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Education for expanding computer curriculums : a symposium

Daniel L. Sweeney

American Institute of Certified Public Accountants (AICPA)

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Education for Expanding Computer Curriculums

A Symposium

AICPA
American Institute of Certified Public Accountants

Education for Expanding

A Symposium

Computer Curriculums

Sponsored by

THE AMERICAN INSTITUTE OF CERTIFIED PUBLIC ACCOUNTANTS

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Edited by

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Preface

Undergraduate Computer Curriculum for Accountants, Auditors, and Consultants—Expectations and Constraints

The computer has been the single most important factor in influencing the way American business is managed for twenty years, and this is a fact that has been widely publicized and accepted. Even so, the undergraduate computer education available to prospective accountants and auditors, as well as prospective computer consultants, is viewed by employers as far more limited than it should be. Such computer education, it is claimed, does not provide a sound understanding of commercial computer applications, or even a foundation upon which such an understanding can be based.

This symposium, under joint sponsorship of the American Accounting Association (AAA) and the American Institute of Certified Public Accountants (AICPA), was conceived as the most efficient and expeditious means of stimulating corrective action. It was believed that the best results would come from a situation bringing together university educators teaching in the area of commercial computer applications for a discussion of the scope and causes of problems. We wanted teachers from schools with an avowed objective to educate students for business careers in accounting and consulting, as well as those from schools which had the resources to implement improvements in computer education.

The joint aspects of the project came first from work with Doyle Z. Williams as Director of Education for AAA and Elba F. (Bud) Baskin, the AAA Staff Director of Continuing Education, in establishing a time, location, and format of the symposium, and secondly, from the selection of speakers and schools to be invited to attend this pilot program. It was hoped that the proceedings of this meeting might be used to create broader interest among both accounting educators and practitioners, and that they in turn would hold similar programs on a regional basis. Ideally, the initial discussion would then develop into an action plan identifying not only the educational needs and their constraints, but also a set of procedures for overcoming those constraints.

The program sequence was for the speakers to present the employers' view of an adequate career entry level of knowledge, the educators' viewpoint as to what actually was being taught, and then, in a general discussion between speakers and attending computer educators, to attempt reaching a consensus as to what should be taught, identifying ultimately a curriculum that would more nearly meet the requirements of accounting and computer career-oriented students.

The assistance of AAA and the participation of the speakers is gratefully acknowledged. If the program proves successful, it will be because of their efforts in generating concern for the matters discussed that finally will lead to action for improved undergraduate computer education.

Schedule of the Symposium

AAA and AICPA Joint Symposium on
Undergraduate Computer Curriculum
(*As relates to applications in accounting, auditing, and management advisory services*)
August 17, 1975

12:00 P.M.	Luncheon	Braniff Place Hotel, Club Capricho. Introductory comments by Donald G. Baker, *Partner, Arthur Andersen & Co., Houston.* First Chairman of AICPA Management Advisory Services Undergraduate EDP Education Task Force.
1:30-3:30 P.M.	Meeting	Braniff Place Hotel, Vista Room.
	Moderator:	Kenneth C. Cole, CPA, *Partner, Haskins & Sells, San Francisco.*
	Speakers:	Michael R. Moore, CPA, *Partner, Arthur Young & Company, Denver.* "Undergraduate Computer Curriculum Requirements for Entering Staff in Accounting and Auditing"
		George H. Rittersbach, *Principal, Peat, Marwick, Mitchell & Co., New York.* "Computer and Information Systems Knowledge and Skills Needed by Entering Staff in Management Advisory Services"
		Gordon B. Davis, Ph.D., CPA, *University of Minnesota.* "Computer Curriculum for Accountants and Auditors—Present and Prospective"
		John O. Mason, Jr., Ph.D., CPA, *University of Alabama.* "Computer Curriculum for the Management Advisory Services Area—Present and Reasonable Potential"
3:30-3:45 P.M.		Refreshment Break
3:45-5:30 P.M.		Discussion with participants of ways and means to bring the desired and available education output closer together by changing the input factors.

Introduction

The following introductory comments were made by Donald G. Baker, Partner, Arthur Andersen & Co., Houston, as the first chairman of the AICPA Management Advisory Services Undergraduate EDP Education Task Force.

It is a pleasure to observe the initial steps being taken to overcome a difficulty which has so far eluded the efforts of the business community toward a solution. The need for improved undergraduate computer education was discussed by myself and others on the AICPA Management Advisory Services committees and ultimately it was decided that organized action should be taken. A task force was named and its first effort was to devise a curriculum for undergraduate computer education which was to be recommended to the school deans by letter. Upon review of this proposal, Management Advisory Services and Education representatives agreed that this symposium is a better way to communicate with all who are most involved in reaching a practical solution to this educational problem.

My own concern grew from an observation of the growing computer education needs which our firm was forced to meet. Despite a company tradition that the best way to obtain competent computer audit or systems consultants was to develop them on the job, I saw no reason why improved preparation in school could not shorten the lag period in effectiveness. Good people must still be selected from the staff or from schools in order to train them in a firm's preferred conduct of a given engagement, but the firm should be most satisfied with the performance of preeducated people.

It should be possible to produce combined accountant-information systems graduates able to perform computer systems work as management advisory services practitioners; graduates possessing these fundamental skills certainly would not have restricted career opportunities in consulting firms. Industry and nonprofit organizations have an expanding need for people with a strong background to work internally in systems development and implementation. Obviously, no one has a better exposure to operations and management at all levels than an individual who has the opportunity to develop audit information systems that provide the operating data for all levels of management. The educational emphasis must be to develop entry-level businessmen who understand systems development and installation, their training and skills enabling them to grow into middle and top management operating positions as a natural process.

It is an unfortunate reality that many of the analysts in industry today are not businessmen and as a result do not always possess the interpersonal skills to allow them to perform most effectively.

As a generalization, I believe I could contrast today's MBAs with an accounting concentration to those with only a computer science concentration. It is far easier to teach the former technical skills than to teach the latter business skills besides the technical skills which their academic studies often did not provide.

Even given this initial advantage, it still takes about two years of training and job experience to give the business or accounting graduate suf-

ficient technical skills to perform as a consulting analyst. Were it not for well-prepared training plans within the consulting area of most firms, these individuals might never reach their full potential.

The combined accounting and computer major, which was proposed by the AICPA Management Advisory Services Task Force on Undergraduate EDP Education, would shorten the training time of the graduate and provide the background needed to develop the individual's skills on the job even if he or she were not a participant in a well-defined, computer-oriented development program. It is the observation of the task force that too many university programs providing computer and systems education are producing only computer programmers.

Computer auditing specialists, consultants, and industry analysts must of course have a working knowledge of computer programming to be effective; this is the easiest technical skill to teach, however, when given a student with a reasonable aptitude for logic. Multiple language-coding ability is not needed in the academic process because a given language is so easily taught once a student with a knowledge of the basics needs to use a specific computer language. The criteria for programming courses to be taught, as with other systems basics, are those which the student needs to properly relate design considerations to programming requirements.

Aside from developing Management Advisory Services consultants, accountants in general, both public and private, must upgrade their knowledge of computers and systems in order to properly perform audits, ultimately developing sufficient knowledge to deal effectively and comfortably with a variety of computer systems and systems personnel. It may be possible that this knowledge can be gained from peripheral courses, but certainly selected courses from a complete, well-defined program, one designed to develop information system skills and integrate them with accounting and auditing processes, would be more effective. It is reasonable to anticipate that the auditor of the future will absolutely need a combined accounting and computer major in order to audit properly. How distant is the key question?

There is nothing in my remarks that is really new, but I do not think it possible to overemphasize the necessity to begin an introduction of the academic programs being discussed here. The schools can do the job, and the firms will assist them to the extent that internal policies permit by making educational materials available to faculty or by encouraging interchanges between faculty and practitioners. I would encourage those of you who can help such a program to increase your support of a combined accounting-computer program of the type being discussed today.

In his introduction of the principal speakers, Kenneth C. Cole, CPA, Partner, Haskins & Sells, San Francisco, made the following comments:

After following Don Baker as chairman of the Institute's Management Advisory Services Undergraduate EDP Education Task Force, I recall that we soon recognized the futility of one more request to business school deans for an expansion of curriculum in an area where we had an obviously selfish interest. We believed, however, in the logic of the position that there was a growing demand for students educated in business applications of computers and, moreover, that such education could con-

tain both the intellectual respectability and applied practicality which would appeal to the academic administration as well as the students.

It was our feeling that the schools would not ignore the needs of the business community if they were aware of them and of the ways they could work toward meeting them. What we want to do here is stimulate discussion, and we hope it will lead us to an outline of concrete proposals for those schools which are interested in providing a stronger computer curriculum for potential accountants, auditors, and computer systems consultants.

The practitioner speakers are Mr. Moore, who will represent the accountants and auditors, and Mr. Rittersbach, who will represent computer consultants. They will discuss the kinds of knowledge, skills, and attitudes they would like to see present in graduates of a business-computer curriculum, while commenting on what presently engaged staff members seem to lack from their university training.

Professor Davis will review the existing computer curricula content for students whose primary interest is accounting and auditing, and Professor Mason will speak of the curricula content for those students interested in the information systems consultant area.

After presenting individual papers, the speakers will act as a panel to discuss with participants the apparent differences between what the universities are offering in course content and what the graduates should know in these two areas of application.

Once the differences are identified, we will explore in further discussion why certain material is not presently being taught, and possible ways to overcome constraints which keep this subject matter from the undergraduate curriculum.

The four speeches follow.

Undergraduate Computer Curriculum Requirements for Entering Staff in Accounting and Auditing

By Michael R. Moore, Partner, Arthur Young & Company, Denver

My role in this panel is to discuss the knowledge, skills, and attitudes desirable in graduates of a baccalaureate program emphasizing computer applications to accounting and auditing. I will also focus on the knowledge deficiencies of entering staff personnel, trying to identify reasons why desirable material is not taught, and discussing ways of overcoming constraints to teaching desirable material.

The computer knowledge requirements for the practice of public accounting are well defined in two up-to-date studies which have broad support by practitioners:

1. AAA-AICPA Task Force on EDP in Undergraduate Auditing Curriculum, "Inclusion of EDP in an Undergraduate Auditing Curriculum," *Accounting Review* (October 1974) and *Journal of Accountancy* (December 1974).
2. Canadian Institute of Chartered Accountants, "Competence and Professional Development in EDP for the CA," *CA Magazine* (September 1974).

Both these studies take an applications-oriented approach to defining knowledge requirements. They emphasize EDP technical proficiency, internal control concepts applied to computers, and audit testing, with or without the computer. The AAA-AICPA study is closely tied to audit objectives and audit procedures. The Canadian study is much broader in scope and more specific as to detailed knowledge requirements and educational approaches, including also a definition of knowledge requirements for effective management of EDP resources. The AAA-AICPA study identifies five major topics which should be taught within the framework of an undergraduate curriculum.

1. EDP technical proficiency requirements for the staff auditor.
2. The review, evaluation, and study of internal control in an EDP environment.
3. Auditing a computer system without using a computer.
4. Using the computer to perform compliance and substantive tests of the records produced by a computer system.
5. Auditing data-processing records produced by a computer service center.

These two studies are good statements of what a large segment of practitioners would like to see in their staff accountants, and they make it easier to pinpoint the knowledge deficiencies of new auditors.

Knowledge Deficiencies

We asked our staff auditors after one year to itemize the deficiencies which they felt most strongly in making the transition from the campus to public practice. Three of the most prominent deficiencies listed relate to the computer. The first involves computer applications in business. Their experience with computers has been in a problem-solving mode, using canned packages or programming rather simple mathematical problems. They seem to have very little feel for accounting transaction processing: the concepts of files, transaction updates, editing, reporting, and so forth. The second common deficiency was in flowcharting analysis and documentation, not strictly limited to computers, but emphasizing computers. The third mentioned the area of auditing with a computer, including application of statistical sampling concepts, as well as the use of the computer in sample design, selection, and evaluation.

Clearly, there exists a need for understanding the control disciplines required in using computers. Beginning auditors tend to be unaware of these disciplines; they often place undue reliance on the output of computers without adequately testing the processes by which the data are generated.

Many new auditors also lack the ability to visualize even a simple system or integrate the various EDP concepts they may have picked up through programming and problem-solving experience with university computers. Early in their staff experience, they are challenged to analyze the transaction-processing trail and to document and evaluate strengths and weaknesses in computer systems.

Constraints to Improved Education

I divide consideration of the constraints on improved preparatory education into two categories: people and resources.

Computers in business have been around for twenty years, but there are relatively limited numbers of teachers with the knowledge and experience to do a quality job in educating auditors to work with the computer. This constraint is fundamental to any broad-based expansion of computer education, yet it is a manageable one. Although coping with new technology is not a new phenomenon in academic life, both academe and practitioners have been terribly slow in attempting to deal with the problem.

Resource constraints are more complex and perhaps more difficult to resolve. Access to computer hardware often seems to be a feast or famine situation, both of which can be drawbacks in preparing individuals for entry into public accounting. Trying to teach computer concepts, systems design, or computer auditing without a computer is somewhat akin to teaching driver training without letting the student use an automobile. The education is not useless, but it can only go so far. Conversely, the giant, sophisticated computers available on some campuses are typical of relatively few business organizations. The student may be shielded from important design, control, and auditing concepts if his only access to the computer is

through a remote terminal or through a major, tightly disciplined EDP shop where he prepares only very high-level job specifications.

Based on my experience in education programs for auditors in public practice, I believe the availability of a midrange, tape-disc computer system is a tremendous asset, and the faculty and students both need hands-on experience with the hardware itself. It seems fundamental that any solution must begin with an increase in the knowledge and experience level of the faculty if we are to enhance computer education in the undergraduate curriculum. Obvious opportunities exist to make greater use of experienced practitioners in developing faculty and in teaching students.

Since textbook coverage of computer control and auditing tends to be rather sparse, it probably will be necessary, in the short range, to develop an individual syllabus on courses concerned with computer control and auditing, making use of what publications are now available in this field. Most large CPA firms have extensive case materials which could be accessed and, if needed, tailored for use in undergraduate curricula. More specifically, this would include live business application programs for analysis and auditing, computer auditing software, as well as guides, checklists, and documentation practices.

Computer Curriculum

As a starting point, it seems that there should be a basic course in EDP concepts and techniques. This course would be a prerequisite to many courses in the business school which would assume some prior computer knowledge, just as prior accounting knowledge is assumed in advanced courses. This concepts and techniques course should rely heavily on hands-on practice if the concepts are to be really understood by the students.

There probably is a need for a second-level course in EDP controls and techniques as a prerequisite for study in auditing or in management information systems. The controls and techniques course would also be a prerequisite for courses concerned with effective management of EDP resources.

Past these two basic courses, there might be a number of optional and more specialized programs available dealing with concepts of computer systems design, use of time sharing, minicomputers, and so forth.

It is essential that this basic training in EDP concepts, controls, and techniques be reinforced throughout the major fields of study in the business school curriculum. Once this solid base has been developed, computer applications, case studies, and examples should be integrated into other courses such as planning, budgeting and forecasting, cost accounting, statistics, or auditing. It is a major deficiency for an auditing course in the 1970's to touch lightly or not at all on computer auditing cases and problems. In public accounting, whether in auditing, tax, or management consulting services, the successful practitioner needs a solid grounding in research and analysis disciplines, such as

1. A systematic approach to problem definition and resolution.
2. An inquisitive, questioning, testing approach to fact gathering.
3. Practice in documentation and in oral and written communication of conclusions.

The student who has these fundamental skills will be able to maintain and expand his knowledge of the computer through the years of rapid change which lie ahead.

Computer and Information Systems Knowledge and Skills Needed by Entering Staff in Management Advisory Services

By George H. Rittersbach, Principal,
Peat, Marwick, Mitchell & Co., New York

Mr. Rittersbach did not prepare a formal presentation but rather spoke from an outline on the subject. This outline has been reproduced here with supplemented notes in parentheses.

Objective

To identify the needs of MAS practitioners regarding knowledge and skills in the computer and information systems areas and the impact this has on planning undergraduate curricula. (Peat, Marwick, Mitchell & Co. now hires only experienced EDP personnel for consulting positions, but Mr. Rittersbach noted that some firms do train—at great cost—their own computer consultants.)

Scope of EDP MAS Services

An evaluation of EDP—Systems and Equipment

- An EDP operational audit (an assessment of the total EDP environment to determine if EDP resources are used appropriately—not at maximum capacity, but appropriately).

- A selection of EDP service approach (a total information system, service bureau, and minicomputer must be decided upon after investigation of the needs of the client, capability of equipment, and reliability of service).

- A selection of computer hardware/software (the architecture of the equipment is very important, as is the estimate of ability for utilization). Review bid specifications and managerial requests and substantiate choices.

- An evaluation of resource utilization and performance management (act as hardware monitor and evaluate the processing characteristics).

- An evaluation of resource needs (in EDP management this is a data-based process).

- An evaluation of EDP standards (these are difficult to develop as well as to evaluate against performance).

- An evaluation of EDP Internal Control/Security (at first related to audit process, but security now is far more important).

Planning

- The EDP long-range plan.
- Project organization, estimating, scheduling, and control.
- Management science.

Design and Development

- Feasibility studies and functional specifications.
- Business systems design and development (must know data-processing design techniques).
- Business systems implementation (actual development and management).

Expertise required

- To do EDP-based MAS work.
- To manage EDP-based MAS work.

Where Undergraduate Education Needs Impact

- The business-orientation area.
- EDP areas.
  - Computer systems fundamentals, architectural organization, and types.
  - Application systems analysis, design, and development. (This includes modularizations such as management of the inventory, receivables, etc. There is also a means vs. ends problem.)
  - Programming languages, program design, and programming. (This is important to a student. The language can be picked up later, but it is needed as you go along in implementation.)
  - Computer file structures and data management.
  - Computer project management and control.
  - Operating systems concepts.
  - Management of the computer environment.
  - Internal control and quality assurance in application systems development.

Computer Curriculum for Accountants and Auditors—Present and Prospective

By Professor Gordon B. Davis, CPA, Ph.D.,
University of Minnesota

Most of my remarks concern a curriculum which would provide a suitable academic background for the accounting student who will be primarily an accountant and auditor rather than a management services consultant.

Since the typical accounting curriculum can absorb only a certain amount of additional material, it is perhaps most useful to consider the fundamental courses which should be available for students in accounting. These are

1. a computer data-processing course,
2. some exposure to computer programming, either using an algebraic language or a data-processing language,
3. an information system analysis and design course, plus
4. an auditing and EDP course.

I will discuss each of these briefly, mentioning what I consider a suitable content and the support material that is generally available.

The Computer Data-Processing Course

Probably more than three-fourths of all accounting programs have an introduction to computer data processing, either required or as an elective course. The content of the computer data-processing course is fairly well understood. (A typical outline for a computer data-processing course is described in Figure 1, page 14.) The data-processing course for accountants should tend to emphasize control over the quality of computer processing as a major topic and also include flowcharting exercises. There are a large number of textbooks available for such a course; perhaps twenty textbooks could be located which would meet most of the needs of the accounting student. A professor seeking to upgrade, change, or introduce a basic computer data-processing course should have no difficulty in obtaining suitable material, outlines, and appropriate exercise material.

Programming for Students in Accounting

A major problem in curriculum design is the question of experience in coding and debugging computer programs. (In considering the design of such a curriculum, there are several curriculum reports which a faculty

should consider listed in Figure 2, page 15.) Those who advocate this instruction feel that programming is an activity that is best understood by experience and that comprehension of computer data processing is enhanced by exposure to computer programming. Those who oppose the inclusion of actual coding say that learning a language which the student may not use takes time that might be better spent elsewhere. I believe a student needs to have participated in the actual designing, coding, and debugging of a computer program in order to understand the process by which a computer program is prepared. The cost of learning the rudiments of a computer language is small compared to the experience and understanding that comes from genuine practice.

Even after deciding that students should be exposed to computer programming, we still have several issues to be resolved. (These are summarized in Figure 3, page 16.) The depth of instruction is related directly to how much a student should know. Should students do only a few simple coding programs or should there be reasonable proficiency in the language chosen? A modest proficiency is certainly most satisfactory because the learning of a language is not as crucial as understanding the process of designing, coding, and debugging programs. This process requires learning the rules of a specific language but does not require high proficiency.

The next issue is whether to locate the instruction as a separate programming course or as part of the data-processing course. At Minnesota, we found that when programming is included with a regular data-processing course the exercises tend to drive the course since programming problems and the instruction overshadow the conceptual material being presented. Separating the programming makes descriptive conceptual material easier to present and more meaningful. We have developed an approach based on one-credit programming modules that a student can use at his own pace without attending formal lectures. The first day of the course the student obtains the description of a set of problems, course materials describing how to gain access to the computer, and so forth. In order to complete the course the student must design, code, and debug a set of five problems and take a set of four or five examinations. Theoretically, the student could appear the second meeting of class and turn in all problems and take all of the examinations. There is no required attendance at lectures. (These are informal and consist primarily of consulting with students.) There are three modules currently operating—FORTRAN, Elementary COBOL, and Intermediate COBOL. Various proposals were made for an RPG module and a simulation language module, but none have been implemented.

There are other advantages to the modular approach. If a course needs a knowledge of COBOL as part of the prerequisites, the students can be required to take the one-credit COBOL module before taking the course needing it. A transfer student may have had COBOL but not FORTRAN; the modular approach allows the student to take only that language in which he or she is deficient.

Figure 1

Outline of Typical Computer Data-Processing Course for Accountants and Auditors

General Content

I. Introduction to Computer Data Processing
   1. Historical perspective
   2. Overview of computers for data processing
   3. Computer-based information systems

II. Short Survey of Computer Hardware Technology
   4. Internal operation
   5. Storage and retrieval of data in a computer

III. Development of Computer Data-Processing Applications
   6. The system master plan and life cycle of development for applications
   7. Tools for analyzing and planning computer applications
   8. Computer program structure and design
   9. Programming in low-level languages
   10. Programming in high-level algebraic languages
   11. Programming in high-level data-processing languages

IV. Processing Methodology and System Technology
   12. Input/output and file storage devices
   13. Data-processing methods
   14. Organizing and processing computer-stored data
   15. Data communications in data-processing systems
   16. Control over quality of computer processing

V. The Computer System in Use
   17. Sharing the use of a computer
   18. Evaluating and installing computer hardware and software
   19. Operation and management of the computer installation
   20. Impact of computer on society, organization, and individuals

Exercises

Flowcharting of processing application
Flowcharting of program logic
Other documentation
Short cases

Textbooks

Several available

The type of language to require of accounting students is a difficult question to answer. In course work, the student will find that an algebraic language is most useful. For example, a knowledge of BASIC, PL/I, FORTRAN, and so forth, allows the student to use the computer effectively in simulation or statistical processing. The algebraic language is therefore preferred for the academic environment. In the data-processing world, however, COBOL dominates, with RPG a close second. This suggests that students who wish to learn something about the environment of commercial data processing should have an exposure to COBOL. At Minnesota, the students are required to learn BASIC as part of a prerequisite mathematics course. Either FORTRAN or COBOL is required as a prerequisite for the computer data-processing course which they are required to take. The accounting students, therefore, tend to choose COBOL over FORTRAN as the language to take. If a student can learn only one language, my preference would be for them to learn an algebraic language because of its usefulness in academic processing.

Remaining is the question of how to teach the programming language. One can merely teach the language elements necessary for coding as a rote system: learn these instructions, code them this way, put them in this

Figure 2

Some Curriculum Recommendations to Consider in Designing an EDP Curriculum for Accountants and Auditors

- ACM graduate in information systems. R. L. Ashenhurst (ed), "A Report of the ACM Curriculum Committee on Computer Education for Management," *Communications of the ACM*, May 1972.

- ACM undergraduate program in information systems. J. Daniel Couger (ed), "Curriculum Recommendations for Undergraduate Programs in Information Systems," *Communications of the ACM*, December 1974.

- Canadian Institute of Chartered Accountants Curriculum Report, 1976 (Updated, 1973) *CA Magazine*, September 1974.

- AAA 1968-69 Committee on the Role of the Computer in Accounting Education, *Accounting Review*, XLV, 1970.

- *Horizons for a Profession*, Roy and MacNeill, AICPA, 1967.

- "Technical Proficiency for Auditing Computer Processed Accounting Records," *Journal of Accountancy*, October 1971 (Updated October 1975).

- AICPA/AAA, Report of a Task Force on Inclusion of EDP in an Undergraduate Curriculum, *Journal of Accountancy*, December 1974 and *Accounting Review*, October 1974.

Figure 3

Alternate Views for Teaching Computer Programming to Accounting Students

	Alternative Views	
Depth of Instruction	A few simple programs written and debugged	Good proficiency
Location of Instruction	Separate programming course	Programming as part of data-processing course
Type of Language	Algebraic • BASIC • FORTRAN • PL/I • PASCAL • etc.	Data Processing • COBOL • PL/I • RPG • etc.
Language Philosophy	Language elements for coding	Program structure and programming discipline

order, and they will work. An alternative approach is to teach programming discipline. This is often termed *structured* programming. In some respects, it is quite effective to teach the students merely the language elements, have the students write a few simple programs in such a way that they work, and ignore efficiency or discipline. However, we are making a major transitional effort at Minnesota. COBOL will be taught completely in the framework of programming discipline and all exercises will be done in a strucured format. In other words, the student will be taught from the beginning to use rules-of-programming discipline and to format programs using the concepts of structured programming, all as a natural part of the programming exercises. FORTRAN does not lend itself quite as well to this approach, but even there an emphasis upon a disciplined style will be given so that the resulting programs are readable and maintainable.

The Information Systems Analysis and Design Course for Accounting Students

Wherever the computer data-processing course is generally required, the information systems analysis and design course is either elective or not offered. Perhaps only 60 percent of the schools offer a systems course and this figure may be high (see Figure 4, opposite). The traditional accounting systems course has had serious problems; the replacement has probably more intellectual content and more utility to the typical accountant/auditor, but there is less agreement as to an outline for such a

course. (A useful outline is shown in Figure 5, below.) The course idea is to present the way by which an information system is developed in both the overall system plan and individual application. Such a process is difficult to teach in the abstract, because there needs to be student involvement in the process through case experience. A teaching of tools and techniques and material relative to the design of applications is required. The student should be apprised of principles and guidelines for data preparation, input procedures, document design, and output procedures. The stu-

Figure 4

Comparison of Requirements for Courses in Systems and Electronic Data Processing

	Number of Schools	Percent
Requires both systems and EDP course	5	5%
Requires EDP; systems is elective	23	22
Requires systems; EDP is elective	5	5
Both systems and EDP are elective	13	12
Requires systems; EDP not offered	5	5
Requires EDP; systems not offered	22	21
Systems is elective; EDP not offered	10	10
EDP is elective; systems not offered	9	9
Neither course is offered	11	11
Total	103	100%

*Survey of 103 schools by Joan Schroeder, "Systems and Electronic Data-Processing Courses in the Accounting Curriculum," *The Accounting Review*, April 1972, pp. 387-89.

Figure 5

An Outline for the Information Systems Analysis and Design Course for Accountants

General Contents

The development of an information system master plan
The process by which an information system application is developed and implemented
Tools and techniques for use in information analysis and system design
Application design—data preparation, input procedures, processing, document design, output procedures
Common applications
Alternatives in application design

Exercises

A comprehensive case problem which carries the student through the application development process

dent may be exposed usefully to common applications, perhaps one or two in some detail to see the entire flow. The student also needs to be aware of alternatives in application theory.

The text material is not as well developed for such a course, although a number of recent texts have been brought out in the field which certainly should be considered. Generally, however, the textbook support material for the course is not yet adequate. They tend to be conceptually weak, offering descriptions of the process and what analysts do but insufficiently describing why things are done the way they are. Consequently, it is desirable for the students to have good case experience so that they can learn by following a process.

Because of the absence of a large body of case support material, an information systems analysis and design course is difficult to teach. A school must be prepared, therefore, to devote considerably more resources than for the basic computer data-processing course or for the teaching of programming. As textbook support becomes better, this course should become a regular offering for accounting students.

The Control and Audit of an EDP Course for Accounting and Auditing Students

One can introduce computer audit concepts and techniques in the regular auditing course. However, it would appear desirable for an optional course to be available which handles the specific problems of auditing and control in an EDP environment. The combination of the two topics is sufficiently rich in concepts and techniques to justify a separate course. (An outline of such a course is included as Figure 6, page 20.) Some good material exists in this area, although the textbook support is fairly weak. Material which should be considered when teaching such a course is listed.

IIA *et al.*	EDPACS Auditing Computer Centers Auditing Fast Response Systems
AICPA	SAS No. 3 Auditing & EDP (in revision) Service Center Audit Guide The Auditor's Study and Evaluation of Internal Control in EDP Systems *(in process)* Report of Special Committee on Equity Funding
Canadian Institute of Chartered Accountants	Computer Control Guidelines* Computer Audit Guidelines*

*Available from the AICPA.

Firms	Touche Ross *Computer Controls and Audit* (1975 edition)
	Arthur Young *Computer Auditing in the Seventies* (1970)
National Computer Center (Great Britain)	Data Control Guidelines
AFIPS	Security-System Review Manual (1974)
Recent Textbooks	Jancura, Elise G., *Audit & Control of Computer Systems*, Petrocelli/Charter, New York, 1974, 355 pages.
	Porter, W. Thomas, *EDP Controls and Auditing*, Wadsworth Publishing Company, Inc., Belmont, California, 1974, 240 pages.

The instructor teaching an auditing controls course should have access to *EDPACS*, a publication rich in useful material. Although somewhat expensive, it is a must. Case and exercise materials, however, are still a problem. There needs to be, for example, exercise material that would allow a student to use computer audit software and to perform test data. At Minnesota we developed a test data problem based on a software package called COMBI, thus allowing the students to prepare test data and get computer-generated feedback indicating how well the test data tested all the documented code. It also illustrates how undocumented code cannot be detected by test data. We have used CARS, a computer-audit software system, although we have access to STRATA and AUDITAPE because it is completely COBOL-based and therefore easily adapted to the control data equipment at the university.

An introductory course on the concepts and structure of a management information system possibly would be valuable for accounting students. Such a course has been taught successfully at Minnesota using a new text designed especially for it. (An outline of the course is given in Figure 7, page 21.) A reading book containing a number of classic or well-stated supportive readings is also available. We use the readings plus the text as an introduction to management information systems.

The last problem to be considered is the training of faculty. It is difficult to teach that which you have not had a chance to study. A faculty member should have, of course, a depth of knowledge greater than that which is required for the students. This involves, therefore, a continuous commitment to the updating of knowledge. A few references which are useful for keeping abreast of developments in the computer data-processing field are the following.

- *Computing Newsletter for Schools of Business* ($20/yr.)
- *Datamation* (Free to qualified individuals)

- *Computerworld* ($15/yr.)
- *Computing Reviews*
- *Datapro* ($325/yr.)
- *EDP Analyzer* ($35/yr.)
- *EDPACS* ($35/yr.)

In the College of Business at the University of Minnesota we have been involved in the implementation of a comprehensive management-information-systems curriculum for the past seven years. It is probably one of the more strongly developed MIS options currently available. Our experience has been that curriculum development, development of teaching materials, and updating of these materials has been a major, on-going undertaking. I believe that bringing the computer-oriented accounting curriculum up to the standard described here is a difficult task. We had extra resources for the Minnesota MIS development. In the absence of such additional resources, the instructor needs to rely even more heavily upon existing course materials, textbooks, and so forth. The number of textbooks in process or recently issued suggests, however, that textbook support is improving. Continuing motivation for curriculum development comes both from the

Figure 6

Outline of a Control and Audit of an EDP Course for Accounting and Auditing Students

Major Topics

Concepts of control in EDP

EDP organizational and management controls

EDP control functions

EDP physical security

EDP application controls

The EDP Audits
- Management audit
- Application post audit
- Financial control audit

Tools and techniques for auditing EDP

Exercise Material

An audit software system plus data files and problems (generally available for classroom use)

A test data problem (e.g., the Minnesota COMBI problem)

Case studies—not completely satisfactory

instructors who recognize the need and from the firms who insist that it is important. It would help if it also came from the CPA exam, which should require that the candidates taking the examination have a reasonable knowledge of computer data processing.

Figure 7

Outline of an Introduction to a Management Information Systems Course*

Section One—Conceptual Foundations

1. An Overview of Management Information Systems
2. Concepts of Information
3. Human Information Processing
4. System Concepts and Information Systems
5. Concepts of Organization and Management Relevant to Information Systems
6. Decision-Making Concepts for Information Systems
7. Value of Information for Decision Making

Section Two—Structure of a Management Information System

8. Structure of a Management Information System
9. The Hardware, Software, and Control Environment for Information Processing Systems
10. The Transaction Processing System
11. The Data Base Subsystem
12. Information System Support for Decision Making
13. Information System Support for Planning and Control

Section Three—MIS Development and Management

14. Organization and Management of Information Systems
15. The Development of a Management Information System
16. Evaluation of Information Systems
17. Current Issues, Societal Implications, and Future Developments

*Based on Gordon B. Davis, *Management Information Systems, Conceptual Foundations, Structure and Development* (New York: McGraw-Hill, 1974).

Computer Curriculum for the Management Advisory Services Area —Present and Reasonable Potential

By Professor John O. Mason, Jr., CPA, Ph.D.,
University of Alabama

The decision of the American Institute of Certified Public Accountants (AICPA) to commission a MASBOKE study (Management Advisory Services Body of Knowledge and Examination Concepts) highlights the continuing investigation of how to teach the skills necessary to use the available tools in the growing specialty of management advisory services. The investigation has focused on a problem consisting of four interrelated parts: (1) what MAS practitioners do, (2) the body of knowledge required for their work, (3) testing for that knowledge by examination or other procedures, and (4) the responsiveness of undergraduate accounting curricula in providing this body of knowledge.

In accordance with the charge of the symposium, I hope to stimulate a discussion of strengths and deficiencies in existing undergraduate EDP curricula for the MAS practice area and provide guidance for improving existing curricula and for establishing new curricula in those colleges and universities that do not offer them at present.

It is obvious that the consultant must be technically competent in his special field. Until recently, however, answers to the question "What are the important features of MAS practice?" have not been well formulated. As the first step in a program to determine the MAS practitioners' educational needs, the AICPA's MAS Committee on Education, after conducting a search of the literature on the practice of management consulting, cataloged areas of knowledge for consultants. Though admittedly not all-inclusive because of the broad nature of management advice, this listing cites twenty major areas (see Exhibit 1, opposite). The importance of computer and information systems development activities in the practice of MAS is readily apparent, for an examination of Exhibit 1 reveals that seven, and possibly eight, different major areas could be considered as subject matter within this specialization.

The next step in defining MAS areas of knowledge is the MASBOKE research project that currently is being conducted by Summers and Knight of the University of Texas. Having recently completed Phase 1 of the study, the MASBOKE researchers have found that the bodies of knowledge required in MAS practice are so diverse that they have divided all fields of pertinent knowledge into four categories: general, industry, functional, and technical (see Exhibit 2, page 24).

The MASBOKE researchers have found, among all types of firms and practitioners, evidence of frequent use of four types of technical skills that are supported by definable bodies of knowledge. In my opinion, each

of the following four types of technical skills could be included within the information systems specialty:

1. Systems concepts, design, and installation
2. Electronic data processing
3. Clerical controls and methods
4. Management sciences and operations research

The importance of these technical fields in MAS practice is indicated by a series of surveys recently completed by the MAS division of the AICPA. A survey of the forty-eight largest accounting firms was conducted by the MAS division via mail questionnaire. An analysis of the findings revealed that the MAS practice areas of systems development, EDP, and systems installation are perceived by large firms to be among the top four in anticipated growth (see Exhibit 3, page 25).

Exhibit 1

Major Areas of Knowledge for Practicing Management Consultants*

Area

Consulting techniques
Conducting a general consulting engagement
†Conducting an EDP consulting engagement
Administering a consulting group
Management technique applications
Organizational development
Financial analysis and planning
Marketing and distribution
Personnel management techniques
Techniques for presenting operating information
Manufacturing-oriented subjects
Office operations subjects
†Accounting systems and control techniques
†Computer concepts
†System design concepts
†Specialized computer applications
†Application of computers in management science
†Computer controls
†Programming languages
New fields, techniques, and equipment

*Adapted from Lowell A. Baker and Monroe S. Kuttner, "Management Consulting Education: Needs, Sources, and Voids," *Management Adviser*, November-December 1973, p. 40.

†Indicates that the area generally would be included as subject matter under information systems development.

A polling of small- and medium-sized firms was conducted for the AICPA by the Roper Organization. According to the results of a mail survey of 2,504 firms, a sizable number of firms not only provide consultative advice on EDP systems, EDP operations, and managerial information and control systems, but also expect to see a rapid rise in requests for such advice (see Exhibit 4, page 27).

Exhibit 2

MAS Bodies of Knowledge— MASBOKE Project*

Knowledge of Organizational Functions

1. Finance and accounting
2. General management
3. Industrial management, operations, and manufacturing
4. Administration and office operations
5. Marketing
6. Personnel

Knowledge of Technical Skills and Disciplines

1. Systems concepts, design, and installation
2. Electronic data processing
3. Clerical controls and methods
4. Management sciences and operations research

Knowledge of Particular Industries, Programs, and Institutions

1. Industry (profit-making)
2. Program and institutional (government, nonprofit, eleemosynary)

General Knowledge, Including the Consulting Art

1. How business operates and is managed
2. How the CPA profession works
3. Communications skills
4. How to conduct an MAS assignment
5. MAS standards and procedures

*Source: Edward L. Summers and Kenneth E. Knight, "The AICPA Studies MAS in CPA Firms," *Journal of Accountancy*, March 1975, p. 60.

Computer Education in the Accounting Curriculum

Can existing computer education in typical undergraduate accounting programs prepare students sufficiently for entry-level positions as computer systems consultants in MAS? A review of the objectives and the present

Exhibit 3

MAS Practice Areas in Which Most Growth is Anticipated by Large CPA Firms*

MAS Practice Area	*Percent Mentioning*
Systems development and design	59%
Managerial planning, information, and control	56
Electronic data processing	41
Systems installation	35
Financial and economic analysis	29
Operational analysis	21
Cost accounting	15
Informal advice	12
Marketing	9
Personnel administration	6
Software development and evaluation	6
Executive and managerial recruitment	6
Operators research	3
Project management	3
Organization analysis	3
Industrial engineering	0

*Adapted from "Nationwide MAS Surveys," *Journal of Accountancy*, March 1975, p. 88.

status of computer education in the accounting curriculum indicates that the answer is probably negative. In many accounting programs the objectives of computer education are not always clear, and the computer content in major course subjects is in various stages of development and maturity.

Objectives

The Report of the 1964 AAA Committee on Electronic Data Processing in Accounting Education, in a departure from reports of its predecessor committees, recommended an increased emphasis on computers and computer systems, stating that accounting students at the undergraduate level should be exposed to electronic data processing in three stages:

1. Concurrent with or prior to the introductory accounting course, students should receive instruction in a basic programming language and should be able to write simple computer problems in that language.
2. Accounting instruction in a variety of subject-matter courses should incorporate some computer-oriented problems where subject matter is conducive to formulation. Such instruction should convey the principles basic to an understanding of the profounder, nontechnical issues to which computer solutions are being applied.
3. The traditional accounting systems course should continue to include coverage of electronic data processing as one of the aids to accounting.[1]

After observing that ". . . unless accountants as reporters and auditors keep abreast of developments in internal information systems, they will be faced with having the engineers and operations research specialists determine what is to be reportable and auditable," the committee set forth its views on the objective of EDP instruction in the accounting curriculum:

> By this three-stage approach, accounting students will be enabled to make use of the computer as a problem-solving tool, as an element in accounting-information systems, and as a basis for a more logical approach to analysis of enterprise transactions.[2]

A more far-reaching and specific statement of the objectives of computer instruction in accounting appears in *Horizons for a Profession: The Common Body of Knowledge for Certified Public Accountants* (CBOK) and the report of the AICPA Committee on Education and Experience Requirements for CPAs (the Beamer Report). In their CBOK study, Roy and MacNeil concluded, with respect to computers, that the CPA just entering the profession should possess

1. Basic knowledge of at least one computer system,
2. Knowledge of at least one computer language,
3. The ability to chart or diagram an information system of modest complexity,
4. And the ability to design an information system, prepare a program for it, and carry the work through the stages of debugging and testing.

These recommendations significantly extend the desired level of knowledge about computers and computer systems. Although the CBOK study does not indicate where such knowledge is to be acquired in the educational process, the Beamer Report recommends that (1) and (2) be ac-

[1] "Report of the 1964 AAA Committee on Electronic Data Processing in Accounting Education," *The Accounting Review*, April 1965, p. 422.
[2] *Ibid.*

Exhibit 4

MAS Market Growth Anticipated by Medium-Sized CPA Firms*

MAS Practice Area	*Percent of Total Firms Performing Services in Area*	*Percent of Total Firms That See Market Demand Growing*	
		Moderately	*Rapidly*
Counsel on general business matters	98%	49%	33%
Manual systems and procedures	97	55	16
Financial and economic analysis	91	50	23
Managerial information and control systems	85	48	17
Cost accounting	80	45	8
Organization and personnel	57	35	7
EDP operations	55	44	25
EDP systems	55	42	29
Production and inventory controls	52	36	6
Executive and managerial recruitment	50	27	4
Marketing	35	28	5
Operations	18	23	3
Industrial engineering	15	24	4

*Adapted from "Nationwide MAS Surveys," *Journal of Accountancy*, March 1975, p. 89.

quired in an introductory computer course of 2 to 3 semester hours and that (3) and (4) be acquired in a 4- to 6-semester-hour course on computers and information systems in business, if a four-year or a five-year accounting program already exists.

Present Status

Given the recommendations by the AAA, the CBOK study, and the Beamer Committee, two comprehensive studies have been conducted since

1970 to determine the state of computer use in the undergraduate curriculum. In early 1970, Moon conducted a questionnaire survey on the status of computer education in the accounting curriculum. The survey was designed to determine the objectives for incorporating EDP instruction into the education of the accounting major and to ascertain the methods used in EDP accounting instruction. The questionnaire was mailed to departments of accounting at the then 128 AACSB member schools. A total of 117 useable replies were received, for a total useable response rate of 91.4 percent.

The results of the survey with respect to objectives of EDP instruction in accounting are summarized in Exhibit 5, opposite. The questionnaire listed ten different objectives commonly referred to in accounting literature and asked each respondent to rank the objectives. By assigning the top three objectives of each response an equal weight and truncating the rest, an analysis of the results indicates that the objectives most commonly mentioned all tend to correspond with the recommendations of the CBOK study and the Beamer Report.

The second aspect of the Moon survey dealt with the methods used to incorporate EDP instruction into the accounting curriculum. As can be seen in Exhibit 5, a decided minority of schools incorporate EDP instruction in the listed accounting course areas. Moreover, as regards incorporation of EDP education accounting courses, the means most commonly mentioned were concepts and programming problems, with less attention given to the use of business games and canned programs. The somewhat amorphous category "other" was hardly mentioned by the respondents (see Exhibit 6, page 30).

In a more recent study (1974), Solomon also attempted to measure the state of computer use in undergraduate accounting instruction. Questionnaires were sent to the 280 U.S. colleges and universities that operate a school or college of business. A total of 172 responses were received, representing 61.4 percent of the questionnaires mailed. The results of his survey with respect to the extent of computer usage in undergraduate accounting instruction are summarized in Exhibits 6 and 7, pages 30 and 31. A review of these findings leads to some interesting observations.

First, 31 percent of the schools do not use the computer in accounting instruction, and the overall course utilization average for all responding schools is 1.5 courses (see Exhibit 7).

Second, on a more disturbing note, only 31 percent of the schools used the computer in a systems course (Exhibit 6). This finding lends weight to the conclusions of the 1973 AAA Committee on Management Information Systems that many accounting systems courses focus on broad management concepts and quantitative analysis rather than concentrating on systems design, management planning and control, and internal control of MIS, of which the computer should be an integral core.

Third, it is rather disconcerting that a number of schools have discontinued the use of the computer in introductory accounting courses. Solomon attributes this to a belief held by these schools that the computer in introductory accounting is (1) ineffective, (2) a distraction from the purpose

Exhibit 5

Top-Ranked Objectives for Computer Education in Accounting*

Objective	*Percent Mentioning*
1. To chart or diagram an information system of modest complexity	66%
2. To provide knowledge of at least one computer language	58
3. To provide knowledge of concepts and terminology such as reliability, redundance, real-time operations, and shared-time use	46
4. To design an information system, prepare a program for it, and carry through stages of debugging and testing	40
5. Other	33
6. To provide knowledge of at least one computer system	32
7. To provide knowledge of techniques for evaluating and selecting equipment	13
8. To provide knowledge of several computer languages	6
9. To provide a basis for estimating savings relating to a computer installation	4
10. To provide a basis for developing a detailed installation schedule and estimating the one-time costs	2

*Adapted from James E. Moon, "An Inquiry into the Objectives and Implementation Methods of Accounting Computer Education" (unpublished Ph.D. dissertation, University of Alabama, 1970).

of the teaching of accounting, or (3) too costly. Despite these findings, Solomon concludes that "computer usage in accounting instruction has grown considerably over the past two to three years and is expected to increase in the future."[3]

Paralleling the Moon and Solomon studies on computer instruction in the accounting curriculum are the Couger surveys on computer uses and

[3] Lanny Solomon, "The Computer in Undergraduate Accounting Education: A Survey," *Journal of Accountancy*, December 1974, pp. 121-25.

Exhibit 6
Present Computer Use and Recent Computer Discontinuance by Course

	*Percentage of Schools**		*Percentage of Schools Incorporating EDP and How Incorporated***				
Course	*Using computer*	*Discontinuing use*	*Concepts*	*Programmed problems*	*Business games*	*Canned programs*	*Other*
Principles I	25	15	24	8	6	12	2
Principles II	22	10					
Cost	19	3	8	8	4	10	0
Advanced cost	13	1					
Intermediate	4	2	2	3	0	3	1
Advanced financial	5	0					
Taxes	2	0	0	0	0	0	0
Auditing	17	2	19	6	3	7	9
Systems	31	1	23	21	3	5	12
Separate EDP	N/A	N/A	7	7	19	9	0
Other	6	1	58	53	9	11	2

*Adapted from Lanny Solomon, "The Computer in Undergraduate Accounting Education: A Survey," *Journal of Accountancy*, December 1974, p. 122.

**Adapted from James E. Moon, "An Inquiry in the Objective and Implementation Methods of Accounting Computer Education" (unpublished Ph.D. dissertation, University of Alabama, 1970).

Exhibit 7

Computer Use in Undergraduate Accounting by Number of Courses*

(Determinable Replies—159)

Number of Courses in Which Computer is Currently Used	*Percent Mentioning*
0	31%
1	24
2	23
3	13
4	6
5+	3

Notes: Course Utilization Average for all Schools = 1.5
Course Utilization Average for User Schools = 2.2

*Adapted from Lanny Solomon, "The Computer in Undergraduate Accounting Education: A Survey," *Journal of Accountancy*, December 1974, p. 123.

computer curriculum in United States schools of business.[4] As a result of a series of surveys of AACSB member schools conducted since 1966, Couger concludes that a four-phase computer curriculum model has evolved as an integral part of the required curriculum in a majority of the schools. These phases are the following:

1. Coverage of computer fundamentals, systems analysis, and design and programming through a course required of all students in their academic program.
2. Coverage of the applications of computers through incorporation of this material into the functional area courses, such as, computer applications in finance in the finance courses, computer applications in marketing in the marketing courses, and so forth.
3. Coverage of computer capabilities for abetting decision making in a dynamic business environment through computer-oriented business games.
4. Coverage of integration and optimization of computer applications through a course on design and implementation of a sophisticated, computer-based management information system.

[4] J. Daniel Couger. *Report on 3d Triennial Survey of Computer Uses and Computer Curriculum in Schools of Business* (Colorado Springs, Colorado: Center for Cybernetics Systems Synergism, October 1974) p. 1.

As I read the results of the aforementioned studies and others that have been conducted during the past several years, it is apparent that increasing emphasis is being placed on knowledge of the computer and computer systems in accounting and business curricula. As Couger's surveys indicate, only 11 percent of AACSB member schools in 1966 required undergraduate computer programming proficiency of students at the undergraduate level, whereas in 1970 and 1974 the levels were 62 and 78 percent, respectively. I am of the opinion, however, that the objective of the curricula is to use the computer as a pedagogical aid, as in computer-assisted instruction (CAI) or as a problem-solving tool, or to provide students with sufficient knowledge so that they can operate as informed users of information systems rather than as designers or managers of information systems. What typically occurs is best described by Carl Bohne, Director of Training at Arthur Andersen & Co.:

> A recent sampling of accounting graduates entering the firm disclosed that 90 percent had taken college courses which, in their opinion, covered computers and/or their application. About 75 percent said that they had learned a language (generally, FORTRAN), had done simple flowcharting, and had keypunched cards. The same percentage thought that they understood how a computer works, the function of input and output devices, and the difference between hardware and software. Beyond this point, the responses showed varying and lesser percentages of persons having any depth of knowledge of or hands-on experience with a computer.[5]

The Report of the 1973 AAA Committee on Management Information Systems supports Bohne's contentions by stating that the graduate

> did not understand tasks performed by computer-based systems, had little appreciation for the key elements of such a system,
> did not possess a framework by which to evaluate their effectiveness, and
> did not understand the process by which systems are developed and installed.[6]

These findings refute the effectiveness of Couger's four-phase computer-curriculum model.

At best, the objectives and content of computer education in accounting and business courses provide an accounting graduate with a sufficient knowledge of computers to form a base for instruction and experience in the use of this accounting and auditing tool. Even at worst, they still serve to make accounting students aware of the computer. In this regard, it is my opinion that the computer content in accounting courses is a series of one-

[5] Carl J. Bohne, Jr., "Objectives of Professional Education and Training," *Accounting Education: Problems and Prospects,* (New York: American Accounting Association, 1974), p. 241.

[6] "Report of the Committee on Management Information Systems, 1973" *The Accounting Review* (Supp. to Vol. XLIX, 1974), pp. 121-25.

shot operations that does not provide an in-depth knowledge of systems work. These courses do little more than indicate how to ask for information and how to read a computer print-out.

ACM's Professional Programs in Information Systems Development

Information systems in organizations function both to facilitate the operations of an organization and to provide information for management planning and control. The information processing required to meet these needs has always been present in organizations, for example, in departments of accounting, in production control, and by the use of the "little black books" of important data kept by most managers. Computers offer the opportunity to formalize, systematize, and automate much of that processing.

The need for professional degree programs in information systems management has been documented in a position paper by the Association for Computing Machinery (ACM) Curriculum Committee on Computer Education for Management. This committee pointed out that adequate preparation for either entry-level positions or more advanced ones in information systems requires an intensive educational program—one providing concentration on both organizational and computer systems, as well as on the information systems development process itself. They concluded that such programs did not then exist in American universities.

In a subsequent report, the ACM Committee offered comprehensive curriculum recommendations for a graduate-level professional program in information systems development. Drawing on the disciplines of computer science and business administration, the committee attempted to integrate the knowledge in these fields by developing a curriculum whose objectives were (1) to develop a systems viewpoint, (2) to provide a conceptual basis for the analysis of information systems in large, complex organizations, (3) to develop an understanding of how to create an economically viable and technologically feasible computer-based system, and (4) to provide experience in the implementation of a complex information system. Based on a set of prerequisities that assure that students entering this graduate program will have sufficient preparation in basic mathematics, operations research, psychology, economics, and computer programming, the program is designed to prepare students both for entry-level positions in information analysis and systems design and for more advanced positions as managers and as consultants of computer-based information systems.

A set of thirteen courses is the basis for the graduate program in information systems development. These are grouped into four categories: Analysis of Organizational Systems, Background for Systems Development, Computer and Information Technology, and Development of Information Systems. (The titles and course numbers are given in Exhibit 8, page 34.)

For many years, hardware and software problems commanded attention while human problems were often ignored. As a result, sophisti-

Exhibit 8

Course Titles and Numbers for Graduate Program in Information Systems Development*

Course Group A: Analysis of Organizational Systems
- A1. Introduction to systems concepts
- A2. Organizational functions
- A3. Information systems for operations and management
- A4. Social implications of information systems

Course Group B: Background for Systems Development
- B1. Operations analysis and modeling
- B2. Human and organizational behavior

Course Group C: Computer and Information Technology
- C1. Information structures
- C2. Computer systems
- C3. File and communication systems
- C4. Software design

Course Group D: Development of Information Systems
- D1. Information analysis
- D2. System design
- D3. Systems development projects

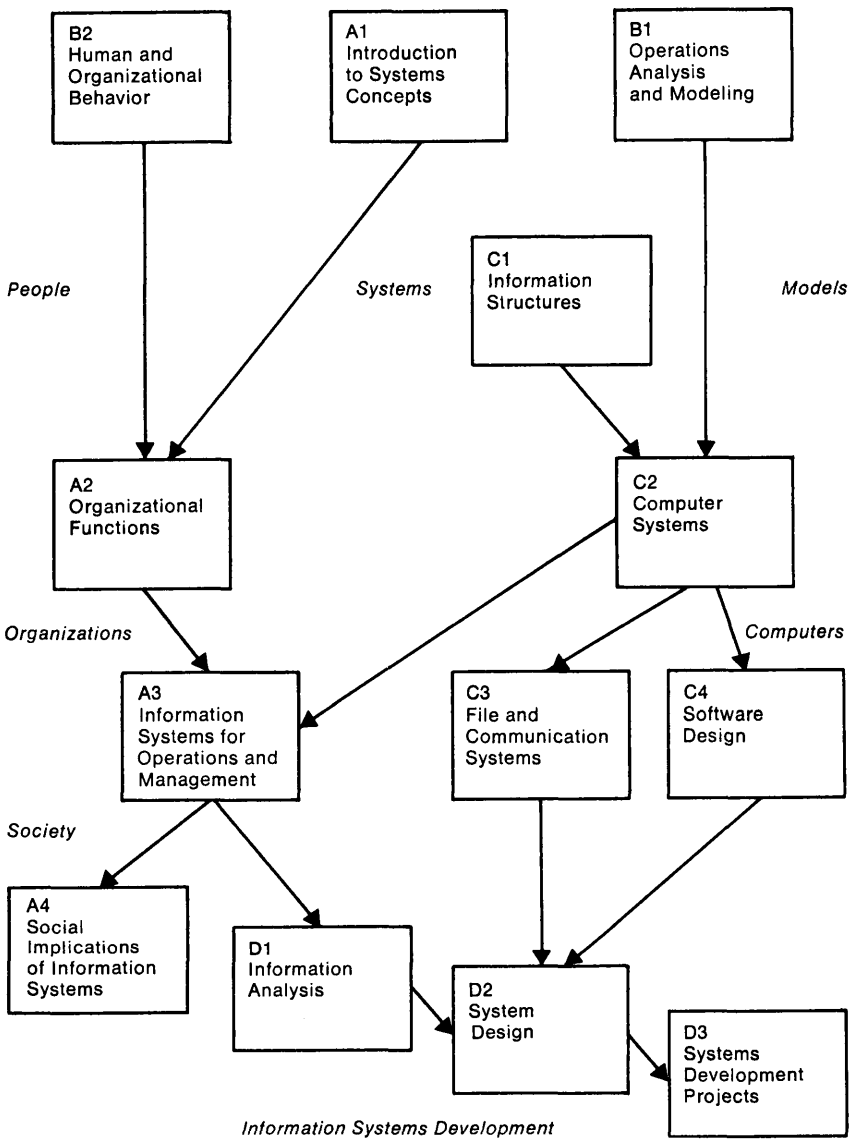
*Source: ACM Curriculum Committee on Computer Education for Management, "Curriculum Recommendations for Graduate Programs in Information Systems," *Communications of the ACM*, May 1972, p. 373.

cated information systems were often developed, but employees experienced difficulty in working with these complex systems. Since information systems are obviously developed, operated, and maintained by people, a program must achieve a balance between organizational behavior and technological considerations. To highlight the need for balance, the analysis and design phase of systems development are recognized in the recommendations as consisting of two activities: information analysis (organizational factors) and systems design (technological factors). This distinction is carried over into skill sets desirable for graduates. Six clusters or groupings of skills are offered—people, models, systems, computers, organizations, and society—and thirteen courses are proposed to impart those skills (Exhibit 9, opposite). These thirteen courses are structured as a two-year graduate core curriculum for both information and design analysis (Exhibit 10, page 36).

In a further report, the ACM Committee proposed a curriculum for an undergraduate program based on the same general concept of the infor-

Exhibit 9

Course Sequences for Graduate Program in Information Systems Development*



*Source: ACM Curriculum Committee on Computer Education for Management, "Curriculum Recommendations for Graduate Programs in Information Systems," *Communications of the ACM*, May 1972, p. 373.

mation systems specialty in organization. In both reports the life cycle of the information systems development process was viewed as consisting of analysis, design, and implementation phases prior to the operating phase. Whereas the graduate program is structured to achieve a balance between organizational and technological processes in terms of required knowledge, the undergraduate program is necessarily less concentrated on the major subject. This makes it more difficult for it to be comprehensive in the coverage of the information systems field, even in the more condensed form. Accordingly, the undergraduate program offers two concentration options instead of a single program of information systems courses. (Exhibit 11, page 38, draws the ACM distinction.) The two concentration options, labeled *organizational* and *technological,* correspond to the terms *information analysis* and *design analysis.*

The main emphasis in information analysis is the determination of that pattern of information flow which satisfies information needs. Interaction with organizational personnel and a good understanding of how the organization functions is required. An important aspect of information analysis is a willingness to consider that information problems may some-

Exhibit 10

Two-Year Graduate Core Curriculum in Information Systems Development*

SEMESTER				
1ST	A1 INTRODUCTION TO SYSTEMS CONCEPTS	B1 OPERATIONS ANALYSIS AND MODELING	C1 INFORMATION STRUCTURES	
2ND	A2 ORGANIZATIONAL FUNCTIONS	B2 HUMAN AND ORGANIZATIONAL BEHAVIOR	C2 COMPUTER SYSTEMS	
3RD	A3 INFORMATION SYSTEMS FOR OPERATIONS AND MANAGEMENT	D1 INFORMATION ANALYSIS	C3 FILE AND COMMUNICATION SYSTEMS	
4TH	A4 SOCIAL IMPLICATIONS OF INFORMATION SYSTEMS	D2 SYSTEM DESIGN	C4 SOFTWARE DESIGN	D3 SYSTEMS DEVELOPMENT PROJECTS

*Source: ACM Curriculum Committee on Computer Education for Management, "Curriculum Recommendations for Graduate Programs in Information Systems," *Communications of the ACM,* May 1972, p. 377.

times be solved best without resorting to the computer. Typically, the information analysis starts with a determination of what the problem is and whether it can, or even should be, subjected to a systems approach.

The main emphasis in systems design is the translation of specified information requirements into a detailed implementation plan that can be realized in hardware and software. This requires interaction with the information processing department and a good understanding of computer technology.

Information analysis and systems design can be compared to product design and manufacturing systems design in an industrial operation. The former is concerned with the purpose and function for potential users of the product, and the latter with what machines are needed to produce it and how they should be organized. In these terms, the function of the information processing department becomes analogous to that of the production control and manufacturing departments for an industrial operation.[7]

Each concentration option is specified in terms of a set of core courses (seven in the core for organizational, eight in the core for technological). The two sets of core requirements share four courses in common. Because it is recognized that the two processes interact, there is overlap between them, since a person functioning in one of these roles must be aware of the dynamics of the other. (These courses are described in detail in the following section). Students pursuing either option would not be trained to step into advanced positions as managers and consultants of computer-based information systems, but rather would receive a basis from which to grow into such positions.

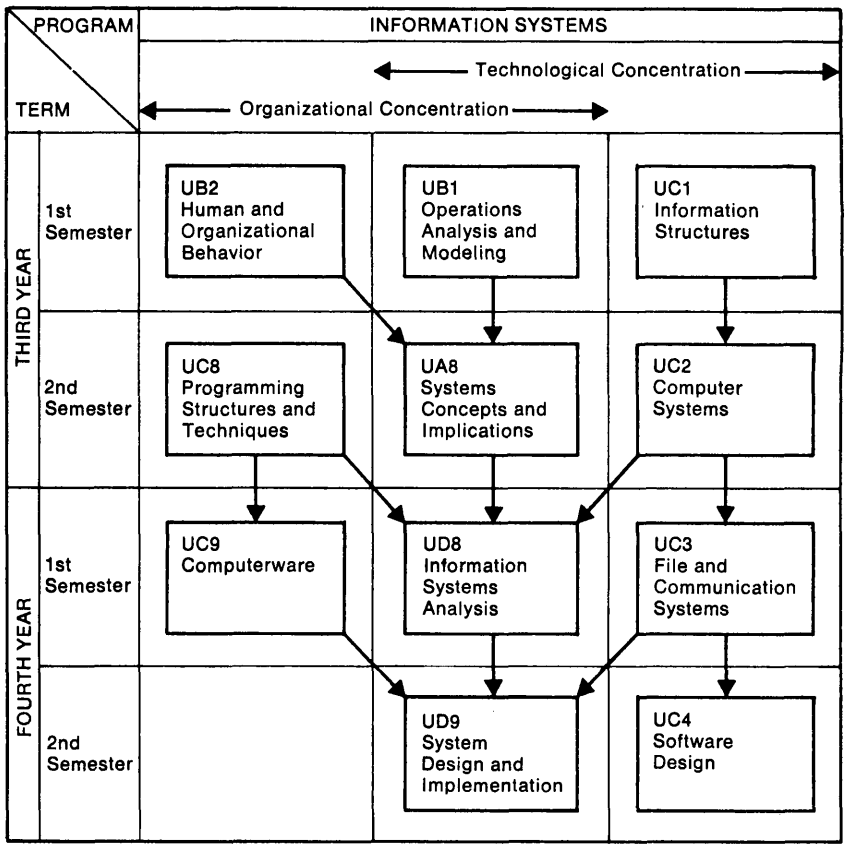
Integrating the Undergraduate Program in Information Systems With the Common Body of Knowledge Recommendations

The options in the undergraduate program in information systems stipulate that the student choose a field of application requiring completion of a minimum of fifteen semester hours of course work. Thus, each concentration is regarded as essentially a double major covering a field of application. Since the two concentration options seem to fit naturally into two different undergraduate schools—organizational into business and technological into engineering—the undergraduate student is faced moreover with school requirements as well as university requirements.

[7] J. Daniel Couger. *ACM Recommended Program in Information Analysis and System Design* (Colorado Springs, Colorado: Center for Cybernetics Systems Synergism, 1972), p. 2.

Exhibit 11

Core Course Sequences for Undergraduate Programs in Information Systems*



*Source: ACM Curriculum Committee on Computer Education for Management, "Curriculum Recommendations for Undergraduate Programs in Information Systems," *Communications of the ACM*, December 1973, p. 732.

The organizational concentration option of a business school provides an area of specialization dealing with the identification and analysis of information needs within complex organizations, as well as with the design and implementation of systems to meet those needs. This option would parallel already existing programs in such areas as marketing, finance, operations management, or planning and control.

Exhibit 12, page 40, gives a typical four-year program for the organizational concentration option in a business school, with accounting as a parallel. To fit these requirements into some of the present-day accounting programs may be more complicated, but the programs should be flexible enough to adjust to most university requirements.

In examining the accounting curriculum, an excellent reference designed to identify the threshold of knowledge that an entrant into the profession should possess is *The Common Body of Knowledge Study* (CBOK), published in 1967 by the American Institute of Certified Public Accountants. Two years later, an AICPA committee attempted to express the conclusions of the CBOK study in terms of a specified accounting curriculum. The ACM curriculum is a common core that can be combined with an existing functional program area (in a sense a double major) in a business or engineering school, while the CBOK study sets forth the common body of knowledge that an entrant to the profession should possess. I would suggest fitting the core content of the ACM curriculum into that of the CBOK recommendations. One question occurs, however. Assuming that the ACM organizational concentration option does prepare students for entry-level positions in the field of information systems consulting, does the CBOK curriculum provide an acceptable vehicle for accomplishing this double major?

Exhibit 13, pages 41-42, compares and integrates the core content of the ACM organizational concentration option with the curriculum recommendations contained in the CBOK. Before examining the exhibit, two comments are in order. First, the knowledge area of accounting per se does not include the entire knowledge area of MAS practitioners. A single, common body of knowledge is too restrictive, and the authors of CBOK did not intend to design a curriculum for professional accounting education in general. As a minimum, however, the CBOK curriculum is certainly aimed at preparing students for careers in professional auditing and accounting. The fact that much of the proposed curriculum is also applicable for careers in management advisory services seems to support my thesis that it is possible to produce combined accountant-information systems graduates able to perform computer systems work as MAS practitioners. Secondly, the basic CBOK proposal involves a five-year program. A four-year program was also presented but appears to have been perceived by its authors as decidedly less preferable. Since the academic community has been reluctant to add a fifth year at the undergraduate level, the comparisons that follow are based on the four-year curriculum in order to remain consistent with the objectives of this symposium.

Exhibit 12
Illustrative Undergraduate Program With Accounting as a Double Major*

TERM / YEAR	1st Semester					2nd Semester				
First Year	Finite Math*	Econ.*	English	Science	Elective	Psych*	English	Science	Humanities	Elective
	← SCHOOL RQMTS. →		← UNIV. RQMTS. →			← SCHOOL RQMTS. →		← UNIV. RQMTS. →		
Second Year	Computer Programming*	Intro. Acct.	Social Science	Humanities	Elective	Statistics*	Intro. Acct.	Social Science	Humanities	Elective
	← SCHOOL RQMTS. →							← SCHOOL RQMTS. →		
Third Year	UB1 Human & Organizational Behavior	UB2 Operations Analysis & Modeling	Marketing	Elective	Elective	UA8 Systems Concepts & Implications	UC8 Programming Structures & Techn.	Money & Banking	Finance	Elective
			← PARALLEL PROGRAM RQMTS. →				← PARALLEL PROGRAM RQMTS. →			
Fourth Year	UD8 System & Information Analysis	UC9 Computerware	(e.g.) Cost Acct.	(e.g.) Intermed Acct.	Elective	UD9 System Design & Implementation	(e.g.) Auditing Theory	(e.g.) Acct. Theory	(e.g.) Acct. Prob. & Cases	Elective

*Information systems prerequisite

*Source: ACM Curriculum Committee on Computer Education for Management, "Curriculum Recommendations for Undergraduate Programs in Information Systems," *Communications of the ACM*, (December 1973), p. 736.

Exhibit 13

Information Systems Organizational Concentration Option Within the Framework of the Common Body of Knowledge Recommendations

Organizational Concentration Option	*Common Body of Knowledge Recommendations*	
Prerequisite Qualifications	**General Education**	**Semester Hours**
	Communication	6-9
(i) finite mathematics, including the fundamentals of formal logic, sets and relations, and linear algebra	Mathematics and Statistics	12
(ii) elementary statistics, including the fundamentals of probability, expected value, and construction of sample estimates.		
(iii) elementary computer programming, including problem analysis and algorithm synthesis, and competence in a higher-level language.	Introduction to Computer	2-3
	Elementary Accounting	3-6
(iv) elementary economics, including microeconomics and theory of the firm, and price theory.	Economics	6
(v) elementary psychology, including fundamentals of personality formation, attitudes, and motivation	Behavioral Sciences	6
Core Courses		
UC7 Programming Structures and Techniques		
UC8 Systems Concepts and Implications	Open General Education*	18-25
UC9 Computerware		60

*There would be sufficient remaining general education electives to permit most students to take one or more specialty courses in the Technological Concentration option: UC1 Information Structures, UC2 Computer Systems, UC3 File and Communication Systems, and UC4 Software Design.

Exhibit 13 (cont.)

Organizational Concentration Option	*Common Body of Knowledge Recommendations*	
Core Courses	**General Business**	**Semester Hours**
	Economics (intermediate theory and the monetary system)	6
	Social Environment of Business	3
	Business Law	4
	Production or Operational Systems	2
	Marketing	2
	Finance	4
UA2 Human and Organizational Behavior	Organization, Group and Individual Behavior	6
UB1 Operations Analysis and Modeling	Quantitative Applications in Business	6
	Written Communications	2
	Business Policy	3
		38
	Accounting	
	Financial Reporting Theory Applied Financial Accounting Problems Contemporary Financial Accounting Issues	6
	Cost Determination and Analysis Cost Control Cost-based Decision Making	3
	Tax Theory and Considerations Tax Problems	3
	Audit Theory and Philosophy Audit Problems	3
UD9 Systems Design and Implementation	Computer and Information Systems in Business	4
		19
UD8 Information Systems Analysis	Elective	3
		120

Prerequisite Qualifications

The ACM report calls for a set of prerequisites in terms of five three-semester-hour course subjects.

1. Finite mathematics, including the fundamentals of formal logic, sets and relations, and linear algebra;
2. Elementary statistics, including the fundamentals of probability, expected value, and construction of sample estimates;
3. Elementary computer programming, including problem analysis and algorithm synthesis, and competence in a higher level language;
4. Elementary economics, including microeconomics and theory of the firm, and price theory; and
5. Elementary psychology, including fundamentals of personality formation, attitudes, and motivation.

The CBOK study recommends twelve semester hours of mathematics, statistics, and probability; two to three hours of introduction to the computer; three to four courses in economics and monetary theory; and six hours of behavioral science within the scope of a student's general education. While reasonable men might disagree on the details of the topics covered by these courses or whether these major content areas provide an adequate foundation on which the student can build and grow, it appears that the CBOK curriculum provides a more adequate coverage of the prerequisites than that required by the ACM study.

Core Courses

The seven courses required for the organizational concentration option and their sequences were presented in Exhibit 11, page 38. Of these, three could be taught in a computer science program or industrial engineering program:

UC7 Programming Structures and Techniques
UC8 Systems Concepts and Implications
UC9 Computerware

The general education part of the CBOK curriculum provides sufficient flexibility for the student electing a double major in information systems development and accounting to include the above courses in the eighteen to twenty-five semester hours of general education electives. Moreover, there would be sufficient remaining general education electives to permit most students to take one or more courses in the technological concentration option.

Two of the courses in the ACM study are similar to the CBOK study recommendations of six semester hours of organizational behavior and six semester hours of quantitative applications in business:

UA2 Human and Organizational Behavior
UB1 Operations Analysis and Modeling

Although I doubt that it would be possible for a student to overprepare in either of these two areas, the CBOK recommendations seem realistic and appear to provide more than adequate coverage of the major content areas specified by the ACM study. In the human behavior area, my own preference is that the second of the two courses recommended by CBOK be structured to aid the student in identifying and specifying the behavioral principles involved in systems design.

The effective design of information systems will only result if the perceptual, cognitive, motor, and motivational capabilities of humans are taken into consideration. For too many years, we have bemoaned a communications gap between the manager and the information systems specialist that prohibited effective systems development. A better understanding of human behavior and its interactions should help narrow this gap.

The remaining two courses could be taught either in the accounting program area or in one of the other program areas in a school of business, probably management or information systems:

UD9 Systems Design and Implementation

UD8 Information Systems Analysis

It is unlikely that these two courses are taught in many universities, either in schools of business or departments of accounting. The report of the 1973 AAA Committee on Management Information Systems, for example, suggests that many systems courses offered in accounting departments focus on three areas: broad management concepts, quantitative analysis, and detailed computer-work operations. The report states that the content of the course is more influenced by what is not being taught to accounting students in other disciplines or in other accounting courses than by what should be taught.

As I see it, two levels of education concerning systems ought to be available to accounting majors in accounting or in other program areas in a school of business. A minimal level ought to be required for accounting majors who do not go into MAS and who will be users and auditors of the results of computer processing. This level could be provided by two courses. Students in the first course would be provided with sufficient information to enable them to operate as informed information systems users. This course would emphasize the relationship between information systems and management planning and control and provide students with a framework within which they can study and evaluate the concept of information systems for management. In the second course, students would concentrate on systems design and internal control of information systems.

Students who are preparing for careers as information systems specialists should take the two courses (UD8 and UD9) required by the ACM study. The difference between the two sets of courses is that the specialist already will have substantial background from the core courses taken in computer science and industrial engineering as a part of the general education electives. The systems courses at this level will provide the specialist with a greater understanding and a detailed knowledge in the art of information analysis and systems design.

Need for Further Research and Development Work

As the ACM undergraduate curriculum is implemented in universities, a research study should be undertaken to evaluate the effectiveness of this particular curriculum for computer systems consulting within MAS practice, determine whether the skills developed are those needed, and indicate areas for improvement in the curriculum.

A study of a similar nature was undertaken by the Management Information Systems Research Center at the University of Minnesota to test the ACM committee's assumptions that sufficient demand exists for information systems graduates in order to justify their proposed curriculum (Graduate Professional Program in Information Systems) and the specific skills stressed by that curriculum.* To do this, the researchers surveyed data processing and information systems specialists. Their objectives were to

1. survey projected demand quantity for MIS graduates,
2. specify skills required, and
3. develop curricular implications.

One hundred and eleven skills provided by the ACM's graduate program in information systems were identified and grouped into seven basic areas: people, organizations, society, systems, models, computers, and performance. Rating instruments were designed for use by supervisors, users, and employees. Supervisors and users rated an information systems employee on the skills the employee actually possessed and the skills deemed useful for that employee's functional level. The employee also rated himself on the skill levels he possessed, the usefulness of each skill for the positional level, and the designated source of his possessed skills.

From this data, the researchers were able to identify entry-level positions, demand, source of skills, and other areas that indicate need for continuing education. Comparisons also were made of the rankings of skills by employees, supervisors, and users.

A similar approach could be applied to the ACM's undergraduate curriculum to determine its effectiveness in the education of an information systems consultant in MAS practice. The subject sample would consist of members of the MAS staff serving as information systems consultants. They would be divided into undergraduates of the ACM program, undergraduates coming from other programs, and senior staff members. This would enable researchers to determine whether the ACM undergraduate curriculum provides advantages in the development of skills over other educational programs, and it would compare the skills developed through formal undergraduate study to those gained through experience. The results of such

*Robert M. Henry. "Skills Possessed and Skills Useful for MIS Practitioners —A Research Report," *AFIPS* (1974), pp. 889-95.

findings would allow educators to evaluate their present position and indicate future direction.

Barriers to Implementation

Despite the promise of a professional program in information systems integrated with a CBOK accounting program, I have to conclude on a somewhat pessimistic note. Several barriers inhibiting the implementation of such a program came to my attention in the course of preparing this paper. Four of these seem particularly relevant to this symposium and to the question at hand.

Computers and systems education on the whole has been turning out programmers. The emphasis has been on scientific computing, which is very different from business data processing. In a recent article in the *Journal of Systems Management*, Heiker analyzed 1,298 programs in computing, EDP, and information systems offered by 774 colleges and universities and found that the curricula were heavily concentrated in seven categories. These seven categories are the following:

1) Computer science—scientific programming (PLI, FORTRAN), operating systems, computer design and theory, mathematics, sundry conceptual information science and operations research courses.
2) Management science—operations research, mathematics, statistics, modeling and simulation, linear programming, FORTRAN, PLI courses.
3) Data Processing—computer programming (FORTRAN, COBOL, BAL, JCL), some systems techniques, data base and file design, some equipment operations courses.
4) Computer engineering—electrical engineering, electronics, limited programming, usually PLI or FORTRAN courses.
5) Systems analysis, DP management—systems techniques, COBOL, FORTRAN, data base and file design, DP management courses.
6) Computer operations—computer operation, unit record equipment, computer operations management, small amounts of programming and systems techniques courses.
7) Other—combinations of above, usually linked to another field, such as hospital management, accounting, or industrial engineering.

Heiker's analysis substantiates the current opinion that existing programs emphasizing the scientific and mathematical aspects of computing do not provide the graduate with sufficient knowledge to manage and consult information systems. It is not surprising, therefore, that Gruenberger says so much education is offered for subjects that are so peripheral to the mainstream of business data processing, while a greater demand exists for adequately trained business—not scientific—data-processing professionals.

Clearly, when implementing a professional program in information systems within the CBOK recommendations, a distinction must be made between computer science processing and business data processing. For too

long now, educational institutions have avoided programs in business data processing for fear of obtaining a "trade school" reputation. But business data processing, as used in conjunction with information systems, is an applied science. Recognizing it is as such may alleviate some problems relating to course content, institutional considerations, and faculty.

A second barrier to implementation exists. Education relevant to a professional degree program in information systems development is available in several degree programs in most universities, but no program alone provides sufficient preparation at the undergraduate level. Although relatively recent in origin, there are many computer science departments with a core of courses related to software systems and programming languages. A number of courses occur at the undergraduate level in industrial engineering, management science, and statistics. Such courses emphasize modeling technology. Surveys by Couger of the use of computers in business schools indicate that the four-phase computer curriculum model is a standard part of the curricula in a majority of AACSB member schools. This model shows that the uses of computers in business schools include coverage of computer fundamentals, applications of computers in functional area courses, uses in management games, and the design and implementation of computer-based information systems. To develop and implement such a program along the lines of the ACM recommendations, therefore, a multidisciplinary approach will be essential. The ACM curriculum requires a multidisciplinary approach because (1) no one discipline will give satisfactory answers to the problem of information systems management, (2) there are multiple disciplines involved and no clear leader emerges among them, and (3) the relevant topics always seem to be shifting.

In effect, many universities are starting from the same base, in that their programs are clearly interdisciplinary and may have to draw on faculty from different academic units. For these reasons, strong coordination of the entire program becomes a requirement in order to achieve a unified approach relative to information systems development. Coordination cannot succeed, however, without a measure of agreement among faculty members teaching the core courses, and it cannot be assumed that students, by taking a number of such courses, will somehow achieve this point of view on their own. Through coordination the possibilities for course interactions and the integration of course material can be more successfully exploited. Coordination efforts can also help to achieve consistency in successive offerings of the same course, as well as among different courses.

Thus, the integration of a professional degree program in information systems development with an undergraduate accounting program represents a significant task for an institution, even one with strong existing programs in both computer science and industrial engineering. For these reasons, I am of the opinion that one or more faculty members in the accounting program area must take the responsibility of devoting substantial effort to coordination, in addition to teaching and organizing individual courses. Such coordination may still be difficult to achieve, however, since it will require a measure of agreement among the faculty who are housed in different academic program areas.

A third challenge concerns instructional materials. A majority of data-processing textbooks are poor, usually written as handbooks with no practical exercises, examples, or case studies. Programming texts are often rewrites of computer manufacturer's manuals with few realistic applications or examples. Computing equipment texts are nonexistent. No single text exists for many courses suggested by the ACM recommendations, and reading assignments may have to draw from a variety of sources. Case studies might prove beneficial, although at the present time few are available. Perhaps, the case files from CPA firms can be raided and studied in order to provide realistic problems for classroom use.

Finally—and this may prove to be the most difficult challenge of all—relatively competent accounting faculty must be recruited or existing faculty must be encouraged to upgrade their own skills in the information systems area to provide for proper guidance in establishing a truly professional program in information systems development. This will prove to be a significant problem, for faculty are in short supply even in the traditional areas of financial accounting, cost accounting auditing, taxes, and governmental accounting. Chairmen of departments of accounting consequently will be reluctant to direct faculty from already hard-pressed areas to an entirely new and untested program with merely speculative market demand.

On a somewhat more promising note, we are already on the learning curve although the ACM undergraduate curriculum is relatively new. The University of Minnesota, the American University, and the University of Maryland have been at the forefront in implementing all or portions of the ACM Curricula for Information Systems Development. At last count, twenty-eight universities and colleges have used the ACM model curricula as a guideline in implementing bachelor's programs in information systems development, though not necessarily coordinated with accounting as the functional area major. We would be well advised to study closely the problems encountered by those implementing information systems programs, for this may assist us in alleviating some problems relating to course content, institutional considerations, text materials, and faculty.

Summary of Discussion Following Speakers' Presentations

Identification of Deficiencies in Computer Knowledge

The speakers displayed general agreement on the computer knowledge requirements of auditing and consulting. They were more cautious, however, in commenting on the actual deficiencies of present undergraduate computer education. While deficiencies varied with individuals and schools, the implication was that the problems generally constituted a major share of the knowledge requirements beyond the basic understanding of computer structure, operations, and programming. One participant noted that the deficiencies reminded him of a large "shopping" list of the kind used in collective bargaining; on such a list, the employers would have to settle for less than what they sought from the schools, and, moreover, both parties were already aware of the inevitable outcome.

Since disagreement existed on the extent of knowledge deficiencies, there was consequently no effort made to rank either the most pervasive or the most critical. When such basic issues as understanding control disciplines and computer applications to accounting-transaction processing are involved, attention can only be moved to the fundamental constraints and how these might be eliminated.

Constraints Operating to Limit Computer Education

There seemed to be no question that the primary constraint to any expansion or improvement of the computer curriculum is the high cost involved and the general lack of resources in the universities.

Identification of the primary constraint was only the beginning. (It was frequently pointed out that the magnitude of unknown cost inhibits any moves to provide an effective program beyond working with existing staff and standard materials.) Probably the best way to structure constraints after all is to rank the costs most often mentioned.

1. Faculty costs. Both salary and education or development costs of secondary users are seen as being above the norms for other faculty.
2. Computer hardware, maintenance, and protection all pose substantial costs, even when distributed among the potential users on a college campus.
3. Teaching materials, ranging from problems and case studies to textbooks, need to be developed and tailored to the desired program.

Each of these was viewed as a substantial and a continuing cost item that must be acquired at the same time, not individually, to provide an effective computer education program. Since most schools are faced with fixed budgetary resources, an impractically large segment of the program in some other area(s) would have to be dropped if a significant computer program were to be developed.

Less prominent constraints were such items as the following:

- Lack of consensus within the profession as to what should be learned on the campus as contrasted with on the job.

- Questionable academic legitimacy of a strong computer curriculum in schools where administration is still dominated by the arts and sciences faculty.

- Accreditation requirements of AACSB as to core curriculum standards. It is almost impossible to have a useful computer curriculum in combination with an accounting concentration.

- The need for a common programming language or universal software-application package. Each manufacturer and each firm tailors its own as things stand now.

- The need for a vehicle of instruction other than computer usage which is excessively costly and time-consuming.

- The need to train instructors in other business courses to use the computer and to integrate it into their course content. This is seen as a greater problem than training instructors to teach the computer courses.

- A lack of relevant audit applications case or problem materials for classroom illustration.

While each of these are problems to be solved in addition to the primary constraints, they reflect conditions which must be resolved over a longer period of time. Our concern at the moment is to make available an expanded and improved computer curriculum to students now.

Proposals to Effect Curriculum Improvement

The dilemma facing most schools was reflected in a question asked by one participant. "If you must have a complete package to present a respectable computer-course sequence of a capable instructor, usable materials, and medium-size hardware, plus an approved course in the catalogue, how can all these be brought together at one time?" Subsequent discussion de-

veloped the answer that it can only be done step by step, moving first in the direction that one can with what one has now.

The consensus was to begin by trying to expand the knowledge and experience level of the faculty teaching the computer courses. This could be done by contacting and obtaining assistance from local practitioners skilled in computer applications in either (or both) of the auditing and consulting areas. Such practitioners might be in public accounting, industry, or governmental agencies who had the practical experience, the time, and the willingness to teach student or faculty classes.

If possible, the school might be able to place such practitioners in a part-time faculty position until a more permanent full-time position for a qualified computer educator becomes available. As an alternative, the school could place a person from the faculty in a practice situation, offering the opportunity to gain experience as a faculty resident, and thus provide both the hands-on experience and the exposure to practical education programs which would further expand his competence.

In either event, faculty computer education must be the first step taken by a school desiring to initiate a new or expanded computer curriculum.

Once the qualified computer educator is on the faculty, his major concern should be to work with other faculty members in expanding their knowledge of computers and to assist them in working into their courses problem and case material that utilizes computers.

Whether the computer access or the teaching materials come as the next step is debatable. Perhaps the easiest to obtain will be the materials. Those present at this meeting recognized that public accounting firms have case and problem information which can be made available to educators if there is adequate assurance given that the materials will be appropriately used and presented. Computer manufacturers have standard application programs that can be used as a beginning; even a textbook that must be liberally supplemented can still provide a starting point for developing the kind of materials necessary to a well-structured computer curriculum.

It was noted that even the most experienced educator in this area must keep up with a wide range of periodical literature which can be used for additional reading by students or possibly as the basis for developing new course problems supplementing existing materials.

Gaining access to suitable hardware for hands-on student experience is likely to be the most difficult problem to yet be solved. The consensus was that a practical computer environment was essential to an effective curriculum. This can be arranged in a variety of ways, ranging from visits to firms that can make time available in slack periods to a leasing arrangement at educational rates with nearby schools (or even other units within the university). The ideal is to have a small to intermediate-sized computer installation for the exclusive use of the business school which will then force both faculty and students to be active in making the unit cost-effective within the university budget.

One suggestion offered as a way to provide the schools with leverage to obtain funds for an expansion of the computer curriculum was to increase the coverage of this subject area in the Uniform CPA Examination. It

was noted, of course, that many other factors must be considered before action can be taken to implement such a suggestion. This matter, along with most of the secondary constraints listed earlier, may be helped toward resolution by the work now being done by the AICPA Board on Standards for Programs and Schools of Professional Accounting. When the report of the Board is presented, it should have considerable influence in establishing a consensus on what the profession expects students to have learned in an accounting program; it also should provide sound arguments to be used in legitimizing solid computer courses (as well as the business curriculum generally) and in providing an alternative to the rigid curriculum requirements needed for AACSB accreditation.

Each of the other constraint areas has committees of the American Accounting Association, the American Institute, and other accounting organizations working on them. The speed with which they develop effective materials or procedures for improved computer education will depend in a major part on the cooperation of both educators and practitioners.