curriculum Implications of Automated Data Processing for Educational Institutions by F. Kendrick Bangs and Mildred C. Hillestad, published by the Office of Education, were the classic documents referenced in the curricula. Business and industry criticized the irrelevance of computer education to on-the-job tasks. Standardized tests and previous course-work showed some measure of data processing job success.

Business data processing curricula varied from one to several courses with one or two courses prevalent in the high school. The data processing core for two-year schools consisted of basic concepts, systems analysis, accounting, mathematics, communication skills, and at least one programming course, generally in COBOL. Two-year educators wanted the program to provide a dual purpose for vocational training and transfer to the four-year institutions. The articulation of programs became an issue still unresolved. The previously stated data processing core was expanded in the four-year schools for more depth in programming and systems analysis.

Although the curricula listed several courses, course descriptions were given mainly for Introduction to Data Processing with or without programming, Introduction to Programming, Computers and Society, programming languages, Systems Analysis, and Teaching Methods. The introductory course, on the secondary and post-secondary levels, dealt with basic concepts and terminology, while Introduction to Programming used mainly FORTRAN integrated with the basic concepts. Computers and Society showed the relationships of the computer to our surroundings. Systems Analysis looked at the tools and techniques of the analyst, while the methods course gave an overview of data processing and procedures for implementing curriculum in data processing.

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Teaching materials at least doubled during the 1971 to 1976 period with the best source for determining what was available in the teaching of data processing coming from the Computing Newsletter for Schools of Business edited by J. Daniel Couger from the University of Colorado at Colorado Springs. Educators produced supplemental materials in the form of teaching guides, learning activity packages, and programmed instruction. Actual job situations were simulated in the classroom through the use of the computer terminal.

Teaching methods varied from on-the-job training and hands-on experiences to computer assisted instruction and audio-visual tutorial, besides the standard method of lecture. The use of the laboratory was essential to computer education for it allowed interactions between the teacher-student and student-student.

With the technological changes in the computer, the stature of the professional data processor rose to meet the need. The education level became at least some college for entry positions of computer operator and programmer. The career ladder for the data processor was from operations to programming to analysis to management. With the designation of the analyst as the doctor of business by industry, the ladder to management has expanded out of data processing to corporate management.

ACKNOWLEDGEMENTS

The completion of a doctoral program can be facilitated when one occasions the understanding of the members of my committee. Dr. Norman T. Bell provided guidance in accomplishing the task of analysis and synthesis. Dr. Robert P. Poland helped plan and adapt the program to fit my needs. Drs. Peter Haines, Stanley Hecker, Roland Solmonson, and Zane Quible provided the needed background knowledge in business and distributive education along with expertise in educational and business administration.

Moreover, Mr. Walter Parrill's initiation of me into data processing deserves applause; as does Dr. Marvin Barth's underscoring the necessity of relating data processing to business education; as does Dr. Robert A. Schultheis' stimulation to know well the discipline of business education.

Although educators helped develop the business educator and data processor in me, little could have been accomplished without the patience and understanding of my wife, Diane.

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CHAPTER I

THE PROBLEM

INTRODUCTION

Data processing has existed since the beginning of time, progressing from the scratching on rocks to the machine called the computer. The use of the computer expands more each year, especially now with the availability of home computers. Because of computers, a revolution in information processing in the past two decades had occurred. As well, educational patterns have been affected by their presence in a variety of academic settings.

Problems have resulted from the rapid changes in computing due to complexity and lack of qualified instructors. In many cases, institutions have failed to provide training in computing, and, in addition, that training which has been provided must often be termed obsolete.[1] Costs related to instruction and technological changes have further disturbed program equilibrium.

While some high educational institutions have not updated their programs, others have adapted to the changes and added courses in science, business, mathematics, engineering, and professional development. Such program designations are: business data processing, computer technology, information processing, and computer science. Course content has ranged

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[1]Gary B. Shelly, "Why Industry Won't Hire Your Graduates," National Computer Conference Proceedings (Chicago, IL, 1974), p. 227.

from the simplest of information to the complexity of the architecture of the computer. Huffman and Welter outlined needs in business data processing education with reference to existing models which should cause future program revisions.[2] Technological changes have caused curriculum revisions. The availability of instructional materials essential to training was oftentimes lacking.[3]

The amount of literature being produced in data processing is on the increase. However, at present, there is an observable lack of leadership in the coordination of the efforts of data processing.[4] Improved training needs and knowledges must be brought together to provide information on the instructional aspects of business data processing.[5]

STATEMENT OF PROBLEM

The problem is to provide a state-of-the-arts document pertaining to business data processing education from 1971 to 1976 through a comprehensive analysis and synthesis of research findings and thought.

Pertinent literature is classified into the categories of history and status; curriculum implications; course content; materials and equipment; teaching methods; and occupational information. An attempt to maintain comprehensiveness of the problem throughout the study of all

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[2]Harry Huffman and Clyde W. Welter, "Updating Business Education Programs," Business Education Forum, XXX (January, 1976), p. 5.

[3]Ibid., p. 6.

[4]Thomas J. Cashman, "Needed: Leadership in Data Processing Education," Business Education Forum, XXX (November, 1975), p. 26-29.

[5]C. C. Calhoun, "Needed Research in Business Education," presentation at the National Business Education Association Convention, April 14, 1976.

completed and available reports for the period in question is reinforced by the non-research literature relation to business data processing education.

PURPOSE

The purpose of the study is to provide a foundation for the improvement of business data processing education in the following ways:

a. a synthesis of research findings and thought in business data processing education from 1971 to 1976.

b. the development of a bibliography of research and literature in business data processing education from 1971 to 1976.

c. the development of abstracts of research dealing with business data processing education from 1971 to 1976.

DELIMITATIONS

The study is limited to research findings pertaining to business data processing education in the United States from 1971 to 1976. Only studies related to data processing education in training for business applications and business education are included. The educational level is limited to high schools and vocational schools on the secondary level; technical institutes/colleges and community junior colleges on the post-secondary level; and college/university programs on the four-year institution level.

Although follow-up studies deal mainly with biographical information, the studies are included if teaching implications are presented. Furthermore, an inclusion is made of information relating to business data processing found in research areas such as accounting, statistics, and office practice. Not included are technical studies on such topics

as building compilers or studies related to computer science or engineering unless a direct bearing on business data processing can be shown. Finally, the study encompasses all research studies and non-research literature referenced and indexed.

The purpose of the study is not a formal evaluation of the research dealing with the problem, methodology, findings, conclusions, or recommendations, or the thought expressed in the non-research literature. Informational observations are shown in the abstract of the research and in the findings chapter. Additionally, the language of the abstracts parallels the meaning of the primary sources as closely as possible.

DEFINITIONS

In order to maintain consistency of explanantion throughout, the following definitions are offered:

Analysis: the detailed evaluation and appraisal of the content of the literature examined.[6]

Business Data Processing Education (BDPE): instruction which prepares people for entry and/or advancement in data processing or in an occupation requiring data processing competencies.[7]

Classification: the act of ordering related phenomena into categories to render the greatest number of general propositions regarding the area of data processing.[8]

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[6]Carter V. Good, ed., Dictionary of Education (New York: McGraw-Hill, 1973), p. 29.

[7]Adapted from the difinition of business and office education preparatory instruction, Ibid., p. 304.

[8]Ibid., p. 104.

Data Processing (DP): the execution of a systematic sequence of operations performed upon data.[9] The execution is understood to have been carried out by the use of a device which evolved into the electronic manipulation of data which related to business education. Synonymous to data processing in the searching of the literature were computer, computer science, and information processing.

Research Findings: the results of data gathering and analysis, usually involving a certain amount of interpretation.[10]

Research Report: a derived manuscript of official character based on a problem to be solved according to a specified research technique which was used in a degree program.

Synthesis: the putting together, after comparison and evaluation, of several sets of findings or points of view to evolve a general point of view embracing what appear to be the sound elements of the sets.[11]

Thought: the active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further consequences to which it tends.[12]

LIMITATIONS

First, the findings of this study are valid and reliable only to the extent of the validity and reliability of the works on which they are based. Second, the ability to abstract accurately and present

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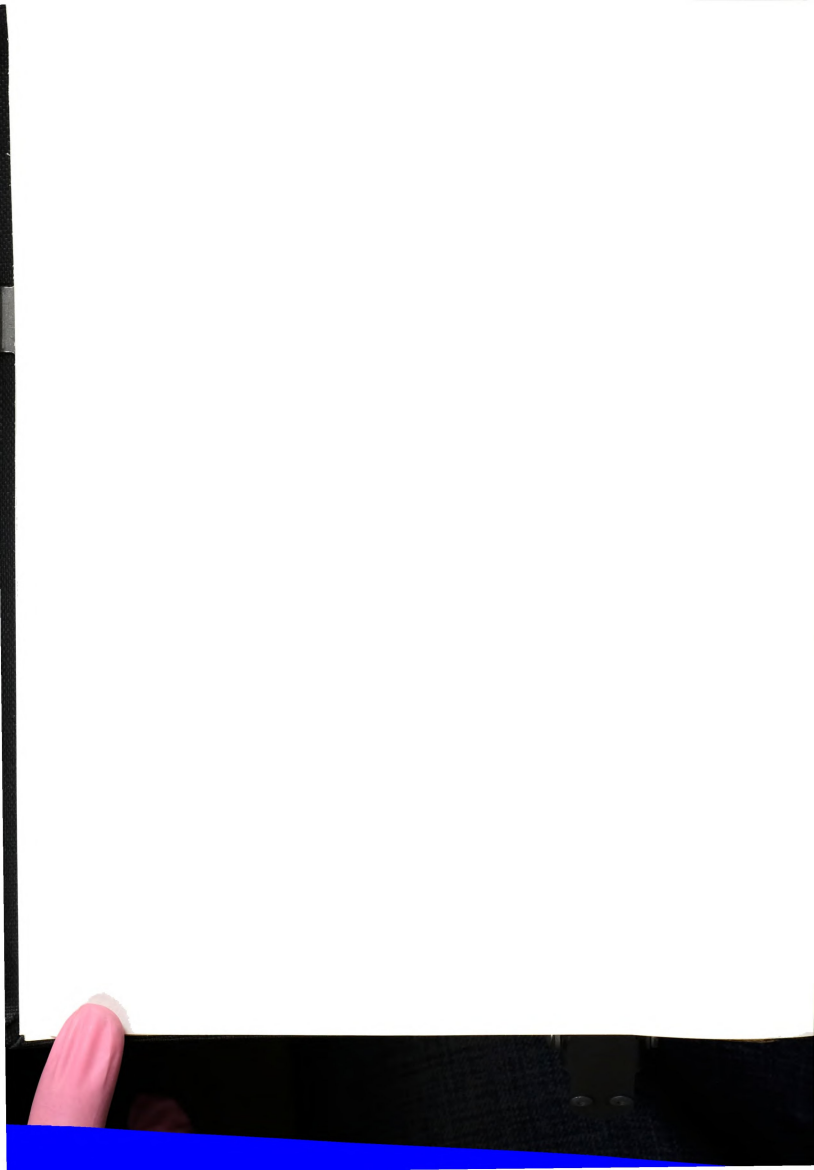
[9]Vocabulary for Information Processing (New York: American National Standards Institute, 1970), p. 34.

[10]Good, p. 242.

[11]Ibid. p. 569.

[12]Ibid., p. 8.



interpretations for synthesis also limits the findings for business data processing education. Third, any interpretation depends on word meanings remaining constant with other factors being equal. Consequently, since the definition of data processing is constantly changing, the process of gathering the total set or research reports was constantly monitored.

Additionally, although the study is based on available literature, it is known that the availability of some research findings could not be located. From the search of bibliographies of the research studies, it became apparent that some were not to be found in the indices.

It is believed that the year span, 1971 to 1976, serves to make relevant research more focal; however, some of the material might contain outdated information as viewed by some business data processing educators.

CHAPTER II

RELATED LITERATURE

This review of literature is divided into two areas: business data processing and business education. Three studies in business data processing education and at least twenty studies in business education have been completed dealing with analysis, classification, and synthesis of research findings and/or thought. Although similarities exist between the studies, each study was distinct and contained an analysis of different aspects of a subject area for different time frames.

BUSINESS DATA PROCESSING

In 1964, Ware[13] reviewed literature concerning business education leaders' views of the impact of automation on business education. The observations of the study were:

a. leaders had only a partial understanding of the impact of data processing on business education.

b. curriculum changes would take place but leaders were unsure of the extent because of the rapid growth of data processing.

c. business education programs needed updating.

d. cooperative and relevant interchange between business and education was needed in data processing.

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[13]Elsie Collins Ware, A Survey of Literature Concerning the Impact of Automation on Business Education, independent study, University of Southern Mississippi, 1964, 64 pages.

e. automation was present in many classrooms where business education was being taught.

In 1967, Maggiore[14] reviewed research studies completed prior to 1967 in business data processing education. The sixty-four studies from 1951 to 1967 were classified in the following categories:

a. curriculum and course content.

b. occupational information.

c. history and status.

d. methods of teaching.

e. instructional materials and equipment.

The research topic most often studied was data processing implications for a business education curriculum. Needed areas of research, based on the study by Maggiore, were instructional materials and equipment, methods of teaching, status of the methods of instruction, and qualifications of business data processing teachers.

In 1971, Hanson[15] prepared a synthesis of selected professional literature pertaining to business data processing at the secondary education level. The purpose was to present available literature in a usable form for the improvement of data processing instruction.

The opinions of the available literature, as expressed by Hanson, were placed in the following categories:

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[14]Judith J. H. Maggiore, A Review of Research in Business Data Processing Education: Studies Completed Prior to 1967, master's paper, Southern Illinois University, Edwardsville, 1967, 150 pages.

[15]Ann S. Hanson, A Comprehensive Study and Synthesis of Professional Literature Pertaining to Data Processing in Secondary Education, 1969 and 1970, master's paper, University of Wisconsin, Eau Claire, 1971, 41 pages.

a. objectives of instruction.

b. course content.

c. development of data processing courses.

d. determinants of course objectives.

e. physical equipment.

f. teaching techniques.

g. teacher training.

Additional findings of the Hanson study indicated the content of data processing courses included terminology, programming, general data processing knowledge, and social implications. Instructional programs were viewed as introductory, non-specialized, experience on equipment, or some combination of the previously stated types. Courses should be at least one semester in length with the use of standardized tests predicting course performance. If equipment was not available, simulation or audio-visual aids were used to help the student achieve basic knowledge. Additionally, team teaching and flowcharting were suggested as techniques to use in the introducing of data processing.

BUSINESS EDUCATION

At least twenty analysis, classification, and synthesis studies were completed at the master's and doctoral level from 1934 to 1976. The studies were done in the following content areas: bookkeeping and accounting, business communications, economics, general business, office practice, shorthand and transcription, supervising teacher, teacher education, and typewriting.

The format of the synthesis studies were the same with the classification of the research and/or non-research literature mainly in the following categories:

a. history and status.

b. occupational information.

c. curriculum and course content.

d. instructional materials.

e. teaching methods.

f. guidance and follow-up.

In addition to providing teaching implications from the analysis and synthesis, a cumulation of research and/or literature of a particular business teaching information was also provided.

The general format and style for this study were drawn from the research of Devine,[16] Sluder,[17] and Gurnick.[18] Minor differences between the previous studies and this study resulted in specific requirements of the difference in preparation for the Michigan State University Graduate School. A more in depth list of analysis, classification, and synthesis studies may be found in the Bibliography.

SUMMARY OF RELATED LITERATURE

Analysis, classification, and synthesis research has been completed in many business education areas from 1934 to 1976. Research by Ware,

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[16]John W. Devine, A Comprehensive Analysis, Classification, and Synthesis of Research Findings and Thought on the Teaching of Bookkeeping and Accounting, unpublished doctor's thesis, Indiana University, 1962.

[17]Lester I. Sluder, An Analysis and Synthesis of Research Findings Pertaining to General Business, unpubished doctor's thesis, Indiana University, 1965.

[18]Stanley Gurnick, A Comprehensive Analysis, Classification, and Synthesis of Research Findings on Business Teacher Education, 1956-73, unpublished doctor's thesis, Indiana University, 1974.

Maggiore, and Hanson showed the definite impact of automation on business education which led to a constant updating of data processing education with reference to curriculum, teaching methods, and instructional materials and equipment. The curriculum designers were attempting to keep pace with the growth of technology for the student's maximum benefit.

Some of the other areas research by analysis and synthesis studies were accounting, secretarial studies, and teacher education. The basic format included a six-category classification. Rich implications for teaching practices can be attributed to the influential research of the late Elvin Eyster and his students and colleagues.

CHAPTER III

PROCEDURE

The procedure for the analysis, classification, and synthesis of research findings and thought on business data processing education from 1971 to 1976 involved the following steps: (1) a master list of research reports and non-research literature was compiled; (2) after gathering the research findings and thought from the master list, the relevant literature was abstracted and summarized into six broad categoried; (3) the characteristics of the research findings and thought were reports, leading to the synthesis of the findings stated by the literature; and (4) the findings were then summarized with conclusions and recommendations drawn from the literature.

PREPARATION OF BIBLIOGRAPHY

The research bibliography contains works found in research indices and classified as reported dissertations, theses, projects, and studies for master's, specialist's, and doctoral degrees. The list was compiled using the following:

a. American Doctoral Dissertations.

b. Business Education Index.

c. Comprehensive Dissertation Index, 1861-1972.

d. Computer Science: A Dissertation Bibliography.

e. Dissertation Abstracts.

f. Doctoral Dissertations Accepts by American Universities.

g. Index to Doctoral Dissertations in Business Education, 1900-1975.

h. Master's Abstracts.

i. Master's Theses in Education.

j. Resources in Education.

The non-research professional literature bibliography contained works from journals, yearbooks, monographs, and government curriculum studies. The list was compiled using the following:

a. Abstracts of Instructional and Research Materials in Vocational and Technical Education.

b. Applied Science and Technology Index.

c. Business Education Index.

d. Business Periodical Index.

e. Current Index to Journals in Education.

f. Education Index.

g. Quarterly Bibliography of Computers and Data Processing.

h. Reader's Guide to Periodical Literature.

i. Resources in Education.

j. "Survey of the Literature in Computer Science Education Since Curriculum '68".[19]

Collection and Organization of Data

The research reports and literature needed for the study were obtained through the interlibrary loan systems of Michigan State University, East Lansing, Michigan, and Indiana University - Purdue

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[19]Richard Austing, Bruce H. Barnes, and Gerald L. Engel. "Survey of the Literature in Computer Science Education Since Curriculum '68," Communications of the ACM, XX (January, 1977), p. 13-21.

University, Fort Wayne, Indiana, the latter utilizing the library systems of Indiana University, Bloomington, Indiana, and Purdue University, West Lafayette, Indiana. Research studies not available through interlibrary loan were purchased on microfilm, obtained from other universities, or obtained directly from the researcher. Non-research literature not available through interlibrary loan was obtained from my personal library, professors' libraries, microfilm sources, and publishers' files. For the purpose of facilitating the synthesis, a complete bibliographical reference was made of each source with notes and relationship to categories.

ANALYSIS, CLASSIFICATION, AND SYNTHESIS OF DATA

Abstracts were prepared for all research reports relating to business data processing education from the master list of sources of data available. The abstract format was as follows:

a. complete bibliographical reference.

b. problem statement.

c. procedure statement.

d. findings.

e. recommendations.

f. abstracter's comments.

The abstracts were then classified into broad areas for further synthesis using the following areas:

a. history and status.

b. curriculum implications.

c. course content.

d. materials and equipment.

e. teaching methods.

f. occupational information.

Research findings and thought were reviewed within each category in order to further refine the initial classification and synthesis.

COLLECTION OF INFORMATION

Research study abstracts were alphabetically indexed. The bibliographic reference and classification of the research studies and non-research literature were subsequently recorded on punched cards for tabulation of data. Classification of both areas were sorted and tallied to facilitate the synthesis.

ORGANIZATION OF REPORT

This research study was separated into five divisions with appendices. The first division consisted of the problem statement, purpose, delimitations, definitions, and limitations. The second division consisted of the review of related analysis, classification, and synthesis literature in business data processing and business education. The third division consisted of the procedures for the preparation of the bibliography; collection and organization of information; and organization of the report. Division four consisted of the characteristics of the research studies and the synthesis of the findings into the categories of history and status, curriculum implications, course content, materials and equipment, teaching methods, and occupational information. Division five consisted of the study summary, conclusions, and recommendations. The appendices consisted of the master list of the sources of data and the abstracts of the research findings.

CHAPTER IV

THE FINDINGS

Sixty-seven research studies and 555 non-research publications pertaining to business data processing education from 1971 to 1976 were analyzed and synthesized for characteristics dealing with history and status, curriculum implications, course content, materials and equipment, teaching methods, and occupational information. The history of data processing was traced to the stone age with the future leading to micro-computers. While "Curriculum '68" was too theoretical, business curricula appeared too vocational or outdated. Computer science needed courses in business for employability, while business curricula needed more technical materials. Methods of teaching data processing varied with new looks at internships, computer assisted instruction, and reading levels. Audio-visual materials and textbooks were improving with relevant, current publications. The occupation was ranked for high future growth by government surveys and the educational level was rising to meet the technology advances.

CHARACTERISTICS OF THE RESEARCH REPORTS

An analysis of the characteristics of the research and literature is essential in understanding the classifications of the material. From a master list of over 4,000 research reports, only 67 were considered relevant to the study. The writings were classified by three variables: time-frame, level of research, and major classification as shown in

Table 1 and Table 2, page 18. Over seventy percent of the research was completed at the doctoral level with studies classified as master's papers or doctoral dissertations. Forty-three different institutions of higher education produced business data processing research during 1971 to 1976. Northern Illinois University, DeKalb, Illinois, led with four dissertations during the period. Approximately thirty percent of the studies dealt with the history and status category while less than ten percent of the studies dealt with course content and occupational information.

TABLE 1

NUMBER AND TYPE OF RESEARCH COMPLETED

Year	Master's Paper		Doctoral Dissertation		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
1971	7	10.4	10	14.9	17	25.3
1972	4	6.0	7	10.4	11	16.4
1973	4	6.0	12	17.9	16	23.9
1974	2	3.0	13	19.4	15	22.4
1975	2	3.0	6	9.0	8	12.0
Total	19	28.4	48	71.6	67	100.0

TABLE 2

RESEARCH COMPLETED BY CATEGORY

Category	Number	Percentage
History and Status	19	28.3
Curriculum Implications	12	17.9
Course Content	6	9.0
Materials and Equipment	13	19.4
Teaching Methods	11	16.4
Occupational Information	6	9.0
TOTAL	67	100.0

CHARACTERISTICS OF NON-RESEARCH LITERATURE

In Table 3, the non-research literature was broken into two classifications along with the yearly analysis. The other literature category dealt with curriculum studies and monographs written by professional organizations and educational agencies funded by the government. Journal articles were authored primarily by high school and college teachers. Apparent weakness of the non-research literature centered on the reliance of the experiences rather than the research of the author's thought. Misleading titles resulted in the elimination of a number of articles.

The most prolific writer during the period was J. Daniel Couger, who had published 14 articles and 45 issues (9 per year for the five years) of the Computing Newsletter for Schools of Business. The journal

with the greatest number of sources was the SIGCSE Bulletin,* followed closely by the Journal of Data Education. As shown in Table 4 on page 20, about the same amount of literature was produced each year in the six categories.

TABLE 3

NUMBER AND TYPE OF NON-RESEARCH LITERATURE

Year	Journal Articles		Other Literature		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
1971	87	15.7	12	2.2	99	17.9
1972	107	19.3	13	2.3	120	21.6
1973	107	19.3	13	2.3	120	21.6
1974	96	17.3	8	1.5	104	18.8
1975	109	19.6	3	0.5	112	20.1
TOTAL	506	91.2	49	8.8	555	100.0

*The SIGCSE Bulletin is a publication of the Association for Computing Machinery dealing with the Special Interest Group on Computer Science Education.

TABLE 4

NON-RESEARCH LITERATURE COMPLETED BY CATEGORY

Category	Number	Percentage
History and Status	138	24.9
Curriculum Implications	109	19.6
Course Content	105	18.9
Materials and Equipment	91	16.4
Teaching Methods	44	7.9
Occupational Information	68	12.3
TOTAL	555	100.0

HISTORY AND STATUS

Business data processing had its beginning at the same time as accounting--the stone age.[1*] The original data processing was completed by the hammer and chisel on stone which led to clay tablets, silk scrolls, parchment, waxed tablets, animal skins, and finally paper.[2] When data processing machines were invented, they performed accounting procedures, but instruction for use in business data processing as a subject did not

*The number contained in the footnotes designate references in the Master List of Sources of Data found in the Appendices. The two digit numbers (1-67) deal with research findings and the three digit numbers (101-607) deal with the non-research literature.

Each page is individually footnoted with numbering beginning with 1 on each page.

[1] 261.

[2] 261.

exist.[1] The first computer for use in business data processing, UNIVAC I, was delivered in 1954.[2] Many changes took place in business operations with the computer handling the data.[3] During 1955 through 1975, constant changes took place in computer hardware, software, and peopleware. Because of a changing attitude in the use of small computers for both business and personal use, one could sense the extent of its impact on our future society.[4]

Computer Generations. Each major technological change brought forth a new computer generation. Frederic Withington, the recognized authority on computer projection, classified the changes in this area as follows:[5]

First Generation Name and Period: Gee Whiz, 1953-1958.

New Hardware: Vacuum tubes and magnetic records.

New Software: None.

New Functions: Initial experimental batch applications.

Organizational Location: Controller's department.

Effect on the Organization: First appearance of technicians with problems in salary, responsibilty, and behavior; furthermore, beginning of the automation fear among employees.

Second Generation Name and Period: Paper Pushers, 1958-1966.

New Hardware: Transistors and magnetic core.

New Software: Compilers and input/output control systems.

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[1] 250, 261.

[2] 250, 261.

[3] 141, 358.

[4] 139, 140, 203.

[5] 601.

New Functions: Full range of applications and inquiry systems.

Organizational Location: Proliferation in operating departments.

Effect on the Organization: With the proliferation of the data processing group, some workers and supervisors were alienated or displaced with an introduction of new rigity but also new opportunities.

Third Generation Name and Period: Communicators, 1966-1974.

New Hardware: Large-scale integrated circuits and interactive terminals.

New Software: Multi-function operating systems and communications controllers.

New Functions: Network data collection and remote batch processing.

Organizational Location: Consolidation into centrally controlled regional or corporation centers with remote terminals.

Effect on the Organization: Centralization of the data processing organization with division data visible to central management and some division managers alienated; generally response times were shortened.

Fourth Generation Name and Period: Information Custodians, 1974-c.1982.

New Hardware: Large file storage and satellite computers.

New Software: General-purpose data manipulators and virtual machines.

New Functions: Integration of files, operational dispatching, and full transaction processing.

Organizational Location: Versatile satellites instead of terminal with control still centralized.

Effect on the Organization: redistribution of management functions with logistic decisions moving to headquarters and tactical decisions moving out, thus resulting in reorganization and pleasing the personnel in the field.

Fifth Generation Name and Period: Action Aids, c.1982-?.

New Hardware: Magnetic bubble and/or laserholographic technology with distributed computer systems.

New Software: Interactive languages and convenient simulators.

New Functions: Private information and simulation systems with intercompany linkages.

Organizational Location: Systems capabilities projects to all parts of the organization with networks of different organizations interconnected.

Effect on the Organization: Semiautomatic operation decisions and planning initiated by many individuals leading toward flickering authority, management by consensus, and greater involvement of people at all levels, thus creating a data processing group shrinkage.

The trend projected in business was to use small computers and service bureaus; while business data processing education should describe the aspects and implications for the future uses of the computer.[1]

The use of the computer has required a new look into the education and training of society.[2] Even the data processing occupations have been updated.[3] Much data processing training was learned on the job because of the rapid changes.[4]

Two milestone documents on computer education that have been referenced were: "Curriculum '68" from the Association for Computing Machinery (ACM) and Curricula Implications of Automated Data Processing for Education Institutions by F. Kendrick Bangs and Mildred C. Hillestad. "Curriculum '68" was more science-oriented than the Bangs/Hillestad study, which was mainly business oriented.

Status of Business Data Processing Education

On-the-job training proved to be a more successful approach in preparing the person for the role of a data processor than was didactic classroom instruction.[5] It appears that the latter approach

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[1] 25, 140.

[2] 353, 447, 510, 559.

[3] 170, 353.

[4] 559.

[5] 469, 461, 352, 121, 160, 503, 340, 587, 356, 385, 153, 118, 389, 223, 257, 178, 112, 274, 159, 412, 502, 173, 291, 243, 579, 145, 330, 330, 359, 383, 247, 189, 331, 220, 564, 360, 329, 365, 146, 332, 104, 565, 395, 519, 384.

to education tended to be too theoretical or outdated.[1] From 1972 to 1974, contentions of support or criticism of the two methods were made.[2] During this period, persons from industry and education gave attention to a resolution of this instructional dilemma.[3] Data processing concepts which were being taught appeared to be inadequate for business practice.[4] Because of this observation, there followed more inclusion of on-the-job training characteristics, thus making the curriculum content more realistic.[5] Educators tried to provide model instruction, but there was little feedback from business for the development of needed programs.[6] From this need, advisory committees were developed.[7] In fact, some states required the use of the advisory committees for reporting on the status of the data processing program.[8]

Placement Testing. The placement and success of the students were brought out in testing procedures which emphasized a successful programmer.[9] The tests used for success prediction were the following: 16 Personality Factor Questionnaire, Scholastic Aptitude Test, Embedded Figures Test, Watson-Glaser Critical Thinking Appraisal, Strong

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[1] 331, 461.

[2] 356.

[3] 447.

[4] 383, 352.

[5] 159, 274, 503.

[6] 2, 173, 178, 189, 220, 502.

[7] 332, 384, 395, 519, 564.

[8] 404.

[9] 42, 50, 434, 500, 435, 603, 602, 55, 110, 49, 549, 346, 436, 509, 7, 24.

Vocational Interest Blank, and others.[1] The major test given to measure possible success was a version of the Programmer Aptitude Test from the International Business Machines Corporation (IBM).[2] Generally, a series of tests provided the best prediction by using equations to measure success.[3] Testing with the cognitive mapping style was also used to predict probable success.[4] Reference to course work and tests showed some relationship between mathematics and other data processing courses to programming aptitude.[5]

With the increase use of the computer in society, materials were recommended for integrating topics into existing courses and adding separate courses in data processing.[6] Business data processing was primarily integrated into accounting, followed closely by office practice courses.[7] Again the overwhelming needs was to teach data processing.[8] Curricula for teach preparation became the next issue because the present teachers did not have the needed data processing background.[9]

Data processing became a challenge and started to get all types of people, both experienced and novices, because of the mystery of the

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[1] 602, 603, 228, 500, 509, 549, 346, 42.

[2] 24, 49, 434, 435.

[3] 24, 40, 50, 435, 436.

[4] 7.

[5] 50, 55, 110.

[6] 574.

[7] 11, 26, 60.

[8] 114, 202, 398.

[9] 54, 56, 58, 319, 524.

computer.[1] In various types of data processing programs prerequisites were required, but few were held to in the business curriculum.[2] Industry, though oftentimes expressing discontent with the data processing graduate, continued to elicit from education the continuing education for the data processor.[3] Educators argued that their first obligation was to the students on campus.[4] Possibly many of the problems could have been ameliorated had there been national leadership in data processing education.[5] Although leadership was not totally absent, no one dominant person or organization assumed this role.

The advent of the computer brought a need for education, both in the secondary and post-secondary areas.[6] With respect to the teaching of data processing, four main issues surfaced:[7]

1. At what level should data processing be taught?
2. How should the faculty be educated?
3. Should training be "hands-on"?
4. Should training be for unit record equipment or the computer?

Secondary Education Status

Students were interested in the computer and related professional organizations promoted learning in this discipline on the secondary

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[1] 199, 488, 570.

[2] 136, 414, 428, 441.

[3] 361.

[4] 277.

[5] 190.

[6] 423, 548, 572, 584.

[7] 163.

level.[1] Secondary educators overwhelmingly supported the inclusion of computer education in the curriculum.[2]

Based on the cumulation of statistics from research studies, about forty percent of the high schools had data processing programs.[3] The high school data processing program normally was started between 1965 and 1970 as part of business education, mathematics, or housed in a separate department.[4] The course content was mainly unit record instruction with some computer concepts. The typical program consisted of one or two courses, one in concepts and the other in programming or one in a combination of topics.[5]

The programming language studies most often was FORTRAN, followed by COBOL, RPG, BASIC, and assembler language.[6] Students in programming classes wrote applications related to payroll, billing, grade averaging, and sales reports.[7] Audio-visual aids and field trips were used extensively.[8] The instruction of data processing was more minimal in many classes than actual.[9]

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[1] 117, 597.

[2] 114, 151, 202, 208, 288, 398, 449, 582.

[3] 11, 26, 27, 53, 58, 60.

[4] 27, 58.

[5] 27.

[6] 11, 27, 53.

[7] 27.

[8] 11, 60.

[9] 60.

Curriculum Objective. According to Wagner, to provide general data processing knowledge was the primary program objective in most high schools.[1] Instructional objectives included the gaining of an understanding of terminology; adding to general knowledge of data processing with emphasis on electronic data processing; introducing students to programming; helping students understand electronic data processing and automation affect for modification of the society in which they live; providing students with the opportunity to become familiar with and development proficiency in operation of unit record equipment; and acquainting students with job opportunities.[2]

Concepts Taught in Introductory DP Courses. According to Paulus, data processing concepts used by more than ninety-five percent of the data processing teachers in the introductory DP course were:[3]

a. punched card served as a primary communication means between man and certain unit recrod equipment.

b. speed, accuracy, and capacity were computer advantages.

c. computer performed only the operations described in its instructional set.

d. equipment and methods were the tools for accomplishing business ends.

e. automated data processing performed functions originally done by mechanical operations.

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[1] 58.

[2] 26.

[3] 40.

f. man can do and make more use of data faster because of the computer.

g. a computer incorrectly programmed does not serve its intended purpose.

h. computers were useful in repetitive calculations.

i. the everyday use of data processing continued to grow.

j. regardless of data processing routine, the following basic oeprations need to be performed: classifying, sorting, computing, recording, summarizing, communicating, and storing.

k. electronic data processing changed the structure of many jobs, directly or indirectly.

l. electronic data processing freed people from some requirements and most repetitive aspects of clerical work.

Concepts Integrated into Non-DP Courses. Likewise, Paulus discovered that the computer concepts used by more than ninety-five percent of the data processing teaching in integrated units of non-data processing courses were:[1]

a. punched card served as a primary communication means between man and certain unit record equipment.

b. equipment and methods were the tools for accomplishing business ends.

c. speed, accuracy, and capacity were computer advantages.

d. computers were useful in repetitive calculations.

e. electronic data processing changed the structure of many jobs, directly or indirectly.

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[1] 40.

f. man can do and make more use of data faster because of the computer.

g. computer performed only the operations described in its instructional set.

h. man must be able to instruct the computer by means of a common language media.

i. essential office activity was collecting and processing data.

j. important functional computer component was storage.

k. automated data processing performed functions originally done by mechanical operations.

l. regardless of data processing routine, the following basic operations need to be performed: classifying, sorting, computing, recording, summarizing, communicating, and storing.

m. entry-level positions were available to high school students, but additional education normally was needed.

n. electronic data processing freed people from some requirements and most repetitive aspects of clerical work.

o. the everyday use of data processing continued to grow.

Entry Position. The entry data processing position held by most high school graduates was that of keypunch operator, followed by a computer operator. Hiring practices and procedures were oftentimes hampered because of the presence of social and intellectual immaturity among youth.[1] Students commented that instruction in business data processing should be more relevant with less unit record concepts.[2]

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[1] 59, 61, 201, 245, 350.

[2] 59, 269, 350.

Traditional Secondary Curriculum. The Bangs/Hillestad study indicated the following content for the high school data processing curriculum:

Introduction to data processing (Tenth Grade)
1. History of manual data processing.
2. Tabulating card and equipment.
   a. card layout and design.
   b. equipment with purposes and operation.
3. Electronic computer.
   a. memory.
   b. input.
   c. calculation/arithmetic.
   d. output.
4. Flowcharting.
5. Computer operations.

Computer concepts and systems development (Eleventh Grade)
1. Review of digital computers and DP concepts.
2. Computer logic.
3. Development of logic through problem-solving.
4. Procedure development.
5. Forms design.
6. Computer languages (two languages: COBOL and possibly an an assembler language.
7. Computer business applications.

Data processing applications (Twelfth Grade)
(This course should be coordinated with Bookkeeping and Business and Office Procedures.)
1. Systems analysis and design.
2. Programming essentials.
3. Report writing and computer printout analysis.
4. Gaming/simulation.
5. Laboratory (or on a cooperative education basis).
   a. forms design.
   b. flowcharting.
   c. writing computer programs.
   d. operating the computer.
   e. program debugging.
   f. actual production.

Post-Secondary Education Status

Although data processing programs existed, problem with business data processing education came at the post-secondary level, especially

at the four-year institutions.[1] Articulation between levels was, for the most part, nonexistent.[2] While integration of topics was still popular, especially in accounting, endless types and numbers of courses existed at the college level with the most prevalent being *Introduction to Data Processing* and *Introduction to Programming*.[3] Business students wanted to learn about data processing, but discovered a reticence on the part of faculty to include an adequate offering.[4] The vocational/technical school faculties were the most successful in their accommodation of this expressed need. Persons teaching in these schools were experienced data processors but ones not necessarily holding academic degrees.[5]

Two-Year Schools. Data processing instruction was offered at two-thirds of the community colleges.[6] IBM equipment was the most often used and the most frequently used programming languages were FORTRAN, COBOL, RPG, BASIC, and assembler.[7] Most two-year students had transfer problems when dealing with the four-year schools. The two-plus-two programs mainly existed in schools which offered the additional two years for the baccalaureate degree.[8] Although the two-year program was designed for immediate access to jobs, about two-thirds of the faculties of the

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[1] 32, 37, 309, 310.

[2] 37, 310.

[3] 32, 517.

[4] 217.

[5] 446, 449, 553.

[6] 12, 13, 400, 454.

[7] 12, 13, 400, 454.

[8] 12, 400.

community junior colleges also believed the program was designed to articulate with the four-year institutions. The major problem with transferring from two-year to four-year programs related to distinctions made between those institutions and their accrediting body.[1] Of the courses offered, nine percent were introductory; twenty-three percent were unit-record; fifty-four percent were computer-related; and fourteen percent were systems design or development.[2] The majority of the data processing program was taught either in the business department or in a separate department.[3] A chief problem within programs was the lack of qualified teachers and up-to-date equipment.[4] The nature of the programs made positions of computer operator, programmer, or, perhaps, systems analyst possible.[5] Unit-record instruction was deemed obsolete by researchers, and it was suggested that it be deleted from the curriculum.[6] Two-year graduates' main complaints about the programs centered around the need for more up-to-date equipment for the training and relevant job training.[7] Some thought the data processing program was without sufficient rigor and did not sufficiently reflect the actual work situation.[8]

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[1] 417.

[2] 13.

[3] 13.

[4] 12.

[5] 154, 400.

[6] 12, 31.

[7] 31.

[8] 31.

Traditional Two-Year DP Curriculum. The typical data processing program described by the Bangs/Hillestad study for the two-year school was as follows:

First Year

First Semester:	Units
College Algebra	4
Written Communications	3
Accounting Principles	3
Principles of Economics	3
Introduction to Data Processing	4
	17

Second Semester:	
Oral Communications	3
Accounting Principles	3
Business Conditions (or Contemporary Economics Problems)	3
Data Processing Mathematics	3
Logic and Introduction to Systems Analysis	5
	17

Second Year

First Semester:	
Business Statistics	4
Psychology	3
Advanced Accounting	3
Introduction to Computer Programming	3
Data Processing Systems	3
	16

Second Semester:	
Principles of Management	3
Human Relations	3
Advanced Programming	3
Data Processing Applications and Practicum in Programming	5
	14

Four-Year Schools. The problem with the degree programs of the four-year schools was based on the perceptions of those in industry that data processing should come from the mathematics area which was

responsible for creating computer science. Small colleges, especially private ones, expedited the implementation by tying computer courses into the computer center and/or mathematics area.[1] Leaders in national organizations, especially Association for Computing Machinery, assisted in the enrichment of curriculum through various means: advisory, conventions, workshops, and committees.[2] Computer education lacked a balanced input between the manager's perspective and that of the science of the discipline, with the latter's dominance causing an imbalance.[3]

Implications were drawn that the computer science degree was similar to the one in liberal arts and that the graduate could learn practicality on the job. The buisness aspects of computer education seemed to be less evident in the curricula of the college and university. Speculation on the business aspects seemed to lie in the ever-present battle of accreditation.[4] Although not so noticeable in the science area, the American assembly of Collegiate Schools of Business closely monitored programs in order to insure professional rather than vocational program status.

Teacher Education. The teaching of data processing was split into business and computer science. Computer science certification stressed the scientific and mathematical backgrounds of individuals and discounted business training.[5] The computer science certification, while including more coursework, omitted the experiential level as recommended in the business data processing training.

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[1] 255, 337, 378, 535, 586.

[2] 256.

[3] 120, 337, 547, 560, 571.

[4] 417.

[5] 124, 319, 431, 534, 568.

The teaching of business data processing required work experience to bridge the previous gap in relevant instruction, and certification was recommended through testing procedures.[1] Problems resulted from educational administrators' not understanding totally the business data processing area.[2] According to Kinzer, data processing should be part of every business teacher's qualifications to provide the student with a basic understanding of computers.[3]

Data Processing Teacher Profile. According to Anderson, James, Reynolds, and Spring, the profile of the typical data processing teacher was a male college graduate with the following characteristics: (1) employed in his present position about three years, (2) received his highest degree after 1965, and (3) employed first when less than thirty-five years old.[4] About fifty percent have a master's degree as well as an undergraduate degree in some business area. Three-fourths had completed some intensive manufacturer's training, and nearly eighty-five percent had previous teaching experience in business or mathematics, usually less than four years prior to the present position. Over sixty percent entered teaching directly from some field of non-teaching employment. Approximately eighty-five percent had data processing experience in industry. Even with the degree, most business data processing teachers expressed the opinion that the college degree was not necessary for teaching at the two-year level.

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[1] 133, 142, 304.

[2] 30.

[3] 370.

[4] 1, 30, 481, 524.

Teacher Knowledge and Skills. Saif discovered in his research that business knowledge and skills needed by the business data processing teacher included statistics, accounting principles, business mathematics, operations research, finance, management principles, business report writing, linear programming, logic principles, introduction to business, cost accounting, accounting theory, and intermediate accounting.[1] Data processing knowledge and skills needed were COBOL, input/output media and devices, storage devices, systems analysis, FORTRAN, central processing unit, flowcharting, batch processing, time-sharing, BASIC, canned programs, record layout and design, operate keypunch, operate terminal, computer memory sizes, forms design, work load evaluation, PL/I, RPG, and history of computers and data processing. Additionally high school and junior college teachers needed assembly language and knowledge on the operation of the sorter, the verifier, and the computer. Machine language was needed for the high school data processing teacher. Even though computer languages were identified as among those items needed by the high school teachers, the means of rating those languages, excluding COBOL, were the lowest of needed items.

College Teachers' Knowledges. According to Saif, work experience was not needed by the high school teacher, but seven to twelve months of work experience as a business applications programmer and/or analyst was listed as a qualification for the junior college and four-year college data processing teachers.[2] Competencies needed by the teacher of the introductory computer course, as rated by practitioners and high school

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[1] 54.

[2] 54.

teachers, were the development of data processing concepts to be learned by the students; knowledge of end results; provision for repair and maintenance of equipment, if needed; knowledge of data processing terminology; knowledge and application of data processing functions; ability to demonstrate flowcharting; need for regular attendance in classroom; development of student confidence by never violating their trust; and establishment of proper teacher behavior as an example to students.[1] Competencies rated critical by data processing authorities and two-year school educators were knowledge of end results; knowledge of data processing terminology; knowledge and application of data processing functions; knowledge of electronic computers; ability to flowchart; ability to demonstrate flowcharting; ability to demonstrate the computer; provision for teacher-pupil interaction; ability to explain verbally; development of ability to follow instructions; knowledge of ethical procedures; and establishment of proper teacher behavior as an example to students.[2]

CURRICULUM IMPLICATIONS

Various curriculum implications existed in business data processing education, ranging from career education to integrating topics, from minors to degree programs.[3] On the high school level, career education prepared the student with basic information from awareness to specialization.[4] Education entailed hardware, software, programming, management, accounting, statistics, mathematics, and systems analysis

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[1] 56.

[2] 56.

[3] 36, 275.

[4] 162, 164.

for the data processor.[1] Concepts of data processing continued to enjoy curricula integration with accounting, office practice, and other business courses.[2] Data processing should be incorporated with existing resources as an improvement to process or method.[3] Special topics needed by the accountant included the technical proficiency, auditing and the computer, compliance testing with the computer, internal controls, and audit of data processing records.[4]

High School DP Curriculum

High school data processing curricula depended mainly on resources, normally equipment, but consisted of one course to multiple course curricula.[5] The simplest program consisted of a general concepts course in which keypunch and unit record concepts were predominant with topics tied into other courses.[6] The two-course curriculum was concerned with data entry and computer operations, with programming taught as a part of one of the courses.[7] Data processing programs with more than two courses operated courses together or were started in the ninth grade.[8]

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[1] 552.

[2] 168, 314, 420, 429, 525.

[3] 171.

[4] 233, 498.

[5] 36, 62, 64, 67, 177, 207, 179, 267, 269, 322, 341, 348, 371, 472, 476, 583.

[6] 177, 207, 583.

[7] 157, 179, 348, 371, 600.

[8] 64, 207, 267, 322.

DP Curriculum Concepts. Besides introductory DP concepts and keypunch, the predominant instruction was programming languages of COBOL, RPG, or FORTRAN using the IBM computer.[1] The high school academic program stressed business programming in the tenth or eleventh grade followed by mathematics and science programming in the eleventh or twelfth grade, and, if possible, concluding with integrating concepts in mathematics and science for the twelfth grade.[2] The business program stressed business programming in the tenth or eleventh grade with accounting and concluded with automated accounting and business-problem programming in the twelfth grade.[3]

Curriculum Examples for DP. Based on an Office of Education Report, Figure 1 on page 41 and Figure 2 on page 42 reflected the accumulated experience of successful programs and the consensus of many professional who have distinguished themselves in technical education.[4]

Post-Secondary DP Curriculum

The post-secondary curriculum could generally be examined as the two-year and four-year programs. The two-year program was three-fold in purpose: computer science transfer, business transfer, and occupational preparation, with a common course base.[5] This base was to consist of generalized courses in data processing for all three curricula.[6]

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[1] 64, 67, 341.

[2] 267.

[3] 267.

[4] 207.

[5] 364.

[6] 106.

FIGURE 1

COMPUTER PROGRAMMING CURRICULUM

Grade 9, First Semester

English
Mathematics
Science
History
Elective

Grade 9, Second Semester

English
Mathematics
Science
History
Introduction to Computers

Grade 10, First Semester

English
Mathematics
Science
Elective
Elective

Grade 10, Second Semester

English
Mathematics
Science
Elective
Introduction to Programming

Grade 11, First Semester

English
Mathematics
History
Elective
FORTRAN Applications Programming

Grade 11, Second Semester

English
Mathematics
History
Elective
Business Applications Development

Grade 12, First Semester

English
Civics
Elective
Procedures for Organizing Information
Introduction to COBOL Programming

Grade 12, Second Semester

English
Economics
Elective
Advanced COBOL Programming
Programming Projects (or Computer Operations)

FIGURE 2

PERIPHERAL EQUIPMENT OPERATIONS CURRICULUM

Grade 9, First Semester

English
Mathematics
Science
History
Elective

Grade 9, Second Semester

English
Mathematics
Science
History
Introduction to Computers

Grade 10, First Semester

English
Mathematics
Science
Typing
Elective

Grade 10, Second Semester

English
Mathematics
Science
Elective
Introduction to Programming

Grade 11, First Semester

English
Mathematics
History
Accounting
Beginning Keypunch

Grade 11, Second Semester

English
Mathematics
History
Keypunch and Data Entry
Punched Card Data Processing I

Grade 12, First Semester

English
Civics
Office Machines
Punched Card Data Processing II
Introduction to COBOL Programming

Grade 12, Second Semester

English
Economics
Elective
Elective
Computer Operations

The two-year program was similar to that proposed for the small four-year colleges because of the restrictions of the small colleges.[1]

DP Job Entry Applications. According to Gorgone and Pollack, the five most important computer applications needed by students in order to gain a workable knowledge for job entry, based on the entry position requirements, appeared to be:[2]

a. manager: accounts receivable/payable, financial statements, inventory control, machine utilization, and management.

b. systems analyst: accounts receivable/payable, financial statements, inventory control, payroll, and production control.

c. programmer: accounts receivable/payable, billing and invoicing, financial statements, inventory control, and payroll.

d. computer operator: accounts receivable/payable, billing and invoicing, inventory control, machine utilization, and payroll.

Computer Job Entry Subject Areas. The study by Gorgone showed that the five most important subject areas needed by students in order to gain a workable knowledge for job entry, based on the entry position requirements, appeared to be:[3]

a. manager: communications, economic principles, finance, industrial organization, and managerial accounting.

b. systems analyst: communications, cost accounting, industrial organization, intermediate accounting, and statistics.

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[1] 125, 489.

[2] 23, 45.

[3] 23.

c. programmer: algebra-trigonometry, communications, intermediate accounting, introduction to accounting, and statistics.

d. computer operator: algebra-trigonometry, communications, economic principles, industrial organization, and introduction to accounting.

Research reported by Bucks, Curless, Gorgone, Joslin, Lyons, and Willhardt analyzed the needed knowledge of the major data processing positions of manager, analyst, programmer, and computer operator.[1] The work of Gorgone reference the previous studies to determine the relative importance of the data processing knowledge.[2]

Requirements for the DP Manager. The student training for data processing management needed working knowledge of data communications, general programming techniques, and systems analysis, and at least a workable knowledge of documentation procedures.[3] Basic knowledge and a limited workable knowledge was needed in sort/merge techniques for tape and disk, storage/retrieval techniques, and specific programming language. At least a basic knowledge and a limited workable knowledge was needed in disk operating systems (DOS) and simulation/decision models.

Requirements for the Analyst. The student training for systems analysis needed a thorough knowledge of documentation procedures and systems analysis, with a workable knowledge of sort/merge techniques for tape and disk, data communications, disk operating systems, general

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[1] 10, 14, 23, 32, 54, 66.

[2] 23.

[3] 23.

programming techniques, specific programming languages, and simulation/decision models.[1] At least a workable knowledge was needed with storage/retrieval techniques.

Requirement for the Programmer. The student training for programming needed a thorough knowledge of storage/retrieval techniques, documentation procedures, general programming techniques, and specific programming languages.[2] A workable knowledge was needed with sort/merge techniques for tape and disk, data communications, disk operating systems, and systems analysis, with a basic understanding of simulation/decision models.

Requirements for the Computer Operator. The student training for computer operations needed a workable knowledge of disk operating systems with a basic understanding and a limited workable knowledge of sort/merge techniques for tape and disk, storage/retrieval techniques, data communications, and documentation procedures.[3] At least a basic understanding and limited workable knowledge was needed for general programming techniques with some exposure and orientation to specific programming languages and systems analysis.

Two-Year Curriculum

Although three-fold, the major premise of the two-year program was occupationally based. Business and industry support was essential to curriculum success and development, which led to operations and

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[1] 23.

[2] 23.

[3] 23.

programming.[1] While some discussion was present about whether or not the program met needs and other problems, generally, the two-year program met business needs.[2] The two-year curricula were similar in core courses and required general education.[3] The bridge with computer science became apparent in comparing business data programming with some computer science programs.[4] Other schools have tried to relax the strict computer science aspects to a modified program to encompass the practical aspects and still conform to "Curriculum '68" from ACM.

Two-Year DP Curriculum Concepts. As summarized by Gill, the two-year curriculum should contain the following important concepts:[5]

1. Program flowcharts.
2. Programming logic.
3. Computer terminology.
4. Hands-on experiences.
5. Systems flowcharting.
6. COBOL tape concepts.
7. COBOL disk concepts.
8. Systems Analysis and design.
9. File design.
10. Machine languages.
11. Computing center operations.

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[1] 266, 326, 463, 542.

[2] 48, 150, 213, 326, 496, 541.

[3] 197, 210, 236, 372, 235, 458, 555, 593, 562.

[4] 390.

[5] 289.

12. Data processing mathematics.

13. Case studies of systems design.

14. Punched card systems.

15. Utility programs.

16. Disk and tape operating systems concepts.

17. Advanced business applications of data processing.

18. Report program generator programming language (RPG).

19. Multiprogramming concepts.

20. Peripheral equipment operation.

Curriculum Examples in DP. The courses suggested for the two-year schools are described in Figure 3 and Figure 4, page 48.[1]

FIGURE 3

TWO-YEAR DP CURRICULUM

First Semester	Second Semester
English	English
History	History
Approved Mathematics	Approved Mathematics
Physical Education	Physical Education
Psychology	*Introduction to Programming (FORTRAN)*
Introduction to Computers	*Systems Analysis*
Computer Operations	
Third Semester	**Fourth Semester**
Accounting	Accounting
Government	Government
Economics	Economics
Physical Education	Physical Education
Management of Computer Centers	*Computers and Data Analysis*
Assembler Programming	*COBOL Programming*

[1] 235, 290, 458.

FIGURE 4

TWO-YEAR DP CURRICULUM

First Semester	Second Semester
Communication Skills I	Communication Skills II
Finite Mathematics I	Finite Mathematics II
Business Practice	Introduction to Accounting
History of Industry	*Computer Operations*
Introduction to Computers	*COBOL Programming*
Programming (BASIC or FORTRAN)	*Special Projects*
Third Semester	**Fourth Semester**
Society and Working Relationships	Business Statistics
Assembler Language Programming	*Data Base Management*
Advanced COBOL Programming	*Advanced Assembler Programming*
Computerized Accounting	*Business Systems Development*
Systems Analysis	*Architecture of Computers and Programming*

Four-Year Curriculum

In the case of Figure 4, the two-year degree transferred totally to the four-year school, which had its own two-year degree program as a prerequisite to the four-year program.[1] The general curriculum of the four-year program was similar to the two-year program. The major courses having articulation programs were listed as junior-level courses but were taken during the sophomore year.

Four-Year DP Curriculum Concepts. According to curriculum work summarized by Gill, the four-year business data processing curriculum should contain the following important concepts:[2]

1. Systems analysis and design.
2. Data processing management.

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[1] 23, 289, 327, 401.

[2] 289.

3. Advanced business applications of data processing.
4. Programming logic.
5. Data base management.
6. Case studies of systems design.
7. Program flowcharts.
8. Management information systems.
9. Multiprogramming concepts.
10. Systems flowcharting.
11. COBOL disk concepts.
12. Hands-on experiences.
13. COBOL tape concepts.
14. Management science.
15. Computer terminology.
16. Machine language.
17. Computing center operations.
18. Data processing mathematics.
19. File design.
20. Statistical techniques.

The four-year program should be planned so that individuals will meet job requirements when completed. Such a program took much planning, and, in one instance, the use of behavioral objectives to describe the competency level.[1] The four-year business curriculum consisted of the following major requirements and electives as needed:[2]

a. Basic concepts or introduction to data processing.

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[1]26, 311, 409, 511.

[2]22, 39, 45, 66, 123, 254, 376.

b. programming languages, minimum of at least one of COBOL, FORTRAN, RPG, BASIC, PL/I, and assembler, in the indicated order of preference.

c. Systems analysis.

d. Accounting principles.

e. Communication skills, oral and written.

f. Statistics with canned programs.

g. Business organization.

h. Management information systems.

i. Calculus and finite mathematics.

Elective courses in the curricula consisted of, but were not limited to the following:[1]

a. Data base concepts.

b. Operating systems.

c. Computer operations.

d. Keypunch and data entry operations.

e. Business applications.

f. Cost and/or intermediate accounting.

g. Simulation and simulation languages, such as General Purpose Systems Simulator (GPSS).

h. Data communications.

i. Mini- and micro-computers.

j. Data structures.

k. Computer installation planning and management.

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[1]23, 39, 45, 445.

Computer Science Curriculum. The Association for Computing Machinery "Curriculum '68" content was deemed too theoretical by its designers and industry, and the university curricula were revised for more increased practical consequences.[1] Steps were taken to put more applications into the curriculum by (1) the reduction of the mathematics requirements, (2) the discussion of job situation in course seminars, and (3) the increased interfacement with business and industry.[2] Throughout the period, computer science incorporated business aspects interfaced with the information science or systems area.[3] The computer science component was recommended as having relevance for and presence in the general education of the college student, which resulted in a course entitled, *Computers and Society.*

Business in Computer Science Curriculum. The computer science approach to business data processing, often termed the commercial option, contained the following courses:[4]

a. Introduction to computer science and computer programming.

b. Computers and society.

c. Programming concepts (COBOL, FORTRAN, and/or assembler).

d. Computer operations.

e. Systems analysis.

f. Statistics and programming applications.

g. Teleprocessing.

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[1] 18, 258, 402, 416.

[2] 111, 120, 357, 334, 401, 440, 545, 468, 407, 581, 577.

[3] 122, 212, 215, 501, 577.

[4] 238, 294, 374, 457, 459.

h. Systems software.

i. Information storage and retrieval.

Other related courses to the business data processing area were:[1]

a. Business management.

b. Accounting principles.

c. Economics.

d. Business law.

e. Mathematics.

f. English.

Information Systems Curriculum. What was once computer science and business combined into a discipline labeled information systems.[2] Curriculum designers created objectives of development from the systems point-of-view; experience in implementation of complex information systems; development of economics and technologies of computer-based systems; and conceptual view of the analysis of information systems.[3] An information systems curriculum placed emphasis on analysis of systems with modification of computer science concepts.[4] Computer science courses modified for the information systems program were:[5]

a. Mathematical analysis to Operations research.

b. Discrete structures to Finite mathematics.

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[1] 459.

[2] 122, 212, 215, 221, 224, 347.

[3] 550.

[4] 212, 215, 403, 550.

[5] 402.

c. Programming languages to Languages and techniques.

d. Data structures to Data base concepts and Data communication.

Courses added to the information systems curriculum were: (1) management information systems, (2) systems analysis, (3) management concepts, and (4) performance evaluation.[1]

Analyst Curriculum. Although a trend in traditional business administration curriculum was to educate the systems analyst, mathematics and engineering have done the majority of the training.[2] Leaders in business administration should emphasize management information systems concepts and applications, which were lacking previously.[3] Success in the systems curricula seemed to be achieved when there was involvement with applications, either with businesses or educational institutions.[4] Collegiate education for analysts resembled a pyramid, with the foundation, or first level, having the base of accounting, law, economics, mathematics, statistics, and computer fundamentals.[5] The second level consisted of communications, finance, human relations, management, marketing, and COBOL programming. Specialization, the third level, was comprised of accounting, administrative management, and systems analysis. The next level was theoretical and included management information systems, while the top level included business and society.

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[1] 403.

[2] 321.

[3] 484, 530, 531.

[4] 490.

[5] 495.

Programming Languages. Throughout most of the literature, programming languages were listed for the curriculum. Many languages were suggested and used and a minimum of one language was deemed necessary.[1] The language used was not so important as the concepts which constituted its structure; thus the best language depended on the geographic area served by the DP program graduates. Languages described in the curriculum were FORTRAN, COBOL, RPG, BASIC, assembler, PL/1, APL, and GPSS.[2]

Teacher Education Curriculum. Curriculum for training the business data processing teacher focused on completion of the business data processing curriculum core and included additional courses in education.[3] Because of the lack of full-time teaching in data processing at the high school level, most certifications were classed as minors. Preparation for collegiate teaching varied; however, work experience and a college degree in some aspect of business were considered the main criteria for qualified teachers.[4]

COURSE CONTENT

The major business data processing courses appearing in the literature were: *Introduction to Data Processing, Computers and Society, Introduction to Programming, Systems Analysis*, and *Methods of Teaching Data Processing*. Besides the integrating of data processing into other courses, overviews of topics for courses were also found.

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[1] 306.

[2] 23, 254, 270.

[3] 22, 176, 399, 485.

[4] 30.

Secondary Level DP Courses

High school DP courses were taught either with or without equipment. The equipment courses stressed keypunch and computer operations training with some exposure to programming in COBOL, FORTRAN, BASIC, RPG, or assembler languages.[1] The major emphasis was on the basic concepts which were described in course outlines and behavioral objectives.[2]

Major Objectives of Introductory DP Courses

According to Litteer, Amundson, and Wagner, the major objectives of high school data processing introductory courses were:[3]

a. to give students a basic foundation on which they can build a career in data processing.

b. to prepare students for jobs in which they can process data automatically, even though they may not be working directly with a computer.

Essential Introductory Course Concepts. According to an analysis of high school data processing courses by Wagner, the concepts essential to the introductory data processing in high schools were the following:[4]

a. Punched card characteristics.
b. Principles of recording data in cards.
c. Basic data processing operations.
d. Electronic data processing concepts.
e. Principles of sorting data in cards.

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[1] 182, 483, 316, 556, 422, 521, 2, 34, 63.

[2] 554, 181, 103.

[3] 2, 34, 63.

[4] 63.

f. Record planning and layout.
g. Electromechanical data processing concepts.
h. Features of computer systems.
i. Input/output media and related devices.
j. Punched cards as input/output media.
k. Basic components of computer systems.
l. Memory devices.
m. Flowcharting.
n. Principles of reporting data from cards.
o. Systems and programming.
p. Principles of classifying data from cards.
q. Employment opportunities for high school graduates.
r. Number systems and data representation.
s. Advancement opportunities for high school graduates.
t. Binary numbering system.
u. Mechanical data processing concepts.
v. Core memory.
w. Decimal numbering systems.
x. Entry-level job requirements.
y. Digital computers.
z. Magnetic tape and disk as input/output media.
aa. Binary coded decimal numbering system.
bb. Manual data processing concepts.
cc. Computer programming.
dd. Principles of verifying and calculating data in cards.
ee. Job descriptions for data processing positions.

Introductory Course Outline. A typical course description and outline of the introductory DP class was as follows:[1]

Course Description: A broad overview of the computer and its applications with emphasis on terminology.

Course Outline Topics:

1. History of data processing.

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[1]103, 554, 207.

2. Punched card principles with unit record.
3. Computer systems.
4. Input, storage, and output devices.
5. Programming languages.
6. Systems analysis.
7. Personnel in computers.
8. Applications in business and society.

Other High School DP Course Content. Keypunch, sometimes called data entry, consisted of terminology, punched card with codes, machine operations, machine programming, program and data punching, and verification of punched input.[1] Programming consisted of problem-solving techniques, flowcharting, language elements, condition statements, loops, functions, and table/arrays, both one and multiple dimensional.[2] Programming in specific languages tended to follow the above outline. Specific concepts that should be included in a COBOL programming course were record layout, programmer documentation, branching and looping, sequential file organization and access, core dumps, keypunch operations, arrays, traces, other debugging procedures, and computer console operations.[3]

Post-Secondary Level DP Courses

Curricula which integrated DP concepts were distributive education, statistics, office practice, management, and accounting.[4] Content

[1] 103, 554, 207.

[2] 103, 554, 207.

[3] 17, 287.

[4] 15, 152, 523, 538, 595, 522.

taught dealt with basic concepts and unit record equipment with the use of canned programs, simple programming, and systems analysis.[1]

Computers and Society Course

Besides the major curriculum, service courses were taught with business concepts or were offered by or for business. These were introduction to concepts or programming courses with an integration of topics course.[2] From this approach, and partly from computer science, came a course in *Computers and Society*. The course content included the use of automation and its effect on the everyday lives of people.[3] The typical course contained the following major topics:[4]

a. Computer users--specialists and non-specialists.

b. Survey of computers and applications.

c. Computer education instructional media.

d. Computers and the study of the future.

e. Automation, production, employment, and leisure.

f. Computers, credit bureaus, cashless society, and data banks.

g. Computers, human thought, and creativity.

h. Social responsibility of computer professionals and scientists.

i. Computers, technology, and man's future in the world.

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[1]186, 585, 426.

[2]533, 196, 537, 423, 543, 293, 452.

[3]387, 336, 335, 437, 325, 324, 433, 108.

[4]324, 325.

Course Content for the Non-Data Processor. From the research of Rall, data processing for the non-data processor should entail an understanding of the following topics:[1]

a. Job opportunities in data processing.

b. Social implications of data bases with credit information based on the social security number.

c. Fundamental limitations of computers and their systems.

d. Social implications of a government data base with detailed information about everyone who has a social security number.

e. How a computerized data base can contribute to privacy evasion.

f. Reasons for increased demands by management for more data interpretation during current fiscal period.

g. Social implications of data base by Federal Bureau of Investigation and Central Intelligence Agency containing biased necessary data.

h. Need for and implications of retraining for new jobs caused by automation.

i. Terms "computer hardware" and "computer software".

j. Reliability of computers.

k. Security of information stored electronically.

l. Implications of computer applications in credit area.

m. Programming in general.

n. Implications of computer applications in business systems.

o. Vocabulary of electronic data processing and computers.

p. Social implications of the computer on the labor market.

q. Term "magnetic tape storage".

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[1] 47.

r. "Cybernetic discipline" as applied to the computer and its potential effect on everyday lives of people.

s. Terms "central processing unit (CPU)", "computer output microfilm (COM)", and "cathode ray tube (CRT)".

t. Flowcharts and flowcharting.

Furthermore, Rall found an additional thirty-nine topics which would be advantageous for the student to have a further general knowledge of DP.

Introduction to Data Processing

The introduction to data processing became restructured in the curriculum, combining several approaches.[1] The restructured course combined lectures on concepts with operations and programming which led to the teaching of applications of problems.[2] Beginning courses which utilized programming with the basic concepts used FORTRAN as the vehicle language.[3]

Introduction Course Topics. The topics studied in the introduction to data processing course included, but were not limited to, the following:

a. Terminology.[4]

b. Information systems.[5]

c. Cards and their codes.[6]

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[1] 396, 362, 305, 349, 278, 187, 194, 134, 312, 369, 135, 300.

[2] 396.

[3] 300.

[4] 237.

[5] 354, 529, 287, 569, 286.

[6] 265.

d. Problem-solving and flowcharting.[1]

e. Programming languages.[2]

f. Hardware.[3]

g. Simulation and the use of programming by users.[4]

h. Configuation of computer facilities.[5]

i. History and status of teleprocessing.[6]

j. Service bureaus in business.[7]

k. Time-sharing and the user.[8]

l. Social effect of the computer.[9]

As a means of combating the dropout rate in data processing courses doing programming, the problem-solving and flowcharting were sometimes done in a separate course dealing with logic.[10]

Typical Introduction Course Outline. According to Cerullo and Lawes, the following was a typical outline for the first course in data processing:[11]

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[1] 307, 444, 544, 377.

[2] 300, 369, 381, 194.

[3] 576, 367, 575, 527, 264, 303.

[4] 585, 426.

[5] 169.

[6] 302, 344.

[7] 195.

[8] 172.

[9] 242.

[10] 131.

[11] 194, 381.

I. Introduction to data processing systems.
   A. Definition of systems.
   B. Business organization system.
   C. Definition of data processing systems.
   D. Levels and/or types of data processing systems.

II. The electronic data processing system.
   A. Definition of electronic computer.
   B. Computer components and characteristics.
   C. Binary number system.

III. Historical development of computers.

IV. Current state of development of the computer industry.

V. Business applications of computers.

VI. The computer and its effect on organizations.

VII. Preparing for and introducing computers.
   A. Top management role in computer planning.
   B. Computer planning process.
   C. The feasibility study.
   D. Costs of implementing a computer installation.
   E. Criteria of and approaches to computer selection.
   F. Computer implementation and post-installation evaluation.

VIII. Introduction to computer programming.
   A. Definition of computer programming.
   B. Major types of programming languages.
   C. Programming levels and classifications.

IX. Steps in using a computer for data processing.

X. Introduction to programming using a specific language.

Although FORTRAN was used with the highest incidence, APL, RPG, COBOL, assembler, and others were used in the beginning data processing course.[1]

Introduction to Programming

The beginning programming course should be separated from the concepts course to accent the differences between the two concepts.[2]

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[1] 475, 272, 229, 283, 313, 381.

[2] 590.

Problem-solving should lead into programming rather than learning the language and then problem-solving.[1] Several languages should be available with some advanced topics in the languages used extensively. The course should deal in basic concepts with advanced topics coming for programming style and difficult manipulations.[2] Different languages should not change the content but should replace the learning with the new language. The major language taught was FORTRAN with more recent work in the programming in a structured modular approach to the language.[3] Programming concepts worked well when later used in a programming practicum.[4]

Programming Course Topics. Content of the first programming course should include a minimum of the following:[5]

a. Input/output methods.

b. Flowcharting/logic.

c. Documentation.[6]

d. Use of counters.

e. Looping concepts.

f. Array/tables with dimensions.

g. Actual computer programming.[7]

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[1] 271.

[2] 567.

[3] 16, 470, 129, 513, 411, 149, 573.

[4] 379.

[5] 493, 494, 298.

[6] 166, 317.

[7] 318, 406.

h. Instill confidence in computer use.[1]

i. Standard language format with American National Standards and programming style.[2]

Typical Programming Course Outline. According to Khailany, Lawes, and Holland, the following was a typical outline for the first course in computer programming:[3]

I. General knowledge about computer area.
   A. Computers industries and the market
   B. Data processing personnel.
   C. Computers as tools in decision-making.
   D. Computers in business and society.
   E. The computer system: hardware and software.
   F. Numbering systems in data processing.

II. Computer problem-solving techniques.
   A. Problem identification and algorithms.
   B. Program flowcharting with symbols.

III. FORTRAN programming language for business applications.
   A. Input and output control.
      1. Data information and programs.
      2. Real and integer variables.
      3. READ and WRITE statements.
      4. Format statements.
   B. Mathematical processes.
      1. Arithmetic statement.
      2. Comments and documentation.
      3. Unconditional GOTO and STOP statements.
      4. Built-in functions.
   C. Array processing and transfer of control.
      1. Logical IF statements.
      2. Computed GOTO statements.
      3. Array: dimension and subscripted variables.
      4. DATA, INTEGER, and REAL statements.
   D. Additional looping techniques in processing.
      1. Arithmetic IF.
      2. DO loop.
   E. Subprograms.
      1. Subroutine subprogram.
      2. FUNCTION subprogram.

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[1] 366, 406.

[2] 366, 253.

[3] 369, 381.

3. Statement functions.
4. COMMON and EXTERNAL statements.

F. Techniques and analysis of storage.
1. Storage devices.
2. Systems flowcharting.
3. Sequential files.
4. Random files.

G. Documentation.

Operating Systems

The concepts of operating systems were explored in the business data processing curriculum, but this also was done in a separate course. The basic content of operating systems focused on the internal controls of the computer with the topics of utility programs, job control monitors. program supervisors, loaders and link editors, computer architecture, and introduction to systems programming.[1]

Systems Analysis

The tools of the systems analyst were explored in the stages of the systems cycle: study, design, development, and implementation.[2] Principles of systems design were stated by Gibson in the following statements:[3]

a. Data are data, no matter where found, and should be available in the needed form at the time needed, at a cost consistent with the operations of the business.

b. Before recommendations for new equipment purchase, first determine if new hardware is needed or new system or both.

c. Do not create a new form unless absolutely necessary to do so.

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[1] 116.

[2] 165, 192, 301, 432.

[3] 284, 285.

d. Work should be done in a manner most economical of the time, energy, and expense with the basic principles of time and motion studies.

e. Norms for all work must be known by the worker and employer to accomplish the task in a given period of time with fair norms established for all situations.

f. Work should flow in a straight line or the nearest equivalent.

g. Operations should be delegated to the proper device for accomplishing the task, be the device a computer or human.

h. a machine should be used in a system at a place, time, and manner that will contribute most to the organization with the system designed before the machine designated.

Systems Course Topics. From research done by Cerullo, the topics presented in a systems course should be the following:[1]

a. The theory of systems.

b. Financial information systems.

c. Information systems and the computer.

d. Principles of systems analysis: manual, mechanical, unit record, accounting machine, and computer.

e. Design techniques.

f. Implementation of systems.

g. Post-installation evaluation of the system.

h. Controls in Systems.

Data Processing Methods Course

From research done by the American Federation of Information Processing Societies and Wood, the methods course for data processing

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[1] 192, 193.

teaching was outlined as follows:[1]

I. The development of data processing technology.

II. Data processing--its impact and implications.

III. Business data processing.
- A. Management need for information.
- B. Clerical implications.
- C. Data processing cycle.

IV. The major operations of data processing.
- A. Originating.
- B. Recording.
- C. Collecting.
- D. Converting.
- E. Verifying.
- F. Classifying.
- G. Sorting.
- H. Calculating.
- I. Storing.
- J. Summarizing.
- K. Communicating.

V. The data processing department.
- A. Equipment.
- B. Personnel.

VI. Existing agencies for instruction.

VII. Existing programs in secondary schools.

VIII. Special methods for instruction.
- A. Historical approach.
- B. Systems approach.
- C. Equipment approach.
- D. Applications approach.

IX. Philosophy of data processing instruction.

X. Instructional materials.
- A. Available aids.
- B. Development of aids.

XI. The "system-wide" approach to data processing instruction.
- A. Business courses (vocational or non-vocational).
- B. Support for instruction in other curricula.

XII. Equipment acquisition.

XIII. The data processing instructor.

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[1] 206, 604.

MATERIAL AND EQUIPMENT

Business data processing could not exist without equipment and materials. The use of teaching aids and equipment increased with the use of the computer.[1] Probably the one best source of teaching aids and materials was the *Computing Newsletter for Schools of Business*.[2] Each January, the newsletter provided an updated list of textbooks on data processing, including a classification for all types of computer-related courses. The annual May issue listed audio-visual aids available for the teaching of almost all aspects of data processing. Other issues presented information about specific textbooks, faculty education programs, use of facilities and curriculum, course content, computing costs, practical experience in the curriculum, teaching effectiveness, tools and techniques of programs, and other items. College facilities, film directory, and integrating concepts were also provided in the literature.[3]

The quality, quantity, and availability of business data processing textbooks has improved greatly during the 1971 to 1976 period.[3] Although much new material was available, selected older books and articles should be kept as a historic perspective on data processing.[4] Textbook authors have deleted older topics or condensed them, thus losing some historic aspects of the computer.[5]

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[1] 492.

[2] 214.

[3] 251, 456.

[4] 486, 450.

[5] 486.

Textbooks in DP

With an abundance of books, careful analysis should be taken in choosing the material suitable for particular audiences. The readability and topicality factors have been studied; resulting in the rating of specific books and the listing of topics for data processing classes in concepts, programming, and systems.[1] Based on a selective study of textbooks for the first course in data processing, *Business Data Processing* by Murach, published by Science Research Associates, was labeled extremely readable, while others fell into the easy to read, readable, and difficult to read categories.[2]

Cognitive Level of Textbooks. From the research done by Radamacher using Bloom's *Taxonomy of Educational Objectives, Cognitive Domain*, the following ratings were established on the content level of data processing textbooks: memory level of 49.1 percent; comprehension level of 25.9 percent; application level of 17.8 percent; analysis level of 3.7 percent; synthesis level of 2.8 percent; and evaluation level of 0.7 percent.[3] The taxonomy was broken into four parts with analysis, synthesis, and evaluation combined in most of the analysis. The rating, based on a scale of 1 to 6, averaged 1.87 with a range of 1.09 to 2.68, mean of 1.76, and median of 1.63.

Introductory Textbook Topics. The major topics of computer fundamental textbooks were hardware (28%), software (25%), general data

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[1] 46, 244, 479.

[2] 479.

[3] 46.

processing (24%), and management considerations (19%).[1] Hardware and software were relatively consistent while the other two areas varied substantially from book to book.

Programming Textbook Topics. The major topics of programming textbooks were fundamentals (56%), general data processing (16%), and advanced techniques (15%).[2] Content of fundamental and advanced topics varied percentage-wise in most books.

Systems Textbooks Topics. The major topics of systems textbooks were theory and components (46%), analysis and design (26%), applications (17%), and qualtitative topics (10%).[3] The greatest variation came between quantitative and application topics.

Other Equipment and Materials

Teaching Guides. Concepts and content have been organized to provide outlines and guides for introductory course concepts.[4] These outlines have included lesson plans with topic, behavioral objectives, information, and assignments.[5] Educators from the State of New York produced a specialized outline for training the deaf in keypunch concepts.[6] Educators from the Dade County Public Schools, Miami, Florida, produced a series of detailed outlines ranging from introductory to

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[1] 46.

[2] 46.

[3] 46.

[4] 115, 126, 102, 263, 234, 180, 455.

[5] 102, 180.

[6] 455.

advanced data processing concepts.[1] Learning activity packages (LAP) and programmed instruction (PI) were done in data processing concepts and programming in BASIC and RPG.[2]

Media Available. Multi-media experts have augmented exponentially materials useful in the major of concepts more lucid.[3] Materials ranged from transparencies to films and slides, and videotaped lessons to television programs of data processing.[4]

Computer Use in the Classroom. The computer has actually come into the classroom through the use of the mini-computer and terminals.[5] ... use of the computer led to projects and simulations to actual work that will be completed on the job.[6] Games have served to motivate the student to want to learn about computer use and control. Too, they have served to remove anxieties about learning data processing. An on-the-job task was illustrated through the use of simulation in introduction to data processing to reveal to the student how input called the computer to processing data for output.[7]

With much material available for data processing education, some computer areas have been described as lacking.[8] If an area, such as

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[1] 511, 512, 368, 520, 200, 563, 345, 205, 239, 464, 465, 515, 467, 514, 516.

[2] 9, 20, 21, 38, 101, 132, 232.

[3] 225, 226.

[4] 144, 148, 198, 214, 315, 588.

[5] 497, 528, 607, 508, 561, 388.

[6] 19, 51, 105, 392, 546, 605.

[7] 19.

[8] 214, 222.

data bases, was noted as needing materials, book publishers have sought out writers to make the idea clear.[1] Materials can be supplemented, if lacking, but the *sine qua non* was the presence of the computer.[2] It was found that direct contact with the computer produced behaviors different from those gained vicariously. Moreover, adequate turnaround was essential in the student's learning.[3]

TEACHING METHODS

The teaching of data processing subjects changed during the 1971 to 1976 era, largely dealing with the technological advances of the field. The teaching methods used were on-the-job training, lecture, programming instruction, hands-on experiences, computer assisted instruction, audio-visual tutorial, field trips, peer interaction, transactional analysis, reading, and role playing.[4] The greatest difference in student learning was attributable to the teacher's abundant understanding of the method being used.

Integrating Topics Methods. When integrating data processing into the accounting curriculum, the method depended on the background of the instructor and funds available.[5] Methods used were either the separate unit or an integration of concepts. Both worked well in the presentation of the material. The most important result was that data processing in

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[1] 222.

[2] 596.

[3] 596, 546, 508, 497.

[4] 408, 591, 397, 248, 262, 578, 127, 478, 482.

[5] 28, 65.

accounting improved students' understanding of concepts.[1] The student's understanding of data processing concepts and programming seemed to improve when peers were allowed to interact, which reinforced instruction.[2] Care should be taken to explain terminology thoroughly because of the semantic differences associated with the main data processing terms.[3] Even the most common terms, such as computer and software, were misrepresented.

High School Teaching Methods. Many different methods were used to teach data processing at the high school level.[4] If possible, data processing should be a separate course with hands-on experiences.[5] When equipment was not available for classroom use, two alternative courses of action were taken: (1) field trips to computer installations and (2) the use of guest speakers.[6]

College Teaching Methods. Data processing on the college level, especially beginning courses, has undergone changes to accommodate teaching large groups.[7] A student guidebook with lecture outlines was used in teaching large classes, with help sessions in courses when the students were doing elementary programming.[8]

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[1] 65.

[2] 127, 478.

[3] 41.

[4] 52, 473, 540, 589, 290, 606.

[5] 52, 450, 473.

[6] 606, 589, 290.

[7] 296, 506.

[8] 296.

The use of the programmed text versus the computer-displayed units showed that computerized units were beneficial to supplement teacher-based learning in teaching FORTRAN.[1] With the expansion of institutional teaching from the home campus, methods have been explored in teaching data processing via extension which resulted in the no-equipment situation of teaching.[2]

The importance of examining reading levels was emphasized as was the examination of questioning techniques used by teachers.[3] The use of the Flanders' Interaction Analysis System seemed not to affect significantly student achievement.

The Computer Laboratory. Computer courses as a laboratory science came under question. For maximum student interaction, the use of the computer laboratory appeared essential.[4] Even in the introductory course, the use of the laboratory, tied into the use of simulation, seemed to arouse student interest in computers.[5] The use of the laboratory brought in the use of time-sharing concepts versus batch processing in the student learning.[6] Syntax error rate was much higher on time-sharing than batch, although no overall significant difference was found between the learning methods of time-sharing and batch processing.[7]

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[1] 43.

[2] 507.

[3] 3.

[4] 249, 532.

[5] 109, 143.

[6] 8, 44, 57, 558.

[7] 8, 44, 57.

Television Courses. An alternative to the lecture was the utilization of the television class which was taped to be used several times during the day as well as subsequent academic periods. Student attitudes were favorable to television learning, especially with the concept of repetitive on the same lesson to reinforce missing or unclear elements.[1]

Programmed instruction methods appeared to begin with providing a basis for problem-solving involving goals to be achieved in the process.[2] Interwoven with problem-solving were the topics of top-down design, programming style, program testing, and error analysis discrimination, which was tied together in a significant project to test the characteristics.[3]

Programming Methods. Indecision prevailed in agreement of which provided superior programming methods for learness. A historical analysis revealed a model of circularity or a constant changing from one method to another.[4] This trend changed somewhat in that new methods provoked discussion concerning learnings which were inefficient. Top-down structure, a new concept, showed significant time savings for the organization, but the learning involved some obvious loss of time which is likely to occur when anything new was learned.[5] Error control

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[1] 5, 462, 128.

[2] 191, 487, 333, 430.

[3] 33, 260, 147, 282, 373, 451, 557, 413, 380.

[4] 466.

[5] 410, 466.

techniques provided teaching methods for the language teacher to develop control methods for student programming.[1]

Heightened realism came through the use of the case study when conducting systems analysis classes.[2] At the same time, the team approach to operating systems helped explain job procedures. Interships or cooperative programs, as a method, assisted the learner's understanding of data processing. From the student view, the foregoing method provided an expedititious way to learn data processing.[3]

OCCUPATIONAL INFORMATION

As an occupation, data processing continued to grow during the period 1971 to 1976. Manpower needs showed a decrease in keypunch positions, but large increased were shown in other data processing positions with the new area of the technician.[4] Job titles in data processing were standardized by the government, and figures showed a need to strengthen available programs.[5] Normally, training was needed for the positions which consisted of at least an Associate Degree with content in terminology, documentation, flowcharting, and command of more than one programming language.[6] Additional educational background included work in accounting, mathematics, general business, and business writing.[7]

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[1] 33.

[2] 338, 448.

[3] 594.

[4] 130, 216, 393, 512, 227, 308, 424.

[5] 394, 566.

[6] 204, 137, 138, 355.

[7] 14.

Generally, the college graduate of a data processing program thought the program was an adequate preparation for the job.[1] Selection for data processing positions normally centered on background characteristics.[2]

Job Tasks In DP. Job tasks were analyzed, and the minimum tasks for specified positions were as follows:[3]

a. Keypunch: operate keypunch, verify data, keypunch programs, interpret data, and log production.

b. Operations: operate console, mount tape and disk, determine machine malfunctions, set-up disk drives, and load forms to the printer.

c. Programming: write programs, correct and test programs, operate computer, document programs, and analyze applications to select tne most appropriate utilities and subprogram.

d. Analysis: operate terminal, design systems, implement systems, review programs, review systems, and type.

Curriculum planners for occupational analysis used behavioral objectives in describing competencies needed on the job. This helped the members of business organizations evaluate data processing program graduates.[4]

Career Progression. The career progression was generally from operations to programming to systems to management.[5] The management position was traditionally in data processing, but the value of the the analyst gave way to promotion out of data processing to corporate

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[1] 137, 138, 273, 355.

[2] 295.

[3] 10, 29, 35, 113, 155, 174, 175, 280, 592.

[4] 474, 185.

[5] 246, 363, 460, 284, 211, 240, 405, 526, 297.

management.[1] The reason for the top management move was the overall organizational knoweldge of the analyst and the communication ability from management to data processing.

The traditional job progression from computer operations to programming has somewhat changed because of complexities in machine operations, which made the operator a more nearly professional person.[2] For diverse goals, the programming professional should receive continuing education in personality and communication skills.[3] The pride of program authorship appeared to bear a meaningful positive relationship to job satisfaction components which involved work, supervision, and co-workers.[4] The programmer's personality was described as quiet, reserved, logical, independent, confident, introverted; furthermore, an analytical person interested in mathematics, nature, and music.[5] Programmers had a mixture of optimism and pessimism; respect for others without a great deal of sensitivity; sufficient capacity for organizing their work and personal lives; and theoretical interests. They were oftentimes young, single males who were the oldest child in their families and who participated in two or fewer extracurricular college activities, those being the Association for Computing Machinery and the honorary fraternity.[6]

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[1] 363.

[2] 158, 219.

[3] 328, 259, 241, 499, 442.

[4] 4.

[5] 6.

[6] 6.

The Systems Analyst. This person was referred to as the doctor of business because of the type of duties performed.[1] The analyst had to be a generalist to serve the business, diagnose its ills, and offer suggested cures. Based on the suggestions, a remedy was sold to the user with implementation by the analyst team. Since the problems dealt with businesses, the analyst knew the details of the business.[2] Analysts were constantly trained to meet the needs of the company.[3] The training received advanced the analyst to management on the career ladder.[4]

Some analysts were involved in an in-between step called the information specialist, which interfaced the user with data processing.[5] The specialist was a vital link in the information transfer network. Training for involvement as an information specialist associated in user operations involved careful examination of all aspects of information.

Many organizations lost top individuals because the career path was previously in data processing. To get capable persons to stay on the job was due largely to the creation of a proper work environment for the individuals.[6]

Computer Salaries. Although not the main motivator, money played an important role in keeping persons at their work. Data

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[1] 471, 580, 391, 505, 188, 161, 323.

[2] 391, 323, 580.

[3] 504, 505.

[4] 188.

[5] 375.

[6] 184.

processors, in various industries around the country, were informed of salaries through the use of yearly surveys.[1] Salaries for operations ranged from $4,000 to $19,150; programming salaries ranged from $5,000 to $17,850; and systems salaries ranged from $6,900 to $24,450 with the average salary for operations of $7,950, programming $11,050, and systems analysis $13,250.[2] Continued training followed the computer professional on the job.[3] Data processing training also affected other occupations such as management and accounting.[4]

Yearly Training. In 1974, the computer operator received about forty hours of training; the applications programmer about eighty hours of training; the systems programmer about 120 hours of training; and the systems analyst about eighty hours of training.[5]

Women in Data Processing. In the beginning, the field was open to men only, but later it was open as well to women and handicapped people.[6] State laws related to heavy lifting and mores associated with women working late hours were reasons for the dearth of women workers early on in the history of data processing. Managers, who intended to keep women, should provide congenial associates as well as sympathetic and competent supervisors.[7]

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[1] 252, 342, 343, 491, 438, 415, 439.

[2] 439.

[3] 292, 551.

[4] 299, 480, 536.

[5] 218.

[6] 351, 418, 183, 598.

[7] 598.

Certificate in Data Processing (CDP). Even with education and training, certification was introduced to strengthen the profession.[1] The use of the Certificate in Data Processing (CDP) was to serve as a bridge between the certifying of the older data processor, who learned the profession on-the-job without formal college education, and the college educated data processors.

SUMMARY OF THE FINDINGS

Sixty-seven research studies and 555 non-research literature articles pertaining to business data processing education from 1971 to 1976 were analyzed, classified, and synthesized. Material was categorized in the area of history and status, curriculum implications, course content, materials and equipment, teaching methods, and occupational information. Northern Illinois University doctoral candidates produced the greatest number of studies, while J. Daniel Couger authored the most non-research literature for the period. The greatest number of non-research sources came from the *SIGCSE Bulletin*, which was followed closely in number by the *Journal of Data Education*. The history and status category had the most classified literature with teaching methods the least literature.

History and Status

The following major points summarize the history and status area of research and non-research writings on BDPE:

1. Data processing evolved from a prehistoric beginning to the use of the sophisticated machine called a computer. Technological

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[1] 443.

changes to the internal structure and speed of the computer brought forth what was termed computer generations.

2. Two historic documents, which were referred to earlier, were: "Curriculum '68" and Curriculum Implications of Automated Data Processing for Educational Institutions.

3. As industrial leaders criticized the irrelevance of computer education, educators asked industrial leaders for help in curriculum.

4. Some job success or aptitude to DP was measured by standardized tests and previous coursework.

5. Problems possibly could have been alleviated with a dominant leader coming forth in the DP field.

6. Secondary students were eager to learn about the computer with the major objectives of high school DP being to provide a general knowledge about the computer. High school educators provided basic training for keypunch and computer operations while integrating concepts into other areas, especially accounting and office practice courses.

7. Two-year schools provided vocational education for operations and programming but also wanted articulation with the four-year schools.

8. The four-year institutions should constantly revise their curricula to keep up-to-date with technological changes.

9. The DP teacher was profiled as a male college graduate with related work experience and knowledge of programming, basic DP skills, and systems analysis.

10. Teacher education was lacking with most DP teachers receiving their knowledge outside of college.

Curriculum Implications

Implications for the DP curriculum can be summarized as follows:

1. BDP varied from one to several courses in the curriculum with one of two courses prevalent in the high school.

2. The high school curriculum consisted on basic concepts with keypunch and possibly programming.

3. The two-year DP program core consisted of basic concepts, systems analysis, accounting, mathematics, communication skills, and at least one programming language, probably in COBOL. Entry level positions available to the graduate were computer operations, programming, and possibly, systems analysis.

4. The four-year programs used an identical base of courses as above but expanded the base for more depth in programming and systems.

5. Programs existed in computer science and business, while computer science underwent some changes to become more practical.

6. COBOL, RPG, and/or FORTRAN were the most predominant languages taught with the major equipment used being from IBM.

7. Programs were developed for teacher training but mainly in preparing teachers at the secondary level. Experienced persons with college degrees were chosed by college administrators to direct DP programs.

Course Content

The following courses were described in literature as representative of the computer area:

1. *Introduction to Data Processing*, on the high school level, gave students a foundation for job preparation. The course was taught with or without equipment, with those using equipment stressing operations training with some exposure to computer programming.

2. *Introduction to Data Processing*, on the post-secondary level, was taught mainly with equipment. The use of programming in the course varied, but programming that was done centered on the language of FORTRAN.

3. *Computers and Society* was similar to the introductory course but stressed automation's effect on society with emphasis on the familiarity of terminology.

4. *Introduction to Programming* was similar to the introductory course with programming. Programming stressed various manipulations of input including documentation and standardization of language format.

5. *Operating Systems* courses dealt with internal controls of the computer.

6. *Systems Analysis* examined the tools and techniques used by the analyst in the design and development of computer applications. Some programming of the system under study was occasionally included.

7. *Methods of Teaching DP* gave the data processing educator an overview of previous coursework and ways for their implementation into the curriculum.

Materials and Equipment

The following points provide a synopsis of the materials and equipment reported in the research and literature:

1. With the increased availability of materials, methods were needed to choose those appropriate to the particular class audiences.

2. Analysis of textbooks showed content topics and their respective levels of cognitive domain. Over fifty percent of introductory texts contained hardware and software concepts. Programming books contained mainly fundamental concepts, while analysis textbooks contained forty-six percent theory and components and twenty-six percent analysis and design.

3. Educators produced teaching guides, learning activity packages, and programmed instruction for the teaching of DP concepts and programming.

4. By bringing the computer to the students, it was possible to create simulations of actual experiences used on the job.

5. Educators conveyed needs for materials to publishers who responded to the requests.

6. The best source for finding out what teaching resources were available could be found in the *Computing Newsletter for Schools of Business*, published out of the University of Colorado at Colorado Springs.

Teaching Methods

Teaching methods can be summarized from the literature as follows:

1. Various methods were used in teaching DP from the standard lecture to the computer providing the instruction.

2. Supplemental methods used for the high school student included field trips and guest speakers.

3. Collegiate DP, especially introductory courses, changed to large lectures with guidebooks to lead students.

4. A recognition of the source and direction of student motivation was essential to the teacher's planning and understanding of the appropriate teaching-learning strategy. In such cases, the teacher organized the subject matter and presented it to stimulate the student to learn.

5. As an alternative and reinforcement to the large lecture, the television class was developed.

6. Student involvement in programming was accomplished through the use of peer involvement.

7. The use of the laboratory in DP instruction facilitated necessary skill building with the concomitant of increased social interaction between teacher-student and student-student.

Occupational Information

The DP area as an occupation can be summaried in the following major points:

1. The professional stature of DP grew along with the ability and knowledge levels of the positions involved. Minimum job tasks were developed for DP positions based on an occupational analysis.

2. The educational level grew to at least some college for entry positions of computer operator and programmer. Coursework should include work in accounting, mathematics, general business, and business writing.

3. Personality descriptions of programmers showed such traits as confidence, independence, and an analytical interest in mathematics and music.

4. The DP career progression was from computer operations to programming to systems analysis to management. The systems analyst as a doctor of business held true for organizations. The positions of the career ladder expanded for the analyst with a new opportunity to move to corporate management.

CHAPTER V

SUMMARY AND CONCLUSIONS WITH RECOMMENDATIONS

SUMMARY OF THE REPORT

The subject of this study was the analysis, classification, and synthesis of research findings and thought pertaining to business data processing education from 1971 to 1976. Literature was analyzed with classification into the categories of history and status, curriculum implications, course content, materials and equipment, teaching methods, and occupational information.

The procedure of the study involved compiling a master list of research reports and non-research literature on BDPE. After gathering the research findings and thought from the master lists, the relevant materials were abstracted and summarized into the six categories of the study. The characteristics of the research findings and thought were reported leading into the synthesis of the findings stated by the literature. The findings were then summarized with conclusions and recommendations drawn from the literature.

Analysis, classification, and synthesis was completed on BDPE using 67 studies and 555 non-research literature publications. The history and status category contained the most material in the findings with teaching methods the least. Based on research methodology, the quality of the research was generally good. Research in business education appeared to follow the procedures the best. While the overall volume of materials

in the computer field was large, based on a comparison of that literature, BDP research and non-research literature seemed somewhat lacking.

History and Status. The evolution of BDP came from the use of prehistoric methods to the highly advanced machine called a computer. "Curriculum '68" and Curriculum Implications of Automated Data Processing for Educational Institutions were the classic documents referenced in curriculum planning. The irrelevance of computer education to actual job tasks was criticized by business and industry. While standardized tests and previous coursework showed some measure of job success, they gave no certainity of the level of that success.

High school educators provided basic training for keypunch and computer operations and integrated concepts into mainly accounting and office practice. Two-year educators wanted to provide a dual purpose for their programs: vocational education and transfer programs. The articulation of programs became an issue still unresolved. Colleges and universities revised their curricula for relevant programs to provide industry with needed data processors. Teacher education was lacking with most receiving their knowledge through work experiences outside of college.

Curriculum Implications. The business DP curricula varied from one to several courses with one or two courses prevalent in the high school. The DP core for two-year schools consisted of basic concepts, systems analysis, accounting, mathematics, communication skills, and at least one programming course, generally in COBOL. Four-year educators expanded the core for more depth in programming and systems analysis. While programs existed in computer science and business, the science program experienced a changing process to become more practical.

Course Content. The DP curriculum on the secondary and post-secondary levels included a variety of courses. Although several were listed, course outlines were mainly given for *Introduction to Data Processing* with or without programming, *Introduction to Programming*, *Computers and Society*, programming languages, *Systems Analysis*, and *Methods of Teaching DP*. The introductory course, on both levels, dealt with basic concepts and terminology. The beginning course in programming used mainly FORTRAN integrated with basic computer concepts. *Introduction to Data Processing* with programming was similar to the *Introduction to Programming* course. *Computers and Society* showed the relationships of the computer to our surroundings. *Systems Analysis* looked at the tools and techniques of the analyst with some integration of programming. The methods course for DP gave an overview of computer concepts and a system for the implementing of programs.

Teaching Methods. The number of teaching materials doubled during the 1971 to 1976 period while the use of media in the classroom also increased significantly. Educators produced teaching guides, learning activity packages, and programmed instruction to supplement published works. Analysis of textbooks were done to determine the extent of the content. The simulating of actual work situations were possible with the mobility of the computer into the classroom. The best source for determining the resources and materials available for teaching DP was found in the *Computing Newsletter for Schools of Business*.

Teaching Methods. Methods used in teaching DP were on-the-job training, hands-on experiences, peer interaction, computer assisted instruction, and audio-visual tutorial besides the standard lecture. Large lectures and television classes were developed to accommodate the

multitude of students desiring DP knowledge. The use of the laboratory in computer instruction allowed interactions between the teacher-student and student-student.

Occupational Information. The DP profession increased in stature as did the competencies needed on the job. The minimum educational level was some college for entry level positions of those below that of programmer. The career progression was computer operator to programmer to systems analyst to management. Designated by industry as the doctor of business, the analyst career opportunities expanded to top management.

CONCLUSIONS WITH RECOMMENDATIONS

To provide insight to the research findings and thought, conclusions with recommendations are presented to convey needed research and efforts for future non-research writings.

Conclusion: Technological advances have made the use of unit record equipment obsolete and created the availability of small computers and terminals linked into computers.

Recommendations: Unit record instruction should be phased out of the curriculum. In its place, the student should receive instruction about the potential and use of terminals, mini- and micro-computers in business. Hands-on experiences with the computer should be used in the classroom, if possible; otherwise, field trips and guest speakers should be used to augment instructional objectives.

Conclusion: Teaching materials are abundant for the post-secondary level but appear to be lacking on the secondary level with a void apparent in that the most recent introductory textbook was written prior to 1972.

Recommendations: Data processing materials need to be produced for the secondary level. As an instructional aid, introductory data processing textbooks that cite application examples should provide computer programs producing such reports for simulation aspects in the course.

Conclusion: Based on technological changes, educational institutions should continually evaluate their programs and courses to assess relevance to placement.

Recommendations: Professional organizations from the computer field and those using DP concepts should coordinate efforts to produce task analyses listing the skills which use DP concepts for use in revising the curriculum. Advisory committees should be used to develop task analysis curriculum, especially where graduates stay in the locally served geographic area.

Conclusion: There is an increased reliance and use of the computer in society.

Recommendations: Students at the secondary and post-secondary levels should have at least an introductory data processing courses utilizing the career education format with emphasis on terminology. To reinforce introductory concepts, relevant topics should be integrated into courses to show the student how the computer can help on the job. At least an introductory course should be at the secondary level; furthermore, programming concepts should be added to that course at the post-secondary level. Additional courses in systems analysis and management information systems should be taught at the post-secondary level. With the expansion of DP into other areas, interdisciplinary programs should be developed with the most concern appearing in accounting and engineering.

Conclusion: With an increase of computer education, institutions need to provide training for the DP teacher to gain necessary skills.

Recommendations: Teacher training and certification programs in data processing needed to be developed. To measure the level of teacher understanding of the computer concepts, competency-based objectives should be developed for the curriculum. Continuing education courses in DP need to be developed for the present teacher along with a mechanism for getting them into such courses.

Conclusion: With the increasing of DP concept needs in the curriculum, programs should become more standardized to alleviate articulation and accreditation problems.

Recommendations: The use of Bloom's *Taxonomy of Educational Objectives*, or something similar, should be used in establishing course objectives for the curriculum. Programming languages taught should be those which were used in the geographically served area, not those preferred by the faculty. Additional languages should be available for the student besides the major languages taught in the curriculum. Since industry has continued to question the relevancy of DP instruction, there appears to be a need to have the student exposed to the business setting through the use of the cooperative education program.

Conclusion: Although the computer concepts are essential to the job, additional content outside of the DP area is needed for the worker, such as communication skills, management, and organizational skills for the major area of programming or analysis work.

Recommendations: Communication skills, both written and oral, should be integrated into the DP curriculum. Other skills should be planned by the student and his/her advisor to determine the most beneficial content for the student.

Recommendations for Future Study

At least eight research needs were apparent in business data processing education. A study similar to this study should be done, starting with 1976. Content levels need to be determined in systems analysis and data processing teaching methods. With the terms "systems analysis" and "management information systems" being used almost synonymously in the literature, an analysis is needed to examine the skills and content of each to determine whether or not they are about the same. To determine the relevance of the curriculum, follow-up studies on the program graduates and enrolled students working part- and full-time need to be accomplished. From the follow-up of the graduates and a survey of needs, a minimum curriculum should be determined for specific entry level positions. Since the technological changes have created new positions of the data processing technician and systems programmer, a task analysis should be undertaken to determine relevant curriculum for the positions.

The list of research in business data processing could continue since nearly all aspects need future research or reporting what is being done by the present data processing instructors. The following quote best sums up the thought of the whole data processing area regardless of placement:[1]

> "Some of the greatest loss of opportunity in business education has been the result of not doing something wrong in the instruction of business data processing but in doing nothing at all."

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[1] 60, 178.

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Alexander, Wilma, Environmental and Educational Characteristics of Secondary Business Data Processing Teachers in the United States, doctor's dissertation, Oklahoma State University, 1973, 216 pages.

Problem

To compare environmental and educational characteristics of four data processing teachers groups: teaching no data processing; teaching data processing unit; teaching separate course with no equipment; and teaching courses with equipment.

Procedure

1. Researched related literature to acquire skills for study.

2. Surveyed literature to determine need of study.

3. Compiled list of secondary schools by random sampling using educational directories of states.

4. Designed questionnaire to determine characteristics with pilot test conducted for revision before mailing.

5. Data was statistically analyzed.

Findings

1. Up to 61 percent female dominated all groups except that in which data processing was taught utilizing machinery which was 55 percent male. Over 46 percent were between the ages of thirty-one and fifty. The majority had less than ten years experience with 92 percent of those teaching data processing having less than two years work experience. Educational level varied from no degree to advanced degree with 70 percent having business or business education major for baccalaureate and more than 53 percent having business education advanced degree. The two most useful college courses were typing and accounting principles.

2. Over 50 percent preferred introduction of data processing on the high school level. About 25 percent wanted integration of data processing concepts to start in junior high school curriculum, but 33 percent thought separate courses should wait for college level.

3. A majority of those teaching data processing did not take advantage of educational materials available in data processing periodicals to keep abreast of changes. Business Automation was the most read data processing periodical. The Balance Sheet and Business Education World were most read periodical by the four groups with the latter most frequently used. Those teaching data processing without equipment most frequently read Journal of Business Education.

4. Less than 20 percent had taken data processing methods course. More who taught data processing with equipment had formal training to prepare themselves than the other categories.

Alexander, Wilma

Findings (Continued)

5. Favorable teaching experience attributes of the data processing teachers were student motivation, subject matter relevancy, creativity, and position autonomy. Hardships in teaching were financial resources and accessibility of machines.

7. Over 60 percent of those teaching data processing units indicated formal education failed to prepare them to teach data processing, while 47.1 percent of teachers without equipment and 38.2 percent of those with equipment indicated the same. Those involved in teaching data processing had not received instruction in topics recommended by literature to be taught.

8. The rank order of languages qualified to teach were COBOL, FORTRAN, RPG, and machine language. Communications courses were considered important to data processing but was the third lowest as being helpful in teaching data processing.

Recommendations

1. Develop career education data processing program to inform students.

2. Develop approach to create interest for business educators to become knowledgeable of data processing.

3. Require data processing courses for business education degree program. Setup certification requirements in data processing such as six hours for general education and nine additional hours for certification.

4. Emphasize the importance of data processing by incorporating materials into all courses.

5. Encourage business to take an active part in data processing curriculum development and use businesses as classroom resources for familiarity of students.

6. Inaugurate three way approach to teaching data processing at the college level: integrate, offer introduction course, and develop vocational skills.

7. The following areas should be studied:

a. status of unit record equipment usage at the secondary level.

b. data processing methods course content on collegiate level.

c. availability of equipment use on the secondary level.

d. follow-up curriculum development of introductory course.

Alexander, Wilma

Abstracter's Comments

Study amplified need for data processing instruction at the college level to prepare data processing instructors for high school and the need for overall teacher information of data processing.

Amundson, Donald A., A Study of the Concepts Developed Through a One-Semester High School Data Processing Course, doctor's dissertation, Northern Illinois University, 1975, 212 pages.

Problem

To determine the data processing concepts possessed by high school students who have completed a one-semester high school data processing course; to determine the gain in conceptual knowledge in a one-semester high school data processing course; and to relate the gain and level of conceptual knowledge to sex, ability, and grade level of students.

Procedure

1. A random selection of high schools offering data processing was subjected to the expost facto research study design.

2. Fifty-five question multiple choice test was developed using the concepts identified by Jay Christensen and Edward Paulus dissertations from which a jury of seven data processing experts judged content validity in relationship to concept. Revisions were incorporated from jury verdict.

3. Test was administered as pre-test during first week of semester with procedure repeated two weeks before the semester end. Students were encouraged not to guess and answer relative certain questions. Personal data was obtained on students.

4. Data was recorded in cards for statistical analysis using the Biomedical Computer Programs (BMD).

Findings

1. A significant gain was recorded for the group on the pre- and post-tests at the .01 level. Above average students gained more on total test than other students. Males scored better than females on the tests. No significant gain from the pre- to post-test for students as groups on anyone of the six data processing categories: operations, data processing impact, software performance, arithmetic-logic calculations, data processing and business enterprise; and information systems flow.

2. Students as a group answered correctly a significantly greater percentage of the time on the post-test than pre-test on eleven of the fifty-five items; whereas, four of the fifty-five pre-test items were answered more than the post-test items. On twenty-seven test items, no significant difference was found.

Recommendations

1. The introduction to data processing course should be structured so that students can get concepts identified by the research.

Amundson, Donald A.

Recommendations (Continued)

2. Require junior standing and at least average grade point average for enrollment in an introduction to data processing course.

3. Even though males indicated more knowledge than females, from the test, more study is needed in analysis of backgrounds before drawing conclusion for data processing field.

Abstracter's Comments

1. Several errors were found in footnotes and bibliography and references thus could not be located.

2. Concepts test should be examined by the introduction to data processing teachers along with the dissertations of Christenen and Paulus.

3. The bibliography references of Christenen and Paulus are as follows:

G. Jay Christenen, Key Concepts in Automated Data Processing for High School Business Students, doctor's dissertation, Colorado State University, 1969.

Edward W. Paulus, An Analysis and Evaluation of Data Processing in Secondary Schools and Universities, doctor's dissertation, Northern Illinois University, 1972.

Anderson, Durward L., An Application of Flanders' Interaction Analysis System and Fluency in Asking Question to Increase Student Achievement in a Data Processing Program, doctor's dissertation, Texas A & M University, 1974, 84 pages.

Problem

To determine if inservice training of data processing teachers in Flanders' Interaction Analysis System (FIAS) and enhanced by inservice training in fluency in asking questions produce a significant difference in student achievement.

Procedure

1. Two public Texas high schools with data processing classes and having two teachers to teach two sections of data processing were chosen for application of techniques.

2. Pre-test, content, and post-test were designed through a joint venture of the four teachers involved and the researcher. The test items were validated by faculty jury.

3. Pre-test was simultaneously given the classes. The teachers underwent two phases of training; question fluency and interaction analysis. Six random hours of audio taping was done on three teachers with exception teacher conducting self-study laboratory. Post-test given at end of study.

4. Content lesson was given by both experimental and control teachers with students being assigned randomly in each school.

5. Data was recorded in cards for statistical analysis.

Findings

1. The reliability of internal consistency of the criterion test was low but still within the acceptable range.

2. Analysis relating to difference in student achievement was not significant.

3. A significant difference existed in the teacher revised I/D ratio while no significant difference existed in the teacher I/D ratio.

4. Teacher training in questionning skills and classroom verbal interaction seems to have failed to increase student achievement during the presentation of self-checking digit feature topic.

5. No significant difference in student achievement between the experimental teacher taught population and control teacher taught group; between I/D ratios for teachers; student achievement between schools; and revised I/D ratio interaction between teachers.

Anderson, Durward L.

Findings (Continued)

6. Significant differences existed in the following: between I/D ratios of schools; I/D ratio interaction between experimental and control groups and teachers with schools; between revised I/D ratio of teachers; and student achievement between schools.

Recommendations

The following changes should be done in the research procedure and then the study replicated:

a. keep teachers unaware of treatments.

b. do not give teacher the content lesson until day before taping.

c. content test on lesson should be scored with right minus wrong.

d. audio tapings should use concealed microphones.

Abstracter's Comments

1. The concepts tested on the research seemed beneficial but the procedures should have been refined before data gathering. The recommendations should have been forseen and procedure adjusted in a pilot attempt.

2. The I/D ratio stands for the indirect teacher influences to direct teacher influences in dealing with students. Included in the indirect are concepts of accepts feelings, praises of encourages, accepts or uses ideas of students, and asks questions. The direct includes lecturing, giving directions, and criticizing or justifying authority.

3. Explanation of the Flanders technique could have been described better for much was left up to the abstracter to know about the technique.

4. For more explanation of the Flanders technique consult the following source:

Amidon, Edmund J. and Flanders, Ned A., The Role of the Teacher in the Classroom, Minneapolis: Association for Productive Teaching, Inc., 1967, 102 pages.

Anthony, Ted F., An Exploratory Analysis of the Role of Pride of Authorship in Job Satisfaction on Non-Scientific Computer Programmers, doctor's dissertation, University of Colorado, 1971, 219 pages.

Problem

To provide a better knowledge and understanding of the conflict areas and programmer job satisfaction.

Procedure

1. Literature was reviewed with the integration of concepts relating to programmer attitudes and job settings in the development of a conceptual/theoretical model.

2. A questionnaire was developed which was pre-tested and revised before testing programmers on job satisfaction.

3. Data was recorded in cards for statistical analysis.

Findings

1. Job and work satisfaction will vary directly with one's feelings of authorship pride.

2. Supervisor satisfaction will vary directly with one's feelings of authorship pride.

3. Pay satisfaction does not vary directly with feelings, and programmers feelings concerning promotion potential of job situation does not appear as functions for authorship pride.

4. Coworker satisfaction varies directly with one's feelings of authorship pride.

5. A slight difference was observed between the job satisfaction obtained from the low and high pride of authorship levels.

6. Though not statistically significant, the more positive a programmer's feelings toward authorship pride, the more negative was the relationship between perceived conversion content and work satisfaction. In the same sense, the following are also true: the more negative was the relationship between conversion content and supervision and pay satisfaction.

7. Although not statistically significant, the regression coefficient of low pride of authorship was less than high level pride.

Conclusions

1. The pride of authorship appears to bear a meaningful and positive relationship to those components of job satisfaction which involves

Anthony, Ted F.

Conclusions (Continued)

the work itself, supervision, and coworkers.

2. Pride of authorship does not appear to be meaningfully related to programmer's satisfaction with pay or promotion prospects.

3. The presence/absence of conversion responsibility in a job setting does not appear to bear a meaningful relationship with overall job satisfaction. Programmmers in job situations involving conversion responsibilities appear to be more satisfied with their promotion prospects than do programmers in jobs of the in-house nature.

4. Higher conversion content levels might be expected to relate more noticeable negative differences or less noticeable positive differences in job satisfaction for programmers to whom pride of authorship was important than for those to whom it was not.

Recommendations

The following areas should be studied:

a. programmer productivity.

b. use of other ego-involvement measures on programmers.

c. replicate study on a larger scale.

Abstracter's Comments

1. Conclusions were included in this study to help understand the findings.

2. The study should be replicated in businesses to validate results and companies should not hold results over the programmers. The only problem in this type of study is willingness of companies and programmers to show what they really do on the job.

Bailey, Therold E., Student Attitudes Toward a New Application of Instructional Television in a Computer Programming Course, doctor's dissertation, Oklahoma State University, 1971, 111 pages.

Problem

To determine student attitudes toward the use of instructional television as a learning device in a computer programming course.

Procedure

1. Instructional television series for a beginning computer programming course was prepared using format of information and entertainment with objective to overcome negative attitude toward its use.

2. Experimental section of programming course was available to give students a choice of attending a television lesson or a conventional lecture covering the same material.

3. Students were surveyed by use of a pre- and post-test questionnaire and attendance data to determine attitudes.

4. Data was recorded for statistical analysis.

Findings

1. As measured by the pre- and post-test questionnaire and the attendance data, the attitudes of the students did change during the semester and became less negative toward educational television.

2. The attendance data indicated that the types of attenders the students became were unrelated to their pre-test attitudes, but data was significantly related to their post-test attitudes.

Recommendations

1. Instructional television at the college level can be used effectively as a teaching medium, provided that the unique capabilities inherent in television are used to their fullest.

2. Content and method should be refined to accomplish objectives more fully.

Abstracter's Comments

The study did not seem to be that of research but data collected as a matter of fact in the innovation of new technique.

Barnes, Patsy H., A Study of Personality Characteristics of Selected Programmers and Computer Programmer Trainees, doctor's dissertation, Auburn University, 1974, 114 pages.

Problem

To ascertain if there were personality characteristics which tend to be common to programmers and programmer trainees and if the personality characteristics of programmers differ significantly from programmer trainees.

Procedure

1. Subjects were academic institution programers who had been employed at least three months, and the trainees were students and programmers employed less than three months. In both cases they were volunteers.

2. All subjects were administered the Minnesota Multiphasic Personality Inventory, the Strong Vocational Interest Blank for Men, the Myers-Briggs Type Indicator, and a Biographical Inventory.

3. Data was recorded in cards for statistical analysis.

Findings

1. Programmers and trainees did not share the interests of people involved in business, social, political, technical supervision, or religious occupations. Interests did not seem to be related to paranoia, schizophrenia, or psychological deviation.

2. Programmers appeared to be interested in mathematics, nature, and music but were not interested in public speaking, law/politics, business management, sales, military activities, technical supervision, and religious activities.

3. Programmers might be described as quiet, reserved, independent, confident, introverted, logical, and analytical individuals. They seemed to have a mixture of optimism and pessimism, respect for others without a great deal of sensitivity, sufficient capacity for organizing their work and personal lives, and theoretical interests. They are most likely to be young, single males who are the oldest child in their family and participated in three or fewer extracurricular college activities being Association for Computing Machinery, honorary fraternity, and scholarship.

Recommendations

The following areas should be studied:

a. replicated with programs other than academic setting.

b. comparison of facts of academic and non-academic programmers.

Barnes, Patsy H.

Abstracter's Comments

1. The assumption stated that business and educational institutions are the same programming environments are totally not substantiated. Experience in working and talking with programmers seems to indicate less pressure situations exist in the academic environment.

2. There was a mixing of results from other studies and journals in the findings discussion.

3. Typing errors made readability awkward in some areas.

Beleutz, John A., Cognitive Style as an Indicator of Possible Success in Mastering Computer Programming, doctor's dissertation, Wayne State University, 1975, 146 pages.

Problem

To identify those cognitive style characteristics in students that can be used to predict probable success of elementary students in a computer science course.

Procedure

1. Literature was reviewed dealing with cognitive style and data processing.

2. Performance objectives were outlined for computer programming class with time scheduled to ensure at least fifty instruction hours during four month period.

3. College and elementary class were cognitive mapped and tested on computer programming objectives. The cognitive mapping was accomplished by use of the Oakland Community College Interest Inventory.

4. Data was recorded for statistical analysis.

Findings

1. The elementary sixth grade class had seven students scoring above 70 percent; six between 50 and 70 percent; and fourteen less than 70 percent. The college group had seven students in the A/B category; nine in the C category; three in the D category; and seven dropping the course. The percentage and letter grade were equated as equal.

2. The unique elements common only to the most successful groups were: theoretical auditory quantitative, deductive, and qualitative code elements of empathetic, esthetic, ethic, proxemics, and synnoetics. Appraisal was the only element common to the least successful groups.

3. The most successful elementary groups had the following cognitive style: appraisal, difference, magnitude influences by associates or peers, theoretical auditory linguistics, theoretical auditory quantitative, theoretical visual linguistics, and qualitative code elements of emphathetic, esthetic, ethic, and kinesics. The least successful group characteristics were: theoretical auditory quantitative, theoretical visual linguistics, qualitative code kinesics, influence by associates or peers, appraisal, and difference.

4. The most successful college groups had the following cognitive style: deductive, appraisal, relationship, difference, individuality, influence by associates or peers, theoretical auditory quantitative, theoretical visual linguistics, theoretical visual quantitative, and quantitative code elements of empathetic, esthetic, ethic, kinesics, proxemics, synnoetics, and transactional. Only three individuals were

Beleutz, John A.

Findings (Continued)

involved in the least successful group which had characteristics of appraisal, difference, individuality, influence by associates or peers, theoretical visual linguistics, and qualitative code elements of proxemics and kinesics.

Recommendations

The following areas should be studied:

a. influence of common elements of groups to individuals.

b. replicate study with larger sample.

c. additional elementary students should be tested and mapped.

d. identify significant of common group elements.

e. techniques should be applied to other career education areas.

Abstracter's Comments

1. The use of cognitive mapping as utilized by Oakland Community College, Bloomfield Hills, Michigan, has been success in determining student styles of learning and interest.

2. The equating of student success of percentage in one group and final course grade gives somewhat of an apple and oranges comparison which could negate findings.

Bennet, Patricia L., A Comparison of Programs and Programming Times Between Secondary Students Employing Time Sharing and Batch Processing Computers for Problem Solving, doctor's dissertation, Columbia University, 1974, 78 pages.

Problem

To examine certain aspects of computer assisted problem solving behavior among secondary school students with an ultimate goal of aiding teachers and school administrators in assessing the optimum computer environment for the education of their students.

Procedure

1. Sample was drawn from computer class based on questionnaire as to the students' preference for time sharing or batch processing and comparison of twenty-three aspects of programming which placed six students in each group.

2. Six problems were solved by each student using FORTRAN and no teacher help. Each problem was of varying difficulty and randomly assigned. Times were logged on each problem dealing with analyzing and coding and debugging.

3. Times were analyzed giving ratios based on consideration of program length, number of input/output statements, and number of decision and looping statements.

4. At the end of the problem, each student completed questionnaire indicating relative degree of difficulty, interest of problem subject matter, and student satisfaction with program.

5. Data was recorded in cards for statistical analysis.

Findings

1. Time sharing produced significantly longer programs, but the time spent on each was significantly less than batch processing. There was no significant difference in debugging times.

2. There was a significant interactive effect between problem and computer mode for both program lengths and number of IF and DO statements; whereas, no such effect was manifested for programming performance.

3. There was no significant difference in either subjects within group or problem over subjects within groups between time sharing and batch students when programs were compared.

4. There was a significant difference in both variations between the two groups when programming performances were compared. Interaction between individual programmers and particular problem influenced results significantly and points for need to classify problems and problem solving styles to determine most effective computer mode for interaction.

Bennet, Patricia L.

Recommendations

The following areas should be studied:

a. performance and product under time sharing and batch processing.

b. function of problem under consideration for time sharing and batch processing.

Abstracter's Comments

Study was well done but results should be discounted because of small number in the queues.

Bishop, Mildred, A Learning Activity Package for Teaching Electronic Data Processing on the High School Level, master's paper, California State Polytechnic University - Pomona, 1972, 71 pages.

Problem

To develop a learning activity package (LAP) in introduction to data processing for high school students utilizing the CARDIAC visual aid (Cardboard Illustrative Aid to Computation) and FORTRAN programming.

Procedure

None

Findings

A project book was assembled utilizing the CARDIAC and elementary FORTRAN programming.

Recommendations

None

Abstracter's Comments

1. Nothing is stated as to the procedures, findings, recommendations, or problem for this study.

2. The package lists background to data processing with behavioral objectives and could have been used in some schools for instruction.

Bucks, Jane A., An Analysis of Data Processing Occupations, doctor's dissertation, Oklahoma State University, 1972, 168 pages.

Problem

To gather regionally applicable information useful as guidelines for planning, implementing, and/or updating educational data processing programs.

Procedure

1. Research instrument was expanded version of occupational analysis forms used in simular previous research.

2. Four hundred selected users, suggested by local computer manufacturer, in forty-five west central Missouri businesses contributed data.

3. Data was recorded in cards of 400 job titles and 4,200 task titles for statistical analysis.

Findings

1. At least eight clusters of occupational titles were identified indicating 178 different occupational titles and 458 different tasks performed in the occupations. The eight clusters were analysts, clerks, secretaries, coordinators, managers and directors, operators, programmers, and supervisors. Minimum education recommended by 130 of the 178 occupations was that of less than junior college.

2. The average on-the-job training costs of 144 of the occupations were $1,000 with eighteen of these exceeding $9,999 (the maximum size allocated the data).

3. Over a 100 percent increase was indicated by 1975 in direct access devices and one percent increase in keypunch. Unit record was being phased out with the sorter and verifier having the slowest removal rates. Installations were using more than one media and language in computer operations. Disk media was being added by 10 percent of the businesses and 5 percent were adding COBOL as programming language.

4. Data entry, meaning keypunch, listed fifty tasks with average monthly salary of $322. The most significant tasks, with number indicating task, were: keypunch jobs (201), verify cards (47), keypunch programs (19), interpret cards (11), log production (10), sort cards (8), and design drum cards (7).

5. Computer operator listed 149 tasks with average monthly salary of $635. The most significant tasks, with number indicating task, were: computer jobs (247), mount tape (107), telephoning (102), mount disk (75), setup disk drives (50), load forms on printer (41), operate plotter (35), prepare tape labels (31), monitor input (25), clear card jams (30), key

Bucks, Jane A.

Findings (Continued)

punch cards (30), monitor system (30), clear card jams (30), keypunch cards (30), monitor system (25), coordinate work flow (25), file tapes (23), reproduce cards (22), test programs (22), list cards (22), correct job control (21), monitor computer (20), and prepare system (20).

6. Computer programmer listed eighty task with average monthly salary of $704. The most significant tasks, with number indicating tasks, were: write programs (23), test programs (16), correct programs (11), computer jobs (9), debug programs (8), document programs (7), flowchart programs (7), change programs (5), maintain programs (4), and design output format (4).

7. Systems analyst listed forty-five tasks with monthly average salary of $911. The most significant tasks, with number indicating tasks, were: operate terminal (10), design systems (7), implement systems (5), review programs (4), review systems (4), type (4), write user guide (3), study (3), telephoning (3), and write memos (3).

8. Data processing managers listed thirty-eight tasks with a monthly salary of $1190. The most significant tasks, with number indicating tasks, were: supervise personnel (6), design systems (6), analyze systems (4), plan work flow (4), and system preparation (4).

Recommendations

1. Educators should phase with the occupational indicators not after the indicators.

2. The occupational hierarchy and comparison tables should be used as reference for planning data processing programs at educational levels indicated.

3. The local office education courses should be phased toward data processing occupations.

4. If employers are phasing out equipment by donating such to schools, note should be attached to equipment indicating obsoleteness.

5. An occupational analyst should be required on every vocational institution staff.

6. The following areas should be studied:

a. replicate at different regions to determine applicability.

b. replicate in study region to keep information current.

Abstracter's Comments

1. Study is impressive and contains so much information that

Bucks, Jane A.

Abstracter's Comments (Continued)

abstracting was difficult.

2. Study is a must for institutions and schools training data processors.

3. Abstracter listed five job categories in the findings which were of specific jobs. Other similar positions, such as programmer/analyst, junior programmer, programmer trainee, etc. existed in each listing. Original abstract was twenty pages to list all applicable positions and associated tasks.

Burgess, Walter J., Business Data Processing Instruction at the Public Secondary Level in Georgia, doctor's dissertation, Georgia State University, 1972, 240 pages.

Problem

To examine the business data processing instruction at the public secondary level in Georgia and determine implication for effective secondary school curriculum and effective business teacher education programs.

Procedure

1. A questionnaire was developed based on related literature and revised by state department of education and two high school data processing teachers recognized as leaders in instruction.

2. The questionnaire was sent to Georgia business education department chairmen which were asked to refer the document to the appropriate teacher.

3. Data was recorded in cards for statistical analysis.

Findings

1. All schools had approximately the same percentage of business education students.

2. Approximately 50 percent of the business education teachers had either no experience or were in their first year of teaching business data processing.

3. Teachers from large schools reported the use of data processing equipment proportionately greater than did teachers from other schools with unit record equipment commonly owned by the school or government agency most mentioned.

4. Data processing was taught as a unit/section of another business course by the majority responding. When a separate course taught, the prerequisites were, in rank order: typing, bookkeeping, general business, business mathematics, and algebra with its status as an elective for several grade levels.

5. When data processing was not taught in the business department, the majority responded that placement was most often in the mathematics department. When it was part of another course, the nearest span of time was one to two weeks with plans for expansion negative or unknown.

6. BASIC and COBOL were the most frequently mentioned languages, but majority of work was done only in coding onto forms with the teacher evaluating the forms. Those schools that taught unit record did not include board wiring in the course.

7. The majority indicated the lack of problem material as the

Burgess, Walter J.

Findings (Continued)

greatest weakness with practice sets as the most effective of the supplemental materials. The majority felt the current text was inadequate.

8. The following topics were listed as most frequently taught in secondary schools, in rank order: data processing terminology; equipment; employment opportunities; record layout and design; data processing history; keypunch operations; flowcharting; binary arithmetic; machine operation; programming languages; systems analysis; and installation management.

9. In rating curriculum items on importance scale, the following were listed as the most frequently mentioned topics: films, field trips, keypunch equipment, sorting techniques, guest lecturers, data processing vocabulary, influence of the computer in society, and emphasis on business applications. The following were the second most frequently mentioned topics: free booklets and pamphlets from producers, bulletin boards, film strips, binary mathematics, systems analysis, flowcharting, basic programming concepts, vendor manuals as supplemental textbooks, and the emphasis on interdisciplinary problem solving skills.

10. Those who took a data processing course in the schools used it as an elective. A majority of teachers responding reported that their data processing professors maintained a positive attitude toward business education as a major field of study, used business examples in the class, exhibited a background in education and business, and taught at the right level of difficulty. The majority had not taken a mathematics course at higher than the college algebra level prior to taking the computer course. Teachers most frequently responded that they were required to perform keypunch operations and operate unit record equipment and not required to write complete computer programs or term papers for the computer class taken in college. Most teachers felt that a data processing course should be required for every business education teacher.

11. The programming languages studied by teachers were, in rank order: COBOL, FORTRAN, and RPG. The major topics of programming instruction in the class were, in rank order: instruction in binary mathematics, writing and debugging programs, keypunching and verifying, experience in either operation of unit record or computer, systems analysis, instruction in matrix concepts, and instruction in basic electrical circuitry. Other related courses termed high in data processing value were, in rank order: accounting, typing, office machines, and statistics. Grades received by students in data processing courses were generally the same as other courses.

12. Of those teachers without a college data processing course, the majority attended only one symposium in data processing, which led them to believe they had sufficient training to teach data processing.

13. Cooperative programs were offered in less than 20 percent of the schools inconcert with a vocational center.

Burgess, Walter J.

Findings (Continued)

14. Teachers with work experience generally had one to three months full-time or less than one month part-time. There were four area of employment experience being keypunching and verifying, machine operations, programming, or systems analysis. The majority felt work experience should be required by all teachers.

Recommendations

The following areas should be studied:

a. most effective programs in data processing between secondary and vocational schools.

b. relation of course content and teaching methods of workshops, seminars, and short courses in data processing.

c. course content of an effective methods course in data processing instruction.

d. availability of supplemental instructional materials for data processing teachers.

e. equipment relationships comparisons between business and education.

f. success of high school data processing graduates as employees in the business community.

g. prerequisites of data processing on the secondary and college levels.

h. analysis of state-wide university system of Georgia computer network with implications for participation by secondary schools for administration and instructional purposes.

i. applicability of employment experience in community as part of an internship program for data processing teachers.

Abstracter's Comments

1. Procedure stated use of standard statistical packages but there was no reference as to what was standard. If the word, "standard", referred to a specific package, abstracter could find no such reference.

2. The rating of selected curriculum items in the paper on an importance scale was unclear as to what the results indicated.

Calli, Joseph J., The Status of Business Data Processing at the Community Junior College Level in the State of Michigan, master's paper, Northern Michigan University, 1975, 68 pages.

Problem

To determine the type of data processing programs and/or courses available to students and to survey the opinions and attitudes of business division chairmen/instructors in the community junior colleges in the state of Michigan.

Procedure

1. The list of the community junior colleges was compiled and college bulletins were secured from each.

2. A questionnaire was developed and mailed to business chairmen or business data processing instructor at each college. If separate campuses existed, then questionnaire was sent to each campus.

3. Data was analyzed from survey results and college bulletins.

Findings

1. Over 80 percent believed every business student should be required to take introduction to data processing and almost 97 percent offered at least one course in business data processing.

2. Almost 60 percent offer at least one of three types of data processing programs being either keypunch, one-year certificate, or Associate degree. About 85 percent offer a course classified as introduction to data processing with 56.3 percent offering a segment or course in COBOL programming and 62.5 percent offering an introductory systems analysis course.

3. Unit record instruction was a waste of time according to 70 percent of the schools, with 86.7 percent believing concept on decline, 16.7 percent phasing concept out of program, and 76.7 percent not offering the course.

4. The programming courses taught, in rank order, were COBOL, RPG, and Assembler with PL/1 the least offered programming language.

5. Almost 50 percent believed that a separate course in data processing mathematics should exist.

6. About two-thirds indicated program and courses were designed to permit immediate access to data processing jobs, but 63.3 percent also believed that the programs and courses were designed for articulation into four-year institutions.

7. Over two-thirds had access to computer equipment on campus.

Calli, Joseph J.

Findings (Continued)

8. The main reasons for not offering data processing program or courses were the lack of trained teacher or equipment.

Recommendations

1. Unit record courses should be eliminated.

2. Community colleges not offering an introduction to data processing course should re-evaluate their reasons.

3. At least introduction to data processing should be offered for business students for computer background.

4. Community colleges without work experience courses in data processing should re-evaluate reasons and add work experience to program.

5. COBOL programming language should be offered by community colleges even if they do not offer any data processing programs.

Abstracter's Comments

1. Although not apparent in the study, the method of mailing questionnaire was in error. As a participant in the survey, two questionnaires were mailed for completion which seemed to indicate a problem in coding the mailings.

2. Results of questionnaires were in conflict with the college bulletins which should have been noted in the study.

Creekmore, Dorothy M., Electronic Data Processing Instruction in the Junior College, master's paper, East Texas State University, 1971, 72 pages.

Problem

To determine the status of electronic data processing instruction in selected junior colleges in the states of Arizona, Colorado, Texas, Oklahoma, and New Mexico.

Procedure

1. A questionnaire was developed and sent to eighty-one directors of data processing departments of junior colleges.

2. Personal interviews were accomplished at thirteen junior colleges of directors of data processing departments.

3. College catalogs were analyzed from fifty-three junior colleges in the five states.

4. Questionnaires, interviews, and catalogs were analyzed to determine status of data processing instruction.

Findings

1. Data processing instruction was offered at two-thirds of the junior colleges with 8 percent adding the subject within five years.

2. Approximately 48 percent of the junior colleges had a computer with the most prevelent brand being International Business Machines (IBM) and 63 percent having unit record equipment.

3. At least one programming language was taught in 47 percent of the junior colleges with the rank order of languages being FORTRAN, COBOL, and RPG.

4. Of the courses offered, 9 percent were introductory; 23 percent were unit record; 54 percent were computer-related; and 14 percent were systems design or development.

5. Manufacturer manuals, teacher-prepared handouts, and published textbooks were all used for data processing instruction.

6. The majority of the data processing courses were taught either in the business department or separate department.

Recommendations

1. The addition of data processing to the curriculum should depend on the needs of business firms and industries of the local area.

Creekmore, Dorothy M.

Recommendations (Continued)

2. More research is needed in data processing especially the follow-up of graduates.

3. All institutions involved in teacher education should offer courses in data processing with everyone having at least one course.

Abstracter's Comments

1. No information is given as to the design or source of the research instruments.

2. The follow-up study has seemed to be an easy project for master's degrees yet only one follow-up was found of data processing graduates. Implications of no follow-ups could substantiate the lack of qualified instructors or follow-ups are being done by department rather than graduate students.

3. Another advocate for a general education course on computers.

Curless, Jack C., A Comparative Analysis Between 1969 and 1973 of the Minimum Educational Requirements Necessary for Entry into 13 Types of Electronic Data Processing Positions, doctor's dissertation, Northern Illinois University, 1973, 210 pages.

Problem

To determine the policies of managers of data processing installations in the metropolitan Chicago, Illinois, area regarding the minimum educational level required for thirteen types of positions in business data processing.

Procedure

1. Literature related to educational level requirements for entry level data processing positions was reviewed. Special attention was given to relevant research and government documents pertaining to employment qualifications.

2. A survey instrument surveying thirteen types of data processing positions was constructed which was modified for second mailing in 1973. Both questionnaires went to the same firm data processing managers.

3. The 1969 and 1973 responses were descriptively analyzed and presented in narrative and tabular forms with Chi-square techniques applied to test hypothesis.

Findings

1. Analysis of the 1969 data indicated the following:

a. educational requirement would increase over next five years.

b. an increased demand for college degree for analyst and programming manager with business administration most beneficial for manager.

c. accounting, computer courses, logic, and mathematics were the most often indicated as valuable college subjects areas for preparing data processors.

d. the larger the company, the greater the chance for higher degree needed for top data processing position.

2. Analysis of the 1973 data indicated the following:

a. educational requirement would increase over next five years.

b. advanced degrees are being required for top data processors with business administration for data processing managers and analysts and computer science for the programmers.

c. accounting, computer courses, logic, mathematics, general business, and business writing were the most often indicated as valuable

Curless, Jack C.

Findings (Continued)

subject areas for preparing data processors.

3. Comparison of the 1969 and 1973 results indicated following:

a. no significant difference between the two years in present educational requirements or the five year anticipated requirements for positions.

b. no significant difference concerning the most beneficial degree; baccalaureate or advanced.

c. some significant difference as to the value of college courses with additional areas of general business and business writing.

Recommendations

1. Higher education institutions should review present programs preparing data processors and determine if business administration exposure is adequate.

2. Higher education institutions should implement programs for the preparation of data processing manager and systems analyst positions.

3. Community colleges should implement programs for the preparation of various data processing positions involving programming.

4. High schools should implement programs for the preparation of entry level positions involving operators and data entry.

Abstracter's Comments

1. More of this type of research is needed, but with many doctoral programs, the time element impedes such unless the candidate has done extensive pre-planning and others have not done similar work in the interim.

2. The thirteen job titles of the study were: data processing manager, assistant data processing manager, systems analysis manager, senior systems analyst, systems analyst, programming manager, senior, programmer, programmer, programmer trainee, operations manager, computer operator, peripheral operator, and tape librarians.

Davies, Ronald E., A Survey of High School Office Practice Classes to Determine the Degree of Data Processing Integrated as a Separate Unit of the Course, master's paper, University of Wisconsin - Whitewater, 1972, 57 pages.

Problem

To determine how data processing is currently integrated with the office practice course in Wisconsin high school whose enrollments are between 400 and 1249.

Procedure

1. Related literature was reviewed on office practice classes and data processing.

2. Questionnaire was developed which was evaluated by education and business faculty members and chairman of business department before finalization.

3. Participants for study were selected based on high school enrollments between 400 and 1249 with the limits set arbitriarily by the researcher.

4. Questionnaires were mailed with data collected as to the degree of integration of data processing into office practice.

Findings

1. More schools integrated data processing with office practice than any other courses or teaching data processing separately.

2. Twelfth graders made up the majority of the office classes.

3. The time allocated to data processing ranged from one to ten weeks with the majority from two to four weeks during the course.

4. The data processing concepts taught by majority included history of data processing and unit record equipment. Concepts of computer technology, programming, and systems analysis were included in a few courses.

5. Over 50 percent had no data processing equipment and none was available for student use.

6. The most prevelent machine was the keypunch (32.6%) with the sorter and verifier in about 10 percent of the schools.

7. Approximately 57 percent used a special textbook for teaching data processing, but no textbook was predominate. The most frequent text was Automated Data Processing (29.4%) followed by Business Data Processing (23.4%).

Davies, Ronald E.

Findings (Continued)

8. The topic covered in theory by the majority was the keypunch machine and unit record flowcharting.

9. The most common topics covered in the study of the keypunch were direct method of card punching and the program card. Approximately 75 percent of the schools including unit record flowcharting emphasized the creation of flowcharts and symbol interpretation.

Recommendations

The following areas should be studied:

a. determine which Wisconsin schools are offering a separate data processing course and its contents.

b. determine degree of data processing taught as separate office practice unit in schools of 1250 enrollment.

c. determine what other high school course include data processing and to what degree content is included.

d. needs of all Wisconsin school communities regarding data processing instruction.

e. determine how important business educators feel data processing be included in high school and what their role should be in increasing knowledge in data processing.

Abstracter's Comments

Study was informative and well conducted except for the arbitriary limits on school population size.

Dunlap, Jackson M., A Preliminary Analysis of Component Skills in Introductory FORTRAN Programming, doctor's dissertation, University of Oregon, 1975, 122 pages.

Problem

To determine the kinds of programming skills that make a student programmer, i.e. college student who is studying computer programming and is writing computer programs inconjuntion with that study.

Procedure

1. Programming skills were identified using current existing information about computer programming and objectives of computer programming courses. Syntatic elements of FORTRAN were organized into consistent categories.

2. Measures were developed from interaction of the language categories and programming skills.

3. Preliminary test of measures was developed to test programming skills.

Findings

The correlation of the test was significant with the labortary grade, final examination grade, and final course grade.

Recommendations

The following areas should be studied:

a. refinement of test of measures for study replication.

b. development of measures to assess student programmers.

c. effectiveness of structured programming in teaching student programmers.

d. diagnotic testing of students.

e. value of automated techniques in testing students.

Abstracter's Comments

Sources of information are lacking in the study with caliber level low. The following items were missing sources:

a. " .. The courses most often selected (for beginning students) are either computer literacy or computer programming. ... ". Statement was true for University of Oregon but not necessarily for the country.

Dunlap, Jackson M.

Abstracter's Comments (Continued)

b. " ... review of literature started just prior to development of computer." Researcher review of literature ends in 1975 but no start was indicated. The first published journal article used was 1960, but the computer existed before that date.

c. " ... course CS 133 FORTRAN was very similar to others in the country." No documentation to support the statement of similarity.

Eineichner, Kathleen L., A Study to Determine Programming Concepts, Problems, and Teaching Methods that Should be Included in a First-Semester Vocational COBOL Programming Course, master's paper, University of Wisconsin - Eau Claire, 1971, 56 pages.

Problem

To determine the programming concepts that should be incorporated into a first-semester COBOL programming course; programming problems associated to developed concepts; and teaching methods for implementing effectiveness in business COBOL programmer training programs.

Procedure

1. Reviewed related literature and COBOL textbooks to develop possible concepts and methods.

2. List of concepts and methods were revised and evaluated by a research methods class.

3. Wisconsin businesses which hired programmers, had training program, and used COBOL were randomly selected. Each business was contacted to determine if they would participate in the survey.

4. Data received was recorded in cards for computer tabulation.

Findings

1. International Business Machines (IBM) manufactures 75 percent of all systems in survey with some companies having more than one machine. Over 72 percent of the companies were using both disk and tape systems with 31.2 percent having 128 to 256K storage and 20.8 percent having over 512K of storage.

2. The top ten programming concepts that should be included in a COBOL course were, in rank order: record layout; programmer documentation; branching and looping; sequential file organization and access; core dumps; keypunch operations; arrays; traces; other debugging procedures; and computer console operations.

3. Based on survey response, the following items should be deleted from the COBOL course: machine and assembly language; all languages other than COBOL; and multiprocessing.

4. The programming problems should be assigned that related to the programming concepts studied in class.

5. The methods of instruction which have been the most effective for programmer training programs are the use of programmed instruction and having the programmer trainee work under the guidance of an experienced programmer.

Eineichner, Kathleen L.

Recommendations

1. The COBOL course definitely should consider the concepts of record layout, programmer documentation, branching and looping, and sequential file access with some access to computer consoles and deletion of languages other than COBOL.

2. The problems assigned should deal with those concepts which cannot be comprehended by the student without assignment of problems.

3. If available, the instructor should consider the use of a programmed instruction textbook as an aid to teaching COBOL.

4. More detailed comparisons should be made between the types of systems and their suggestions regarding beginning COBOL programming.

5. Business should be contacted frequently to gain rapport between vocational data processing teachers and business to keep content relevant.

Abstracter's Comments

1. The recommendation which states that the problems assigned should deal with those concepts which cannot be comprehended by the student without assignment of problems implies that if the concept can be comprehended then no problem need be assigned. Without some success by the student at the beginning of the course, the comprehension will not be developed in the course.

2. According to the recommendations, only four of the top ten programming concepts were utilized in the course content implying that the others either were not that important or were taught else where in the curriculum.

Engel, Gerald L., A Review and Analysis of "Curriculum '68", doctor's dissertation, Pennsylvania State University, 1974, 175 pages.

Problem

To review and analyze materials written, programs, courses, books, etc., regarding the Association of Computing Machinery (ACM) curriculum on computer science education of 1968.

Procedure

Reviewed and analyzed materials on "Curriculum '68" with following organization of materials:

a. work that lead up to and parallelled curriculum.

b. relationship to existing curriculum.

c. specific courses in curriculum.

d. subsequent work done on the curriculum.

e. summary and assessment of curriculum impact.

Findings

1. From 1971 to 1972, there were 770 degree programs with thirteen different names ranging from the highly mathematics programs to the highly business programs.

2. The courses which related to business data processing education in "Curriculum '68" generally are introduction to computing, computers and programming, programming languages, computer organization, and systems programming.

3. Surveys on the curriculum rated the programming classes highly in value and the mathematics courses low in value. Graduates recommended more practical courses.

Recommendations

1. "Curriculum '68" needs to be updated to include more practical applications for materials are too theoretical and specialized to only majors.

2. Teacher training programs are needed for college and high school teaching. With school systems acquiring computer access, students should have experiences with the computer.

Abstracter's Comments

1. The dissertation was an analysis and synthesis study, but content concentrated on the computer science area.

Engel, Gerald L.

Abstracter's Comments (Continued)

2. Just as there are several thoughts on the placement of business education programs in higher education institutions, so is the case of computer training. Although the study contained little on business aspects of the computer, the work should be considered by anyone considering a computer curriculum. The Association of Computing Machinery has a Special Interest Group on Computer Science Education (SIGCSE) which is constantly looking at the curriculum. The two-year college members deal mainly with business data processing, while the four-year college members are still computer scientists, but some are leaning to practical applications.

3. The researcher is a very dominate force in computer science education with many publications in that area.

Erickson, Ronald W., Development and Field Test of a Student-Centered Business Simulation Project for Use in Introduction to Data Processing, master's paper, University of Minnesota, 1973, 92 pages.

Problem

To develop and field test in the classroom a student-centered project in data processing that will satisfy the following requirements:

1. The project should be a real-life business simulation.

2. The project should give students experience of actually preparing, handling, and analyzing input and output documents.

3. The project should provide students with the opportunity to visit the data processing center or the computer and see the various pieces of equipment in operation of processing data from their project.

Procedure

1. Discussion was held with school district data processing director and personnel on project which led to the development of transparencies and production of needed forms based on the accounting system of the school district.

2. The project using the accounting system was field tested with class and changes were incorporated for the actual simulation project.

Findings

The project consists of the input document; procedures dealing with the system documents; keypunching and verifying of input data; visit to computer center during processing; and analysis of the resulting computer output reports.

Conclusions

1. Based on the evaluation, student interest, and project comments the simulation project appears to be an excellent instructional method.

2. Based on the simulation field test, the students gained much secondary or supplementary knowledge in the area of budgeting, accounting, and payroll.

Recommendations

A project such as this simulation should be used in an introduction to data processing courses with supplemental use in model office, office procedures, and accounting classes.

Erickson, Ronald W.

Abstractor's Comments

1. Inferences were given based on speculation of hardware changes in school district and that simulation could result in an expansion of existing course.

2. Based on my teaching of introduction to data processing and talks with other experienced teachers, the use of a simulation project seemed to keep student interest in the course and was most benefical to the student taking just one basic course in data processing.

3. If anyone would try simulation for their introduction course, best results are to coordinate simulation with examples from the text.

Fagerstrom, DuWain A., The Development of a Programmed Instructional Unit Containing Basic Concepts of Data Processing for Use in the Business Education Curriculum of Secondary Schools, doctor's dissertation, University of Northern Colorado, 1974, 230 pages.

Problem

To construct and text a programmed instructional unit containing basic concepts and terminology of data processing intended for use in high school business education programs.

Procedure

1. A general and then specific outline of material was developed to be used in the unit. Materials was reviewed to eliminate insignificant items.

2. A programmed unit was constructed, with Flesch readability test applied to the frames, using the outline as a guide. A fifty item multiple choice test was developed based on the unit material.

3. A pilot group was tested and through analysis of detailed frame time on each student, the unit was finalized.

4. A revised unit and test were given to a target population with statistical analysis of the results.

Findings

1. The times for students completing the unit varied considerably with three hours and thirty-eight minutes the average time to complete the material.

2. The scores obtained on the test indicated an increased learning by the participants with the mean score of 41.59 out of 50. Approximately 80 percent of the target group responded correctly to at least 76 percent of the test items.

3. Allowing the students to work no more than thirty minutes in any class period and continue for approximately two weeks appeared to be conducive to achievement in data processing.

4. The level of performance by students on the achievement test after the programmed unit was administered showed the student's interest was maintained throughout his/her participation.

Recommendations

1. The programmed unit and test should be used by business education teachers to stimulate interest in data processing among unselected groups of business education students.

2. The following areas should be studied:

Fagerstrom, DuWain A.

Recommendations (Continued)

a. periodic follow-up by teachers using the unit to test retention of concepts, understandings, and terminology.

b. effectiveness of the unit where students do all of the work outside of class.

c. effectiveness of programmed instruction in data processing for teaching more complex data processing concepts.

d. experimental work to compare concepts and terminology in the unit as compared to concepts learned in the regular classroom unit on data processing.

Abstracter's Comments

1. Although for the high school, the abstracter has used some of the concepts in the college classroom with good results.

2. The Flesch readability test was very interestingly used in the project. Future data processing research should consider readability of material.

3. The references in the bibliography of the study were not complete.

Friedman, Lucille T., Programmed Lessons in RPG Computer Programming for New York City High School Seniors, doctor's dissertation, New York University, 1973, 508 pages.

Problem

To develop and test a series of introductory linear programmed lessons that could be used for senior studying RPG programming in the New York City High Schools.

Procedure

1. Eight textbooks and the Board of Education proposed data processing curriculum were studied to develop performance objectives.

2. Jury was selected to whom validation would be submitted.

3. Objectives were ordered for presentation and frames were designed according to objectives, content, order of presentation, and understandability by students.

4. Frames were reviewed by International Business Machines (IBM) systems engineer.

5. Frames were submitted to students for test of lessons and then reviewed by jury from which analysis was completed.

Findings

1. The RPG unit normally taking six to eight weeks to present with lecture was cut to three to four weeks with programmed lessons.

2. The comprehension level was satisfactory for group tested. Students were satified with lesson format, and programmed lessons were not used alone as teaching device.

3. Students scored less than 70 percent on only 2 percent of the frames. On 81 percent of the frames, the student error rate was between 0 and 10 percent.

4. An analysis of incorrect responses enabled the teacher to determine areas of remedial instruction. For those students absent, the lessons enabled them to work on missed assignments with all students having tangible examples for reference.

5. The programmed instruction method of presenting information in the high school course is speedy, efficient, effective way to minimize learning time.

Recommendations

1. Through the use of media, make the programmed lessons into

Friedman, Lucille T.

Recommendations (Continued)

computer assisted instruction (CAI) format.

2. Continue with RPG lesson development to make complete course.

3. Linear programmed lessons should be adapted to give slower student more thorough frames and the more capable student the chance to branch past some frames.

Abstracter's Comments

Study was well done and has been usable to abstracter for students studying the RPGII language.

Gloster, Emily D., A Curriculum Study in Data Processing: Curriculum Development, doctor's dissertation, Nova University, 1974, 152 pages.

Problem

To develop a curriculm of data processing to be used in teacher training and business administration for implementation at Appalachian State College, Boone, NC.

Procedure

Literature and college catalogs were reviewed to determine the state of the art for data processing from which courses were developed.

Findings

Eight data processing courses should be in the curriculum of which each was outlined with recommended textbook(s):

a. Principles of Automated Data Processing

b. FORTRAN Programming

c. Electronic Data Processing (two courses)

d. COBOL Programming

e. Systems Analysis

f. Application of Computers to Research

g. Electronic Data Processing for Teachers

Recommendations

1. Business education students required to take principles of automated data processing, FORTRAN, electronic data processing (two courses), COBOL, and systems analysis.

2. Business administration students required to take electronic data processing (first course), COBOL, and systems analysis.

3. Graduate students in education required to take electronic data processing (first course) and application of computers to research.

Abstracter's Comments

1. Research methodology missing from the study.

2. The textbooks recommended were out-of-date even for the year 1974 with most books being pre-1971 texts.

Gorgone, John T., 1974 Industrial and Business Computer Technology Needs in Indiana, doctor's dissertation, Southern Illinois University - Carbondale, 1974, 190 pages.

Problem

To ascertain higher education needs in computer technology by comparing and contrasting perception of managers of data processing and perceptions of public college and university computer department faculty members regarding the educational experience required of data processing career personnel.

Procedure

1. Literature and research were reviewed related to data processing.

2. Two questionnaires were developed and submitted for pilot study to educators, practitioners, and researchers for evaluation.

3. List of data processing managers and computer faculty members developed from state manpower study.

4. Revised questionnaires were sent to educators and managers.

5. Data was recorded in cards for statistical analysis performed by using the Statistical Package for Social Sciences (SPSS).

Findings

1. The five most important computer applications for students to gain workable knowledge for job entry, based on entry position, are:

a. manager: accounts receivable/payable, financial statements, inventory control, machine utilization, and management.

b. systems analyst: accounts receivable/payable, financial statements, inventory control, payroll, and production control.

c. programmer: accounts receivable/payable, billing and invoicing, financial statements, inventory control, and payroll.

d. computer operator: accounts receivable/payable, billing and invoicing, inventory control, machine utilization, and payroll.

2. The most important type of computer programming language for the programming was compiler followed by assembler. COBOL was considered the most important compiler language for training the programmer with the faculty considering FORTRAN second and managers considering RPG second most important. BAL/ALC was the most important assembler language for training by both groups with no assembler language considered second uniformily.

Gorgone, John T.

Findings (Continued)

3. International Business Machines (IBM) was the computer brand preferred by both groups for training prospective employees. Disk operating system (DOS) was preferred and most used by both groups for training purposes with consideration for reasonable costs and adequate training facilities.

4. The student training for data processing management needs working knowledge of data communications, general programming techniques, and systems analysis, and at least a workable knowledge of documentation procedures. Basic knowledge and very limited workable knowledge is needed in sort/merge techniques for tape and disk, storage/retrieval techniques, and specific programming languages. At least basic knowledge and very limited workable knowledge is needed in disk operating systems and simulation/decision models.

5. The student training for systems analysis needs a thorough knowledge of documentation procedures and systems analysis, with workable knowledge of sort/merge techniques for tape and disk, data communications, disk operating systems, general programming techniques, specific programming languages, and simulation/decision models. At least a workable knowledge is needed with storage/retrieval techniques.

6. The student training for programming needs a thorough knowledge of storage/retrieval techniques, documentation procedures, general programming techniques, and specific programming languages. Workable knowledge is needed with sort/merge techniques for tape and disk, data communications, disk operating systems, and systems analysis, with basic understanding needed of simulation/decision models.

7. The student training for computer operations needs a workable knowledge of disk operating systems with a basic understanding and very limited workable knowledge of sort/merge techniques for tape and disk, storage/retrieval techniques, data communications, and documentation procedures. At least basic understanding and very limited workable knowledge is needed for general programming techniques with some exposure and orientation to specific programming languages and systems analysis. No exposure is needed in simulation/decision models.

8. The five most important subject areas for students to gain workable knowledge for job entry, based on entry position, are:

a. manager: communications, economic principles, finance, industrial organization, and managerial accounting.

b. systems analyst: communications, cost accounting, industrial organization, intermediate accounting, and statistics.

c. programmer: algebra-trigonometry, communications, intermediate accounting, introduction to accounting, and statistics.

Gorgone, John T.

Findings (Continued)

d. computer operator: algebra-trigonometry, communications, economic principles, industrial organization, and introduction to accounting.

Recommendations

1. Higher education should expend more effort to implement curricular changes in data processing that better reflect employer needs.

2. Installation management and systems analysis classes should study applications of accounts receivable/payable, financial statements, inventory control, production control, machine utilizations, and management.

3. Programming classes should be given assignments in accounts receivable/payable, financial statements, payroll, billing and invoicing, and inventory control.

4. Operations classes should study application areas of accounts receivable/payable, payroll, billing and invoicing, inventory control, and machine utilization.

5. COBOL should be the required compiler language with either FORTRAN or RPG the second required language. The required assembler language should be BAL/ALC.

6. A medium-scale, digital computer with a disk operating system should be used for data processing training with the manufacturer advising the manager and faculty of educational benefits for training on the equipment.

7. The data processing curricula should include a variety of options among the data processing subject areas according to the occupational goals of the students. Heavy emphasis should be placed on communication skills in the curricula but not a heavy emphasis on mathematics requirements.

8. The following areas should be studied:

a. employment success of graduates.

b. computer technology needs survey (repeated every three years).

c. required understanding level of a comprehensive list of computer technology subject areas.

d. computer educational needs of management.

e. why data processing curricular offerings at higher education institutions do not reflect general agreement among faculty and managers

Gorgone, John T.

Recommendations (Continued)

concerning course offerings that ought to be in the curricula.

f. how research can be used for curriculum changes in higher education institutions.

Abstracter's Comments

1. The findings of this study were consistent with findings of others dealing with curriculum offerings and industrial needs.

2. Although no formal curriculum was recommended in the study, the findings and recommendations are implemented in the higher education institutions where researcher was professor.

Gray, James D., Predictability of Success and Achievement Level of Data Processing Technology Students at the Two-Year Post-Secondary Level, doctor's dissertation, Georgia State University, 1974, 125 pages.

Problem

To determine whether a student's sex, age, general aptitude test battery (GATB), revised programmers aptitude test (RPAT), and aptitude test for programmer personnel (ATPP) were valid predictors of successful completion of the data processing technology programs at the two-year post-secondary level, and valid predictors of achievement level of graduating students.

Procedure

1. A list of graduates and students enrolled in the data processing technology program was obtained with associated variables of personnel and family background, high school achievement, intelligence quotient scores, entrance examination scores, and battery of test scores with the RPAT given from 1961 to 1966 and the ATPP given from 1967 to 1971.

2. Permanent records of the students were analyzed by the researcher and data recorded on cards for statistical analysis.

Findings

1. The mean scores of all graduates exceeded the scores of all non-graduates on all sections of the GATB except for perception and motor coordination.

2. The mean RPAT and ATPP scores and age were higher for all graduates.

3. The differences were only significant for intelligence, verbal, and spactial sections of the GATB, RPAT, and ATPP.

4. The means of the independent variables for all females exceeded those of all males in every case except age.

5. The single best indicator of success appeared to the ATPP test with the G-score from the GATB as the second best predictor.

6. An equation for the purpose of predicting achievement level was formulated by using the stepwise multiple regression technique as follows:

success = .00683 + .00516 (G-score on GATB) + .01170 (ATPP) - .01202 (K-score on GATB) +.01107 (V-score on GATB) + .00631 (N-score on GATB) +.00566 (Q-score on GATB) + .0144 (age) + .00337 (P-score on GATB) - .00223 (S-score on GATB).

Gray, James D.

Findings (Continued)

This equation provided the ability to predict explained portion of variance within .5839 grade points, positive and negative, with approximately 68 percent accuracy.

Recommendations

1. The aptitude test for programmer personnel and the general aptitude test battery should be given to all prospective data processing students.

2. International Business Machines norms should be used for the purpose of advising students of probable program success.

3. The GATB and ATPP should be used to predict achievement levels for student placement and the equation should be used for predicting grade point average.

4. Pertinent historical data should be maintained on students for the purpose of acquiring additional variable for validation of success and achievement.

5. Reasons for withdrawal should be determined and maintained in the files.

6. Additional entrance examinations and aptitude tests should be administered for the purpose of success indicators.

Abstracter's Comments

The information seemed to be useful in predicting success but with some schools the feasibility of administering the battery of tests should be examined.

Gunderson, David A., The Implications of the Data Processing Service Center Industry for Education and Business, doctor's dissertation, University of North Dakota, 1972, 159 pages.

Problem

To determine the current status of commercial business data processing service centers in the United States and to interpret the findings for use by businessmen, business educators, and business students.

Procedure

1. Literature from 1961 through 1971 was reviewed dealing with business data processing service centers using reference indexes.

2. Research instrument was developed and revised before sending to service bureaus in the United States.

3. Four service centers were visited for analysis.

4. Data combined from literature, interviews, and questionnaires for statistical analysis.

Findings

1. Of the about 500 centers in 1971, approximately 85 percent were traditional and 15 percent were remote process with 60 percent using one computer and 30 percent using two computers. Fourteen different manufacturer brands and models were reported with a greater variety of peripherals.

2. Revenue was mainly received from four categories: data processing services, block computer time, software sales, and remote access processing. General accounting and scientific applications were the major revenue producers with approximately sixty different services reported by one or more companies.

3. Twenty-four different languages were used with the most common being COBOL, RPG, FORTRAN, and BASIC.

4. The majority of the companies had eleven to seventy-five employees with approximately 60 percent of the firms preparing and selling software.

5. A total of 247 current problems were reported which were classified in the following eleven categories: marketing and sales, financial and growth, competition, personnel and training, software technology, operations and internal costs, equipment technology, external economic situations, image and identity, data communications, and miscellaneous.

6. The most frequently listed current trends and future opportunities for centers were, in rank order: expansion and improvement of all forms of remote access processing; facilities management services; and

Gunderson, David A.

Findings (Continued)

software giving industry and specialized application packages.

7. Centers were in dynamic condition reflecting economy.

8. Traditional revenues were retail, wholesale, and services; finance, insurance, banking, real estate, and accounting; and manufacturing thus using the languages of COBOL, RPG, and BASIC. The remote revenues were engineering and scientific; finance, insurance, banking, real estate, and accounting; and manufacturing thus using the languages of FORTRAN, BASIC, and COBOL.

Recommendations

1. Data processing service centers should unite behind trade organization of the Association of Data Processing Service Organizations, Incorporated (ADAPSO) in promoting service center concept.

2. Businesses should evaluate the potentials of the service center as an alternative to their own system.

3. Business educators should be familiar with the service center concept and provide a field trip to such for the business class.

4. The following areas should be studied:

a. historic development of the service center industry.

b. conduct survey of software, consulting, and facilities of management firms.

c. customer and service center relationships.

d. functional areas of the service center.

e. identify additional applications for present and potential service center users.

f. legal ramifications of the service center as a utility.

Abstracter's Comments

1. The organization of the findings seemed to be jumpy with one part dealing with centers and applications and then future part dealing with the same items said somewhat differently.

2. The study was informative as to the service center concept.

Hanson, Ann S., A Comprehensive Study and Synthesis of Professional Literature Pertaining to Data Processing in Secondary Education, 1969 and 1970, master's paper, University of Wisconsin - Eau Claire, 1971, 41 pages.

Problem

To make a comprehensive study and synthesis of professional literature pertaining to data processing in secondary education as revealed in business education periodicals for the period January 1969 to December 1970.

Procedure

1. A review of professional literature in data processing was made to become familiar with the nature and quality of literature and the purpose of estimating availability of literature for the study.

2. A tentative bibliography was made from the Business Education Index.

3. Data was collected and studied with thoughts classified into categories of objectives of instruction; determinants of course performance; physical equipment; teaching techniques; and teacher training.

4. The thoughts drawn from literature in major classifications were synthesized for presentation.

Findings

1. The objectives of instruction were: gaining an understanding of terminology; adding to general knowledge of data processing with emphasis on electronic data processing; introducing students to programming; helping students understand electronic data processing and automation affect for modification of the society which they live; providing students with opportunity to become familiar with and develop proficiency in operation of unit record equipment; and acquainting students with job opportunities.

2. The objectives of course content were: introductory, non-specialized course; course with hands-on experience on equipment; and integration of both in the class. Topics recommended for the course were: history of data processing, machine language, COBOL, FORTRAN, unit record equipment, flowcharting, computer usage, and programming. While hands-on experience was considered a valuable asset to course, some authors felt that following should be eliminated from course: unit record equipment, keypunch operations, and technical matters. In order to reduce costs a mobile classroom should be used with costs shared by several schools. If no data processing course taught, then material should be integrated into present course, preferably accounting after practice sets.

3. In developing a data processing course, the local area should be studied to determine needs and demands for positions. Normally a

Hanson, Ann S.

Findings (Continued)

one-semester course was adequate. The future trends suggest continuing needs for qualified teachers, using advisory committees, developing flexible programs for changing environments, and financial assistance for programs.

4. Successful course performance can be determined by ACT scores and the IBM programming aptitude tests. Computer programming aptitude, typewriting skills, and ACT achievement affect the rate of performance and achievement in data processing.

5. Students can acquire an understanding of data processing even without equipment through the use of simulation and audio-visual aids.

6. Teaching techniques discussed in literature included: teaching binary arithmetic through use of cups, pints, and quarts; introduction of flowcharting through electronic calculators; using the audio-visual approach; introduction of class projects; teaching keypunch using the machine or simulator; and using port-a-punch cards. Team teaching could be used.

7. Teachers should become familiar with data processing through faculty seminars, computer manufacturer courses, professional societies, and self-education. Teachers need from one course to twelve semester hours in data processing for knowledge to teach subject matter.

Recommendations

None

Abstracter's Comments

1. Most studies of this type do not include formal recommendations chapter for synthesis implies recommendations of the article authors and researcher.

2. Implication in developing bibliography that only Business Education Index listed business education periodicals which has generally been true.

Holt, Mary K., An Analysis of Data Processing Programs in Texas AAAA High Schools, master's paper, East Texas State University, 1971, 114 pages.

Problem

To determine current practices of teaching data processing classes in AAAA high schools in the state of Texas.

Procedure

1. A letter was sent to the vocational office education director of the Texas education agency requesting information about high schools in Texas that offered data processing programs.

2. A questionnaire was sent to twenty-five high schools offering data processing programs requesting information as to programs, courses, and teachers.

3. Data returned was tabulated for analysis.

Findings

1. Of the twenty-five schools that offered data processing program, eight started program between 1960 and 1964 and thirteen started programs between 1965 and 1970.

2. Enrollment in program was less than fifty students in seven schools; between fifty and one-hundred in ten schools; between 101 and 150 in three schools; and between 151 and 200 in one school.

3. The data processing program was part of the business education department in five schools and was housed in a separate department in sixteen schools. The majority of the schools offered two courses.

4. Pre-requisites were required in 85.7 percent of the schools with the following requirements, not all required at every school: high score on the IBM data processing aptitude test; junior/senior class standing; one-year of typewriting; good mathematics background; "C" grade average; interview with teacher/counselor and recommendations; one-year of bookkeeping; and SRA evaluation test.

5. Course content in the fourteen schools was a combination of unit record equipment and computers with seven schools using only unit record in instruction.

6. The machines used in instruction were the basic unit record machines.

7. High schools did not use any specific textbook, and various manufacturer manuals were used for instruction. Experience on machines was gained through utilizing practical assignments normally created by the instructor.

Holt, Mary K.

Findings (Continued)

8. Almost 90 percent of the teachers had computer-related work experience. College training semester hours ranged from 35.7 percent of teachers with less than six hours to 35.7 percent having more than twenty-four hours, while 46.5 percent had taught data processing for four to six years.

9. The rank order of the computer programming languages taught are: FORTRAN, COBOL, RPG, and autocoder.

10. Most of the programming projects completed by the students pertained to payroll, averaging grades, customer billing, and sales reports.

11. Films and transparencies were used extensively by schools.

12. Nineteen schools indicated that they would change their program if changes could be made with additions of equipment; teachers; hands-on experience; more screening of students; relevant instruction on equipment; training for two years for students; separating instructor from computer center work; and the deletion of unit record instruction.

Recommendations

1. More high schools should offer a data processing program.

2. Teacher training for data processing should be improved.

3. Colleges and universities should study what should be offered at the college level for data processing training.

4. More workshops on data processing should be developed for the teacher, counselor, and administrator with especially material on equipment selection.

5. Studied should be done on follow-up of existing programs and analysis of course offerings in the data processing field.

Abstracter's Comments

1. Nothing was stated as to the design of the questionnaire.

2. Analysis of existing program, courses, and teachers was good but loopholes existed based on the lack of key questions in the research instrument.

Huggett, Michael J., A Survey of the Methods Used in Incorporating Electronic Data Processing into First-Year Bookkeeping in Minnesota High Schools, master's paper, Mankato State College, 1971, 57 pages.

Problem

To determine whether the applications of electronic data processing to bookkeeping procedures were being incorporated into the teaching of the first-year bookkeeping course in Minnesota high schools.

Procedure

1. Literature was reviewed for questionnaire preparation which was tested in a pilot study.

2. The revised questionnaire was sent to business teachers based on a list compiled by the Minnesota Business Education Association and sent under a cover letter of the Minnesota Department of Education with the signature of the business education vocational program supervisor.

3. The data returned was recorded in cards for statistical analysis.

Findings

1. Data processing was incorporated mainly in bookkeeping followed by office machines and then a course by itself, with 30.4 percent not incorporating the material in any business course.

2. The larger the school, the more the chance of data processing incorporation. Smaller schools showed proportionally fewer plans for future incorporation.

3. Incorporation into bookkeeping was accomplished by using the text material method with teacher-devised material, computer terminal, and unit record also noted. If machines were available, hands-on experience was permitted.

4. The method used for data processing incorporation was selected because of teacher familiarity with funds mentioned as main deterient.

5. Incorporation normally occurred after competing the first bookkeeping cycle (49.3%) or including general concepts with each chapter plus a major unit after the first cycle (34.9%).

6. Data processing knowledge was gained by the teacher normally from coursework after teaching (41.8%) with 24 percent teaching themselves the concepts. The majority of teachers did not feel an importance of data processing in bookkeeping.

Huggett, Michael J.

Recommendations

1. High schools without data processing in any business course should evaluate curriculum.

2. If data processing not incorporated in course and the students leave the geographic area, data processing concepts should be examined to determine need of data processing.

3. Schools not using data processing concepts should contact area businesses to determine the affects, if any, on business operations.

4. Student and teacher interest in data processing should be stimulated by guest speakers and field trips.

5. Teachers without adequate data processing background should take an introduction to data processing course.

6. At the least, applications should be discussed dealing with data processing.

7. Replicate study in future to see changes of incorporation of data processing in bookkeeping and/or other courses.

Abstracter's Comments

1. Organization of paper could have been better for there was a mixing of some findings and recommendations with findings coming out as recommendation.

2. The procedures stated statistical analysis but nothing was stated as to what type or types were used. The findings imply use of frequency distribution as main statistic.

Jackson, Marilyn S., A Survey of the Data Processing Positions, Job Duties, and Personnel in Roswell, New Mexico, master's paper, Emporia Kansas State University, 1974, 65 pages.

Problem

To determine what kinds of data processing jobs, equipment, and installations are located in Roswell, New Mexico, and if need existed for data processing education at Goddard High School in Roswell with action recommendation concerning data processing education in Roswell, New Mexico.

Procedure

1. Literature on data processing education was reviewed.

2. A questionnaire was developed, checked, and compared with similar questionnaires for analysis of jobs, equipment, and installations.

3. A list of installations was developed for use in the study by contacting computer manufacturers.

4. Interviews were arranged and conducted with data processing managers and employees of firms known to be using computer equipment and firms using peripheral equipment and data processing related forms.

5. The data collected from the interveiws were recorded on the questionnaires for tabulation and analysis.

Findings

1. The types of businesses using data processing were classified as financial, industrial, medical, educational, governmental, and computer services.

2. The most frequently used language was COBOL followed by RPG.

3. The supply of personnel for positions was rated adequate by 44.4 percent of companies while another 44.4 percent gave no opinion.

4. The main source of personnel appears to be hiring and training within the company with the second source being the hiring of experienced personnel from other companies.

5. While 33 percent of the companies responded that education was definitely used as promotion criterion, 44 percent stated that education had some affect om promotion.

6. Almost 60 percent of the managers anticipated additional personnel, equipment, and higher salaries in the next three to five years with data processing having a generally positive outlook.

7. All managers interviewed preferred to hired personnel with a

Jackson, Marilyn S.

Findings (Continued)

basic knowledge of data processing.

8. The age and experience of data processing personnel varied greatly in the Roswell area, but approximately 53 percent of the workers were under thirty years of age, and 42 percent had one to nine years experience in their current position.

9. Approximately 48 percent of the data processing personnel had obtained their job through inquiry and application.

Recommendations

1. A one-semester introduction to data processing course should be implemented to give basic information on unit record equipment and the computer with COBOL and RPG languages studied.

2. Part of the introduction to data processing course should be career information on the job available, and material should be presented on schools which could be attended for future training.

3. Due to the growth of the Roswell data processing facilities, a future study should be conducted to determine the need for a vocational data processing program.

Abstracter's Comments

1. The study was a typical survey which should be done in an area anticipating data processing instruction.

2. The survey instrument design was adequate for mailing, but the researcher interviewed the population for greatest participation in the study.

James, Daniel J., An Analysis of Community College Administrators' and Community College Data Processing Teachers' Opinions as They Relate to Qualifications and Specific Teaching Difficulties in The State of Illinois, doctor's dissertation, Indiana University, 1972, 118 pages.

Problem

To investigate community college administrators' and community college data processing teachers' opinions as they relate to qualifications necessary to teach data processing and rating specific difficulties involved in teaching data processing at the community college level.

Procedure

1. Two questionnaires were developed and utilized dealing with qualifications and difficulties. Both groups responded to identical groups of questions: one to determine opinions concerning qualifications to teach and the other to determine specified difficulties and problems.

2. Teachers and administrators were identified by personal contact at each of the Illinois community colleges offering occupational computer curriculum.

3. Data was recorded in cards for statistical analysis using programs from the Indiana University computer center.

Findings

1. The typical community college data processing teacher was a male college graduate employed in present position 2.8 years who received his highest degree since 1965 and was less than thirty-five year old when first employed. About 50 percent had at least a master's degree with undergraduate degree in some aspect of business. Three out of four teachers had completed some intensive manufacturer training. About 85 percent had previous teaching experience but usually less than four years prior to present position. Over 60 percent entered data processing teaching directly from some field of non-teaching employment. Approximately 85 percent had data processing experience in industry. Even with degree, most expressed the opinion that the college degree was not necessary to perform their function.

2. No data processing teacher had an undergraduate degree with a major in data processing or computer science.

3. Teachers (55%) and administrators (61%) indicated that a college degree should not be necessary to teaching data processing at the community college level.

4. A significant positive relationship was calculated between data processing teachers and administrators in the way they ranked areas of instruction identified as providing helpful knowledge for teachers.

James, Daniel J.

Findings (Continued)

Both agreed to ranking of programming and systems analysis, one and two, respectively. Other key areas were systems design, introduction to data processing, installation management, accounting, machine operations, mathematics, keypunching, and unit record.

5. Teachers (65%) and administrators (80%) believed that data processing teachers should received college/university training.

6. As to rating specific courses/equivalent knowledge from business experience, teachers and administrators agreed on all except systems design, which the administrators thought was absolutely necessary and the teacher thought was extremely helpful. Programming and systems analysis was considered absolutely necessary with installation management and machine operations extremely helpful and keypunch helpful by both groups.

7. A significant positive relationship was obtained between data processing teachers and administrators on the way they ranked specified teaching difficulties. Main difficulties were keeping up-to-date with technological changes, inadequate textbooks/manuals, inadequate student background and evaluation of students, lack of computer time, and inadequate visual aids.

8. There was significant differences between the way teachers and administrators rated four specified teaching problem areas. Differences were on testing and grading, lesson planning, organizing class work, and accounting for individual differences.

Recommendations

The following areas should be studied:

a. determine the possibility of isolating identifiable factors common to successful data processing teachers.

b. determine the difference in personality characteristics of data processing teachers and other community college teachers.

c. determine teachers and administrators agreement with employers as to what should be taught.

d. student and administrator rating of data processing teachers.

Abstracter's Comments

1. Based on knowledge of Illinois community colleges during the period of the study, the degree was more important than work experience in hiring data processing instructors. This held only up to the master's degree. Most community colleges were skeptical of doctor's degree without

James, Daniel J.

Abstracter's Comments (Continued)

practical experience.

2. Based on informal talks with community college teachers during this time, they believed that administrators had problems defining data processing and components. College administrators were typical of management of corporations as to data processing knowledge.

Jenkins, Robert B., A Follow-up Study of 1968-1972 Business Data Processing Graduates of Two-Year Degree and Certificated Programs in the Two State Supported Technical Colleges of Utah, master's paper, Utah State University, 1973, 72 pages.

Problem

To provide information for guidance and counseling and implications for curriculum revision by conducting a survey of the job status of graduates from the two-year Associate degree business data processing programs at Utah Technical Colleges at Provo and Salt Lake City for the years 1968-1972.

Procedure

1. A questionnaire was devised and criticized by five graduates before finalization.

2. Alumni lists and permanent record information provided mailing lists of population.

3. Data was collected and kept separate by the two schools for statistical analysis.

Findings

1. Provo had 84 percent of graduates working, while Salt Lake City had 92 percent working. In both cases, 50 percent were employed in data processing.

2. Job finding was conducted in a variety of manners and there was no concentration of job titles in either group.

3. The following activities were performed on the job by at least 50 percent of the Provo graduates: punch cards, verify cards, sort cards, operate computer, operate computer console, use random access device, and operate high speed printer. The following activities were performed on the job by at least 50 percent of the Salt Lake City graduates: punch cards, program preparation, analyze flow of data, make flowcharts, prepare documentation, confer about forms design, operate computer, operate computer console, use random access device, operate high speed printer, test sample routines, debug programs, and monitor computer console.

4. The following activities received multiple responses as to the three duties most frequently performed by Provo graduates: punch and verify cards, program preparation, and operate computer and keyplex. The following activities received multiple responses as to the three duties most frequently performed by Salt Lake City graduates: punch cards, program preparation, analyze flow of data, analyze system, prepare documentation, schedule computer time, confer about problems on running computer, operate computer, test sample routines, debug computer programs, coding programs, and control language.

Jenkins, Robert B.

Findings (Continued)

5. Salaries for Provo were grouped in two ranges: $300-499 and $600-699 monthly. Salaries for Salt Lake City were grouped in two ranges: $500-599 and $700 and above monthly.

6. Graduates in both places were employed in varying sizes of firms with International Business Machines (IBM) the most frequently used machinery. Most indicated that they learned the job mainly while working under supervision at the company.

7. The educational experiences most helpful to the Provo graduate were accounting, keypunch, and programming, while Salt Lake City graduates used programming, operating computer, accounting, mathematics, COBOL, BAL, and basic computer concepts. Both groups found general education the least helpful.

8. Provo graduates recommended future students work on larger system and have more programming classes; Salt Lake City graduates recommended work on disk and tape, on-the-job training, control language, and systems analysis.

Recommendations

1. Curriculum should be updated to third generation hardware and software. Programs should meet area needs.

2. Programs should be consolidated because of smallness in size.

3. Graduates need to use variety of methods and sources in job placement. Salary expectations should be discussed with graduates.

4. General education should be evaluated in the programs as to content and relevance.

5. Job definitions and tasks should be surveyed for the area.

6. With variety of firms and equipment, instruction should be general but directed to the predominant equipment in the area.

Abstracter's Comments

1. More analysis should have been done on the questionnaire. Some items were excellent while others were wordy. Question content implied IBM equipment.

2. More follow-up studies needed in data processing.

3. The study was generally well done.

Joslin, Edward O., Computer Education: College Offerings and Industry's Requirements, doctor's dissertation, The George Washington University, 1972, 130 pages.

Problem

To determine if colleges are providing enough of the proper data processing oriented graduates to satisfy industry's needs.

Procedure

1. Questionnaire was developed for two populations, schools and industry, to determine computer-oriented courses being offered and students enrolled and to determine computer background college recruiters are seeking in graduates hired and the adequancy of the graduates computer-oriented background.

2. The school questionnaire was tested by two hundred schools for revisions before being sent nationally and selected industries tested their questionnaire before mailing.

3. The results were tabulated and the findings were compared with selected literature.

Findings

1. The course requirements sought by industry vary with the position to be filled, but in general, industry would prefer that the graduates hired have a broad background in the concepts of a computer and peripheral equipment; be familiar with typical computer applications; and have an awareness of problems of managing a computer and making a computer work for the manager. Except in a few cases, industry was not overly interested in hirees knowing how to program a computer nor in being familiar with advanced computer concepts.

2. There are approximately enough graduates available to industry with knowledge about computers. The status seemed to be balanced with no surplus or shortage specified.

3. There is an endless variety of computer courses being offered in colleges. Almost any conceivable course relating to comptuers can be found at one college or another. While many colleges offer only an introduction to computers or computer survey course, several large colleges offer fifty or more different courses. The most offered course was introduction to data processing and second offered was introduction to programming.

4. Although a variety of courses are being offered, industry seems content with a broad knowledge of computers and applications.

Recommendations

1. Colleges should look at their present curriculum and consult with industry to determine any re-directions.

Joslin, Edward O.

Recommendations (Continued)

2. The following course offerings should be considered by schools:

a. a one-semester computers and society course for general education.

b. a two-semester introduction to data processing sequence for students going into industry.

c. a minor in computers consisting of four to six courses utilizing the two-semester introduction sequence, an introductory software course, and FORTRAN or COBOL, with the other courses based on the student's interests.

d. a major in computers consisting of eight to twelve courses.

3. The following areas should be studied:

a. study similar to this conducted by national organization.

b. follow-up of graduates in data processing programs.

c. number of computer graduates needed by industry.

d. who sets the computer education standards.

Abstracter's Comments

1. The method of determining the selected literature was missing.

2. The study results seemed very general or shallow leaving much omitted or much to be read into the material.

Litecky, Charles R., A Study of Errors, Error-Proneness, and Error Diagnosis of Programming Languages with Special Reference to COBOL, doctor's dissertation, University of Minnesota, 1974, 192 pages.

Problem

To provide error information for potential use to the design of student-oriented COBOL compilers and the teaching of COBOL programming; to provide quantitative error information and error-proneness for possible change in the standard COBOL language and industrial compilers; and to assess the error-proneness of design features of COBOL with possible interest in the design of new programming languages.

Procedure

1. An error classification scheme and data collection method were developed in conjunction with two samples of student COBOL programs. The error classification scheme was interatively developed from consideration of samples, and the appropriateness of the data collection methods were appraised for the study use.

2. Computer control cards in student program allowed the collection of 1,379 COBOL programming runs from seventy-three subjects.

3. Student runs were arranged in subject and chronological order and run listings were annotated with the 134 taxonomy error codes developed.

4. Annotations of the student listings were transferred to keypunch forms on error frequency according to classified categories of density, probability, proneness, diagnosis, and specific errors.

Findings

1. Error density was high with 20 percent of the error classes containing 80 percent of the total error frequency.

2. High frequency errors which should have been corrected by computer error correction algorithms were:

a. misspelling of non-structurals in PROCEDURE DIVISION.

b. hyphenation.

c. period missing.

d. undefined data-name.

e. reserved word as data-name.

f. period added.

Litecky, Charles R.

Findings (Continued)

g. data description errors.

h. multiple defined data-names.

i. invalid class in arithmetic.

j. misspellings of structural.

k. coding left of column 12.

m. invalid work delimiter, comma.

3. The error-proneness of high frequency errors was estimated by adjusting error frequency by language element usage. The following four errors were considered as error-proneness:

a. computational class requirement of arithmetic.

b. period required after 01 record-names.

c. use of commas as word delimiters.

d. period added after FD file-name.

4. The following rank order of errors were done by students:

a. identifier referenced undefined or improperly qualified.

b. bad word or source error caused compiler to lose place - attempting recovery.

c. incorrect starting column before column 12 - generation good.

d. an acceptable name does not follow level - assume filler.

e. identifier references multiply defined or improperly qualified.

f. syntax error, keyword expected and not found or period missing.

g. all arithmetic operands must be numeric, only GIVING option allows editing.

h. legitimate data-name characters are A - Z, 0 - 9, and - , coding dropped.

i. missing or misplaced period.

j. word after UPON not defined in SPECIAL-NAMES.

5. The content of specific high frequency errors to determine

Litecky, Charles R.

Findings (Continued)

implications for teaching, compiler design, and programming languages, implied that 80 percent of the COBOL spelling errors could be corrected by existing algorithms based on error classes.

Recommendations

1. The language elements should be changed in COBOL and avoided in future languages to assume accepting the four error-pronenesses from findings number three, as compiler additions.

2. The following areas should be studied;

a. relationship of diagnostic accuracy to learning programming.

b. further work on accuracy of COBOL compiler diagnostics.

Abstracter's Comments

1. Recommendations were present in the findings.

2. Although error-proneness was done on Control Data Corporation machinery, similar errors have been common generally on International Business Machines equipment.

3. The findings of the study should be used in teaching students COBOL programming. Abstracter's use of findings has helped teaching methods and explanations in COBOL programming courses.

Litteer, Loren K., Proposed Outline for Two-Semester Course in Electronic Data Processing at Wellsville High School, master's paper, Emporia Kansas State University, 1971, 61 pages.

Problem

To determine who should be eligible to enroll, what equipment and supplies should be considered necessary, and what subject matter should be considered appropriate for possible presentation in a proposed two-semester data processing course to be adopted into the curriculum of Wellsville High School.

Procedure

1. Literature was reviewed from two libraries and the personal library of the researcher in searching sources on data processing programs.

2. Information was gathered, sorted, and selected for appropriateness for the purpose of this study from which the results are directly from the literature.

Findings

1. Course outline was developed from literature for a two-semester introductory course in data processing with content similar to that recommended by the Bangs-Hillestad study.

2. The course should be available for all students in grades eleven and twelve regardless of educational background, but consideration should be given for the student's ability to show interest; to adapt to new situations; to think creatively; and to possess a general education background. No directions were found to place any distinction on student's sex.

3. Pre-requisites for the course should be a course in each of the following: business and mathematical logic.

4. Programming should emphasize familiarity with language (COBOL then autocoder), and concepts should develop ability to meet and accept changes. Hands-on experiences are highly recommended.

Recommendations

1. Wellsville high school administration should adopt a two-semester course in data processing.

2. Field trips and audio-visual aids should be used to supplement classroom materials.

3. Further studies should be done to keep the curriculum coordinated with the state of the art of data processing.

Litteer, Loren K.,

Abstracter's Comments

1. Analysis of literature type of study although limited in scope and procedures.

2. Research recommends the school adopt course but no reasons are given as to why a data processing course should be taught.

3. Procedures should have been explained more in detail for the steps were not clear creating loopholes in the procedure.

4. The literature and research materials covers about 1967 through 1970 with research limited to master's papers.

Lyon, Robert L., A Determination of the Relative Importance of Tasks Performed in Selected Entry Level Data Processing Jobs in Texas with Curricular Implications, doctor's dissertation, Texas A & M University, 1973, 106 pages.

Problem

To determine the relative importance of tasks performed by personnel in selected entry level data processing job classifications in Texas.

Procedure

1. Data processing job classifications of programmer, computer operator, and keypunch operator were selected for study.

2. A list of tasks was assembled and a four category scale established for rating by data processing supervisors, technicians, and instructors of proprietary and post secondary schools. Background data was collected on the raters.

3. Data was recorded in cards for statistical analysis.

Findings

1. At least 80 percent of the tasks showed no significant difference between groups in rating.

2. The top five tasks for the programmer were: isolate and correct programming errors discovered during testing; prepare documentation including formats and layouts for input and output media; revise and retest computer programs; analyze applications to select appropriate utility programs and subroutines; and determine most appliable programming language. Industry agreed with education on tasks one, three, and four, but preferred additional tasks of test new computer programs and analyze programming documentation, instead of the tasks listed.

3. The top five tasks for computer operators were: operate console; load programs and data cards; determine cause of machine stops and malfunctions; analyze machine operation by use of messages or displayed signals from the equipment; and adjust sequence of runs during shift for effective organization of runs. Industry agreed with education on all except task three which industry task being: select and mount disks or tapes.

4. The top five tasks for keypunch were: operate cardpunch; key alphabetic data only from source card; prepare and insert drum card; operate card verifier; and setup card punch for operations.

Recommendations

1. Technicians from each job category stressed in a vocational curriculum should be on the advisory committee as their opinions may truly reflect task importance.

Lyons, Robert L.

Recommendations (Continued)

2. A task analysis approach to curriculum development should be initiated and applied to vocational curriculum revision by both post secondary and proprietary schools.

3. A curriculum should be developed by task analysis approach so that an advisory committee of industry representatives could evaluate these tasks and, by conferring with educators, an agreement could be reached on specific task to be included in the curriculum.

4. The following areas should be studied:

a. existing post secondary and proprietary curriculum should be examined to ensure top ranked tasks are emphasis.

b. tasks should be used as basis for curriculum revision and development based on high agreement of the population on the tasks.

Abstracter's Comments

Curricular implications hazy except for general statement that tasks should be emphasized.

Miller, John E., The Comparative Effectiveness of Data Processing Programs in Proprietary and Public Post Secondary Institutions, doctor's dissertation, Ohio State University, 1973, 162 pages.

Problem

To compare the effectiveness of data processing programs in proprietary and public post secondary institutions.

Procedure

1. Population was four Ohio proprietary and public post secondary institutions which offered data processing program designed to train programmers. Proprietary schools were accredited by Association of Independent Colleges and Schools and located in same geographical area as public institutions offering same program with 1972 graduates.

2. Three different instruments were developed for targets of program completer, immediate supervisors of employed program completer, and data processing chairman. Instruments were pilot tested for revision before sending to population.

3. Data was recorded in cards for statistical analysis.

Findings

1. Only 8 percent of the program completers from proprietary institutions had any data processing work experience while over 33 percent from public institutions had experience. The average program completers age from public institution was 25.6, while the average age from proprietary institution was 22.9. None of the other variables were found to be significant in one institution type versus the other. The differences that did exists, while statistically not significant, were in the opposite direction than hypothesized in every case except for staff data processing work experience and clock hours in non-data processing classes.

2. The significant contributors to program effectiveness were data processing work experience and enrollment in a high school college preparatory program. Other variables had relatively strong correlations but based on multiple step-wise regression, their separate effects were not as significant because of work experience inter-correlations.

Recommendations

1. Program or institution flexibility scale should be developed and validated.

2. Instruments to measure essential program characteristics need to be developed which educational authorities should use for funding, accreditation, and licensing decisions.

3. Articulation is needed between educational levels dealing

Miller, John E.

Recommendations (Continued)

with courses and programs for high schools and post secondary schools.

4. Counseling and placement services are needed to give help especially to the female to enter the male dominated profession of data processing.

5. The following areas should be studied:

a. explore the "best path" into a given occupation.

b. career patterns of female data processors.

c. relationship between time and effectiveness of data processing programs.

d. supporting evidence of student-centered programming.

e. difference between high school college preparatory and non-preparatory majors for data processing program success.

f. replicate study with greater care on valid instruments and limit variables that are not so pervasive.

g. competency based teacher education selection criteria.

Abstracter's Comments

1. Study needs to be done in most areas of the country to test effectiveness of data processing programs on all levels.

2. Recommendations were vague as to if the recommendation was to teacher education in general or to data processing education.

3. Several typing errors were found in the paper but meanings for content were not disturbed.

Miller, Georgia B., A Study to Develop a Model for Data Processing Programs in the High Schools, Vocational Schools, and Community Colleges of Kentucky, doctor's dissertation, University of Kentucky, 1975, 129 pages.

Problem

To develop a model for an integrated data processing course in the high schools and post-high schools in Kentucky.

Procedure

1. A stratified, random sample was obtained from a list of secondary schools, vocational schools, and community colleges in Kentucky with student population count and school address broken into different school sizes and regions.

2. A letter was sent to selected business teachers explaining the purpose of the study and the time needed from each person.

3. The questionnaire was developed and revised before sent to the teachers. A telephone follow-up was done on a sample of the non-responding schools.

4. A minimum of one large secondary school and one vocational or community college in each geographical area was visited to observe their program with the questionnaire used for discussion.

5. A study of literature was made to ascertain the opinions and recommendations of authorities with data processing education programs of other states being reviewed.

6. The person responsible for the state data processing plans was contacted for input.

7. Data was recorded in cards for statistical analysis.

8. A data processing model was suggested for each level.

Findings

1. There was general agreement in literature that students may be prepared at the high school level for data processing positions below that of a programmer.

2. Equipment was not mandatory in teaching students except for the vocational level.

3. High schools with sufficient facilities for data processing courses generally integrate materials through modules in accounting or office practice. Nearly two-thirds of the high schools taught at least one data processing unit with 12 percent having a one-semester junior or

Findings (Continued)

senior level course. Of the unit type of data processing, 80 percent were in accounting, office practice, or office machines with the content introductory or processing of data using a text or workbook as the major teaching material. About 62 percent of the high schools were integrating data processing in business courses and 20 percent which did not have a course was planning to start courses with those having nothing planning something. The lack of equipment was given as the main reason for no courses with the lack of trained teacher given as the second most reason.

4. Post secondary schools were expected to house vocational data processing programs to prepare programers and should include introduction, programming, systems, and work experience courses. Approximately 42 percent of the post secondary schools offered one or more data processing courses. Each school had a introduction to data processing course with more than 33 percent having at least programming, data processing math, and/or systems. More than half of the data processing courses in the vocational schools were available to the high school junior or senior. Almost 80 percent of the equipment was available for full time use of students. Modules in other courses were available in 40 percent of the schools with material being introductory, processing of data, or keypunch thus being related to data entry. Data processing was integrated into accounting, introduction to business, office machines, and/or clerical practice by at least 33 percent of schools having data processing.

5. Most state departments having data processing programs available for high schools students described the programs as vocational; training keypunchers and equipment operators. Introductory courses were more prevalent with unit record being phased out except for those areas demanding unit record. Post secondary plans were geared for computer operators and programmers. Most states stressed need for accounting and communications skills and articulation with four-year schools.

Recommendations

1. Data processing should be incorporated in the business education curriculum for high school via courses, modules, and integration into other courses. Vocational programs should be initiated only based on the needs of the local community.

2. Since equipment is not needed for instruction, many instructional aids and resources should be used.

3. To avoid program duplication, advisory committee should monitor programs.

4. Post secondary school should have program to training programmers with the preliminary by-product computer orperators. Community college should work on articulation with the four-year schools.

5. Education should stay as current as possible with industry,

Miller, Georgia B.

Recommendations (Continued)

6. A procedure is needed whereby the high school student with data processing coursework can test out of introduction to data processing in college.

7. Regardless of how the content is structured, post secondary schools should incorporate the following content areas: introduction to data processing, minimum of two programming languages, systems design and development, and field project or applications course.

8. The following areas should be studied:

a. data processing equipment used in businesses and possible way of making equipment available for data processing education.

b. should high schools initiate future data processing plans.

c. teacher preparation for data processing instruction and improvements in training.

Abstracter's Comments

1. Dissertation was very informative and the model is usable for the high school setting.

2. The copy received from the University of Kentucky on loan hopefully was not the original accepted by the school for the work was ladened with very obvious typing errors.

Nichols, Dean E., An Audio-Visual Learning Package in BASIC Programming for Business Administration Students, master's paper, Pacific Lutheran University, 1973, 275 pages.

Problem

To develop an audio-visual learning package to give business administration students a computer programming language skill with a minimum of faculty resources.

Procedure

1. Literature was reviewed on the BASIC programming language and instructional methods.

2. A segmented plan was developed for implementing an audio-visual approach to the BASIC language.

3. A BASIC learning package was designed which utilized an audio-visual machine called Audiscan with the following parts to the package: defining the problem; BASIC part one; BASIC part two; and a workbook of materials which included ten projects.

Findings

A course was developed using the audio-visual machine and workbook utilizing the computer programming lanaguage BASIC.

Recommendations

To test the effectiveness of the audio-visual presentation, the learning package was used on an experimental basis Fall 1973 at Green River Community College, Auburn, WA.

Abstracter's Comments

1. The package looked good for instructional purposes and as a package test, the abstracter utilized the learning package in systems class as an example of individual prepared learning packages with positive response from students.

2. The package was hard to read because of its organization. The narrative and evaluation should have been part of the paper with having the content and workbook in the appendices.

3. The evaluation should have been part of the paper rather than recommendation for the success or failure of package is unknown.

Overton, R. Jean, Business Data Processing Curriculum in the Community Colleges and Technical Institutes and Data Processing Job Classifications in Selected Businesses and Industries in North Carolina, doctor's dissertation, University of North Carolina at Greensboro, 1973, 295 pages.

Problem

To determine the business data processing job classifications of businesses and industries in North Carolina and the knowledges and technical skills needed for each job classification; to survey the community colleges and technical institutes in North Carolina to determine the current curriculums in the business data processing education programs; and to determine how the current curriculums related to the job classifications and the knowledges and technical skills needed for each job classification.

Procedure

1. Preliminary questionnaire and interview schedule were prepared and tested in the state of Virginia.

2. The taxonomy of job classifications was developed from the North Carolina State Personnel Department and the definition of industries was prepared from the Standard Industrial Classification Manual.

3. Community colleges and technical institutes data processing chairs were interviewed about their programs.

4. Business/industry data processing managers were randomly selected for the mailing of questionnaires.

5. Data was recorded in cards for statistical analysis.

Findings

1. The main role of the schools was training for programming which was associated with need of local areas. Evening classes were offered for retraining and upgrading for adults.

2. Mathematics was a prerequisite for entry into the program in over 50 percent of the schools and the primary interest of program graduates was gainful employment.

3. The data processing chair indicated close work with counseling and placement of students.

4. Bookkeeping/accounting was the business course most frequently used for integrating data processing in community colleges with management and statistics being equally reported for technical institutes.

5. Concepts in all schools were: unit record systems, history and principles of data processing, coding and condensing data, computer

Findings (Continued)

equipment, central processing unit, registers, characteristics of core memory, and input/output controls. Flowcharting was the only performance skill receiving the majority of school responses. Other skills mentioned frequently included record layout, card design, forms design, and COBOL.

6. Programming languages offered included assembly, COBOL, FORTRAN, PL/1, RPG, and canned programs. Topics in all languages except RPG and canned programs were: flowcharting, coding and condensing data, programming instructions, systems, registers, looping, indexing, input/output controls, and debugging programs. RPG emphasized programming instructions and essentials with looping, indexing, input/output controls, random access devices, and debugging. Emphasis in canned programs was on computer applications.

7. Other courses offered were: unit record systems and equipment, data processing applications, data processing mathematics, data processing and programming systems, and field work in data processing.

8. Cooperative work experience programs were generally missing from the schools. Computer equipment was available for student use with all but one school maintaining terminals with the Triangle Universities College Computations (TUCC).

9. Approximately 50 percent of the schools did not require data processing work experience for teachers. Teachers received additional education through workshops or manufacturer schools.

10. Business/industry have at least one in-house computer or purchase computer services with video display/terminal scopes being utilized to a great extent.

11. The majority of businesses have between six and ten job classifications with computer operator, programmer, keypunch, data processing technican comprising the majority of jobs and generally the greatest turnover.

12. Managers seemed to agree that computer operators and programmers educated in the community college or technical institute were good employees, and managers were interested in hiring part-time/cooperative work experience students.

13. COBOL, RPG, and assembler were the three languages used in business/industry with the IBM programmers aptitude test used to test prospective programmers. Various aptitude tests were used in selecting keypunch operators.

14. No previous data processing experience was required of keypunch operators, data processors, computer operators, or cooperative computer programmer trainees. Experience for programmers ranged from none to thirteen to eighteen months with seven to eighteen months required

Ove_ton, R. Jean

Findings (Continued)

by 46.7 percent of the managers.

15. A high school education was required for all job classifications with a technical institute education desirable for computer operator, programmer, programmer trainee, and data processor. The four-year degree was highly desirable for analysts and managers.

16. Most classifications required general mathematics with exceptions being for data processing coordinator, keypunch supervisor, and manager. Oral and written communications were desirable for all, and introduction to business was highly recommended for all except keypunch operator and systems manager. An introduction to data processing course type was generally recommended for all workers.

17. The promotion patterns were considered normal: keypunch to keypunch supervisor or computer operator; computer operator to computer programmer; and programmer to analyst or manager. Education was a definite effect on promotion opportunities for programmer, analyst, and manager.

18. Further education would be needed of personnel based on proposed changes in hardware and software.

Recommendations

1. A plan should be developed by schools to update and modify existing programs to meet future changes by business/industry.

2. Uniform courses and titles should be established by schools to meet the needs of student and prospective employers.

3. More effort should be made to bridge the gap between academics and industry as to communications.

4. Advisory committees should be strongly utilized to provide input/output of programs.

5. An introduction to data processing and fundamental mathematics course should be offered in secondary schools for preparatory to college. The four-year college should introduce more business-oriented data processing courses. Teacher training should be developed for data processing.

6. A thorough investigation is needed in communities before establishing new data processing programs in order to avoid duplication of programs and saturation of job market with programmers.

7. The community college system should consider returning to the stand-alone computer.

Overton, R. Jean

Recommendations (Continued)

8. The following areas should be studied:

a. data processing on the secondary level.

b. selection procedures of students for data processing programs.

c. cooperative programs in data processing.

d. integrating data processing into other courses.

e. equipment and supplies needed for data processing programs in relation to other programs in school.

f. special program to train data processing jobs requiring less than a two-year education.

g. uniform titles and courses in data processing.

h. data processing for the non-data processor.

Abstracter's Comments

1. Chapters 1 and 2 were too long thus creating a wordiness.

2. The questionnaire should have been shorter or less information should have been gathered. Because of the length, some respondants might just be marking to complete the questionnaire.

3. The job classification of data processor is a person skilled in the operating of tabulating equipment meaning unit record operator.

4. Statement " ... all programming languages with the exception of ALGOL and AUTOCODER were recommended for the programmer, ... " was misleading for implication given for hundreds of languages recommended except the two mentioned. Statement would be clearer to list languages recommended.

5. Statement " ... bookkeeping/accounting was the business course mentioned most frequently in which data processing was integrated, with management and statistics being equally reported as integrated with data processing by the technical instutites ... " carried unclear meaning as to bookkeeping was the main to community college and others were in the technical institute.

Paulus, Edward W., Jr., An Analysis and Evaluation of Data Processing Education in Secondary Schools and Universities, doctor's dissertation, Northern Illinois University, 1972, 198 pages.

Problem

To establish relationships between content of high school data processing during the 1969 to 1970 school year, and number and content of university level data processing courses which high school data processing teachers included in their university preparation to teach data processing.

Procedure

1. Literature was reviewed and the survey research method was chosen for utilization in this study.

2. The population was high school introduction to data processing teachers belonging to the Society for Automation in Business Education which now is the Society of Data Educators.

3. Instrument was constructed using fifty-five items identified by Jay Christenen dissertation which was sent to population under cover letter with check box if person not qualified to answer instrument.

4. Validation of responses done through an additional survey of Illinois high schools offering introduction to data processing concepts.

5. Data was recorded in cards for statistical analysis.

Findings

1. The data processing concepts included by more than 95 percent of the data processing teachers in the introduction course were:

a. punched card serves as primary communication means between man and certain unit record equipment.

b. speed, accuracy, and capacity are computer advantages.

c. machine performs only operation described in instructions.

d. equipment and methods are tools for accomplishing business ends.

e. automated data processing performs functions originally done by mechanical operations.

f. man can do and make more use of data faster because of computer.

g. computer incorrectly programmed will not serve intended purpose.

h. everyday use of data processing continued to grow.

i. computers are useful in repetitive calculations.

Paulus, Edward W., Jr.

Findings (Continued)

j. regardless of data processing routine, following basic operations need to be performed: classifying, sorting, computing, recording, summarizing, communicating, and storing.

k. electronic data processing has changed the structure of many jobs, directly or indirectly.

l. electronic data processing frees people from some requirements and most repetitive aspects of clerical work.

2. The data processing concepts included by more than 95 percent of the data processing teachers in integrated units in non-data processing courses were:

a. punched card serves as primary communication means between man and certain unit record equipment.

b. equipment and methods are tool for accomplishing business ends.

c. speed, accuracy, and capacity are computer advantages.

d. computers are useful in repetitive calculations.

e. electronic data processing has changed the structure of many jobs, directly or indirectly.

f. man can do and make more use of data faster because of computer.

g. machine will perform only operations instructed to perform.

h. man must be able to instruct computer by means of common language media.

i. essential office activity was collecting and processing of data,

j. important functional computer component was storage.

k. automated data processing performs function originally done by mechanical operations.

l. regardless of data processing routine, following basic operations need to be performed: classifying, sorting, computing, recording, summarizing, communicating, and storing.

m. entry-level positions are available to high school students, but additional education normally needed for positions.

n. electronic data processing frees people from some requirements and most repetitive aspects of clerical work.

o. everyday use of data processing continues to grow.

Paulus, Edward W., Jr.

Findings (Continued)

3. Introduction to Data Processing teachers reported exposure to all fifty-five concepts at rates less than 85 percent. Teachers which integrated data processing reported exposures at varying degrees with forty-seven concepts given exposure at rates less than 85 percent.

4. There was no significant relationship between the number of university-level data processing courses taken by teachers and the rate at which they included essential data processing concepts.

5. For introduction teachers, the following five concepts were significantly correlated at the .01 level: data processing operations; data processing impact; software performance; arithmetic-logic calculations; and electronic data processing and the total business enterprise. The concept of information systems flow was significant at the .05 level. For teachers that integrated the concepts data processing operations and impact were significant at the .01 level and information systems flow was significant at the .05 level.

Recommendations

1. University data processing teacher education programs should concentrate on the content areas utilized in the concepts identified by Christenen and further researched in this study.

2. Because of the little relationships between university program and concepts, the universities should switch data processing emphasis to include the concepts.

3. Universities should examine data processing courses to make certain concepts are being covered in the present courses.

4. The following areas should be studied:

a. periodic refinement of concepts and content areas.

b. isolate critical background factors of high school data processing teachers that contribute to high inclusion rates of essential data processing concepts.

Abstracter's Comments

1. Some results were reported in the first chapter even before the review of literature.

2. Except as noted, the study was well done and informative.

3. The bibliographic reference for the Christenen study is:

G. Jay Christenen, Key Concepts in Automated Data Processing for High School Business Students, doctor's dissertation, Colorado State University, 1969.

Pearce, William L., Understanding Data Processing Terminology: A Study of Semantic Congruency Between Data Processors and Data Processing Users, doctor's dissertation, University of Missouri - Columbia, 1973, 282 pages.

Problem

To determine how much congruency existed between data processors and data processing users on selected data processing terms.

Procedure

1. Survey instrument was developed of background information and multiple choice test based on twenty common data processing terms, ten for determining denotative congruency level and ten for semantic differences, Terms were selected by panel of data processors and users which was modified by researcher for connotations. Pre-test was done on instrument for revisions with factor analysis on pre- and post-tests.

2. Subjects were from twenty companies of various makeups with ten data processors and ten users from each company.

3. Twelve scales were used to analyze the meaning with data statistically analyzed.

Findings

1. The mean test scores and subgroup mean scores were significantly different on the multiple choice test. The relative linear distances as computed from the semantic differential scores and the conceptual structure of data processing terms computed from semantic differential scores were significantly different.

2. The results of the denotative tests implied that terms do present user problems, even though terms might be considered common. Job classification was a significant factor in recognizing terms with highest score by systems analyst followed by supervisors, programmers, and top management. The poorest showing was done by middle management, operators, line management, and clerks. The longer the work experience the better the data processing had to gain knowledge with eleven to twenty years of experience scoring the highest. The ability to identify terms was independent of environmental factors, company size, and company experience. While differences existed in identification ability based on experience, the survey did not reveal the reason why.

4. Differences of opinions were observed on all ten semantic difference terms. Data processors disagreed with users on meaning of terms measured by semantic difference. Most significant differences occurred on COMPUTER, MULTIPROGRAMMING, REAL TIME, and SOFTWARE. Groups agreed on only one term, EXCEPTION REPORTING. Groups exhibited disagreements on at least one meaning level on other five semantic words. The three words presenting fewest problems were REAL TIME, SOFTWARE, and MULTIPROGRAMMING. Clerks and systems analysts account for a large

Pearce, William L.

Findings (Continued)

portion of differences expressed between groups, while supervisors and top management had the fewest disagreements. Company size and experience provided little evidence of influencing opinions of subjects on terms.

Recommendations

The following areas should be studied:

a. systems analysts role in communications encounters with users.

b. effective way to teach users proper meaning of computer terms.

c. middle management attitudes toward data processing.

d. continue finding critical computer terms that are in conflict with data processors and users.

e. refine semantic differential used in study.

Abstracter's Comments

1. The denotative congruency terms were: application package, audit trail, block diagram, communication link, control program, data base, direct access, hash total, master file, and time sharing. The semantic terms were: audit of system, computer, documentation, exception reporting, file maintenance, management information system, multiprogramming, real time, simulation, and software.

2. There is so much truth behind the misunderstanding of data processing terminology that has made the machine the enemy in computer utilization. Users has to be educated on the terminology just as the data processor has to be educated on some of the user terminology.

Pellegrino, James P., A Model for Evaluation of Disadvantaged Students Participating in a Computer Science Program, doctor's dissertation, University of Pittsburgh, 1971, 96 pages.

Problem

To propose a model for evaluation of the affective components of a high school computer science program for disadvantaged students.

Procedure

1. Literature was reviewed.

2. Selected population of students from Erie, Pennsylvania, schools (public and non-public eleventh and twelfth graders) based on program interest, ability to attend classes, ability in math and science based on a grade of "C" or better from grade nine to present, and qualified under Title I, ESEA financial criteria.

3. Students were tested by a series of five instruments: High School Aptitude Scale, Attitude Toward Education, the Social Attitude Scale, Attitude Toward Patriotism, and The Semantic Differential with instruments subjected to series of criteria checks and given in pre- and post-test times. All were taught an introductory computer course.

4. Data was recorded for statistical analysis.

Findings

1. Response to Attitude Toward High School group scale did not change in the level of significance from pre- to post-test, however, the data revealed an increase in negative response.

2. Attitudes Toward Patriotism remained unchanged as affective components in the program.

3. Attitude Toward Education Scale revealed significant increase in favor of structure and rigorous school practices, while Attitude Toward High School scale remained unchanged, except in specific instances, where there was an appreciable increase in negative response.

4. The positive increase in mean scores on Attitude to Computer, The Semantic Differential, based on change in knowledge level.

Recommendations

1. Attitude Toward Patriotism and Attitude Toward Society instruments be dropped from model because of no significance.

2. Attitude Toward High School stay as instrument but personal interviews used as follow-up to scale.

Pellegrino, James P.

Recommendations (Continued)

3. If more than one-half hour is needed for tests, procedure should be broken into two weeks.

4. Additional versions of the tests be given as pre- and post-tests with scales designed on a continuum.

5. The course of study should be described in behavioral terms and academic credit given for participation.

6. A job placement service should be provided to seniors in the program.

7. Guest speakers and field trips should be part of the program.

8. The school year should be used for the course with student projects involving the home high school.

9. Multi-level textbooks should be used in the program.

Abstracter's Comments

More research needs to be done relating to the disadvantaged and data processing. This is the only such found. Journal articles also seldom treat the disadvantaged area.

Phillips, Thomas G., Jr., A Comparison of the Effectiveness of a Programmed Text and a Computer-Based Display Unit Media in Teaching FORTRAN IV, doctor's dissertation, University of Missouri - Columbia, 1971, 533 pages.

Problem

To compare experimentally the relative effectiveness of two instructional media for presenting selected instructional units of a common program for teaching FORTRAN IV.

Procedure

1. A common teaching program in FORTRAN was prepared and presented by media of programmed unit and computer-based display unit.

2. A FORTRAN computer class was randomly assigned into two groups in which one spent regular class periods reading the programmed text and group two presented materials utilizing display units.

3. Measurements were obtained on each student from tests as follows: programming aptitude measured by Programmer Aptitude Test and course attitude measured by Remmer's Attitude Scale.

4. Programming data was obtained from error numbers on medium, programming rules based on four assigned programs, and programming achievement measures by performance on problems with the performance rated by panel of four judges.

5. Data was statistically analyzed.

Findings

1. Students receiving programmed instruction made significantly fewer cognitive errors than did students using display units.

2. Positive relationships between programming aptitude and achievement; between programming aptitude and attitude toward course; and between FORTRAN knowledge rules and attitude toward course were found in the group using programming instruction. Negative relationships were found between FORTRAN knowledge rules and number of errors made in programming and between programming achievement and number of cognitive errors made by the group using programmed instruction.

3. Positive relationships between programming aptitude and FORTRAN knowledge rules; between programming aptitude and achievement; and FORTRAN knowledge rules and programming achievement were found in group using display units. Negative relationships were found between programming aptitude and number of cognitive errors made; and between programming achievement and number of cognitive errors made by students in display units group.

4. The correlations between programming aptitude and FORTRAN

Phillips, Thomas G., Jr.

Findings (Continued)

knowledge rules and between programming aptitude and the number of cognitive errors made were significantly higher from display units group than the correlations for the programmed instruction group. Students in the display units group showed significantly higher relationships between knowledge of FORTRAN language rules and the number of cognitive errors made than did the student in the programmed instruction group.

Recommendations

1. While display units or programmed instruction can be used effectively to supplement classroon lectures, the media should not be used in every instances to replace the classroom teacher.

2. Computer based instruction is recommended for supplemental classroom lectures for those school which can afford the associated cost.

3. Computer based display medium be used to further study the learning process.

4. Teachers should become familiar with programmed instruction as a supplement to classroom teaching and school should make the medium available.

5. The following areas should be studied:

a. follow-up on study class to determine if computer based instruction turned out better programmers.

b. compare typewriter terminal used for computer based units to paper text method of programming instruction.

c. compare typewriter terminal and cathode ray tube (CRT) of computer display units for cognitive error differences.

d. method plus teacher lecture for effectiveness.

e. levels of programmers using study tools.

f. replicate study with different lenguage.

Abstracter's Comments

The teaching methods of programmed istruction and computer based instruction should be utilized more in teaching.

Pinneo, Robert O., A Comparative Study of Time Sharing Versus Batch Processing in the Teaching of Introductory Programming in FORTRAN, doctor's dissertation, Oregon State University, 1973, 138 pages.

Problem

To determine if the use of time sharing facilities in the teaching of introductory FORTRAN at the university level is significantly, at the 0.05 percent level, different from the use of more conventional batch processing facilities in such a class.

Procedure

1. FORTRAN students at the University of Nevada - Las Vegas were randomly assigned into two groups, one to use time sharing and the other to use batch processing.

2. Each student was administered the aptitude test for programmer personnel (ATPP), and personal data was collected on each student.

3. Three weeks of treatment with three problem assigned the students with the situation repeated during the semester constituted the data gathering procedure. A post-test problem was written in class and a general evaluation was completed at the end of the semester.

4. Data was recorded in cards for statistical analysis.

Findings

The six hypotheses tested in the study were accepted which stated that there was no difference between the control and experimental groups as measured by:

a. number of minutes required to prepare initial run on problems.

b. number of syntax errors detected for each problem.

c. number of logic errors detected for each problem.

d. total number of minutes required for a correct problem solution.

e. count of syntax and logic errors on the test problem.

f. count of syntax and logic errors on the test problem done at the end of the ninth week in the course.

Recommendations

1. Since time sharing is more costly, 2.9 to 1 cost ratio between time sharing and batch processing, economics suggest batch processing of student jobs.

2. The following areas should be studied:

Pinneo, Robert O.

Recommendations (Continued)

a. replicate with different language.

b. replicate to eliminate errors in reporting for procedures having a computer utility monitor student actions.

c. replicate with different problems.

d. time sharing in problem approach to which problems have no particular solution.

e. inter-disciplinary teams to identify and classify requisite knowledge.

f. most meaningful methods for imparting knowledge and developing and increasing the level of skills.

Abstracter's Comments

Study was well conducted except as research admitted in relying on students to report problems in their programs. Normally people are reluctant to state the truth thus discrepancies probably existed in the program reporting.

Pollack, Morris, Principal Employers' Personnel Requirements and Higher Education Course Offerings in Business Data Processing, doctor's dissertation, New York University, 1973, 367 pages.

Problem

To analyze the personnel and educational requirements of principal employers and the college course offerings in business data processing to develop criteria for planning curricula guidelines and instructional programs based upon the requirements of business firms that normally recruit college graduates.

Procedure

1. A questionnaire was designed for industry based on the New York Times advertisements, Occupational Outlook Handbook, and other questionnaires, which was evaluated by jury of data processing experts from which a pilot study was undertaken for further refinement.

2. Questionnaire was mailed to industry population taken from the College Placement Annual, 1971 edition.

3. Data was divided into ten geographic groups based on zip code to compare with proportion of responses to insure no difference in data.

4. Data processing managers were interviewed within a file mile radius of New York for record bias.

5. Education questionnaire was based almost entirely upon industry questionnaire with data gathered from schools listed in Patterson's Educational Dictionary, 1972. Questions were modified to include curriculum offerings and admission requirements, with jury evaluation and pilot done on education questionnaire.

6. Schools were interviewed within a fifty mile radius of New York for record bias.

7. Data was record in cards for statistical analysis.

Findings

1. Significant difference existed between the needs reported by employers and courses covered by colleges. Only subjects with no significant difference were higher mathematics taught at the two-year colleges in 1972 and PL/1 and cost accounting planned for inclusion in curriculum by 1975 by four-year colleges. Only topic where difference was not significant was plotter planned for inclusion in four-year college by 1975.

2. By 1972, about 50 percent of the two-year colleges were preparing entry level data processing positions and 37.3 percent of four-year colleges had programs, which should change to 46 percent by 1975.

3. Employers overwhelming preferred the Bachelor degree for the

Pollack, Morris

Findings (Continued)

position of programmer and analyst with the Associate degree second choice level.

4. Enrollment in data processing programs will increase with the four-year programs increasing substantially.

5. Employers emphasis grades and programmer's aptitude test about 60 percent in hiring; whereas, schools used grade and aptitude tests only about 22 and 13 percent, respectively, in program entrance.

6. International Business Machines (IBM) is the largest provider of equipment, but a large proportion of colleges are using obsolete equipment and languages.

7. The laboratory method produced the best results in teaching data processing students with the discussion method second best.

8. Industry ranked programming languages COBOL then assembler with colleges ranking FORTRAN, COBOL, then assembler.

9. Industry and two-year colleges ranked accounting and oral and written communications as most necessary related courses. Four-year colleges gave accounting top rank with written communications fifth and oral communications sixth. Senior colleges ranked business statistics, business organization, and management above communications.

10. Two-year colleges came the closest to industry needs. Four-year colleges stressed scientific computing; whereas, business preferred topics of documentation, operating systems, random access systems, table handling, and tape sorting.

11. Two-year colleges were generally split on advise from industry for curriculum.

Recommendations

1. Education offered programmer and analyst should prepare them with complete background of programming, systems, and related courses utilized in the business world.

2. Closer cooperation should take place between industry and school through the use of advisory committees.

3. Programming languages offered should be those most widely used rather than preferred by faculty.

4. Communications should be stressed more in the curriculum.

5. Screening devices should be used more in education.

Pollack, Morris

Recommendations (Continued)

6. Programming and systems education should be confined to a narrow theoretical approach.

7. All data processing students should be given in depth coverage of flowcharting, input/output, forms design, and documentation.

8. More internship and cooperative work experience programs should be started.

9. Business should permit schools to utilize their equipment if the school does not have up-to-date machinery.

10. Industry should keep schools informed on the screen devices used for jobs.

11. The following areas should be studied:

a. personnel requirements for small companies.

b. follow-up of personnel requirement in two years.

c. learning theory concepts for data processing.

d. internship and cooperative work experience and their effects on data processing programs.

Abstracter's Comments

Probably the best structured study of the group analyzed.

Rademacher, Robert A., Cognitive Levels in Computer Education for Business, doctor's dissertation, University of Nebraska, 1971, 166 pages.

Problem

To determine the level of intellectual abilities reflected in current introductory textbooks in instructional areas of computer fundamentals, COBOL and FORTRAN programming, and information systems and the relationship between these textbooks and educational objectives recommended by a panel of computer professionals.

Procedure

1. The textbook population was defined from which the sample for the study was taken consisting of twenty-four of the possible fifty-four textbooks.

2. The rating techniques from Bloom's Taxonomy of Educational Objectives - Cognitive Domain were used to collect data from the books.

3. An instrument was developed based on the objectives from the books to collect data from the computer professionals.

4. Data was recorded in cards for statistical analysis.

Findings

1. The major topics of computer fundamental texts were as follows: hardware (28%); software (25%); general data processing (24%); and management considerations (19%). Hardware and software were relatively consistent while the other two areas varied substantially from book to book.

2. The major topics of programming texts were: fundamentals (56%); general data processing (16%); and advanced techniques (15%). Content to fundamental and advanced topics varied percentage-wise in most books.

3. The major topics of systems texts were: theory and components (46%); analysis and design (26%); applications (17%); and quantitative topics (10%). The greatest variation came between quantitative and application topics.

4. Based on the taxonomy of the objectives, the following ratings were established: memory (49.1%), comprehension (25.9%), application (17.8%), analysis (3.7%), synthesis (2.8%), and evaluation (0.7%). The taxonomy was broken into four parts with analysis, synthesis, and evaluation combined in most analysis. The ratings, based on a one to six scale, averaged 1.87 with range from 1.09 to 2.68, mean 1.76, and median 1.63.

5. Educators selected statements in all three areas at slightly higher level than practitioners. The following three statements were the most often selected fundamental statements: provide general orientation to the computer; knowledge of data processing terminology used in

Rademacher, Robert A.

Findings (Continued)

business/industry; and knowledge of features of various hardware types. The following three statements were the most often selected programming statements: skill in constructing flowcharts of defined problems; practice in using FORTRAN statements for logic and control; and ability to use COBOL in solution of defined problems. The following three statements were the most often selected systems statements: able to identify and explain difference between the duties of programmer and analyst; ability to write system reports that are easily understood by laymen as well as computer professionals; and knowledge of possible ways of utilizing equipment in meeting needs of a system.

6. The textbook prefaces represented the level of cognition found in the book. Textbook questions, exercises, and problems were developed at different cognitive levels for textbooks used in three areas and the statement of educational objectives stresses significantly different taxonomy levels of cognition.

Recommendations

1. The most advantageous arrangement of cognitive learning for developing relevant and applicable computer courses was not determined but results led researcher to following suggestion: fundamentals course should have 40 percent memory, 30 percent comprehension, 20 percent application, and remainder in other three areas; programming course should have 20 percent memory, 20 percent comprehension, 40 percent application, and remainder in other three areas; and systems should have the objectives spread in four equal areas of memory, comprehension, application, and other three areas.

2. The taxonomy should be used to make cognitive analysis of curricular materials.

3. Appropriate statements of educational objectives should be developed for separate courses.

4. Curriculum decision makers should select computer textbooks with care when cognition is considered.

5. Inservice training and summer workshops could provide additional impetus for developing appropriate objectives and ranking of curricular materials.

6. The taxonomy and its concern for quality of thought should not be considered a total philosophy of education.

7. The role of the systems analysis and type and content of courses leading to such employment should be clarified and developed.

8. The following areas should be studied:

Rademacher, Robert A.

Recommendations (Continued)

a. identify cognitive levels currently encouraged in courses.

b. curriculum effect on materials and methods based on varied levels of cognition.

c. whether teachers who study the taxomony offer students a greater variety of intellectual experiences.

d. methods of this study refined and replicated.

Abstracter's Comments

The study should be done again now for the structure of texts have changed and the learning level in the business computer education has greatly changed.

Rall, DeForest J., Data Processing for Non-Data Processors, doctor's dissertation, University of North Dakota, 1974, 175 pages.

Problem

To identify understandings about electronic data processing and computer applications which should be developed as part of the general education curriculum in secondary schools.

Procedures

1. Population was selected from American Records Management Association from ten categories: education, financial, government, health services, insurance, judicial and law, manufacturing in general, sales and services, transportation, and utilities (gas, electricity, water, and telephone).

2. Two personal interviews were conducted with each of the ten groups for input to survey instrument leading to eight-five questions with four understanding levels.

3. Questionnaire was sent to 250 randomly selected individuals of which twenty-five came from each of the ten groups.

4. Data was coded into cards for utilization of statistics of frequency and analysis of variance. Computer programs were taken from the Statistical Package for Social Sciences (SPSS).

Findings

1. No understanding listed was deemed essential in order to effectively function in society.

2. Twenty-three understandings every student should know (in rank order):

a. job opportunities in data processing.

b. social implications of large central data base with credit information based on social security number.

c. fundamental limitations of computers and computer systems.

d. social implications of large central government data base with detailed information about everyone who has a social security number.

e. how computerized data base can contribute to evasion of privacy.

f. reasons for increased demands by management for more data interpretation during current fiscal period.

g. social implications of large central data base by Federal

Rall, DeForest J.

Findings (Continued)

Bureau of Investigation and Central Intelligence Agency containing information about individuals they considered necessary.

h. need for and implications of retraining for new jobs caused by automation.

i. term "computer hardware".

j. term "computer software".

k. reliability of computers.

l. security of information stored electronically.

m. implications of computer applications in credit information.

n. programming in general.

o. implications of computer applications in business systems.

p. vocabulary of electronic data processing and computers.

q. social implications of computer on labor market.

r. term "magnetic tape storage".

s. "cybernetic discipline" as applied to electronic data processing and computers and its potential effect on everyday lives.

t. term "central processing unit (CPU)".

u. term "computer output to microfilm (COM)".

v. term "cathode ray tube (CRT)".

w. flowcharts and flowcharting.

3. Thirty-nine understandings received ratings which revealed to be a student's advantage to develop them if time was available (in rank order):

a. term "optical character recognition (OCR)".

b. implications of computer applications in securing employment.

c. term "magnetic ink character recognition (MICR)".

d. computer-related numbering system.

e. history of electronic data processing and computers.

Rall, DeForest J.

Findings (Continued)

f. data processing service bureaus and their functions/services.

g. functions and uses of input devices.

h. fundamental uses of mini-computer.

i. functions and uses of terminals.

j. data communications via telephone lines.

k. implications of computer applications in government.

l. implications of computer applications in banking.

m. elements of programming.

n. eighty column punched card.

o. time-sharing computer systems.

p. implications of computer applications in law enforcement.

q. functions and uses of remote terminals.

r. functions and uses of keypunch cards.

s. need for awareness of differences in sizes and capacities of computers.

t. functions of mini-computers connected to larger computers.

u. conversion of one numbering system to another.

v. implications of computer applications in education.

w. data communications via microwave.

x. functions and uses of storage disks.

y. functions and uses of printers.

z. functions and uses of computer consoles.

aa. ninty-six column punched card.

bb. functions and uses of tape punch.

cc. differences in speeds of modern computers.

dd. mark sense forms.

Rall, DeForest J.

Findings (Continued)

ee. functions and uses of storage drums.

ff. implications of computer applications in manufacturing.

gg. fundamentals of Hollerith code.

hh. implications of computer applications in investments.

ii. functions and uses of sorters.

jj. implications of computer applications in insurance.

kk. term "large-scale integrated circuit storage (LSI)".

ll. functions and uses of verifiers.

mm. voice communications with computers.

Recommendations

1. The social implications of computers and large centralized data bases should be included for all students.

2. High school students should develop a terminology of computers.

3. The general education computer class should not teach a computer language but only an understanding of programming in general.

4. If the history of electronic data processing is taught, the topic should be covered briefly with few details.

5. If class time permits, the development of understanding about input/output equipment should be included.

6. Educators should take a general approach to data processing for general education and use keypunch, eighty column card or programming language as media to develop understanding.

7. There is a need to correct the misconceptions about the "mysterious magic box" of the computer.

8. A greater effort should be given to create an awareness of job opportunities in electronic data processing.

9. The application of the computer to the various disciplines may be taught in those specialized curriculum areas. All students should be taught about credit information and business applications.

10. An introduction to data processing course should be required for general education.

Rall, DeForest J.

Abstracter's Comments

1. The computer printouts listing the study statistics were hard to read.

2. The list of topics which revealed items to be a student's advantage to develop had an error. Item hh, implications of computer applications in investments was written as implications of computer applications in insurance, which was a repeat of item jj. The items seemed to indicate just a typing mistake for other areas were correct.

3. The term COM stands for computer output microfilm not computer output to microfilm as specified in the research.

Reynolds, Robert J., An Analysis of the Business Data Processing Programs and Facilities of the Illinois Junior Colleges with Curricular Implications for Teacher-Education Institutions, doctor's dissertation, Southern Illinois University - Carbondale, 1971, 149 pages.

Problem

To locate and evaluate the existing business data processing programs in the Illinois junior colleges and to analyze and evaluate the educational preparation and work experience backgrounds of the individuals currently teaching business data processing courses in these institutions.

Procedure

1. A list of junior colleges in Illinois was developed based on educational directory and consultation with state department of education.

2. A letter was sent to junior college administrators for names of the data processing chairman and full and part-time data processing teachers.

3. College catalogs were collected to survey the contents of listed programs.

4. Two questionnaires were developed and revised with consultation, one for administrators and one for data processing teachers.

5. A pilot test was done at the Vocational Technical Institute at Southern Illinois University - Carbondale to finalize questionnaires.

6. The questionnaires were mailed to chairmen and teachers with results tabulated on cards for computer analysis.

7. Comparisons were made between data gathered and criteria for programs set forth in the Bangs-Hillestad study and National Advisory Committee on Data Processing of the American Association of Junior Colleges.

Findings

1. Almost 75 percent of Illinois junior colleges were operating data processing programs at the time of this study with 10 percent planning to initiate two-year programs and less than 10 percent hoping for new one-year programs.

2. The most likely curriculum changes to take place over the next five years will be to increase emphasis on programming languages, systems, teleprocessing, cooperative work training, and related-business courses.

3. The two-year program primary objective was vocational/career preparation as programmers. The one-year program primary objective was

Reynolds, Robert J.

Findings (Continued)

to train computer and peripheral equipment operators. In comparison with the Bangs-Hillestad study and the American Association of Junior Colleges, the overwhelming majority met or exceeded suggested curriculum, but deficiencies were shown in programming, systems, and cooperative work training.

4. Over 70 percent of the junior colleges utilized International Business Machines (IBM) equipment with future acquisitions considered for teleprocessing and overall better machinery.

5. Over 41 percent of the junior colleges looked for teachers in business and industry with most desiring an advanced degree, data processing experience, and background in accounting work. Part-time teachers were hired based on bachelor degree and experience.

6. Almost 90 percent of the data processing teachers held at least one college degree with the most frequent major in business. The most frequent way of obtaining specialized backgrounds were manufacturers schools, work experience, on-the-job training, college classes, and self-study.

7. Over 91 percent of the data processing teachers had work experience in data processing and were interested in pursuing a degree in business data processing.

8. During the period 1971 through 1975, 106 additional full-time data processing teachers will be needed by the thirty-six participating junior colleges.

Recommendations

1. Administrators should improve articulation between junior and senior colleges for the transfer of Associate degree students and determine the most appropriate course of study for the data processing teachers on the junior college level.

2. Teachers should take additional courses in business data processing and look for work experience to prepare better for teaching.

3. A program for teacher preparation for data processing on the junior college level should be initiated in the central/southern part of the state of Illinois; a program exists in the northern part of Illinois.

4. The following areas should be studied:

a. job opportunities for junior college graduates in Illinois.

b. follow-up of data processing graduate to determine program success.

Reynold, Robert J.

Recommendations (Continued)

c. determine education and faculty of Illinois high schools as to possibility of data processing taught on that level.

d. determine standard courses in a data processing program.

Abstracter's Comments

The findings and recommendations are consistent with personal knowledge of the Illinois junior colleges during 1971 and 1972.

Ritch, Paul A., A Study of the Aptitude Test for Programmer Personnel as a Predictor of Success for Students Majoring in Computer Science and Data Processing at the Chattanooga State Technical Institute, doctor's dissertation, University of Tennessee, 1973, 107 pages.

Problem

To develop a prediction model based upon the Chattanooga State Technical Institute's specific history which, along with the aptitude instrument, can be used in counseling students in regard to their success potential in computer science and data processing programs.

Procedure

1. Examined student record file from September 1965 to August 1972 for information on program dropouts and graduates to obtain the following: name, identification data, aptitude test for programmer personnel (ATPP) score, Otis Quick-Scoring Mental Abilities score, SAT-mathematics score, and history of computer courses.

2. Subsample was taken of graduates during period June 1971 to August 1972 to measure job success as rated by employers during the first six months on the job.

3. Data was recorded in cards for statistical analysis.

Findings

1. At the confidence level of 90 percent for those completing the program, the following minimum can be used as predictors: ATPP score of 35; Otis score of 110; and SAT-mathematics score of 12.

2. The ATPP was a minimal predictor of job success based on the subsample.

3. Based on correlation, the SAT-mathematics score was more slightly useful as a predictor of success than the ATPP and Otis scores.

Recommendations

1. A standardization of testing and grading practices among teachers at the Chattanooga Technical Institute would be valuable.

2. The following areas should be studied:

a. use of different variables to predict data processing success.

b. ATPP and its subtests as success predictors in data processing.

c. criteria of supervisors with regard to job success.

d. ATPP, Otis, and SAT-mathematics scores are success predictors

Ritch, Paul A.

Recommendations (Continued)

in individual data processing courses.

e. human dimensions which have implications for success which would be beneficial in predicting job success for programmers.

f. variables of motivation and determination and their impact upon success/failure of individuals in data processing.

Abstracter's Comments

The aptitude test for programmer personnel has been the main test used as a screening device for entrance into the data processing field.

Robb, James A., A Study in the Selection of Predictors for Success in an Electronic Data Processing Course, doctor's dissertation, Southern Illinois University - Carbondale, 1974, 50 pages.

Problem

To determine personality factors which could be used for the counseling of students interested in a career in the programming field.

Procedure

1. Selected two instruments, ACT for cognitive and 16 Personality Factor Questionnaire (16PF) for non-cognitive personality traits, for identification of personality factors in counseling and data processing success.

2. Subjects were selected from the School of Technical Careers at Southern Illinois University - Carbondale which were tested.

3. Data was recorded in cards for statistical analysis using the Statistical Package for Social Sciences (SPSS).

Findings

1. None of the 16PF variables taken individually had a significantly high correlation with criterion to be considered significant. Four variables, relaxed versus tense; practical versus imaginative; tough-minded versus tenderminded; and conservative versus experimenting, considered collectively as selected group were significant predictors.

2. When two or more variables were considered as group, each group was found to be significant except those containing two factors of undisciplined self-conflict versus controlled and self-assured versus apprehensive.

3. All ACT variables except natural science correlated sufficiently to be considered significant. Mathematics alone was a better predictor than any combination of ACT scores except the composite score.

Recommendations

1. Students with above average ACT math, composite, and social science are encourages to explore data processing unless scores in the other two ACT areas are quite low.

2. Students with a good ACT score and one or more of the four variables specified in findings number one, preferably all four, are encouraged to student data processing.

3. Students lacking recommendations one and two criteria should be cautioned in studying data processing.

4. The following areas should be studied:

Robb, James A.

Recommendations (Continued)

a. replicate study with larger sample.

b. different sets or combination of instruments used for success predictors.

c. four personality factors used as predictors in problem solving.

Abstracter's Comments

1. The groups used were small thus possibility of misleading statistics of queues.

2. Format of the study was as described in educational research classes.

Roloff, H. Alfred, A Payroll Data Processing Project, master's paper, University of Georgia, 1972, 90 pages.

Problem

To develop a set of computer programs that will provide calculations and printed reports for computer processing of payroll.

Procedure

1. Literature was reviewed concerning the most used data processing applications of which payroll was normally number one.

2. Prepared payroll application following the computer problem solving steps as follows: analyze the problem; prepare flowcharts, write program code; keypunch program; desk check the program; syntax check the program; debug the program and test data; volume test the program with data; and operational stage.

3. Revisions were done in the model to have application used handle hourly worker only and have 250 people on the master file.

Findings

1. With the program written in FORTRAN, student opinion of the language changed from one implying only scientific programming to a language also suitable for business applications.

2. Project was beneficial to students for they learned about the language used and how to manage a large data file on disk.

Recommendations

None

Abstracter's Comments

1. Thirteen pages constitute the paper with the remainder the program lists and associated project information.

2. The project programs lacked internal documentation which is essential in programming.

3. This type of project has been useful in beginning classes and should be used in the introduction to data processing class.

4. As a project, the paper was well done.

Rowe, William N., A Study of Methods of Teaching Basic Data Processing on the High School Level, master's paper, Northern Michigan University, 1971, 38 pages.

Problem

To determine the best data processing teaching methods.

Procedure

1. The Business Education Index from 1960 to 1969 was studied, and thirty articles were selected on the office machines area dealing with data processing. Only works available in the Northern Michigan University library were considered for analysis.

2. Articles were summaried and brought together into three classes: methods and course content, equipment, and materials.

Findings

1. Many different methods and contents were suggested for teaching ranging from courses related to data processing and a part of courses already existing to courses which were devoted entirely to teaching data processing.

2. The entire range existed in content from the general to complete and from basic concepts to programming. Some courses used equipment, while other courses were lacking equipment.

3. Subject topics suggested in literature were introduction to data processing, instruction on the collator, training on the card sorter, and group consisting of card format, keypunching, and interpreting.

4. The equipment found most in the high schools were, in rank order: keypunch, sorter and accounting machine, reproducer, and other unit record equipment.

5. The materials used in teaching depended somewhat on teaching method. Manufacturer information was most often recommended teaching material followed by transparency sets, practice sets, and textbooks.

Recommendations

1. All high schools should have some type of introduction to data processing course.

2. If possible, the data processing course should be a separate course with hands-on experiences.

3. Because of the lack of textbook materials, supplementary aids must be developed for use.

4. If equipment is not available, field trips should be taken for computer equipment awareness.

Rowe, William N.

Abstracter's Comments

1. As a time constrained paper, adequate coverage was given of the material and content.

2. The research material was too limited, thus the paper should be discounted.

Rudolph, Eleanore L., A Survey of Data Processing and Computer Use in Instruction in Illinois Secondary Schools, doctor's dissertation, Northern Illinois University, 1971, 115 pages.

Problem

To investigate how Illinois secondary schools use computers and how much of this use is for instruction.

Procedure

1. Literature on the topic was reviewed.

2. Modification was done on a survey instrument used by the American Institutes for Research entitled, "Survey of Computing Activities in Secondary Schools."

3. Questionnaire and cover letter mailed to all secondary school principals in Illinois with interview technique used for Chicago district.

4. Collected data was divided into groups for statistical analysis.

Findings

1. Approximately 43 percent of the schools used the computer with 40 percent for administration only, 5 percent for instruction only, and 54.3 percent using the machine in both areas. The computer use was concentrated in the metropolitan Chicago area. Schools with over 900 students were more likely to have computer. The presence of state universities had no noticeable influences on computer use. Equipment funding was by local source. About three out of every seven schools used computers, but only one in four used computer in the classroom.

2. The most frequent instructional application was problem solving with teaching of electronic data processing skills second. The most frequently used language was FORTRAN followed by BASIC, COBOL, and assembler.

Recommendations

1. Teacher education institutions should include data processing as option for teacher candidates to learn dimensions of instructional use of computers.

2. The following areas should be studied:

a. state-of-the-art report on computer instructional uses.

b. competence and qualification of educational users.

c. how data processing is incorporated in the curriculum at teacher education institutions.

Rudolph, Eleanore L.

Abstracter's Comments

1. Recommendations have led to further research by individuals and schools.

2. Typing errors were found which made some interpretations difficult.

Saif, Khalid Abdulraham, Technical Competencies in Business and Electronic Data Processing Needed by Business Electronic Data Processing Teachers, doctor's dissertation, University of Northern Colorado, 1975, 327 pages.

Problem

To identify the technical competencies in business and electronic data processing needed by business data processing teachers at the high school, junior college, and four-year college level in Colorado.

Procedure

1. Literature was reviewed to identify technical competencies.

2. Research instrument was developed based on competencies which was tested for revision.

3. Population of teachers and administrators were identified.

4. Data was recorded in cards for statistical analysis.

Findings

1. Business knowledge and skills needed by all three levels of teachers were: statistics, accounting principles, business mathematics, operations research, finance, management principles, business report writing, linear programming, logic principles, introduction to business, cost accounting, accounting theory, and intermediate accounting.

2. Data processing knowledge and skills needed by all three levels of teachers were: COBOL, input/output media and devices, storage devices, systems analysis, FORTRAN, central processing unit, flowcharting, batch processing, timesharing, BASIC, canned programs, record layout and design, operate keypunch, operate terminal, computer memory sizes, forms design, work load evaluation, PL/1, RPG, and history of computers and data processing. Additionally high school and junior college teachers need: operate computer, operate sorter and verifier, and assembly language. Machine language was needed for the high school data processing teacher. Even though computer languages were rated as among the items needed by high school teachers, the means of rating those languages, excluding COBOL, were the lowest of needed items.

3. Work experience was not needed of any type or length by the high school teacher; whereas, seven to twelve months of work experience as a business applications programmer and/or analyst was rated as needed by the junior college and four-year college data processing teachers.

4. There is a need for more and better college programs to prepare data processing teachers.

5. At each level, there was no significant difference between

Saif, Khalid Abdulraham

Findings (Continued)

experienced and inexperiences of rating technical competencies. There was a significant difference among teachers at the three levels and also administrators in rating technical competencies.

Recommendations

1. Educational institutions preparing data processing teachers should include competencies as stated in this research and de-emphasis those not needed.

2. Better programs and courses should be offered to prepare prospective data processing teachers and enable current teachers to update skills.

3. Educational institutions training high school data processing teachers should provide hands-on experience to meet teaching needs.

4. Educational institutions training programmer and analyst should emphasis hands-on experience through internship, actual case studies, field studies, games, simulations, and exercises that involve business applications.

5. Because of the rapid changes in data processing, educational institutions should constantly update their programs.

6. Present data processing teachers should update their skills to include technical skills identified in the study, and prospective teachers should acquire identified skills.

7. Certification agencies should require data processing teachers to have identified skills.

8. The qualified immediate supervisor and data processing directors of institutions should consult in planning and designing program to prepare teachers for those schools.

9. The following areas should be studied:

a. identify other skills and topics not covered in this study.

b. replicate study in other area of country and in Colorado every three years.

c. compare methods, applications, and equipment used in teacher training schools for data processing teachers.

d. follow-up programs, job performance, and success of students.

e. level of mastery for technical competencies with establishment of criterion to measure mastery.

Saif, Khalid Abdulraham

Recommendations (Continued)

f. development of a comprehensive curriculum for college teaching that includes needed competencies.

Abstracter's Comments

The study was very well done. The six phases of data analysis were particularly beneficial in analysis of the data of the study.

Sando, Robert N., The Relationship of Selected Personal and Curricular Variables to Achievement in COBOL, doctor's dissertation, University of North Dakota, 1973, 114 pages.

Problem

To determine the relationship of selected personal and curricular variables to the achievement in COBOL programming classes.

Procedure

1. Problem proposal was developed during research class.

2. Post cards were sent requesting current academic catalogs to determine which schools taught COBOL and required the ACT for admission.

3. A list of professors teaching COBOL on a semester basis was obtained with five agreeing to participate in the study.

4. A standardized COBOL test was developed consisting of sixty-two multiple choice questions. The test reliability was calculated using the Kuder-Richardson Formula 20.

5. The test was administered during the last week of classes or as a final examination by the five professors in the study.

6. Data was statistically analyzed on the six sets of variables used in the study: high school variables, college grade point average, college course variables, personal (sex and age), percentile rank, and ACT set of scores.

Findings

1. The college course variables were consistently the best set of predictors for the study. College grade point average was significant in predicting the dropout and performance rates with sex and age insignificant predictors. No students in the study had a previous high school data processing course and a high dropout rate (25%) was experienced.

2. Students with prior programming experience performed better than those without a prior course as was the same situation with a prior course in introduction to data processing.

3. Scores on the ACT were insignificant as dropout predictors. High school percentile rank had consistently high correlation with predicting dropout and performance. In predicting dropout, college variables of natural science, introduction to data processing, and computer programming were the most significant variables. High school data, other than percentile rank, contributed little to prediction of dropout and performance.

4. Computer programming, economics, and accounting were the most significant prediction variables.

Sando, Robert N.

Recommendations

1. Introduction to Data Processing should be a prerequisite to a course in COBOL.

2. The following areas should be studied:

a. continuing work on establishment of selection policies for COBOL classes.

b. ascertain specific reasons for dropping COBOL class.

c. most effective teaching method for COBOL regarding order and procedure of theory and applications.

d. achievement levels of business and non-business student in COBOL classes.

e. FORTRAN achievement similar to this study.

f. whether sequential order in which students study programming using COBOL or FORTRAN has effect on achievement.

Abstracter's Comments

1. Nothing was evaluated as to the teaching methods of the five professors teaching the COBOL sections with the variables.

2. COBOL programming teachers should analyze the multiple choice test.

Sherman, Nora J., An Analysis of Competencies Needed by Introductory Data Processing Teachers as Perceived by Authorities and Teachers of Data Processing, doctor's dissertation, University of Houston, 1975, 266 pages.

Problem

To compile a rank ordered list of competencies which introductory data processing teachers should possess and to analyze the competencies as perceived by data processing teachers and authorities in the field of business data processing.

Procedure

1. A list of competencies was developed through a review of literature and observation of practicing high school and junior college data processing teachers.

2. A three questionnaire modification of the Delphi technique was used as the research instrument with five categories of grouping based on eight areas in competency based teacher education.

3. Instrument was sent to high school teachers, junior college teachers, and data processing authorities with data recorded in cards for statistical analysis.

Findings

1. The following competencies were rated crucial by authorities and junior college teachers: knowledge of end results; knowledge of data processing terminology; knowledge and application of data processing functions; knowledge of electronic computers; ability to flowchart; ability to demonstrate flowcharting; ability to demonstrate the computer; provision for teacher-pupil interaction; ability to explain verbally; development of ability to follow instructions; knowledge of ethical procedures; and establishment of proper teacher behavior as an example to students.

2. The following competencies were rated crucial by authorities and high school teachers: development of data processing concepts to be learned by the students; knowledge of end results; provision for repair and maintenance of equipment, if needed; knowledge of data processing terminology; knowledge and application of data processing functions; ability to demonstrate flowcharting; stressing the need for regular attendance in classroom; development of student confidence by never violating their trust; and establishment of proper teacher behavior as an example to students.

3. The following competencies were rated crucial by junior college and high school teachers: knowledge of end results; knowledge of data processing terminology; knowledge and application of data processing functions; ability to demonstrate the computer; ability to demonstrate

Sherman, Nora J.

Findings (Continued)

flowcharting; and establishment of proper teacher behavior as an example to students.

4. Using Chi-square, a significant difference at the .05 level was determined among the three groups as convergent opinions far outnumbered divergent opinions.

Recommendations

1. Crucial, highly desirable, and combination of two categories by 50 percent or more of the responding competencies should be included in data processing methods courses.

2. The following areas should be studied:

a. validity of competencies.

b. state competencies in behavioral terms.

Abstracter's Comments

1. Dissertation should be the part of business education methods courses in data processing.

2. The paper was well done and has been useful in abstracter's Computer Technology Department for teacher evaluation.

Skelton, John E., Evaluation of the Effect of Time-sharing and Batch Processing on Student Achievement and Attitude in a Beginning Computer Science Course, doctor's dissertation, University of Denver, 1971, 422 pages.

Problem

To evaluate the effect of time-sharing and batch processing on student achievement and attitude in a beginning computer science course.

Procedure

1. The study was conducted in two phases, one the pilot and then the research. The study used two sections of the course, Introduction to Digital Computer Programming, at the University of Denver dealing with FORTRAN language.

2. One section was arbitrarily assigned to use time-sharing and other used batch processing during each phase of the study.

3. Three evaluative instruments were used to measure performance and attitude. The instruments were validated by a jury of experts. The instruments were FORTRAN programming ability tool, problem solving ability tool, and questionnaire used to obtain estimates of computer system parameters.

4. Data was recorded for statistical analysis.

Findings

1. There was no difference in FORTRAN programming ability between students in either processing method.

2. There was a difference in problem solving ability between students learning programming using the two modes in only two of thirteen cases which the two exceptions being time-sharing learning better skills.

3. The syntax error rate was much higher for time-sharing than batch.

4. The cost of providing time-sharing service was substantially higher than batch processing at a ratio of at least 2.3 to 1.

Recommendations

The following areas should be studied:

a. effect of waiting time and the larger overall problem of scheduling terminal use so as to accomodate more students with less terminals.

b. replicate with another subject matter such as statistics.

Skelton, John E.

Recommendations (Continued)

c. ascertain if psychological theory of massed and spaced learning situations applicability to time-sharing and batch processing.

Abstracter's Comments

Researcher stated that study did not seem to accomplish the expected results which was the only study to indicate such.

Solak, James A., A Follow-up Study of the Graduates of Plum Senior High School From 1971 to 1975 Who Were Enrolled in the Data Processing Program, master's paper, Indiana University of Pennsylvania, 1975, 57 pages.

Problem

To determine if data processing education offered by Plum Senior High School assists a student in obtaining a job, provides adequate background for students wanting to further their data processing education in college or business school, and improvements that might be made in the data processing curriculum.

Procedure

1. Other follow-up studies were reviewed from which a questionnaire was constructed for use in the study.

2. The names and addresses of data processing graduates were obtained from class grade sheets and the questionnaire was sent with cover letter to the graduates.

3. The data collected was analyzed utilizing frequencies and percentages in relation to jobs, problems, job skills, training, and other courses.

Findings

1. The position held by most graduates was keypunch with computer operations second. Instruction of keypunching ranked number one followed by areas of operations, programming, and forms work.

2. Unit record instruction was of little value to the graduate. The most frequent problem relating to equipment was the lack of adequate hands-on experiences.

3. Graduates indicated additions to the curriculum with more training needed in programming languages, and operating keyplex and flexowriter.

4. One out of ten graduates had applied data processing training from high school to additional courses taken after graduation.

5. The most frequent non-data processing positions held were sales clerk and secretary. Graduates going on to college most frequently majored in secretarial or accounting areas.

6. Graduates who received additional training said they needed more understanding of programming languages and construction of flowcharts in their high school data processing education.

Solak, James A.

Recommendations

1. A follow-up of the data processing ggraduates should be done every three years.

2. A data processing curriculum should be developed on the high school level.

3. A cooperative work program should be established in data processing at Plum High School with selection and criterion system determined for participation.

4. Program changes should include following: increased hands-on training with double periods for program to provide more time; increased instruction and work with flowcharts; decrease of instruction on unit record equipment; and additional work in programming languages, computer terminal, keyplex, and flexowriter.

Abstracter's Comments

1. Recommendation which asks for development of data processing curriculum seemed out of place for program existed.

2. Study refers to the eighty column punched card as an IBM card which is generally done by laypeople but should be avoided by practitioner.

3. Study sample started adequately but returns were low thus number of people in queues were small which statistically was misleading.

Smith, Alfred E., Survey of Data Processing Instruction in Selected Secondary Public Schools of the United States, doctor's dissertation, University of Nebraska - Lincoln, 1974, 284 pages.

Problem

To examine data processing instruction in selected public secondary schools of the United States during the 1972 to 1973 school year.

Procedure

1. Based on a review of research, the expost facto design was chosen for the research study.

2. A questionnaire was designed which included modified materials from the Bang and Hillestad study. Questionnaire was revised and sent to selected teachers for validity check.

3. Revised questionnaire was sent to five selected National Business Education Association regions randomly selected schools.

4. Data was recorded in cards for statistical analysis.

5. Internal reliability of instrument was checked with instrument being sent to ten additional schools in the regions.

Findings

1. Approximately 39 percent of the schools offered data processing courses with 19.4 percent offering one-year program, 9.9 percent offering programs two or more years, and more than 50 percent offering units in data processing. Over 25 percent anticipated computer offering by 1978.

2. Over 50 percent specified business department as responsible department for data processing instruction with 38.5 percent reporting mathematics department responsible. More than 20 percent of instruction was started from 1967 through 1969 with about 20 percent increase for the next three year period, 1974 to 1977.

3. The three courses most frequently mentioned were: introduction to data processing (83%), data processing applications (63.8%), and programming (61.8%). Schools emphasize an introduction/familiarization level of course competency in data processing.

4. The princpal languages offered were FORTRAN (40.7%), BASIC (36.6%), and COBOL (34.2%).

5. Data processing units were offered primarily in bookkeeping (47.2%) and clerical practices (47.6%).

6. Providing students with general data processing knowledge was primary objective of most instructors (56.8%) with vocational preparation

Smith, Alfred E.

Findings (Continued)

primary objective of only 28.5 percent of the data processing teachers.

7. More than 50 percent of the teachers revised the courses since first introducing data processing into the curriculum based on discussion with other data processing teachers (37.8%) and businessmen and advisory committees (36.8%).

8. The most frequent instructional problems were lack of adequate equipment (21.5%), curriculum development (12.1%), and evaluation of the students (11.6%).

9. Program equipment included keypunch simulator (9.5%), keypunch (27.6%), verifier (15.4%), reproducer (23%), accounting/tabulating machine (23.7%), sorter (35.2%), remote timesharing terminal (25.2%), and independent computer and/or terminal (32.6%).

10. Instructors (42.5%) stated college data processing courses as main reason for entry into data processing field. Background knowledge was provided by college courses (67.9%), workshops (44.3%), and self study (43.6%). The data processing course most often taken by instructors (61.7%) was introduction to data processing with others being introduction to programming (51.2%) and other courses in programming (47.4%). Keeping up-to-date was done by reading data processing periodicals (55.8%) and by information received via mailing lists of equipment manufacturers (41.5%).

11. State certification varied with 36.7 percent having no state certification requirements and 17.4 percent reporting only a four year degree as certification requirement. Vocational requirements for data processing teachers were virtually unknown with 51.8 percent having no vocationally reimbursable data processing programs and 52.1 percent indicating no federal or state program funding.

Recommendations

1. Data processing workshops concerning guidelines for curricula and equipment for schools should be conducted by state business education department for school administrators and data processing instructors. The findings of this study should be made available to state supervisors.

2. Data processing instruction should be offered in all high schools at the junior and senior levels, with business and mathematics departments responsible for equipment, control, and instruction and working together in planning the curriculum.

3. High schools should offer at least one computer language and units of instruction should be for introduction/familiarization with the best equipments possible provided for student instruction.

4. Schools offering data processing for the first time should consider integration with another class such as bookkeeping, office

Smith, Alfred E.

Recommendations (Continued)

practice, or clerical practice.

5. If equipment is not available, schools should consider time sharing or use of computer time from area businesses.

6. More effort should be exerted by high school principals and data processing instructors to initiated programs and update existing data processing curricula.

7. Data processing instructors and state officials should work together to create guidelines for relevant data processing education.

8. The following areas should be studied:

a. replicate study in three to five years to note changes.

b. follow-up to ascertain further developments in data processing instruction.

c. follow-up using random oral interviews to written questionnaire.

Abstracter's Comments

1. The study revealed many important aspects of secondary data processing education.

2. The writings could have been summarized more for wordiness made the study hard to read. Sometimes several sentences were used when a table and summary statement would have been adequate.

3. Reference is made to the Bangs and Hillestad study done by a grant from the United States Department of Education, the following is the complete reference:

F. Kendrick Bangs and Mildred C. Hillestad, Curricular Implications of Automated Data Processing for Education Institutions, Washington: United States Department of Education, 1968.

4. The Bangs and Hillestad study is a must reading for all data processing teachers for historic view of data processing curriculum on secondary and post secondary levels.

Stinnett, Velma K., The Emphasis Placed upon Automation and Automated Data Processing in High School Courses in the United States and in Other Selected Countries, master's paper, Southwest Missouri State University, 1974, 62 pages.

Problem

To determine the emphasis placed on automation and automated data processing programs in the high schools of the United States and in other selected countries to ascertain: whether teachers are adequately prepared to teach data processing; whether the schools possess proper facilities, equipment, and materials necessary to prepare students in data processing; whether data processing is integrated into a sufficient number of other courses in the curriculum; and whether sufficient numbers of course offerings exist exclusively dealing with data processing.

Procedure

1. Literature was analyzed dealing with the problem.

2. Interviews were conducted with three authorities on high school data processing in the state of Missouri.

3. Literature and interviews were synthesized.

Findings

1. Most teacher training institutions do not stress data processing training for their students.

2. Data processing was integrated primarily in accounting courses.

3. Business education has been giving mainly lip service to the high school training in data processing.

4. Data processing has not been spread as needed in high school.

5. Manpower need exists for data processors trained in high school.

Recommendations

1. High education should review degree requirements regarding data processing instruction for the high school teacher. Data processing courses should be offered at the undergraduate and master's levels with hands-on experience for the high school teacher.

2. State departments of education should require certification in data processing for business education license.

3. Data processing should be integrated into all courses because of the technological uses of the procedures in jobs.

Stinnett, Velma K.

Abstracter's Comments

1. Study was well done for the time frame of an eight-week summer session.

2. When compared to other master's papers dealing with survey of literature, research found a variety of sources to substantial previous information.

3. Research methodology should have been explained better. Procedure did not state how interviews were conducted or literature was found and analyzed for synthesis.

Stockman, David C., A Survey of Computer Technology in Ohio's Public Vocational Business Education Programs, master's paper, Wright State University, 1973, 50 pages.

Problem

To identify and document current trends in business data processing in Ohio vocational education, and to summarize contributing factors which have affected the development of computer technology in education.

Procedure

1. The names and locations were gathered on vocational school districts in Ohio which consisted of thirty-three institutions.

2. District supervisors and students were interviewed regarding data processing curriculum from which a questionnaire was developed and sent to active vocational districts.

3. Data was recorded in matrix form to obtain percentile results.

Findings

1. Ohio is technologically underdeveloped in its vocational data processing programs. Emphasis tends to be placed on low-level jobs with placement of graduates good.

2. The state level of management planning and coordination of data processing efforts is deficient if not entirely missing. Primary deterrants were high financial investment and administrative resistence to change.

3. An inordinate relationship exists between equipment usage rates for student instruction and administration functions.

4. Only a small percentage of vocational students are enrolled in data processing and enrollment figures do not seem to be totally correct.

5. Low-level jobs were available for graduating data processing students who were rated as highly qualified.

Recommendations

1. A central staff should be established tasked with an overall planning and administration of vocational training.

2. The data processing curriculum should be revised to include current technology and expanded into other areas.

3. A planned inservice program for teachers and administrators should precede instruction of students.

Stockman, David C.

Recommendations (Continued)

4. Teacher qualifications should be established for data processing instruction.

5. A how-to plan should be established for districts with emphasis on advisory committees.

Abstracter's Comments

1. The findings did not seems to coordinate with the questionnaire. Even for that period of time, the vocational schools mainly produced unit record or keypunch people which implies the program was weak.

2. Researcher wanted one instructor to manage the computer center and also wanted master's degree and five years work experience to teach data processing but did not list this in findings or recommendations.

3. Loopholes were apparent in the study which made the material with unanswered questions. Findings reminded abstracter of work as statistical research assistant in computer center where candidates would bring in questionnaire and want you to prove what they wanted for results.

Toyne, Marguerite C., An Evaluation of Data Processing Training in Georgia Public and Private Schools and the Derivation of Behavioral Objectives for Entry-Level Computer Programmer and Operator Curricula Based Upon Responses of Data Processing Managers, doctor's dissertation, Georgia State University, 1974, 310 pages.

Problem

To evaluate the public and private schools in determining whether they were preparing students to meet the needs of data processing managers.

Procedure

1. Research methods were analyzed with descriptive or exploratory method used for predicting and identifying relationships among and between variables.

2. Literature was reviewed in the preparation of the questionnaires which were developed in consultation with education leaders and advisory committee before being sent to schools and computer managers.

3. Data gathered was recorded on cards for computer analysis.

Findings

1. Public and private schools taught the tasks identified by data processing managers to the level and skill knowledge considered necessary for entry level.

2. There was a significant difference between the needs of computer installations in the greater Atlanta area and their counterparts in other Georgia cities for entry level programmers except for the task "operates the computer system", which was not significant. Metropolitan managers required a significantly higher level of competency than other cities managers for computer operations.

3. There was not a significant difference between the tasks taught at public and private schools located in and/or operating in the state of Georgia for entry level programmers.

4. There was a significant difference between the importance managers and schools placed on the following tasks: builds loops within programs; analyzes programming problem for solution; handles card properly; reads information punched in cards; keypunches from source document and key verifies punched accuracy; operates the sorter; operates the printer; and binds printed output. Public schools placed significantly more importance than managers on the following: builds loops within programs; analyzes problem for solution; keypunches from source document and key verifies for accuracy; and operates the sorter. Public schools placed more importance on the following than managers outside the Atlanta area: operates the printer and binds printed output.

Toyne, Marguerite C.

Findings (Continued)

5. Schools and managers agreed on the tasks for teaching operator skills except for codes in computer language and utilizes math in problem solving. Public schools appeared to teach a higher level of competence than required.

6. A significant difference between the needs of computer installations in the greater metropolitan Atlanta area and their counterparts in other Georgia cities for entry level operators occurred only on the handling of tapes with inside managers requiring a significant higher level.

7. A significant difference between the tasks taught at schools for entry level operations occurred in tasks of codes in computer language and utilizes math in problem solving with the public school giving more than the private school.

8. There was a significant difference on importance of tasks between managers and schools on the following: codes in a computer language; builds loops within programs; writes subprograms; designs and codes file maintenance logic; tests and debugs programs; reads information punched into cards; codes information to be punched into cards; and keypunches from source document and key verifies for accuracy. Public schools place a higher importance level on tasks of codes in a computer language; builds loops within programs; designs and codes file maintenance logic; reads information punched into cards; codes information to be punched into cards; and keypunches from source document and key verifies for accuracy than data processing managers.

Recommendations

The following areas should be studied:

a. qualifications of data processing instructors who teach entry level students.

b. source of particular equipment used for data processing teaching.

c. analyze and evaluate equipment and teaching materials for relevancy to data processing industry.

d. follow-up first year of work by data processing graduates.

e. the extent, if any, in which the experienced student performs better than the student without experience.

f. courses that should be included in high school curriculum and offered in the first two-years of post secondary education.

g. what makes students from particular schools more successful at finding entry level positions than other students from other schools.

Toyne, Marguerite C.

Recommendations (Continued)

h. steps which school should undertake in determining what should be included in its curriculum.

i. whether managers and educators place the same value of work importance and determine if meaning is same for both groups.

j. determine specific areas in which private schools are lacking in preparing their students.

k. determine if managers really require training to the level indicated in this study.

l. schools which gave managers bad impressions and which are still in operation.

Abstracter's Comments

The comparison of the geographic areas in Georgia type of analysis should be done more in studies.

Wagner, Gerald E., An Analysis of Present High School Data Processing Courses with Implications for the Academic Preparation of High School Data Processing Teachers, doctor's dissertation, University of California at Los Angeles, 1973. 138 pages.

Problem

To determine the ideal background and training for teachers planning to teach data processing in the secondary schools.

Procedure

1. Research methods were reviewed in settling on descriptive research method.

2. Defined the problem based on literature review and determined assumptions for study.

3. Obtained a list of teachers from South-Western Publishing Company and determined "qualified" data processing teachers with criterion of recognized four-year degree, one year data processing teaching experience, and data processing work experience.

4. Designed two questionnaires of which one was used as initial screening device and other as survey instrument. Screening device was reviewed by research authority and revised. Survey instrument was reviewed by junior college data processing instructors and revised before mailing.

5. Data was recorded in cards for statistical analysis.

Findings

1. Data processing was taught by the business department in 90 percent of the schools with 75 percent sole responsibility, 18 percent shared, and 7 percent varied. The primary purpose of data processing was general education. Teachers were males under thirty with baccalaureate in business education who had taught data processing for four semesters and had over five years of teaching experience. Over 50 percent had no data processing work experience.

2. Essential subjects for the introduction to data processing course were the following thirty-three topics:

a. punched card characteristics.

b. principles of recording data in cards.

c. basic data processing operations.

d. electronic data processing concepts.

e. principles of sorting data in cards.

Wagner, Gerald E.

Findings (Continued)

f. record planning and layout.

g. electromechanical data processing concepts.

h. features of computer systems.

i. input/output media and related devices.

j. punched cards as input/output media.

k. basic components of computer systems.

l. memory devices.

m. flowcharting.

n. principles of reporting data from cards.

o. systems and programming.

p. principles of classifying data from cards.

q. employment opportunities for high school graduates.

r. number systems and data representationn.

s. advancement opportunities for high school graduates.

t. binary numbering system.

u. mechanical data processing concepts.

v. core memory.

w. decimal numbering system.

x. entry-level job requirements.

y. digital computers.

z. magnetic tape as input/output media.

aa. magnetic disk as input/output media.

bb. binary coded decimal numbering system.

cc. manual data processing concepts.

dd. computer programming.

Wagner, Gerald E.

Findings (Continued)

ee. principles of verifying data in cards.

ff. principles of calculating data in cards.

gg. job descriptions for data processing positions.

3. The chief objectives of introduction to data processing should be:

a. to give students the basic foundation on which they can build in order to prepare for a career in data processing.

b. to get students ready for job in which they need to know how data are processed automatically even though they may not be directly connected with the computer.

4. The keypunch machine was the only machine considered essential for hands-on experience use in the classroom. Other unit record machines and the computer should be on the university campus for training of the prospective data processing teacher.

5. The five most difficult teaching topics for an introduction course were, in rank order: electronic data processing concepts, flowcharting, programming, binary coded decimal numbering system, and systems and programming.

6. The data processing teacher should have a baccalaureate degree in business education or business administration. The business education major was preferred in a two to one ratio. The needed courses are: three in data processing, two in accounting, two in economics, two in mathematics, and one in either statistics or logic. The methods course in data processing was recommended by 90 percent of the teachers with hands-on experience likewise recommended.

Recommendations

1. The data processing teacher preparatory program should include:

a. minimum of a baccalaureate degree.

b. major in business education or business administration.

c. three courses in data processing, two courses in accounting, economics, and mathematics, and one course in statistics or logic.

d. the three data processing courses should be an introduction to data processing, programming concepts, and COBOL programming.

e. special emphasis of topics should be on those listed as difficult for the teacher to teach.

Wagner, Gerald E.

Recommendations (Continued)

f. a special data processing methods course should be developed and required for the data processing teacher.

g. a laboratory-oriented course should simulate hands-on experience for the teacher.

h. teacher trainees should be made aware of the training needed for self-improvement.

2. The following areas should be studied:

a. replicate study every three years.

b. ascertain the benefits, if any, to use hardware in classroom.

c. identify social implications of data processing.

d. effect, if any, of data processing course on office workers.

Abstracter's Comments

1. Terminology of the topics seemed awkward and in some cases, implying outdated, even pre-unit record, terms.

2. The study was very informative and should be used as guidelines in establishing data processing teacher education preparatory programs.

Wenger, James L., The Determination of a Data Processing Curriculum for the North Central Kansas Area Vocational Technical School, master's paper, Emporia Kansas State University, 1972, 73 pages.

Problem

To determine a data processing curriculum for the North Central Kansas Area Vocational Technical School.

Procedure

1. Questionnaire was sent to fourteen area vocational technical schools and twenty-four community junior colleges in Kansas concerning present curriculm and programs in data processing.

2. Interviews were scheduled and completed with managers of selected data processing installations concerning curriculm and vocational training in data processing.

3. Information from questionnaires was compiled and comparisons made between vocational schools and junior colleges.

Findings

1. Approximately 53 percent of the schools offered data processing with the most popular languages being FORTRAN and RPG. Program requirements included accounting (63%); mathematics (53%); communications (37%); at least one programming language (79%); and instruction in unit record and keypunch equipment.

2. Based on the interviews, the following rank order of subjects is desired by the prospective employer: accounting and RPG; COBOL and FORTRAN; mathematics; and human relations and typewriting. All managers agreed that it was imperative to have access to or have computer equipment in-house for training with International Business Machines (IBM) the most popular equipment.

Recommendations

1. Schools offering data processing programs should submit a survey of data processing installation to an advisory committee to determine importance of unit record instruction.

2. School should become familiar with community needs and programs should evolve around the community needs.

3. Programs should be based on a two-year course which will allow students to obtain a wide variety of saleable skills.

4. The state should adopt uniform guidelines for instruction in data processing programs to assist existing programs and help initiate new programs.

Wenger, James L.

Recommendations (Continued)

5. Unit record instruction in the area school should be minimized.

6. The program at North Central Vocational School should strive for varied background of skills for students.

Abstracter's Comments

1. Nothing was stated as to the structure of the questionnaire.

2. The selection method for interviews was missing until the conclusion.

3. There was no stated testing of methods for questionnaire or interviews before the actual use of the instruments in the study.

Werner, Donald A., A Comparison of Two Methods of Teaching Business Data Processing and Accounting Concepts in High School Accounting, doctor's dissertation, Arizona State University, 1971, 99 pages.

Problem

To determine if the method of integrating business data processing concepts with accounting instruction was more effective than the other method of teaching business data processing as a separate unit in accounting.

Procedure

1. The quasi-experimental design with non-equivalent control group was selected as the research design based on review of literature. An analysis of covariance was use to statistically analyze data with control variable of mental ability, age, and prior knowledge of accounting and data processing and criterion variables were post-test scores on inventory tests.

2. Seventy-five eleventh grade students enrolled in accounting were the subjects with the three tests administered.

3. The tests given were California Test of Mental Maturity; standardized first-semester accounting final examination for text of 20th Century Bookkeeping and Accounting by South-Western Publishing Company; and business data processing inventory adapted from Study Guide for Introduction to Automated Data Processing by South-Western Publishing Company and Understanding Modern Business Data Processing by McGraw-Hill Publishing Company.

4. Two groups of students were assembled with group one taught accounting by traditional method for first eight weeks and then a two week unit on data processing with subject not discussed for remainder of semester, and group two received instruction in data processing with subject related to accounting for remainder of semester.

5. A pilot study was done at the same school the year before for refinement before actual study.

6. Results of the tests were compared by analysis of covariance to equate difference which might have effect upon accounting and data processing achievement.

Findings

1. No significant difference was shown between the adjusted mean accounting achievement scores of accounting students when accounting was studied and related to data processing and the adjusted mean of accounting achievement scores of accounting students who study accounting as separate units.

2. There was a significant difference in the adjusted mean data

Werner, Donald A.

Findings (Continued)

of data processing achievement scores by accounting students when data processing was studied as an integrated part of accounting instruction.

Recommendations

1. Data processing should be integrated into accounting instruction at the secondary level.

2. The following areas should be studied:

a. similar study with data processing introduced at beginning of course before accounting.

b. replicate study at secondary, junior college, and university levels for broader base of analysis.

c. replicate study with different socio-economic background of students.

d. similar study with differenct lengths of time of data processing instruction.

Abstracter's Comments

Although not strictly data processing study, the research shows that instructors are trying to integrate data processing instruction into classes.

Willhardt, John A., A Comparison of Data Processing Business Curricula with Business Job Entry Positions, doctor's dissertation, University of Iowa, 1971, 176 pages.

Problem

To investigate various high school and collegiate business data processing curricula in Iowa and Missouri; to examine and specify business data processing job entry requirements; to determine whether study schools were teaching the necessary skills, knowledges, and information to obtain positions; and to determine data processing positions available for the graduates of each type of school.

Procedure

1. Two questionnaires were developed and revised before being sent to business data processing teachers and managers in Iowa and Missouri.

2. Data was recorded in cards for statistical analysis.

Findings

1. Of the ninty-nine companies surveyed with five to 110,000 employees and three to 250 in data processing, 70.7 percent used International Business Machines (IBM) equipment. Of the twenty-two schools surveyed with seven four-year, thirteen two-year, and two high schools, 86.4 percent used IBM equipment.

2. Industry would accept school training for all positions except analysts which they preferred to have experience but would consider programmer/analyst with a degree. The positions of computer operator, clerk, and keypunch provided the most opportunity for high school graduate.

3. Programming languages used by business were COBOL, RPG, and assembler with all plus FORTRAN taught by the schools. Over 86 percent of the schools taught FORTRAN which 8 percent of the businesses used.

4. Operator skills were stressed more by teachers than managers. In addition to ability to operate computer, managers stressed unit record knowledge. While teachers additionally stressed accounting, flowcharting, and programming, less than 25 percent of the managers required those skills.

5. Programmer skills were stressed more by teachers than managers. Skills required by more than 50 percent of the managers were, in rank order: COBOL, flowcharting, systems applications, and accounting. Skills stressed by more than 50 percent of the teachers, in addition to manager required, were: RPG, assembler, FORTRAN, and applications of inventory, sales analysis, invoicing, and payroll. Managers (77%) stressed overall applications rather than one segment of applications.

6. Systems analysis skills stressed by both groups were flowcharting, programming, and business applications with instructors also

Willhardt, John A.

Findings (Continued)

stressing accounting.

7. With exception of business programming, both groups were quite consistent regarding the ranking of programming skills. With the exception of flowcharting, both were consistent regarding ranking of systems analyst skills.

8. Although a wide variety of courses were offered by schools, almost 82 percent annually consulted with business regarding curricula and 63 percent annually revised the curricula.

9. The majority of the businesses provided in-house training for employees. Training most recommended by the managers included communication skills, variety of programming languages, computer operations, and mathematics.

10. The most critical human relations problem was communications with minor problems of good work habits and willingness to work overtime.

11. PL/1 was innovative for teachers (27%) but not used much in industry (11%).

Recommendations

1. More operations research should be done in schools.

2. The following areas should be studied:

a. repeat of this study in other states.

b. programming and systems courses offered in schools.

c. management knowledgability of data processing.

d. aptitude test for data processing.

e. human relations factors in data processing.

Abstracter's Comments

1. Recommendations appeared in the conclusion.

2. Summary information on FORTRAN usage by business stated in two different percentages in the study.

3. The problem statement was wordy which caused some confusion as to what the problem solution sequence would entail.

4. Operations research is recommended but concept is not in the findings portion of the paper.

Zapach, Joseph B., Electronic Data Processing: Implications for the Secondary School, doctor's dissertation, Arizona State University, 1972, 258 pages.

Problem

To recommend curricular revisions for high schools regarding electronic data processing based on data obtained from members of the Data Processing Management Association (DPMA) as to the following:

a. present utilization of electronic data processing equipment and supporting software.

b. minimum employment requirments for computer positions.

c. data processing concepts for inclusion in high school data processing course.

d. opinions of businessmen related to offering data processing at the secondary level.

Procedure

1. Descriptive survey was selected as method to gather data.

2. Population was selected from the Data Processing Management Association.

3. A questionnaire was developed and submitted for evaluation with pilot completed for further revisions.

4. Data returned from population was recorded in cards for statistical analysis using frequencies and percentages.

Findings

1. The keypunch, verifier, interpreter, and sorter were used by more than 54 percent of the companies and 55 percent had no intention of phasing out unit record equipment.

2. International Business Machines (IBM) was the predominant computer system with UNIVAC and General Electric each representing 20 percent of the market. Peripheral usage was mainly cards (80.8%) and lessening. Substantial increases were anticipated with magnetic disk. optical characters readers (OCR), and cathode ray tubes (CRT). Other peripheral usages were, in rank order: magnetic tape (63.4%), magnetic disk (52.9%), and remote terminals (33%).

3. Data processing facilities were relatively distributed in service bureaus, time-sharing, programming and facilities services, and data processing manufacturer's software services.

4. The predominant programming language was COBOL (63.2%)

Zapach, Joseph B.

Findings (Continued)

followed by RPG (52.9%) and FORTRAN (47.1%).

5. Data processing experience was most frequently noted for all positions surveyed with no experience required for card/tape converter operator, coding clerk, data typist, high speed printer operator, tape librarian, or sorting machine operator. The number of months experience ranged from one to eight months for twelve positions to sixty months for two positions. The widest range was found for programmer and computer operations supervisors. Firms which required business or general work experience most frequently wanted twelve months experience. Companies with minimum experience wanted six to twelve months experience for the computer peripheral equipment operator, digital computer operator, keypunch operator, and verifier operator. No minimum education requirement by the majority for the card/tape converter operator, coding clerk, data typist, high speed printer operator. High school education was minimum by the majority for computer peripheral equipment operator, keypunch, sorting machine operator, tape librarian, and verifier. The positions of programmer and computer operations supervisor required college education. The majority of the training was done in-house and ranged from one week to thirty-six months with six months the most frequent response. No training was given to the card/tape converter operator, coding clerk, data typist, high speed printer operator, or tape librarian. Manufacturer training was required for the programmer and computer operator supervisor.

6. The study of electronic record systems was classified as essential by 66.2 percent for inclusion in the high school course. Topics considered essential were, in rank order: electronic record systems, card design, keypunch purposes, input, arithmetic logic, control, memory, console, printer, tape devices, block diagrams, decision tables, COBOL, systems analysis, alphanumeric and numeric coding systems, decimal number system, binary number system, hexidecimal number system, nature of automated data processing system, major uses of data processing system, and types of data handling.

7. Topics classified as desirable content were, in rank order: history of record systems, manual record systems, mechanical systems, reproducer purposes, collator purposes, PL/1, gaming/simulation, importance of automation and data processing to society, structure of data processing department, and future of data processing.

8. Positions available for high school graduate taking a data processing course were coding clerk, keypunch operator, verifier operator, data typist, and sorting machine operator. The majority of high school data processing should be preparation for advanced study or training with secondary emphasis on job preparation. Students should be given the opportunities of work experience programs in high school data processing.

9. There is a need for data processing offerings on the high school level.

Zapach, Joseph B.

Recommendations

1. Data processing courses should be established on the secondary level with overall emphasis for preparation for advanced training or study and secondary emphasis on vocational preparation.

2. Essential items should be included in the data processing course with desirable items included as time permits. Computer characteristics common to most frequent machines should be included with continued training in keypunch. Because of trend to more rapid input methods, course should include information on tape/disk, remote terminals, cathode ray tubes, and optical character readers. The types and functions of data processing services should be integrated into the materials.

3. A data processing cooperative work experience plan should be established.

4. The following areas should be studied:

a. identify specific data processing content used on the secondary level.

b. employment requirements for data processing.

Abstracter's Comments

1. Conclusion was very good with evidence as to why conclusions were drawn.

2. Researcher uses term "EDP" many times in the dissertation but term was not defined in the definition of terms or glossary.

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