IDENTIFYING AND EVALUATING COBOL COMPETENCIES FOR FOUR-YEAR INFORMATION SYSTEMS PROGRAMS

by

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Dedicated to

My Mother, Sister

and Two Sons

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CHAPTER I

INTRODUCTION AND BACKGROUND INFORMATION

It is the responsibility of educational institutions to see that students receive the necessary, updated training to do whatever is required on the job. The need for individuals trained in the technical computer area and the expansion of the communication field suggest an increase in job opportunities for those knowledgeable of computers. In keeping with the idea of job availability and training for such, Popkin and Pike (1977, p. 385) state that for many years to come it is likely there will be a strong demand for men and women with technical skills in data processing because of the increasing use of computers in business.

More recent writings reveal the continuous use of computers in all phases of life and the need for graduates to be qualified to meet the demands of computer related jobs. Further, Sanders (1983, p. 584) points out the need for a college degree if individuals are planning to seek careers in the area of information systems, the use of computers in processing business information.

Since COBOL is the most popular business language, this study sought to identify and evaluate COBOL

competencies taught in four-year information systems programs and to compare them with the COBOL competencies needed on the job.

Background of the Problem

In an effort to keep pace with constant technological change, educators must evaluate and revise curricula periodically to assure their conformity to current trends and needs. According to Stoehr (1976, p. 2), a need exists for a curriculum-review instrument to determine what skills are being required in the data processing job market.

Constant changes and new developments in computers and peripheral equipment require changes in job preparation. Thus, a shift from the first generation of computers which consisted of vacuum tubes and were extremely large, to the second generation which were characterized by transistors, and next to the third generation with integrated circuitry has led to changes in job opportunities and requirements. These changes become even more pronounced when consideration is given to the smaller computer systems such as the minicomputer and microcomputer currently capturing the market.

Markoff (1983) notes that fourth generation computers were based on very large scale integration (VLSI) circuitry. Further, he states that:

> The fifth generation is now on the horizon. Industry experts claim that this generation will be based on a new synergy of hardware and software. New architectural models will break with sequentially processing Von Neumann computers. Software techniques will for the first time permit systems to emulate human thoughts. (p. 25)

Complex software depends on the effective use of programming languages. The acronym COBOL stands for Common Business Oriented Language. Edwards and Broadwell (1982, p. 176), and Sanders (1983, pp. 372-373) note that it was designed by a committee known as the Conference of Data Systems Language (CODASYL). This committee, representing computer manufacturers, government agencies, user organizations, and universities assembled at the Pentagon in Washington, D.C., in May, 1959. They saw the need to establish a common language for programming electronic computers for business type applications, and they agreed to undertake the development of the language.

The CODASYL Short-Range Committee, consisting of representatives from federal government agencies and computer manufacturers, prepared the COBOL framework and the language specifications, which were approved in January,

1960, and published by the Government Printing Office. COBOL compilers have since been prepared for all processors used in business data processing, and for most minicomputers and microcomputers. (A COBOL compiler is a special program which translates source programs, those written by programmers, into object programs, programs which are in machine language). The initial COBOL specifications were revised in 1968, and in 1974, and a third revision is scheduled to appear during the 1980's. The revisions were called ANSI COBOL, ANSI being the acronym for American National Standards Institute.

Grace M. Hopper of the United States Navy devoted continuous work to developing and testing various COBOL compilers. Most of the credit for the development of the COBOL language is given to Commodore Hopper. Concerning her, Rademacher and Gibson (1983) state:

> In a major software development, Grace M. Hopper, U.S. Naval Officer, developed the first compiler (translator of computer languages) in 1952. She was also instrumental in the development of the popular computer language called COBOL. (p. 210)

Adams, Wagner and Boyer (1983), Dock and Essick (1981), Sanders (1983), and Teagarden (1983) agree that COBOL, first used in 1960, is now the most widely used language for large business application programming and that there are several reasons for its popularity. Among them are: (a) It is well suited to solving business data-processing problems since emphasis is on the problem to be solved and the results to be obtained rather than on the specific features of the computer; (b) This high-level programming language is available on most large and medium sized computers, and on many minicomputers and microcomputers; (c) It contains extensive features for creating, maintaining, and accessing data files; (d) In its early stage, business organizations received pressure from the government to adopt the language, and (e) It has become cost effective for business because it can be transported easily between different kinds of computers.

Spencer (1981, pp. 436-437) states that, primarily because it is the only business programming language with sufficient versatility, COBOL will continue to gain in popularity for years to come. Other languages, such as RPG and PL/I, are limited in use or not available on many computers. There is no known development of other data-

processing languages for business applications by computer vendors or software service firms at this time.

In keeping with this same trend of thought, Ward (1983) reiterates a statement made in numerous trade journals that more than 80% of all programming is done in COBOL. Thus, the programmer preparing for data processing in business should be proficient in COBOL. It is the emperor of programming languages in the real world, and the amount of money and applications invested in it is too great to expect this fact to be changed in the foreseeable future. As Ward states, "Until the millenial age arrives when C (or maybe PASCAL) overthrows the monarch, COBOL will remain the king of programming languages" (p. 29).

Sanders (1983), Shelly and Cashman (1978), Spencer (1983), and Stern and Stern (1980), along with other computer programming writers state the following concerning the COBOL programming language: COBOL contains sentences, paragraphs, sections, and divisions. The sentences direct the processor in performing the necessary operations. Groups of sentences dealing with the same operations form a paragraph. Related paragraphs are organized into sections. Then, sections are grouped into a division. COBOL has four divisions. They are the IDENTIFICATION

DIVISION, ENVIRONMENT DIVISION, DATA DIVISION, AND PROCEDURE DIVISION.

The PROCEDURE DIVISION is considered the most important one because it contains all the instructions and logic to be executed by the computer. The core of programming is in the manipulation of data in this Division. Executable instructions on how to access input and output files, how to read and write information, how to perform simple move operations, and how to perform specific end-of-job operations are included. Based on objectives frequently listed in instructors' manuals for COBOL programming, students possessing knowledge of the types of instructions used in COBOL should be able to: (a) draw appropriate flowchart symbols and document them so as to include the algorithmic steps, with at least one decision, necessary to solve a simple COBOL problem, and (b) write a simple COBOL program and process it on a given computer to achieve an expected outcome for a problem which includes at least one perform statement. A flowchart, program, and printout appear in Appendix A.

Statement of the Problem

This study was undertaken to determine how the COBOL competencies taught in information systems programs and those attained by information systems students compare to

those needed on the job. Perceptions of faculty, prospective employers, and information systems seniors regarding COBOL competencies were obtained through survey procedures.

Kettner (1976,p.1) states that relevancy of curriculum content, instructional processes, competencies and performance levels need to be considered by instructors. In turn, task competencies and performance levels must be determined in order to evaluate and revise curricula. Thus, educators striving to prepare graduates adequately should know the strengths and weaknesses of their programs in order to improve them.

The purpose of the study was to identify and evaluate COBOL programming competencies in information systems programs. To meet the purpose, these research questions were answered:

1. What are the introductory COBOL programming competencies required to be a COBOL programmer?
2. To what extent do information systems program faculty perceive that they have taught COBOL programming competencies?
3. What level of competence in COBOL programming do prospective employers expect information systems graduates to have on the job?

4. To what extent do information systems seniors perceive that they have developed COBOL programming competencies?
5. Which COBOL programming competencies did the faculty, prospective employers, and seniors rate similarly in regard to level of skill?

Significance of the Study

Adams, Wagner and Boyer (1983, p. 206) state that credit should be given to computers for the way companies and individuals do business today. From the mid thirties to the late fifties, it was evident that the volume of business transactions was growing rapidly and becoming increasingly more complex. The government added to the complexities by introducing payroll deductions. During these rapid changes, data processing became a job opportunity area. Thus, it became necessary for educational institutions to prepare individuals for these jobs.

This study is significant in that it compared competencies instructors believed they taught students with the ones needed and expected on the job. Further, students provided information as to what competencies they perceived they had learned.

Results of the study may be used to evaluate and update the information systems curriculum in order to assure the

teaching of essential COBOL competencies, to assess course content, and to identify areas of weaknesses so far as student learning of COBOL competencies is concerned.

Definition of Terms

To assist the reader in achieving a clear understanding of their use and meaning in this study, the following terms are defined.

Business--industry, government, education, or any other organizational form that involves the employment of persons, methods, and materials to accomplish some particular objective.

Business System--an organized method for accomplishing a business function.

COBOL--an acronym which stands for Common Business Oriented Language.

Competency--the components of any topic or job students are expected to master.

Computer Programmer--individual who writes the instructions that are executed by the computer in carrying out its functions.

Data--raw facts needed to be processed to produce information.

Data Base Administrator--person responsible for determining the total information needs of the organization

and for defining the form and content of the data base.

Data System--a combination of persons, methods, and materials needed to process raw data into significant information to be used for management decisions.

Framework--a conceptual model that fosters understanding and communication about information systems. systems.

Information--processed, structured, and meaningful data.

Information System--the organized, structured, and integrated computerization of a system.

System--a collection of people, machines, programs, and methods organized to accomplish a set of specific functions.

Systems Analyst--a computer specialist who is responsible for computerizing business operations.

Substantive Assumption

The study had one underlying assumption. It was collegiate instruction in COBOL should meet the needs of business.

Scope and Delimitations

This study identifies and evaluates introductory COBOL programming competencies. It is limited to the responses

from information systems faculty and seniors of five Virginia universities offering four-year programs in business information systems, and from prospective employers.

Outline of the Remainder of the Study

This study contains five chapters. Chapter two is a review of literature covering the following: (a) introduction, (b) the curriculum, (c) competencies taught in information systems programs, (d) the information systems field, (e) competencies needed in the labor market by information systems graduates, (f) other relevant studies, and (g) summary.

Chapter three contains the methodology of this study. Topics covered are: (a) research design; (b) identification of the COBOL competencies; (c) development of the survey instrument used with faculty, prospective employers, and seniors; (d) panel of experts for the survey instrument; (e) the study participants; (f) faculty participants; (g) prospective employers; (h) senior participants; (i) data collection and recording; (j) data analysis; and (k) summary.

Chapter four includes the findings of the study. Topics covered are: (a) research question outcomes, and (b) summary of the outcomes. Chapter five includes: (a) summary of the study, (b) conclusions, and (c) recommendations.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

This chapter will review selected literature and research so that a foundation for the proposed study may be established. It is divided into four areas: (a) the curriculum; (b) competencies taught in information systems programs; (c) competencies needed in the labor market by information systems graduates; and (d) other relevant studies. It also includes a summary.

The Curriculum

Institutions with four-year programs are concerned that their curricula are current. Thus, evaluation of what is needed by graduates seeking jobs and what graduates have been taught should be considered periodically. This procedure is essential if institutional representatives are to contend that individuals who have learned the subject matter covered in their curricula have obtained certain competencies required on the job. In this connection, Davis (1976, p. 83) stated that the question, "What will the schools teach?" has dominated curriculum-making from the

beginning. Traditionally, the emphasis has been on curriculum makers and determinants (traditional and political pressures). Concerning the curriculum, Zais (1976) states that:

> Curriculum construction in the United States is generally conducted in a shockingly piecemeal and superficial fashion, with the whole process being influenced mainly by mere educational vogue. As a result, school programs are characterized by fragmentation, imbalance, transience, caprice and, at times, incoherence. (p. xi)

A point of view relative to curriculum update is expressed by Finch and Crunkilton (1979, p. 13); they note that a vocational and technical curriculum becomes outdated when steps are not taken to keep it from remaining static. However, the curriculum is considered relevant if it assists students to enter and succeed in the work world.

The discussion on curriculum planning and changes in keeping with job market demands has been approached in some form or other by a number of writers. In order for curriculum planners to know whether graduates have learned and are applying competencies learned in the job market, they must secure some type of feedback. According to

Williams and Snyder (1974, p. 1), the following methods may be used: (a) administer ability tests before and after course of instruction; (b) examine conditions of resources, such as quality of instruction and facilities; and (c) examine post-college experiences and perceptions of former students in order to determine whether educational goals have been achieved, a procedure that involves evaluation through follow-up research.

The collection of employer satisfaction data by each state is mandated by the Vocational Education Section (Title II) of the Educational Amendments of 1976 (P. L. 94-482). Consideration is given to what employers think about on-the-job performance of student employees. The feedback as to whether or not the students are well-trained and prepared for employment will enable the administrators of institutions to evaluate their programs and to make changes when necessary.

Competencies Taught in Information Systems Programs

Couger (1973, p. 728) suggests that there is a need for education related to information systems. He assisted in preparing an undergraduate program curriculum that includes two concentration options, organizational and technological. The organizational concentration prepares a student to be an effective computer-user. It "combines

information systems course work with the academic area of emphasis in a field of application, such as business or government." The technological concentration prepares a student "for an entry-level job in an information processing department." This point of view is reiterated by Couger (p. 95) in the 1979 Association of Computing Machinery (ACM) completed report.

The Information Systems Field

The information systems field consists of the analysis, design, implementation, and operations phases. According to Couger (pp. 95-96), analysis and design proceed together, each affecting the other. An operation phase follows successful implementation, but analysis, design, and implementation activities generally continue as the system is modified and eventually supplanted. He further states that implementation involves writing and debugging programs; gathering information for data bases; training personnel who will use, operate, and maintain the system; and finally installation and checkouts. The operation phase involves the routine running of a system; the analysis and design phases consist of information needs and patterns of information flow that will satisfy these needs. The systems design is the translation of specified information

requirements into a detailed implementation plan that can be realized in hardware/software.

Growth of Information Systems Instruction

Information on education, employment, and future needs of personnel in information systems has been summarized in several studies: Couger (1979); Culen (1980), Donio (1971); Goulet, Morris, and Staal (1982, pp. 44-48), and Suppes (1971). Goulet, Morris, and Staal comment:

> The computing profession as a whole has been concerned with the educational preparation for people entering the profession. The concerns have been manifested by curricula studies and proposals by several professional computing organizations. They are ACM's Curriculum '78, IEEE's A Curriculum in Computer Science and Engineering, CUPM's Report on Subpanel on Computer Science, and most recently DPMA's Model Curriculum, and Pittsburgh Large User Group Education Committee Model DP Curriculum. (p. 44)

The writers further state that all curricula exist in a particular educational environment and must be tailored to that environment. Thus, even though the curriculum may be sound from the educators' point of view, it must adhere

to the identified constraints of the educational institution and to the user communities desiring to employ the program's graduates.

Further, Goulet, Morris, and Staal note that in a computer information systems program, the main thrust is to develop computing as a tool to solve management problems. In a business information systems program, the main thrust is the development of computing management tools that relate directly to the use of computer-generated information within the context of the business community needs. They believe that the majority of students are going to enter the job market directly upon graduation. Thus, their basic tasks will demand that they solve problems, and educational institutions should provide the skills needed to do this. Hence, the course structure is applied rather than theoretical, and students are given hands-on experience and real-life problems scaled to their level. The mathematical and computer tools are developed as a means to solving problems.

Stoehr (1976), in discussing the expansion of the computer era, notes that job opportunities in data processing and information systems have increased. Business and industry are providing employment for persons trained in

the computer area; therefore, educators must develop curricula to accommodate such. He further states that:

> One of the most important components of effective teaching is the adequacy of the curriculum to insure that what is being taught meets the requirements of the employers and the graduates. (p. 2)

In keeping with Stoehr's trend of thought, Keeton and Soskis (1975, p. 42) indicate that the vocational teacher's job is to train people for work, and that the instruction will not be worthwhile and realistic unless the content and performance standards meet the requirements of entry-level positions. Teachers and administrators should present job-oriented curricula which serve students' employment needs.

Adams, (1981) believes there are three educational thrusts within data processing: business data processing, management information systems (MIS), and computer information systems (CIS).

> Business data processing programs are offered at the community college level and are designed to train applications programmers for commercial environments. MIS programs are offered at the baccalaureate level and

> prepare persons for systems management careers. CIS programs offer four-year technical/business programs to prepare business applications programmers/analysts. (p. 62)

Competencies Needed in the Labor Market by Information Systems Graduates

This section explores job opportunities and job requirements for graduates of information systems programs. Kindred (1980, p. 31) stated that the services of people with many different talents are needed to design, develop, install, and operate information systems required for businesses. Information systems jobs cover a wide range of experience, technical knowledge, responsibility, and opportunity for advancement. Information systems personnel include: (a) data-entry operators to ensure completeness and accuracy in the preparation of information systems; (b) computer operators to run the central processing unit (CPU) and associated peripheral equipment in a computer center (highly trained and experienced persons often use this position as a prerequisite to that of computer programmer); (c) computer programmers to write the instructions for the computer (they work from detailed specifications provided by the systems analysts); (d) systems analysts to secure data

for input and output and to translate it into specific records, files, and programs; (e) data-base administrators (DBA) to determine the total information needs of a business organization and to define the form and content of the data base; and (f) computer center directors to manage total computer services. Other jobs available in the information systems area include: (a) salespersons; (b) systems personnel; (c) computer designers; and (d) equipment and maintenance technicians.

In reference to information systems personnel, Bohl (1980) states that the use of computers creates many jobs. In this connection, Barna (1979, pp. 124-125) revealed that a survey of the top 50 companies in the data-processing industry showed a total revenue of $36.1 billion. These 50 companies develop and build computer systems, prepare programs to instruct these systems, provide services such as processing time on computer systems, using specific programs, designing, developing, and implementing particular applications, and selling related equipment such as magnetic tape and disk storage units, printers, and visual displays. Other companies provide supplies such as punched cards, magnetic tapes, and preprinted forms. These companies employ systems analysts who understand user information needs; business planners who coordinate the manufacturing

and sale of computers and related equipment; systems designers and programmers who develop programs to instruct the computers; sales personnel who exhibit and sell computers; machine repairers who service equipment; computer manufacturing workers who build computers; quality-control personnel who makes sure that the equipment specifications adhere to standards; personnel who process orders, prepare goods for shipping, receive goods, and control the inventory; and managers to coordinate all computer-related activities. Many thousands of governmental agencies, businesses, educational institutions, and other organizations use computers. They hire systems analyst, systems design, programming, data-entry, output distribution, and support personnel; data-base administrations or library staff; data-processing auditors; and managers for all data processing functions.

Self-employment opportunities in the data-processing industry have increased with the availability of personal computers. Some individuals serve as consultants or contract programmers. Others operate computer stores, publish computer-related newsletters, magazines, paperbacks, and complete program listings for the general public. With the continuous increase in computer usage, information systems programs are increasing in enrollment. In order to

be prepared for computer or computer related jobs, students should follow updated curricula. In this connection, Bohl (1980, p. 25) states that by 1990 as many as one in five of the U.S. Labor force will require some knowledge of data processing. More than six out of ten will depend in some way on data processing for their livelihood, and more than 90% of the cost of data processing will be attributable to personnel costs.

According to the 1978-1979 Occupational Outlook Handbook, published by the U.S. Department of Labor (pp. 25-26), by 1985 the job market for systems analyst and programmers is expected to increase to 500,000 persons. Job prospects will be best for four-year graduates of computer-related curricula or graduates of two-year programs in data-processing technologies. Persons with a computer background will find more job opportunities than individuals without this kind of training. The 1984-85 Occupational Outlook Handbook also predicts continuous growth in computer-related jobs for individuals who are prepared for them.

According to a report (1977, pp. 5-8), completed by the Washington Office of the American Federation of Information Processing Societies (AFIPS), more than 850,000 individuals have computer-related jobs; of these 110,000 were employed by computer manufacturing and service firms, and the other

740,000 were employed by computer users. A growth to more than 1,000,000 by 1985 is projected.

On the other hand, there has been some discussion about use of computers contributing to a decrease in jobs. This trend of thought is expressed by Lucas (1982, p. 482) who stated that labor leaders have been concerned about the possibility of wide-scale unemployment because of computers. However, he observed that "the computer industry is now a very large component of the United States economy and it has created hundred of thousands of jobs" (p. 482).

Other Relevant Studies

Several studies are detailed in this section because of their similarities in some respect to this study. In a study conducted by Talbot (1976), the computer needs of office managers in the work force were compared with the computer course requirements of universities and colleges offering bachelor's degrees in office management. He secured information for his study by sending questionnaires to chairpersons of departments of business education affiliated with National Association of Business Teacher Education (NABTE) and to a selected list of office managers of leading companies throughout the United States.

The two major areas of training listed as most essential were: (a) training that would assure office

managers having a knowledge of the work capabilities of computers and the tasks that should be effectively handled by them; and (b) training that would assure managers can effectively interpret and use computer output.

In a study by Smith (1979), competencies in office management performed on the job were compared with training offered in colleges and universities. Both Talbot's and Smith's studies compared competencies in some discipline with tasks performed on the job and training offered in universities and colleges. Also, both studies identified competencies in a given discipline and sought to find the degree of importance given to them by employers.

In a study by Stallard, Bahniuk, and Petree (1979), the problem was to determine, verify, and validate competencies needed by administrative office managers. The authors sought to identify competencies in administrative office management textbooks that are widely used, to determine whether administrative office managers agree on the importance of the competencies identified, and to determine whether the competencies of an administrative office manager are related to people or systems and procedures.

The researchers included in the survey instrument competencies secured through a survey of literature. After a pilot study, the revised list was sent to a jury of

experts, who made further suggestions and comments. The final revised list served as the survey instrument.

The previous studies were similar to the present study in that: (a) the purposes of the studies were to provide research information that could be used by educators to improve the instruction of selected courses, (b) each study sought to validate competencies secured from the literature through a questionnaire survey, (c) each study had participants to rate competencies on a Likert-type scale, and (d) the studies utilized the SPSS program to analyze the data.

Irwin's (1977) study sought to identify competencies for post-secondary mid-management instructor-coordinators by comparing their opinions and perceptions with selected administrators. He listed 100 items on the survey questionnaire and analyzed the items by using a one-way analysis of variance to determine if significant differences occurred between the responses from mid-management instructors and administrators. Since no significant difference was found between the opinions and perceptions of the groups studied, Irwin indicated that the list of competencies could be used to validate the ones required for certain positions.

Smiley (1972) sought to identify and compare accounting concepts that should be and are included in the course content of the first-year high school and post-secondary accounting courses. A three-point scale was used to rank each concept. The rank order of importance assigned to the 81 accounting concepts by high school and post-secondary teachers of first-year accounting indicates that there was duplication of instruction in the two courses.

Summary

This chapter has dealt with literature related to the proposed study. The areas covered were the curriculum, competencies taught in information systems programs, competencies needed in the labor market by information systems graduates, and other relevant studies.

The review of literature provided a basis for this study which was to determine how the COBOL competencies taught in information systems programs and those attained by information systems students compare to those needed on the job.

Study of the literature revealed the following.

1. Institutions with four-year information systems programs and related programs are concerned that curricula are current.

2. A need exists to identify introductory COBOL programming competencies required of an information systems graduate.
3. No studies were found that determined COBOL programming competencies that should be emphasized in four-year information systems programs.

The review of literature also provided the bases for the research design and methodology of this study.

CHAPTER III

METHODOLOGY

This chapter includes (a) research design; (b) identification of the COBOL competencies; (c) development of the survey instrument used with faculty, prospective employers and seniors; (d) the study participants; (e) data collection and recording; (f) data analysis; and (g) summary.

Research Design

A review of literature was completed to identify COBOL programming competencies in information systems programs. A survey instrument was then developed and was used to evaluate the extent that faculty believed COBOL programming competencies were taught, prospective employers expected the competencies, and seniors believed the competencies were learned. Thus, a descriptive survey procedure was the basis for the research. According to Kerlinger (1973), "Research design is a plan, structure, and strategy of investigation conceived so as to obtain answers to research questions and to control variance" (p. 300). He further states that it

sets up the framework for tests of the relations among variables.

Identification of the COBOL Competencies

To answer the research questions of the study, an initial list of COBOL programming competencies was compiled as a result of an extensive review of the related literature. Kettner (1976), in his final report on a study concerning competencies for job entry of data processing programmers, listed competencies that were included in this study. Also a competency-based course outline for business and office education, edited by Ricks and Schmidt (1981); textbooks for structured, introductory COBOL programming by Shelly and Cashman (1978), and Stern and Stern (1980); and a study by Stoehr (1976), were used in listing the competencies. Each competency was placed on an index card and then a list was made of the competencies. The list was reviewed for repetitious or similar statements and those observed were combined. Each statement was then written so that it would be specific enough to provide complete information. All COBOL programming competencies secured were included on the initial list.

Development of the Survey Instrument used with Faculty, Prospective Employers, and Seniors

The compentencies were arranged according to logical classifications so as to assist the respondents who evaluated them. The three classifications were preparation, writing, and debugging.

Panel of Experts for the Survey Instrument

A panel of experts was asked to validate the list of COBOL competencies. The panel consisted of three information systems faculty, three graduates of information systems programs, and three employers of information systems graduates selected from the Petersburg, Virginia, metropolitan area. Each panel member was personally interviewed. The instrument that was reviewed with the panel of experts contained two parts. The first part was the list of COBOL programming competencies. The second part provided space for the addition of competencies or for other comments concerning the competencies.

The panelists were provided a letter to read explaining the research project. A copy of the letter appears in Appendix B. They were asked to evaluate the competencies listed as to appropriateness for a COBOL programming information systems program and to make recommendations

concerning clarity of the statements and completeness of the list. In addition, they were asked for other comments that might be helpful. A copy of the initial list of competencies is in Appendix C along with a copy of the sheet provided for the panelists' comments.

The personal interview method was used to secure input from the members of the panel. According to Kerlinger (1973, p. 412), this method represents a powerful and useful tool because it enables the researcher to explain portions of the instrument or directions that may not be clear, to obtain immediate responses, and to secure additional information relative to the respondents reasons for giving answers.

After securing input from the panel on the survey instrument in personal interviews, the list of competencies was reviewed and revised. The draft survey instrument was again presented, through personal interviews, for review by three of the nine panel respondents--one representing each of the three groups involved in the study. Again revisions, as needed, were made and the list of competencies compiled was used as the basis for the survey instrument used in the study.

The final list of 60 competencies with the competencies classified under the headings preparation, writing, and debugging appears in Appendix D.

The Study Participants

Five Virginia four-year universities offering a B.S. degree in information systems through the School of Business were included in the study. The population for the study was the information systems faculty, the prospective employers of graduates from the information systems programs, and the seniors from these universities. Table 1 provides details as to the number of participants available from each institution.

Faculty Participants

The heads of the information systems departments at the universities were contacted by telephone and sent a letter to explain the study and solicit their support. (Refer to Appendix E for a copy of the letter). They were asked to identify only faculty in their departments who were involved with COBOL. They confirmed a list of appropriate faculty secured from the 1982-83 catalogs of their respective institutions. Names of new faculty were also provided. The faculty identified were asked to participate in the study to evaluate COBOL programming competencies in

Table 1

Participants Available

Group	University A	B	C	D	E	Total
Faculty	03	03	05	04	06	21
Prospective Employers	07	07	19	08	11	52
Seniors	42	58	74	49	39	262
Total	52	68	98	61	56	335

information systems programs. They were contacted by mail at their respective universities to explain the study and to solicit their support. A survey instrument, and a self-addressed, stamped envelope were included with the letter requesting that the survey instrument be completed and returned to the researcher. A copy of the letter along with directions for completing the instrument are presented in Appendix F. The scale used by the information systems faculty to rate the competencies was as follows:

Faculty

1 = None--Students do not develop any skill in this COBOL programming competency

2 = Some--Students develop enough skill to describe but not to perform this COBOL programming competency.

3 = Moderate--Students develop considerable skill and can perform this COBOL programming competency with some assistance.

4 = Extensive--Students can perform this COBOL programming competency independently.

Prospective Employers

The personnel offices of each university participating in the study were contacted by telephone, and asked to provide the names and addresses of employers interviewing information systems seniors on their campuses during the months of February and March. The employers were then telephoned for the names of appropriate individuals within their organizations who could be contacted to participate in the study.

Each individual identified by the employers was mailed a survey instrument; a self-addressed, stamped envelope; and a letter explaining the study, soliciting the individual's participation. The explanation of the study in the letter was in keeping with the purpose of this study, which was to identify COBOL programming competencies in information systems programs through related literature and to evaluate them. A copy of the letter and directions for completing the survey instrument are in Appendix G.

The scale used by the prospective employers to rate the competencies follows:

Prospective Employers

1 = None--Employees do not need any skill in this COBOL programming competency.

2 = Some--Employees need enough skill to describe but not to perform this COBOL programming competency.

3 = Moderate--Employees need considerable skill and should be able to perform this COBOL programming competency with some assistance.

4 = Extensive--Employees must be able to perform this COBOL programming competency independently.

Senior Participants

The number of seniors and classes where they were contacted was obtained from the heads of the information systems programs at the participating universities. Arrangements were made through the information systems department heads and instructors so that the seniors could respond to the survey instrument in groups. The instructors were asked to distribute the instrument to the seniors. A letter explaining the study and requesting their participation was given to the seniors to read. Refer to Appendix H for a copy of the letter and directions for completing the instrument.

The seniors were each given a copy of the survey instrument with directions and asked to complete the

instrument by circling a level of each competency they believed they had developed. The scale they used was as follows:

Seniors

1 = None--I did not develop any skill in this COBOL programming competency.

2 = Some--I developed enough skill to describe but not to perform this COBOL programming competency.

3 = Moderate--I developed considerable skill and can perform this COBOL programming competency with some assistance.

4 = Extensive--I can perform this COBOL programming competency independently.

Data Collection and Recording

Consideration was given to the collection procedure listed by Dillman (1978). He suggested a method of research that would consistently receive a high rate of response for mail surveys, since it involves using the following factors

and steps of the research process collectively rather than singly: instrument design and construction, content of cover and follow-up letters and follow-up cards, and the manner in which follow-up mailings are conducted. The procedure was also followed by telephone calls.

Two weeks after the initial mailing to each faculty member a postal card follow-up was mailed to those who had not responded to the survey instrument. A copy of the follow-up postal card is in Appendix I. One week after mailing the postal card, a telephone call was made to the faculty who still had not responded. The entire mailing and collection time for the faculty survey was three weeks. After the collection of the completed instruments, a summary was made to determine the percentage of responses. Prospective employers were also contacted by mail and follow-up procedures as detailed for the faculty were followed with them.

Seniors were contacted in class groups on campuses and asked to complete the survey instrument. A summary of the number of instruments distributed to faculty, prospective employers, and seniors; number of responses received; and the percent of responses is provided in Table 2.

Table 2

Number of Instruments Distributed and Response Rates

Group	Number Distributed	Responses Received	Percent of Responses
Faculty	21	18	85.7
Prospective Employers	52	45	86.6
Seniors	262	220	83.9
Total	335	283	85.4

Data Analysis

The following research questions were answered as the data were analyzed.

Question 1. What are the introductory COBOL programming competencies required to be a COBOL programmer?

An initial list of COBOL programming competencies compiled from the literature was reviewed by a panel of experts, representing information systems faculty, prospective employers of information systems graduates, and information systems graduates. The revised list was considered the COBOL programming competencies that should be taught in information systems programs. This list was the basis of the survey instrument used in the study.

Question 2. To what extent do information systems program faculty perceive that they have taught COBOL programming competencies?

A survey instrument which listed COBOL programming competencies and included a four-point scale, extensive to none, was distributed to information systems faculty in five Virginia universities. Only faculty members who were familiar with COBOL programming were included in the study. Based on the responses from the faculty, a list of COBOL programming competencies that the faculty perceived they had

taught and the extent to which the competencies had been taught was compiled.

A value of four points was assigned to the rating extensive; a value of three points was assigned to the rating moderate; a value of two points was assigned to the rating some; and a value of one point was assigned to the rating none. If a competency had a mean score between 4.00 and 3.50, the interpretation was that the faculty believed students developed extensive skill in the competency. A summary of the interpretation of the responses is provided in Table 3.

Part 2 of the instrument requested that the faculty provide comments, remarks, or suggestions helpful to the study.

Question 3. What level of competence in COBOL programming do prospective employers expect information systems graduates to have on the job?

A survey instrument which listed COBOL programming competencies and included a four-point scale, extensive to none, was distributed to prospective employers of information systems graduates of five Virginia universities. Only individuals who were familiar with COBOL programming were contacted. Based on the responses from them, a list of COBOL programming competencies that prospective employers perceived graduates need and the extent to which they need

Table 3

Summary of the Mean Score Ranges

Response to Competency	Mean Score
Extensive	4.00-3.50
Moderate	3.49-2.50
Some	2.49-1.50
None	1.49-1.00

to be competent was compiled. Interpretation of the responses was similar to that for the faculty.

Question 4. To what extent do information systems seniors perceive that they have developed COBOL programming competencies?

Information systems seniors of five Virginia universities were asked to respond to a survey instrument which listed COBOL programming competencies and included a four-point scale, extensive to none. Based on their responses, a list of COBOL programming competencies that seniors perceived they had learned was compiled. Interpretation of the responses was similar to that for the faculty and prospective employers.

Question 5. Which COBOL programming competencies did the faculty, prospective employers, and seniors rate similarly in regard to level of skill?

Based on responses to the survey instrument by the faculty, prospective employers, and seniors, a statistical analysis was completed. First, chi-square values were computed for each competency. Since data were collected from the entire populations of faculty, prospective employers, and seniors, it was inappropriate to compare the calculated chi-square values with critical values from a table to determine if the groups did or did not respond

similarly. Thus, contingency coefficients (C) were computed to measure the relationship between group membership and the responses to the competencies. The contingency coefficient (C) is computed directly from the X^2 value, and can be computed for any size contingency table. (Hinkle, Jurs, & Wiersma, 1979, pp. 104, 349-350). It is defined as follows:

$$C = \sqrt{\frac{X^2}{X^2 + N}}$$

According to Hull, Jenkins, Nie, Bent and Steinbrenner (1975), the possible values of C ranged from .000 to .816 for a 3 x 4 table, with greater value of C representing the stronger relationship between group membership and responses.

To interpret the contingency coefficients, the following table was used:

.000 to .322 Little, or no relationship

.323 to .463 Low relationship

.464 to .613 Moderate relationship

.614 to .762 High relationship

.763 to .816 Very high relationship

The information systems faculty, the prospective employers, and students were considered to have responses that were similar if the value of C was .322 or less since

there was little or no relationship between group membership and the responses. The groups were considered to have responses that differed if the value of C was .323 or greater.

Summary

This chapter on methodology included the following topics: research design; identification of the COBOL competencies; development of the survey instrument used with faculty and prospective employers and seniors, panel of experts for the survey instrument; the study participants; data collection and recording; and data analysis.

Three groups constituted the population of the study. They were faculty of five Virginia universities with four-year information systems programs, prospective employers of information systems graduates, and information systems seniors.

The research questions posed were:

1. What are the introductory COBL programming competencies required to be a COBOL programmer?
2. To what extent do information systems program faculty perceive that they have taught COBOL programming competencies?

3. What level of competence in COBOL programming do prospective employers expect information systems graduates to have on the job?
4. To what extent do information systems seniors perceive that they have developed COBOL programming competencies?
5. Which COBOL programming competencies did the faculty, prospective employers and seniors rate similarly in regard to level of skill?

CHAPTER IV

FINDINGS OF THE STUDY

The problem of this study was to determine how the COBOL competencies taught in information systems programs and those attained by information systems students compare to those needed on the job. The results of the study are presented in two sections. The first section gives outcomes of the five research questions posed in the study and the second section gives a summary of the outcomes.

Research Question Outcomes

The research questions were answered through the development of a survey instrument that was sent to information systems faculty, prospective employers, and students.

Table 4 shows the numbers and percentages of usable returns collected. A total of 283 respondents (faculty 18, prospective employers 45, and seniors 220) provided information that was used in the data analysis. The respondents represented 85.4% of the total population. One university had no senior or faculty responses; however, responses were received from the university's prospective

Table 4

Number and Percent of Usable Returns

	Faculty		Prospective Employers		Seniors		Total Group	
RETURNS	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
Returned Usable	18	85.7	45	86.6	220	83.9	283	85.4
Returned Unusable	00	00.0	01	01.9	02	00.8	03	00.9
Not Returned	03	14.3	06	11.5	40	15.3	49	13.7
Total	21	100.0	52	100.0	262	100.0	335	100.0

employers. The university had three faculty and 40 seniors involved. Copies of the survey instrument and directions were sent to the information systems department for distribution by the faculty after the researcher had completed two telephone conversations with the faculty representative for information systems. A telephone conversation later with this individual concerning collection of the instruments revealed that they had not been distributed for completion by the seniors as discussed. Four subsequent calls to the instructor of the course where the information was to be collected and the department head were made. It was determined that the seniors were not permitted to complete the instrument. A request was made for addresses of seniors so they could be contacted by mail. The registrar's office at the university noted that providing the addresses would be in violation of the privacy act. Another request was then made that a secretary at the university be permitted to address envelopes with the researcher defraying all expenses involved in mailing the instruments. The researcher was informed by the department head that the secretary would be unable to complete the mailing.

Outcomes to the five research questions follow.

Question 1. What are the introductory COBOL

programming competencies required to be a COBOL programmer?

The 60 COBOL programming competencies determined as needed are listed in Table 5. The list was compiled from a review of literature. It was validated by a panel of experts representing information systems faculty, prospective employers of information systems graduates, and information systems seniors.

Question 2. To what extent do information systems program faculty perceive that they have taught COBOL programming competencies?

This question was answered by data collected from the information systems faculty. They responded to the competencies listed on a survey instrument, with a four-point scale. Table 5 shows the list of COBOL programming competencies and the extent to which the faculty perceived they had taught them. The mean scores as indicated by their responses are listed for each of the 60 competencies. The faculty rated 41 of the competencies as extensive indicating that they believed students can perform them independently. They rated the other 19 competencies as moderate indicating that they believed students can perform them with some assistance. None of the competencies was rated by the faculty as some or none.

Table 5

COBOL Programming Competencies and Level of Skill in Each Perceived as Taught by Information Systems Faculty

Competency	Mean Score	Rating Level*
Preparation		
1. Prepare a card record layout	3.714	E
2. Prepare a general (logic) program flowchart	3.429	M
3. Prepare a system flowchart	3.214	M
4. Prepare a detail program flowchart	3.214	M
5. Use standard flowchart symbols	3.714	E
6. Use coding sheet for writing program	3.571	E
7. Prepare a printer spacing form	3.571	E
8. Prepare test data for use in testing program	3.429	M
9. Prepare real data for use with program	3.429	M
10. Be familiar with list of COBOL reserve words	3.643	E
11. Be familiar with job control cards	3.286	M
12. Write simple COBOL programs	3.929	E
13. Write headers for programs	3.643	E
14. Divide a program into modules	3.714	E
15. Select appropriate data names for files, records and fields	3.929	E
16. Write simple add statements	3.857	E
17. Know the rules for writing simple arithmetic operations	3.786	E
18. Know the formats for writing simple arithmetic operations	3.786	E

Table 5 (Continued)

Competency	Mean Score	Rating Level
Writing		
19. Write simple subtract statements	3.846	E
20. Write simple multiplication statements	3.846	E
21. Write simple divide statements	3.923	E
22. Write statements using the COMPUTE verb	3.769	E
23. Write statements using the ROUNDED option	3.846	E
24. Use appropriate PICTURE clause	4.000	E
25. Be familiar with the hierarchy of arithmetic operations	3.714	E
26. Write PERFORM . . . TIMES statements	3.231	M
27. Write simple condition statements	3.714	E
28. Write PERFORM . . . UNTIL statements	3.714	E
29. Write main modules	3.714	E
30. Write compound conditional statements	3.538	E
31. Write negating compound condition statements	2.923	M
32. Be familiar with the JUSTIFIED RIGHT clause	2.929	M
33. Be familiar with REDEFINES clause	2.923	M
34. Be familiar with MOVE CORRESPONDING statement	2.786	M
35. Write statements to secure edited results	3.615	E
36. Write statements to test for end of page	3.154	M
37. Write statements to skip to a new page	3.692	E
38. Write statements to print job headings	3.714	E
39. Write statements to print field delineators	3.385	M
40. Write statements to align data under headers	3.714	E

Table 5 (Continued)

Competency	Mean Score	Rating Level
Writing		
41. Write statements to use tape file	2.604	M
42. Write statements to use disk file	3.385	M
43. Be familiar with group printing	3.385	M
44. Be familiar with display statements	3.429	M
45. Be familiar with accept statements	3.462	M
46. Use structure programming techciques	3.571	E
47. Write identification for program	3.929	E
48. Write documentation for program	3.714	E
49. Write the select clauses for a program	3.643	E
50. Write the WORKING-STORAGE SECTION	3.857	E
51. Write statements to access input and output files	3.857	E
52. Write read and write statements	4.000	E
53. Write statements to perform simple move operations	4.000	E
54. Write simple PERFORM statements	3.929	E
55. Write specific end-of-job statements	3.929	E
56. Write documentation updates after a program revision	3.429	M
Debugging		
57. Read a program listing	3.786	E
58. Desk check a program	3.714	E
59. Correct logical errors	3.571	E
60. Correct syntax errors	3.714	E

*Rating of E = Extensive (4.00-3.50)
M = Moderate (3.49-2.50)
S = Some (2.49-1.50)
N = None (1.49-1.00)

Question 3. What level of competence in COBOL programming do prospective employers expect information systems graduates to have on the job?

This question was answered on the basis of responses from prospective employers of information systems graduates of the five Virginia universities. Each prospective employer was asked to respond to the competencies on the survey instrument on a four-point scale. Table 6 indicates the level of skill in the COBOL programming competencies that the employers expected information systems graduates to have on the job. The prospective employers rated 28 of the competencies as extensive indicating that they expected new employees to perform them independently. They rated the skill needed as moderate for 32 of the competencies indicating that they expected new employees to perform them with some assistance. The employers rated fewer competencies as extensive than the faculty did. Likewise, they rated more competencies as moderate than the faculty.

Question 4. To what extent do information systems seniors perceive that they have developed COBOL programming competencies?

To answer this question, seniors at the universities were asked to respond to the competencies listed on the survey instrument on a four-point scale. Table 7 indicates

Table 6

COBOL Programming Competencies and Level of Skill in Each Expected by Prospective Employers of Information Systems Graduates

Competency	Mean Score	Rating Level*
Preparation		
1. Prepare a card record layout	2.711	M
2. Prepare a general (logic) program flowchart	3.200	M
3. Prepare a system flowchart	2.667	M
4. Prepare a detail program flowchart	2.667	M
5. Use standard flowchart symbols	3.222	M
6. Use coding sheet for writing program	3.000	M
7. Prepare a printer spacing form	3.222	M
8. Prepare test data for use in testing program	3.311	M
9. Prepare real data for use with program	2.844	M
10. Be familiar with list of COBOL reserve words	3.267	M
11. Be familiar with job control cards	3.205	M
12. Write simple COBOL programs	3.689	E
13. Write headers for programs	3.556	E
14. Divide a program into modules	3.622	E
15. Select appropriate data names for files, records and fields	3.556	E
16. Write simple add statements	3.667	E
17. Know the rules for writing simple arithmetic operations	3.667	E
18. Know the formats for writing simple arithmetic operations	3.689	E

Table 6 (Continued)

Competency	Mean Score	Rating Level
Writing		
19. Write simple subtract statements	3.689	E
20. Write simple multiplication statements	3.689	E
21. Write simple divide statements	3.689	E
22. Write statements using the COMPUTE verb	3.422	M
23. Write statements using the ROUNDED option	3.333	M
24. Use appropriate PICTURE clause	3.689	E
25. Be familiar with the hierarchy of arithmetic operations	3.667	E
26. Write PERFORM . . . TIMES statements	3.378	M
27. Write simple condition statements	3.622	E
28. Write PERFORM . . . UNTIL statements	3.467	M
29. Write main modules	3.644	E
30. Write compound conditional statements	3.378	M
31. Write negating compound condition statements	2.933	M
32. Be familiar with the JUSTIFIED RIGHT clause	2.911	M
33. Be familiar with REDEFINES clause	2.844	M
34. Be familiar with MOVE CORRESPONDING statement	2.667	M
35. Write statements to secure edited results	3.400	M
36. Write statements to test for end of page	3.111	M
37. Write statements to skip to a new page	3.422	M
38. Write statements to print job headings	3.511	E
39. Write statements to pront field delineators	3.422	M
40. Write statements to align data under headers	3.422	M
41. Write statements to use tape file	3.222	M

Table 6 (Continued)

Competency	Mean Score	Rating Level
Writing		
42. Write statements to use disk file	3.244	M
43. Be familiar with group printing	3.133	M
44. Be familiar with display statements	3.244	M
45. Be familiar with accept statements	3.222	M
46. Use structure programming techniques	3.533	E
47. Write identification for program	3.566	E
48. Write documentation for program	3.568	E
49. Write the select clauses for a program	3.600	E
50. Write the WORKING-STORAGE SECTION	3.644	E
51. Write statements to access input and output files	3.733	E
52. Write read and write statements	3.733	E
53. Write statements to perform simple move operations	3.689	E
54. Write simple PERFORM statements	3.644	E
55. Write specific end-of-job statements	3.489	M
56. Write documentation updates after a program revision	3.400	M
Debugging		
57. Read a program listing	3.644	E
58. Desk check a program	3.644	E
59. Correct logical errors	3.600	E
60. Correct syntax errors	3.689	E

*Rating of E = Extensive (4.00-3.50)
M = Moderate (3.49-2.50)
S = Some (2.49-1.50)
N = None (1.49-1.00)

the level of skill in COBOL programming competencies that the information systems seniors perceived they had developed.

Information systems seniors rated 39 competencies as extensive, and 21 competencies as moderate. These numbers compare respectively, to 41 and 19 for the faculty, and 28 and 32 for the prospective employers.

Question 5. Which COBOL programming competencies did the faculty, prospective employers, and seniors rate similarly in regard to level of skill?

Responses of the three groups were used to answer this question. The contingency coefficient (C) was computed to determine level of skill needed in each competency that was rated similarly by information systems faculty, prospective employers and students on the none--extensive scale. For a 3 x 4 table the possible values of C ranged from .000 to .816, with the greater value of C representing the stronger relationship between group membership and responses. If the value of C was greater than .322, the groups were deemed to have responded differently since there was a relationship between group membership and responses.

Table 8 presents the contingency coefficients, the mean scores for the faculty, the mean scores for the prospective employers, the mean scores for the seniors, and the mean

Table 7

COBOL Programming Competencies and Level of Skill in Each Perceived as Learned by Seniors

Competency	Mean Score	Rating Level*
Preparation		
1. Prepare a card record layout	3.642	E
2. Prepare a general (logic) program flowchart	3.662	E
3. Prepare a system flowchart	3.404	M
4. Prepare a detail program flowchart	3.402	M
5. Use standard flowchart symbols	3.735	E
6. Use coding sheet for writing program	3.673	E
7. Prepare a printer spacing form	3.598	E
8. Prepare test data for use in testing program	3.235	M
9. Prepare real data for use with program	3.372	M
10. Be familiar with list of COBOL reserve words	3.349	M
11. Be familiar with job control cards	3.469	M
12. Write simple COBOL programs	3.743	E
13. Write headers for programs	3.774	E
14. Divide a program into modules	3.626	E
15. Select appropriate data names for files, records and fields	3.772	E
16. Write simple add statements	3.808	E
17. Know the rules for writing simple arithmetic operations	3.726	E
18. Know the formats for writing simple arithmetic operations	3.721	E

Table 7 (Continued)

Competency	Mean Score	Rating Level
Writing		
19. Write simple subtract statements	3.766	E
20. Write simple multiplication statements	3.780	E
21. Write simple divide statements	3.661	E
22. Write statements using the COMPUTE verb	3.229	M
23. Write statements using the ROUNDED option	3.502	E
24. Use appropriate PICTURE clause	3.795	E
25. Be familiar with the hierarchy of arithmetic operations	3.662	E
26. Write PERFORM . . . TIMES statements	3.189	M
27. Write simple condition statements	3.742	E
28. Write PERFORM . . . UNTIL statements	3.688	E
29. Write main modules	3.616	E
30. Write compound conditional statements	3.450	M
31. Write negating compound condition statements	3.243	M
32. Be familiar with the JUSTIFIED RIGHT clause	2.742	M
33. Be familiar with REDEFINES clause	3.088	M
34. Be familiar with MOVE CORRESPONDING statement	2.598	M
35. Write statements to secure edited results	3.430	M
36. Write statements to test for end of page	3.548	E
37. Write statements to skip to a new page	3.667	E
38. Write statements to print job headings	3.722	E
39. Write statements to pront field delineators	3.373	M
40. Write statements to align data under headers	3.685	E
41. Write statements to use tape file	2.604	M

Table 7 (Continued)

Competency	Mean Score	Rating Level
Writing		
42. Write statements to use disk file	3.307	M
43. Be familiar with group printing	3.039	M
44. Be familiar with display statements	3.972	M
45. Be familiar with accept statements	3.157	M
46. Use structure programming techniques	3.546	E
47. Write identification for program	3.721	E
48. Write documentation for program	3.578	E
49. Write the select clauses for a program	3.618	E
50. Write the WORKING-STORAGE SECTION	3.735	E
51. Write statements to access input and output files	3.687	E
52. Write read and write statements	3.801	E
53. Write statements to perform simple move operations	3.829	E
54. Write simple PERFORM statements	3.820	E
55. Write specific end-of-job statements	3.623	E
56. Write documentation updates after a program revision	3.164	M
Debugging		
57. Read a program listing	3.659	E
58. Desk check a program	3.493	E
59. Correct logical errors	3.599	E
60. Correct syntax errors	3.719	E

*Rating of E = Extensive (4.00-3.50)
M = Moderate (3.49-2.50)
S = Some (2.49-1.50)
N = None (1.49-1.00)

scores for the total group for each competency. There were two competencies, 1 and 3, with contingency coefficients of .403 and .331, respectively, for which the groups responded differently. These competencies were both in the preparation area. They were "Prepare a card record layout," and "Prepare a system flowchart." The faculty and seniors rated skill needed for the first competency as extensive (3.714 and 3.642, respectively), while the prospective employers rated it moderate (2.711). For the third competency, faculty, prospective employers, and seniors had ratings of moderate with means of 3.214, 2.667, and 3.404, respectively.

The two competencies which the groups had the least disagreement on were numbers 43 and 45, with contingency coefficients of .103 and .105, respectively. These competencies were both in the writing area. They were "Be familiar with group printing," and "Be familiar with accept statement." The faculty, prospective employers, and students rated number 43 as moderate (3.385, 3.133 and 3.039, respectively). They also rated number 45 as moderate (3.462, 3.222, and 3.157, respectively).

Summary of the Outcomes

A total of 283 respondents provided usable returns out of 335 survey instruments that were distributed. The 18

Table 8

Contingency Coefficients and Mean Scores for Information Systems Faculty, Prospective Employers, Seniors, and the Total Group

Competency	Contingency Coefficient	Mean Score			
		Faculty	Prospective Employers	Seniors	Total Group
Preparation					
1. Prepare a card record layout	.403	3.714	2.711	3.642	3.495
2. Prepare a general (logic) program flowchart	.276	3.429	3.200	3.662	3.576
3. Prepare a system flowchart	.331	3.214	2.667	3.404	3.274
4. Prepare a detail program flowchart	.318	3.214	2.667	3.402	3.273
5. Use standard flowchart symbols	.304	3.714	3.222	3.735	3.651
6. Use coding sheet for writing program	.314	3.571	3.000	3.673	3.557
7. Prepare a printer spacing form	.237	3.571	3.222	3.598	3.536

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Faculty	Prospective Employers	Seniors	Total Group
Preparation					
8. Prepare test data for use in testing program	.147	3.429	3.311	3.235	3.257
9. Prepare real data for use with program	.235	3.429	2.844	3.372	3.289
10. Be familiar with a list of COBOL reserve words	.204	3.643	3.267	3.349	3.350
11. Be familiar with job control cards	.136	3.286	3.205	3.469	3.409
Writing					
12. Write simple COBOL programs	.270	3.929	3.689	3.743	3.744
13. Write headers for programs	.208	3.643	3.556	3.774	3.732
14. Divide program into modules	.176	3.714	3.622	3.626	3.629

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Prospective			
		Faculty	Employers	Seniors	Total Group
Writing					
15. Select appropriate data names for files, records, and fields	.248	3.929	3.556	3.772	3.745
16. Write simple add statements	.239	3.857	3.667	3.808	3.788
17. Know the rules for writing simple arithmetic operations	.253	3.786	3.667	3.726	3.719
18. Know the formats for writing simple arithmetic operations	.265	3.786	3.689	3.721	3.719
19. Write simple subtract statements	.242	3.846	3.689	3.766	3.757
20. Write simple multiplication statements	.274	3.846	3.689	3.780	3.768
21. Write simple divide statements	.216	3.923	3.689	3.661	3.678

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Faculty	Prospective Employers	Seniors	Total Group
Writing					
22. Write statements using the COMPUTE verb	.229	3.769	3.422	3.229	3.289
23. Write statements using the ROUNDED option	.298	3.846	3.333	3.502	3.491
24. Use the appropriate PICTURE clause	.221	4.000	3.689	3.795	3.788
25. Be familiar with the hierarchy of arithmetic operations	.203	3.714	3.667	3.662	3.665
26. Write PERFORM . . . TIMES statements	.167	3.231	3.378	3.189	3.222
27. Write simple condition statements	.237	3.714	3.622	3.742	3.721
28. Write PERFORM . . . UNTIL statements	.173	3.714	3.467	3.688	3.653
29. Write main modules	.177	3.714	3.644	3.616	3.626

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Prospective			
		Faculty	Employers	Seniors	Total Group
Writing					
30. Write compound conditional statements	.215	3.538	3.378	3.450	3.442
31. Write negating compound conditional statements	.266	2.923	2.933	3.243	3.176
32. Be familiar with JUSTIFIED RIGHT clause	.181	2.929	2.911	2.742	2.783
33. Be familiar with REDEFINES clause	.236	2.923	2.844	3.088	2.783
34. Be familiar with MOVE CORRESPONDING statements	.172	2.786	2.667	2.598	2.620
35. Write statements to secure edited results	.121	3.615	3.400	3.430	3.434
36. Write statements to test for end of page	.240	3.154	3.311	3.548	3.491

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Prospective			
		Faculty	Employers	Seniors	Total Group
Writing					
37. Write statements to skip to a new page	.174	3.692	3.422	3.667	3.628
38. Write statements to print job headings	.203	3.714	3.511	3.722	3.687
39. Write statements to print field delineators	.182	3.385	3.422	3.373	3.382
40. Write statements to align under headers	.181	3.714	3.422	3.685	3.644
41. Write statements to use tape file	.224	2.604	3.222	2.604	2.708
42. Write statements to use disk file	.121	3.385	3.244	3.307	3.300
43. Be familiar with group printing	.103	3.385	3.133	3.039	3.072

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Faculty	Prospective Employers	Seniors	Total Group
Writing					
44. Be familiar with display statement	.168	3.244	3.244	2.972	3.072
45. Be familiar with accept statement	.105	3.462	3.222	3.157	3.182
46. Use structure programming techniques	.190	3.571	3.533	3.546	3.545
47. Write identification for programs	.211	3.929	3.556	3.721	3.705
48. Write documentation for program	.183	3.714	3.568	3.578	3.583
49. Write the select clauses for a program	.180	3.643	3.600	3.618	3.616
50. Write the Working-Storage Section	.206	3.857	3.644	3.735	3.727
51. Write statement to access input and output files	.280	3.357	3.733	3.687	3.703

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Prospective			
		Faculty	Employers	Seniors	Total Group
Writing					
52. Write read and write statements	.269	4.000	3.733	3.801	3.800
53. Write statements to perform simple move operations	.255	4.000	3.689	3.829	3.815
54. Write simple PERFORM statements	.205	3.929	3.711	3.820	3.808
55. Write specific end-of-job statements	.185	3.929	3.489	3.623	3.617
56. Write documentation updates after a program revision	.203	3.429	3.400	3.164	3.218
Debugging					
57. Read a program listing	.156	3.786	3.644	3.659	3.529
58. Desk check a program	.217	3.714	3.644	3.493	3.529

Table 8 (Continued)

Competency	Contingency Coefficient	Mean Score			
		Prospective			
		Faculty	Employers	Seniors	Total Group
Debugging					
59. Correct logical errors	.310	3.571	3.600	3.599	3.598
60. Correct syntax errors	.268	3.714	3.689	3.719	3.714

faculty indicated extensive as the mean skill level (rating of 3.50 to 4.00) for 41 competencies and moderate as the mean skill level (rating of 2.50 to 3.49) for 19 competencies. The 45 prospective employers indicated extensive (rating 3.50 to 4.00) for 28 competencies and moderate (rating 2.50 to 3.49) for 32 competencies. The 220 seniors indicated extensive (rating of 3.50 to 4.00) for 38 competencies and moderate (rating of 2.50 to 3.49) for 22 proposed competencies. None of the groups indicated some (rating of 1.50 to 2.49) or none (rating 1.00 to 1.49) as the skill level response to any of the COBOL competencies.

The contingency coefficient (C) was used to determine if the responses of the three groups were different. For only two competencies, 1 and 3, was the contingency coefficient interpreted as showing a relationships between group membership and response.

For 25 of the competencies, all three groups rated the skill level needed as extensive. These competencies were:

12. Write simple COBOL programs
13. Write headers for programs
14. Divide programs into modules
15. Select appropriate data names for files, records and fields
16. Write simple add statements

17. Know the rules for writing simple arithmetic operations
18. Know the formats for writing simple arithmetic operations
19. Write simple subtract statements
20. Write simple multiplication statements
21. Write simple divide statements
24. Use the appropriate Picture Clause
25. Be familiar with the hierarchy of arithmetic operations
27. Write simple condition statements
29. Write main modules
38. Write statements to print job headings
47. Write identification for programs
48. Write documentation for programs
49. Write the select clauses for a program
50. Write the WORKING-STORAGE SECTION
53. Write statements to perform simple move operations
54. Write simple PERFORM statements
55. Write specific end-of-job statements
57. Read a program listing
59. Correct logical errors
60. Correct syntax errors

Although only two competencies had contingency coefficients indicating that the groups had responded differently, the faculty, employers, and seniors did not perceive the skill level taught, needed, or learned at the same level in the extensive, moderate, some, or none categories for 17 competencies. These competencies along with the skill level ratings for the three groups are listed in Table 9. The faculty rated only one of the 17 as moderate, number 51, that the employers rated as extensive. For two of the competencies, both faculty and employers gave ratings of moderate and for one competency, both groups gave ratings of extensive. For the other 13, the faculty rated the skill level needed as extensive, while the employers rated it as moderate. Thus the faculty tended to rate the competencies taught at a somewhat higher level than the prospective employers rated them as expected on the job.

Similar to the faculty, the seniors rated more of the competencies as learned at the extensive level than the employers rated as needed at that level. For 12 of the competencies, the seniors rated the skill level as extensive, while the employers rated it as moderate. For four competencies both groups rated the skill level as moderate. The seniors rated only one competency, number 58, as moderate, that the employers rated as extensive.

Table 9

Seventeen Competencies That the Faculty, Prospective Employers, and Seniors Did Not Perceive As Taught, Needed, or Learned at the Same Level

Competency	Faculty	Employers	Seniors
Preparation			
1. Prepare a card record layout	E*	M**	E
2. Prepare a general (logic) program flowchart	M	M	E
5. Use standard flowchart symbols	E	M	E
6. Use coding sheet for writing program	E	M	E
7. Prepare a printer spacing form	E	M	E
10. Be familiar with a list of COBOL reserve words	E	M	M
Writing			
22. Write statements using the COMPUTE verb	E	M	M
23. Write statements using the ROUNDED option	E	M	E

Table 9 (Continued)

Competency	Faculty	Employers	Seniors
Writing			
28. Write PERFORM . . . UNTIL statements	E	M	E
30. Write compound conditional statements	E	M	M
35. Write statements to secure edited results	E	M	M
36. Write statements to test for end of page	M	M	E
37. Write statements to skip to a new page	E	M	E
40. Write statements to align data under headers	E	M	E
46. Use structure programming techniques	E	M	E
51. Write statement to access input and output files	M	E	E
Debugging			
58. Desk check a program	E	E	M

*E = Skill level for competency rated as extensive.
**M = Skill level for competency rated as moderate.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem of this study was to determine how the COBOL competencies taught in information systems programs and those attained by information systems students compare to those needed on the job. In this chapter a summary of the study, conclusions, and recommendations are presented.

Summary

The survey of the literature revealed no studies that determined COBOL programming competencies that should be emphasized in four-year information systems programs. Further, an instrument with competencies for COBOL programming was not available. Therefore, the literature was searched to collect a list of competencies that was used as the basis for the survey instrument in this study. The initial list was reviewed and evaluated by a panel of experts representing information systems faculty, graduates of information systems programs, and employers of information

systems graduates selected from the Petersburg, Virginia, metropolitan area. The final list of 60 competencies was compiled from the experts review.

The information systems faculty and prospective employers were sent a survey instrument containing the competencies and a rating scale by mail. The response rate was 85.7% from the faculty and 86.6% from prospective employers. Students constituted the third group. They were contacted on their campuses and the instrument and cover letter were distributed to them. The response rate for the students was 83.9%.

Five research questions in the study were answered.

Question 1. What are the introductory COBOL competencies required to be a COBOL programmer?

An initial list of COBOL programming competencies was reviewed by a panel of experts. The compiled, revised list was considered the COBOL programming competencies that should be taught in information systems programs.

Question 2. To what extent do information systems program faculty perceive that they have taught COBOL programming competencies?

A survey instrument which listed COBOL programming competencies and included a four-point scale, extensive to

none, was distributed to information systems faculty in five Virginia universities. Only faculty members who were familiar with COBOL programming were included. Based on the responses from the faculty, a list of COBOL programming competencies that the faculty perceived they had taught and the extent to which the competencies had been taught was compiled. The faculty rated 41 competencies as extensive and 19 competencies as moderate.

Question 3. What level of competence in COBOL programming do prospective employers expect information systems graduates to have on the job?

A survey instrument which listed COBOL programming competencies and included a four-point scale, extensive to none, was distributed to prospective employers of information systems graduates of five Virginia universities. Only individuals who were familiar with COBOL programming were contacted. Based on the responses from them, a list of COBOL programming competencies that prospective employers perceived graduates need and the extent to which they need to be competent was compiled. Interpretation of the responses was similar to that for the faculty. The prospective employers indicated

extensive for 28 competencies and moderate for 32 competencies.

Question 4. To what extent do information systems seniors perceive that they have developed COBOL programming competencies?

Information systems seniors of five Virginia universities were asked to respond to the survey instrument which listed COBOL programming competencies and included a four-point scale, extensive to none. Based on their responses, a list of COBOL programming competencies that seniors perceived they had learned was compiled. Interpretation of the responses was similar to that for the faculty and prospective employers. The seniors indicated extensive for 38 competencies and moderate for 22 competencies.

Question 5. Which COBOL programming competencies did the faculty, prospective employers, and seniors rate similarly in regard to level of skill?

Based on responses to the survey instrument by the faculty, prospective employers, and seniors, a statistical analysis was completed. First, chi-square values were completed for each competency. Since data were collected from the entire populations of faculty, prospective employers, and seniors, it was inappropriate to

compare the calculated chi-square values with critical values from a table to determine if the groups did or did not respond similarly. Thus, contingency coefficients (C) were computed to measure the relationship between group membership and the responses to the competencies. Two of the competencies had contingency coefficients that showed a relationship between group relation and responses. These competencies, both in the preparation area, were "Prepare a card record layout," and "Prepare a system flowchart."

Conclusions

The following conclusions have been drawn from the findings of this study:

1. The competencies identified through the search of the literature and validated by the panel of experts are the competencies needed on the job for COBOL programming and therefore appropriate for inclusion in the four-year information systems programs. This conclusion is substantiated by the findings that all three groups of respondents rated all 60 competencies as taught, needed, or learned at the extensive or moderate level. None of the competencies

were rated as taught, needed or learned at some or none level.

2. The information systems faculty are adequately emphasizing in their programs the COBOL competencies they should be. The faculty rated the competencies somewhat higher than the prospective employers in that they rated 41 competencies as extensive and 19 competencies as moderate; whereas, the prospective employers rated 28 of the competencies as extensive and 32 of the competencies as moderate.
3. From the seniors' perspective, again the information systems faculty are apparently adequately emphasizing in their programs the COBOL competencies they should be. The seniors rated competencies learned somewhat higher than the prospective employers felt they were needed in that their ratings indicated extensive for 38 competencies and moderate for 22 competencies.
4. All groups agree that the competencies taught by the faculty and learned by the students are

the ones required by prospective employers for entry-level positions. Further, some on-the-job training or assistance may be available to graduates who need it since employers tended to rate level of expected competence for the 60 competencies lower than the faculty rated them as taught and the seniors rated them as learned.

Recommendations

Based on the results of the study, the following recommendations are made:

1. That all information systems faculty review the competencies identified to be sure they are included in their information systems programs.
2. That further research be conducted based on the competencies identified in this study. For example, seniors may be tested on these competencies.

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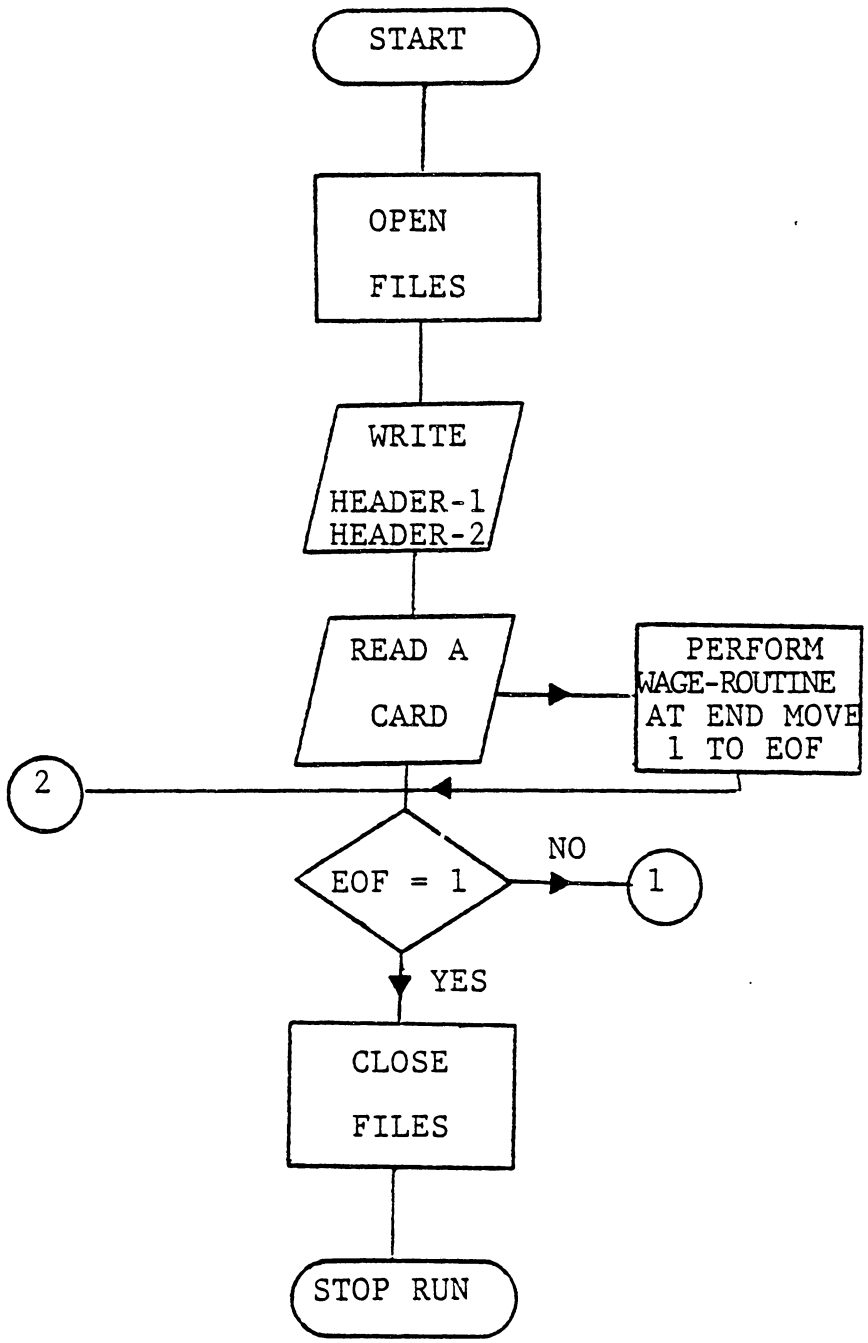
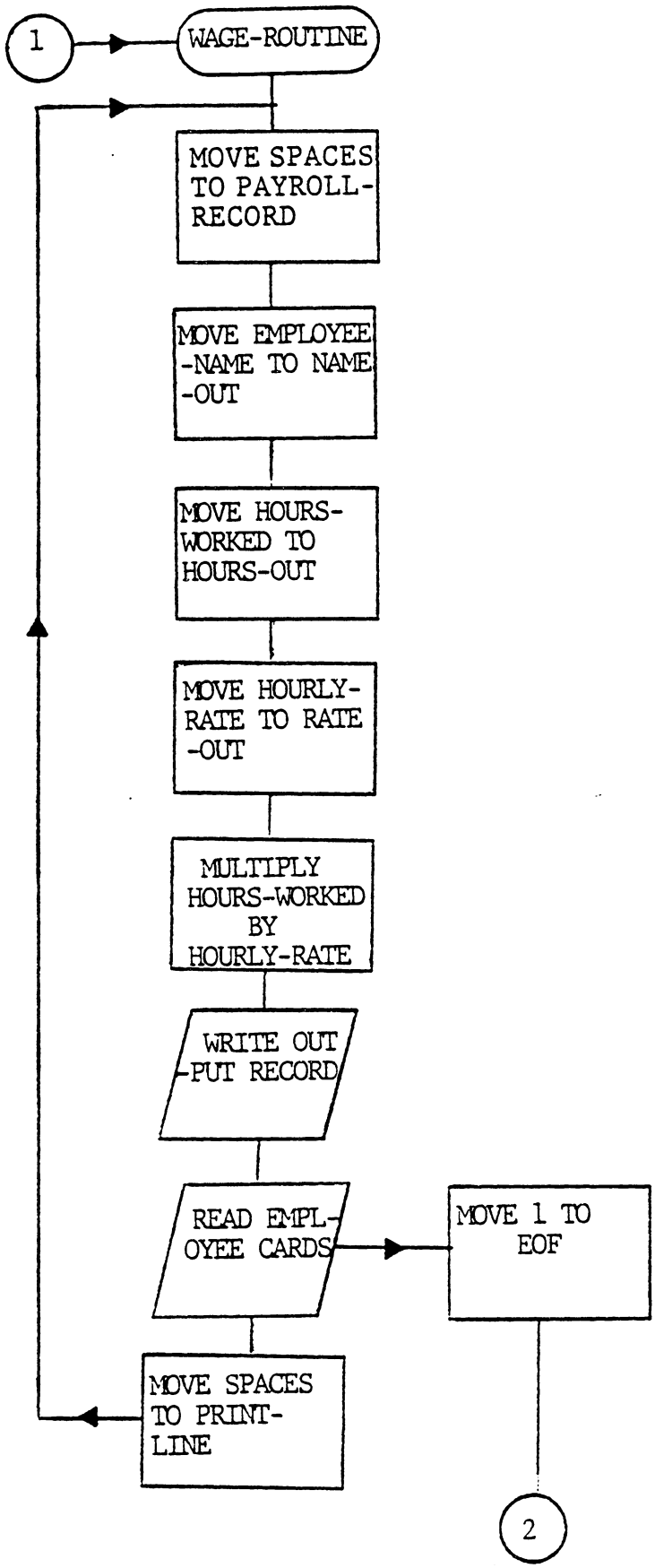
APPENDIX A

Flowchart, Program, and Printout


START
OPEN
FILES
WRITE
HEADER-1
HEADER-2
READ A
CARD
PERFORM
WAGE-ROUTINE
AT END MOVE
1 TO EOF
2
EOF = 1
NO
1
YES
CLOSE
FILES
STOP RUN


1
WAGE-ROUTINE
MOVE SPACES TO PAYROLL-RECORD
MOVE EMPLOYEE-NAME TO NAME-OUT
MOVE HOURS-WORKED TO HOURS-OUT
MOVE HOURLY-RATE TO RATE-OUT
MULTIPLY HOURS-WORKED BY HOURLY-RATE
WRITE OUT-PUT RECORD
READ EMPL-OYEE CARDS
MOVE 1 TO EOF
MOVE SPACES TO PRINT-LINE
2

```
IBM DOS VS COBOL
100  IDENTIFICATION DIVISION.
110  PROGRAM-ID.  SAMPLE2.
120  AUTHOR.  DORIS P. MASON.
130  INSTALLATION.  MASON AND PEEPLES, INC.
140  DATE-WRITTEN.  09/29/83.
150 DATE-COMPILED.  10/02/83.
160  SECURITY.  AUTHORIZED PERSONNEL ONLY.
170  *  THIS PROGRAM PRODUCES THE WEEKLY WAGES OF
180  *  EMPLOYEES OF MASON AND PEEPLES, INC.
190  ENVIRONMENT DIVISION.
200  CONFIGURATION SECTION.
210  SOURCE-COMPUTER.  IBM-4331.
220  OBJECT-COMPUTER.  IBM-4331.
230  SPECIAL-NAMES.  C01 IS NEW-PAGE.
240  INPUT-OUTPUT SECTION.
250  FILE-CONTROL.
260       SELECT EMPLOYEE-CARDS ASSIGN TO SYS001-UR-3504-S.
270       SELECT PAYROLL-FILE ASSIGN TO SYS003-UR-3203-S.
280  DATA DIVISION.
290  FILE SECTION.
300  FD  EMPLOYEE-CARDS
310       LABEL RECORDS ARE OMITTED
```

```
                SAMPLE2          07.34.35       10/02/83
320         RECORD CONTAINS 80 CHARACTERS
330         DATA RECORD IS EMPLOYEE-RECORD.
340   01    EMPLOYEE-RECORD.
350         02  FILLER                  PICTURE X.
360         02  EMPLOYEE-NAME           PICTURE A(19).
370         02  HOURS-WORKED            PICTURE 9(2).
380         02  HOURLY-RATE             PICTURE 9V99.
390         02  FILLER                  PICTURE X(55).
400   FD    PAYROLL-FILE
410         LABEL RECORDS ARE OMITTED
420         RECORD CONTAINS 133 CHARACTERS
430         DATA RECORD IS PAYROLL-RECORD.
440   01    PAYROLL-RECORD.
450         02  FILLER                  PICTURE X.
460         02  FILLER                  PICTURE X(10).
470         02  NAME-OUT                PICTURE A(19).
480         02  FILLER                  PICTURE X(9).
490         02  HOURS-OUT               PICTURE 9(2).
500         02  FILLER                  PICTURE X(10).
510         02  RATE-OUT                PICTURE $9.99.
520         02  FILLER                  PICTURE X(9).
530         02  WEEKLY-WAGES            PICTURE $$$$.99.
540         02  FILLER                  PICTURE X(55).
```

```
                SAMPLE2      07.34.34      10/02/83
550  01  PRINT-LINE.
560      02  FILLER                  PICTURE X(133).
570  WORKING-STORAGE SECTION.
580  01  EOF                         PICTURE 9 VALUE 0.
590  01  HEADER-1.
600      02  FILLER                  PICTURE X(46)
610          VALUE SPACES.
620      02  FILLER                  PICTURE X(16)
630          VALUE 'EMPLOYEE PAYROLL'.
640      02  FILLER                  PICTURE X(70)
650          VALUE SPACES.
660  01  HEADER-2.
670      02  FILLER                  PICTURE X(78)
680          VALUE'        NAME          HOURS'
700          'RATE         WEEKLY WAGES'.
710      02  FILLER                  PICTURE X(55)
720          VALUE SPACES.
730  PROCEDURE DIVISION.
740      OPEN INPUT EMPLOYEE-CARDS, OUTPUT PAYROLL-FILE.
750      MOVE HEADER-1 TO PRINT-LINE.
760      WRITE PRINT-LINE AFTER ADVANCING NEW-PAGE.
770      MOVE HEADER-2 TO PRINT-LINE.
780      WRITE PRINT-LINE AFTER ADVANCING 4 LINES.
```

SAMPLE2 07.34.34 10/02/83

```
790       READ EMPLOYEE-CARDS AT END MOVE 1 TO EOF.
800       PERFORM WAGE-ROUTINE UNTIL EOF = 1.
810       CLOSE EMPLOYEE-CARDS, PAYROLL-FILE.
820       STOP RUN.
830   WAGE-ROUTINE.
840       MOVE SPACES TO PAYROLL-RECORD.
850       MOVE EMPLOYEE-NAME TO NAME-OUT.
860       MOVE HOURS-WORKED TO HOURS-OUT.
870       MOVE HOURLY-RATE TO HOURS-OUT.
880       MULTIPLY HOURS-WORKED BY HOURLY-RATE
890       GIVING WEEKLY WAGES.
900       WRITE PAYROLL-RECORD AFTER ADVANCING 2 LINES.
910       READ EMPLOYEE-CARDS AT END MOVE 1 TO EOF.
920       MOVE SPACES TO PRINT-LINE.
```

EMPLOYEE PAYROLL

NAME	HOURS	RATE	WEEKLY WAGES
	42	$3.10	$130.20
	45	$4.80	$216.00
	48	$8.85	$410.40
	40	$4.10	$164.00
	25	$7.10	$177.50
	20	$3.50	$ 70.00
	40	$5.60	$224.00
	40	$4.90	$196.00
	40	$4.90	$196.00
	45	$4.75	$213.75
	36	$4.45	$160.20
	40	$3.50	$140.00
	45	$6.50	$292.50
	40	$8.00	$320.00
	38	$4.75	$180.50
	42	$5.87	$246.54
	36	$3.93	$141.48
	50	$5.50	$275.00
	30	$4.90	$147.00
	40	$3.35	$134.00

APPENDIX B

Letter to the Panel of Experts

SAMPLE LETTER TO PANEL

COBOL Competencies

Dear

Please take a few minutes to complete the enclosed survey instrument. It should require approximately 10-15 minutes of your time, and it will be of invaluable assistance to me as I prepare to do a research study on COBOL programming competencies taught in five four-year Virginia institutions offering information systems programs.

The survey instrument is part of a research project being conducted through the Virginia Polytechnic Institute and State University, Blacksburg, Virginia. The study is being directed by Dr. June Schmidt, my major professor.

Your participation on the panel will enable me to determine whether the survey instrument items are easily read, understood, and appropriate. Thus, please read the directions accompanying the instrument and advise whether you find them easy to follow. Also, please read each item carefully to determine whether it is clear and understandable. Feel free to add or delete items as you deem helpful. Revisions, as needed, will be made to the survey instrument on the basis of your suggestions and comments.

The revised survey instrument will be distributed to professors of five universities and to selected employers of the graduates. Complete the survey instrument during this interview and return to me, along with your suggestions and comments.

Feel free to contact me later if you have any questions. I may be reached in the office at Virginia State University or at home in Ettrick

Sincerely,

Doris P. Mason

m

Enclosure

APPENDIX C

Initial List of COBOL Programming Competencies and Instrument Used for Comments from the Panel of Experts

INTRODUCTORY COBOL PROGRAMMING COMPETENCIES

1. Write simple COBOL programs
2. Write headers for programs
3. Divide a program into modules
4. Select appropriate data names for files, records and fields
5. Be familiar with job control cards
6. Be familiar with list of COBOL reserve words
7. Prepare real data for use with program
8. Prepare test data for use in testing program
9. Prepare a printer spacing form
10. Use coding sheet for writing program
11. Use standard flowchart symbols
12. Prepare a detail program flowchart
13. Prepare a system flowchart
14. Prepare a general (logic) program flowchart
15. Prepare a card record layout
16. Write simple add statements
17. Know the rules for writing simple arithmetic operations
18. Know the formats for writing simple arithmetic operations
19. Write simple subtract statements
20. Write simple multiplication statements

21. Write simple divide statements
22. Write statements using the COMPUTE verb
23. Write statements using the ROUNDED option
24. Use appropriate PICTURE clause
25. Be familiar with the hierarchy of arithmetic operations
26. Write PERFORM . . . TIMES statements
27. Write simple condition statements
28. Write PERFORM . . . UNTIL statements
29. Write main modules
30. Write compound conditional statements
31. Write documentation for program
32. Write the select clauses for a program
33. Write the WORKING-STORAGE SECTION
34. Write statement to access input and output files
35. Write read and write statements
36. Write statements to perform simple move operations
37. Write simple PERFORM statements
38. Write specific end-of-job statements
39. Write documentation updates after a program revision

40. Read a program listing
41. Desk check a program
42. Correct logical errors
43. Correct syntax errors
44. Know the function of the Identification Division
45. Know the function of the Procedure Division
46. Write statements for group items
47. Write statements for elementary items
48. Be familiar with decision tables
49. Be familiar with pseudocode
50. Know the function of the Environment Division
51. Know the function of the Data Division
52. Know the two types of headers
53. Know about source programs and object programs
54. Know the function of compilers
55. Be familiar with literals and constants
56. Write negating compound conditional statements
57. Be familiar with JUSTIFIED RIGHT clause
58. Be familiar with REDEFINES clause
59. Be familiar with MOVE CORRESPONDING statement
60. Write statements to secure edited results
61. Write statements to test for end of page
62. Write statements to skip to a new page

63. Write statements to print job headings
64. Write statements to print fields delineators
65. Write statements to align data under headers
66. Write statements to use tape file
67. Write statements to use disk file
68. Be familiar with group printing
69. Be familiar with display statement
70. Be familiar with accept statement
71. Use structure programming techniques
72. Write identification for program

PANEL

COBOL Competencies

Please complete this sheet along with the survey instrument during my interview with you.

NAME_____

1. Number of minutes you took to complete this survey instrument _____.
2. Comments or suggestions about directions accompanying the survey instrument.

3. Comments or suggestions about how easy or difficult it is to respond to items on the survey instrument.

4. Please indicate any changes you recommend in specific items on the survey instrument. Are they understandable?

   Item Number_____

   Item Number_____

   Item Number_____

   Item Number_____

5. Please give any other suggestions for improvement of the survey instrument before distributing the

revised instrument to professors, students and employers.

(Please use the reverse side of this sheet, if needed.)

To be collected by Doris P. Mason,

APPENDIX D

Survey Instrument of COBOL Programming Competencies

COBOL PROGRAMMING COMPETENCIES

Competency	Level of Skill: None	Some	Moderate	Extensive
Preparation				
1. Prepare a card record layout	1	2	3	4
2. Prepare a general (logic) program flowchart	1	2	3	4
3. Prepare a system flowchart	1	2	3	4
4. Prepare a detail program flowchart	1	2	3	4
5. Use standard flowchart symbols	1	2	3	4
6. Use coding sheet for writing program	1	2	3	4
7. Prepare a printer spacing form	1	2	3	4
8. Prepare test data for use in testing program	1	2	3	4
9. Prepare real data for use with program	1	2	3	4
10. Be familiar with list of COBOL reserve words	1	2	3	4
11. Be familiar with job control cards	1	2	3	4
Writing				
12. Write simple COBOL programs	1	2	3	4
13. Write headers for programs	1	2	3	4
14. Divide a program into modules	1	2	3	4

COBOL PROGRAMMING COMPETENCIES

Competency	Level of Skill: None	Some	Moderate	Extensive
Writing				
15. Select appropriate data names for files, records, and fields	1	2	3	4
16. Write simple add statements	1	2	3	4
17. Know the rules for writing simple arithmetic operations	1	2	3	4
18. Know the formats for writing simple arithemtic operation	1	2	3	4
19. Write simple subtract statements	1	2	3	4
20. Write simple multiplication statements	1	2	3	4
21. Write simple divide statements	1	2	3	4
22. Write statements using the COMPUTE verb	1	2	3	4
23. Write statements using the ROUNDED option	1	2	3	4
24. Use appropriate PICTURE clause	1	2	3	4
25. Be familiar with the hierarchy of arithmetic operations	1	2	3	4
26. Write PERFORM . . . TIMES statements	1	2	3	4
27. Write simple condition statements	1	2	3	4
28. Write PERFORM . . . UNTIL statements	1	2	3	4

COBOL PROGRAMMING COMPETENCIES

Competency	Level of Skill: None	Some	Moderate	Extensive
Writing				
29. Write main modules	1	2	3	4
30. Write compound conditional statements	1	2	3	4
31. Write negating compound conditional statements	1	2	3	4
32. Be familiar with JUSTIFIED RIGHT clause	1	2	3	4
33. Be familiar with REDEFINES clause	1	2	3	4
34. Be familiar with MOVE CORRESPONDING statement	1	2	3	4
35. Write statements to secure edited results	1	2	3	4
36. Write statements to test for end of page	1	2	3	4
37. Write statement to skip to a new page	1	2	3	4
38. Write statements to print job headings	1	2	3	4
39. Write statements to print fields delineators	1	2	3	4
40. Write statements to align data under headers	1	2	3	4
41. Write statements to use tape file	1	2	3	4
42. Write statements to use disk file	1	2	3	4

COBOL PROGRAMMING COMPETENCIES

Competency	Level of Skill			
	None	Some	Moderate	Extensive
Writing				
43. Be familiar with group printing	1	2	3	4
44. Be familiar with display statement	1	2	3	4
45. Be familiar with accept statement	1	2	3	4
46. Use structure programming techniques	1	2	3	4
47. Write identification for program	1	2	3	4
48. Write documentation for program	1	2	3	4
49. Write the select clauses for a program	1	2	3	4
50. Write the WORKING-STORAGE SECTION	1	2	3	4
51. Write statement to access input and output files	1	2	3	4
52. Write read and write statements	1	2	3	4
53. Write statements to perform simple move operations	1	2	3	4
54. Write simple PERFORM statements	1	2	3	4
55. Write specific end-of-job statements	1	2	3	4
Debugging				
57. Read a program listing	1	2	3	4
58. Desk check a program	1	2	3	4

COBOL PROGRAMMING COMPETENCIES

Competency	Level of Skill			
	None	Some	Moderate	Extensive
Debugging				
59. Correct logical errors	1	2	3	4
60. Correct syntax errors	1	2	3	4

APPENDIX E

Letter to the Heads of Information Systems Departments

LETTER TO HEADS OF
INFORMATION SYSTEMS DEPARTMENTS

COBOL Competencies

Dear Information Systems Department Heads:

Please confirm the enclosed list of information systems faculty secured from the 1982-83 catalog of your institution. Identify only the faculty in your department who are involved with COBOL, including names of new faculty. This will be of invaluable assistance to me in completing a research study on COBOL programming competencies taught in five four-year Virginia institutions offering information systems programs.

The faculty identified will be asked to participate in this study to evaluate COBOL programming competencies in information systems programs.

The research project is being conducted through The Virginia Polytechnic Institute and State University, Blacksburg, Virginia. The study is being directed by Dr. June Schmidt, my major professor.

Your assistance is very important. Confirm the enclosed list and return to me by April 27, 1984.

Feel free to ask any questions you may have. I may be reached in the office at Virginia State University or at home in Ettrick if you deem it necessary to contact me regarding this project.

Thank you for your help.

Sincerely,

Doris P. Mason

m

Enclosure

APPENDIX F

Letter to Information Systems Faculty and Directions for Completing Survey Instrument

LETTER TO INFORMATION SYSTEMS FACULTY

COBOL Competencies

Dear Information Systems Faculty:

Please take a few minutes to complete this survey instrument. It should require approximately 10-15 minutes of your time, and it will be of invaluable assistance to me in completing a research study on COBOL programming competencies taught in five four-year Virginia institutions offering information systems programs.

The survey instrument is part of a research project being conducted through The Virginia Polytechnic Institute and State University, Blacksburg, Virginia. The study is being directed by Dr. June Schmidt, my major professor.

Please read the directions and respond to each competency carefully. Your input is very important. Complete the survey instrument and return to me by May 9. A self-addressed, stamped envelope is enclosed for your convenience.

Feel free to ask any questions you may have. I may be reached in the office at Virginia State University , or at home in Ettrick , if you deem it necessary to contact me regarding this project.

Thank you for your help.

Sincerely,

Doris P. Mason

m

Enclosures

INFORMATION SYSTEMS COMPETENCY SHEET

Information Systems Faculty

Directions

Please read and respond to each competency carefully. Circle the number that best represents the level of skill you believe information systems students develop at your institution in competency.

Scale Ratings

1 = None -- Students do not developany skill in this COBOL programming competency.

2 = Some -- Students develop enough skill to describe but do not perform this COBOL programming competency.

3 = Moderate -- Students develop considerable skill and can perform this COBOL programming competency with some assistance.

4 = Extensive -- Students can perform this COBOL programming competency independently.

APPENDIX G

Letter to Prospective Employers and Directions for Completing Survey Instrument

LETTER TO PROSPECTIVE EMPLOYERS

COBOL Competencies

Dear Prospective Employer:

Please take a few minutes to complete this survey instrument. It should require approximately 10-15 minutes of your time, and it will be of invaluable assistance to me in completing a research study on COBOL programming competencies taught in five four-year Virginia institutions offering information systems programs.

The survey instrument is part of a research project being conducted through The Virginia Polytechnic Institute and State University, Blacksburg, Virginia. The study is being directed by Dr. June Schmidt, my major professor.

Please read the accompanying directions and respond to each competency carefully. Your input is very important. Complete the survey instrument and return to me by May 9. A self-addressed, stamped envelope is enclosed for your convenience.

Feel free to ask any questions you may have. I may be reached in the office at Virginia State University , or at home in Ettrick if you deem it necessary to contact me regarding this project.

Sincerely,

Doris P. Mason

m

Enclosures

INFORMATION SYSTEMS COMPETENCY SHEET

Prospective Employers

Directions

Please read and respond to each competency carefully. Circle the number that best represents the level of skill you believe information systems graduates should have in the competency when they come to the job.

Scale Ratings

1 = None -- Employees do not ned any skill in this COBOL programming competency.

2 = Some -- Employees need enough skill to describe but not to perform this COBOL programming competency.

3 = Moderate -- Employees need considerable skill and should be able to perform this COBOL programming competency with some assistance.

4 = Extensive -- Employees must be able to perform this COBOL programming competency independently.

APPENDIX H

Letter to Information Systems Seniors and Directions for Completing Survey Instrument

LETTER TO SENIORS

COBOL Competencies

Dear Senior:

Please take a few minutes to complete this survey instrument. It should require approximately 10-15 minutes of your time, and it would be of invaluable assistance to me in completing a research study on COBOL programming competencies taught in five four-year Virginia institutions offering information systems programs.

The survey instrument is part of a research project being conducted through The Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Your participation in this research is essntial. Thus, please read the accompanying directions and respond to each competency carefully. Complete the survey instrument during the allotted period and return it to your instructor.

Feel free to ask any questions you may have. I may be reached in the office at Virginia State University or at home in Ettrick , if you deem it necessary to contact me regarding this project.

Sincerely,

Doris P. Mason

m

INFORMATION SYSTEMS COMPETENCY SHEET

Seniors

Directions

Please read and respond to each competency carefully. Circle the number that best represents the level of skill you believe you have developed in the competency.

Scale Ratings

1 = None -- I did not develop any skill in this COBOL programming competency.

2 = Some -- I developed enough skill to describe but not to perform this COBOL programming competency.

3 = Moderate -- I developed considerable skill and can perform this COBOL programming competency with some assistance.

4 = Extensive -- I can perform this COBOL programming competency independently.

APPENDIX I

Follow-up Card

April 30, 1984

Dear

Recently a survey instrument was mailed to you with a request that you participate in a study seeking to identify and evaluate COBOL competencies in four-year information systems program.

Thank you if you have already responded. If not, please do so at once. Your assistance in this study is important.

Please contact me at (Home) or (Office), if you have any questions.

Sincerely,

Doris P. Mason
Researcher

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IDENTIFYING AND EVALUATING COBOL COMPETENCIES FOR FOUR-YEAR INFORMATION SYSTEMS PROGRAMS

by

Doris Peeples Mason

(ABSTRACT)

This study determines how the COBOL competencies taught in information systems programs and those attained by information systems students compare to those needed on the job. Five research questions were posed:

1. What are the introductory COBOL programming competencies required to be a COBOL programmer?
2. To what extent do information systems program faculty perceive that they have taught COBOL programming competencies?
3. What level of competence in COBOL programming do prospective employers expect information systems graduates to have on the job?
4. To what extent do information systems seniors perceive that they have developed COBOL programming competencies?
5. Which COBOL programming competencies did the faculty, prospective employers, and seniors rate similarly in regard to level of skill?

The respondents in the study were information systems faculty, prospective employers of information systems graduates, and information systems seniors. Usable responses were received from 85.4% of the total population.

Findings reveal that there were two competencies for which the groups responded differently. These competencies were both in the preparation area. They were "Prepare a card record layout," and "Prepare a system flowchart." The two competencies which the groups had the least disagreement on were "Be familiar with group printing," and "Be familiar with accept statement."

Based upon the findings in this study, the following conclusions were drawn:

1. The competencies identified through the search of the literature and validated by the panel of experts are the competencies needed on the job for COBOL programming and therefore appropriate for inclusion in the four-year information systems programs.
2. The information systems faculty are adequately emphasizing in their programs the COBOL competencies they should be.
3. The faculty rated the competencies taught somewhat higher than the prospective employers felt they were needed.