COMPUTERS IN PUBLIC MANAGEMENT EDUCATION: A CURRICULA PROPOSAL FOR THE NEXT TEN YEARS

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EDITORS' NOTE

Over thirty years have passed since computers were first introduced into public organizations, yet their role in education for public management is slight. Some educational programs have begun, in recent years, to introduce students to the use of computers in management but preparation of students for their future role as information systems managers is non-existent. Some educators question whether the latter role is needed in public management education, suggesting that business schools can adequately meet the need. The authors of this article, and a new Ad Hoc Committee on Computers in Public Management Education created by NASPAA, disagree.

This article, which was originally prepared for the NASPAA Committee, sets forth a framework for integrating computers into public management education and for developing of a strong technical specialization in information systems. Because of its potential significance in setting guidelines and developing standards for graduate curricula in Schools of Public Affairs and Administration, the Ad Hoc Committee seeks broad comment on the assumptions, framework and implementation suggestions of the article from practitioners, educators, and students.

The Editors would like to encourage a vigorous dialogue about the subject of this article. Therefore, readers are

encouraged to write to the Editors commenting on the article and/or suggesting alternative frameworks. The Editors will publish carefully prepared comments and proposals and may ask the authors of this current article to prepare a response. All comments received will be forwarded to the two authors and to NASPAA's Ad Hoc Committee.

INTRODUCTION

The systematic education of public managers has undergone various changes throughout its history. [1] As recently as the nineteenth century, there was no formal educational programs because it was thought that any citizen could perform the duties of a government employee. By the early 1900s, however, this attitude started to change and specialized education for public managers began. During the 1930s and 1940s, scientific management techniques were incorporated into programs; then social sciences and human relations became solid parts of the curriculum in the 1950s and 1960s. These general changes in public management curricula reflected changes in society, duties of government, and advances in knowledge. Today, if we are to continue to educate qualified public managers, we must update our programs to reflect the continuing changes in society, government, and knowledge--particularly those changes precipitated by the computer age.

SOCIETY, GOVERNMENT, AND COMPUTERS

The United States is increasingly becoming an information society. Over half of the labor force is now engaged in work requiring some level of information processing. Computers are the "engines" powering this information society and, consequently, their diffusion is considerable and growing. From the beginning of the computer age, government has been at the forefront of computer utilization.

In 1976, 97% of municipal government in cities with populations over 50,000 reported using computers. In 1978, 71% of municipal governments in cities with populations less than 50,000 also reported using computers. (Kraemer, Dutton,

and Matthews; Anochi and Smolin, 1978) County governments and school districts exhibit similar patterns. All fiftey state governments use computers extensively, with many states having computer networks that not only connect their own agencies and local governments statewide but also connect with federal agencies thereby creating national information systems. State and local governments each spent close to $2 billion a year on computer and information systems in 1980. (National Association of State Information Systems, 1980) The federal government uses computers most extensively. As of 1981, the federal government was expending approximately $5 billion annually to operate an estimated 16,000 computer systems. (Head, 1981)

Until recently, government computing usage was necessarily oriented toward large computers or minicomputers. These large systems were cloistered in computer centers where they were the province of a computer elite. Now with the advent of smaller and less expensive hardware, computers are appearing on the desktops of end users--clerks and managers alike. Moreover, computers are also adopted in increasingly diverse areas of information processing. In local government alone, there are some 300 identified information processing tasks that can be and are being automated. (Kraemer, Danziger, Dutton, Mood, and Kling, 1976)

Computers have already become integral parts of day-to-day operations such as accounting, recordkeeping, client tracking, information and referral, and routine reporting in government agencies at all levels of the federal system. They are increasingly used as aids to management decision-making about manpower allocation, facility location, vehicle routing, and budget allocation. Computers are even employed for strategic planning with regard to forecasting government revenues and expenditures, simulating urban development patterns, and evaluating fiscal impacts of development. It is safe to say that computers have already permeated most levels of government.

Given the extensive diffusion of computers throughout our government, it seems critical for both current and future managers to learn more about computers and information systems. The authors believe that knowledge about computers

is an organizational asset on three levels: 1) a personal asset to public management graduates; 2) a strategic asset to practicing managers; and, ultimately, 3) an institutional asset for more effective government. These three points are elaborated as follows.

First, knowledge and skill in the use of computing is an important personal asset for public management graduates and is increasingly recognized as such by practicing managers. Computers are a tool for enhancing personal effectiveness, especially for beginning professionals who perform staff functions involving analysis and writing. However, knowledge and skill in computing is also recognized as an asset by experienced managers. For example, the International City Management Association recently surveyed managers who received service awards about their opinions of what tomorrow's public managers need to know. Information systems was one of two areas experiencing the largest increase in ranking over time. (Kerrigan and Hinton, 1980) Further, in order to understand the other highly ranked areas, such as causes of urban problems and managing government personnel, public managers develop their ability to interface with computers or utilize computer-based information.

Second, knowledge of computers and information systems can be considered a strategic asset for public managers in two regards. On the one hand, computerized information systems involve "power payoffs" (Downs, 1967; Kraemer and King, 1976) from increases in personal and organizational effectiveness. For example, new and better information can contribute to shifts in the relative influence of managers (versus elected officials and staff) on decision-making. On the other hand, computer automation also generates new management problems such as organizing computer systems, allocating resources among automated departments, and controlling development projects. (Downs, 1967; Kraemer and King, 1976) Managers who understand the payoffs and can avoid the problems will be better prepared to function in a computer-based environment.

Third, employee knowledge about information systems is an institutional asset because it improves the utilization of computing in the performance of governmental tasks. Every

year the General Accounting Office produces reports critical of many federal computer systems. These criticisms are more often focused on managerial problems with cost/time overruns and poor system performance than on technical problems with the computer software or hardware although the latter may contribute to the managerial problem. For example, the Air Force abandoned a computerized system after spending nearly $250 million; the blame for shelving the project was placed on unrealistic and inconsistent managerial policies. (Ruth, 1980) The cost to governmental effectiveness in such instances is not only sunk costs of the abandoned computer system but also the opportunity costs for the system's failure to perform the intended governmental tasks. Uninformed management decisions are also attributed to many problems with computer systems in local governments. The 1976 study of 42 cities' computerized tasks consistently found that the quality of computer task performance depended on management making the right decisions, such as deciding when to centralize or decentralize computer systems. (Kraemer and Northrop, 1981)

PRESENT STATE OF COMPUTING EDUCTION IN PUBLIC MANAGEMENT PROGRAMS

Given the rapid and continuing growth in the use of computers across governmental levels and the increasing importance placed on managerial knowledge about computers, those of us responsible for conducting and directing public management education must ask ourselves if we are adequately preparing our students for employment in this changing environment. Surprisingly, the answer seems to be an unqualified "no." The current guidelines of the National Association of Schools of Public Affairs and Administration (NASPAA) require only that students become familiar with computer technology and learn how to run statistical packages such as SPSS and SAS and it appears that most schools are not attempting to exceed this requirement. For example, only ten percent of public management programs listed in the 1980 NASPAA Directory required a computer applications or management information systems (MIS) course. (Munzenrider,

1981) Gore's (1982) review of 74 NASPAA schools' Self-Study Reports found that only 10 percent of those schools even offered a course on information systems and only 18 percent offered a course on computer fundamentals. Sorg and Laverty (1981) did find that MIS topics were covered in courses in 118 schools in 1980 but only 32 percent of schools required courses that referenced MIS. Finally, Motto's (1983) study of 36 schools in 1980 found only 14 offering computer topics in more than one course and of those latter schools there was no common pattern of topics covered.

A review of these statistics leads to several conclusions. First, most schools are incorporating minimum levels of computer knowledge and only in areas specified by NASPAA requirements. Second, only a minority of schools address the broader topic of MIS in their required courses and even these schools limit their requirement to a single course on basic computer literacy.

Hence, the basic manipulation of statistical packages is the only common training we currently provide students of public management. It is a useful experience for students and a good introduction to computers but it is only an introduction. In order to prepare our students to function in a management environment that we have shown has already undergone a dramatic transition, we need to develop a more extensive curriculum on computer topics. To begin this development process, it would be helpful to review the extent to which business schools are teaching computer topics.

PRESENT STATE OF COMPUTER EDUCATION IN BUSINESS SCHOOLS

The use of computers in business schools began in the late 1960s and was given such a large boost by the 1972 report of the ACM Curriculum Committee on Computer Education for Management that today the use of computers is considered a must in business schools. Moreover, the two dozen leading business schools do not merely offer introductory courses on computers; rather, they have fully integrated computing into the curriculum and have developed MIS as a functional area

of business equivalent to marketing, accounting, organizational behavior, and quantitative methods.

Finally, many business schools have developed their own computing laboratories for instruction. For example the Tuck School at Dartmouth has a microcomputer laboratory based around 50 IBM personal computers which provides the school with a student-computer ratio of 7 to 1. (**Computerworld**, 1983:12) UCLA has a minicomputer-based laboratory with a student-terminal ratio of 10 to 1. (**Management**, 1983:9) At UCLA, 82 percent of the first-year MBA students who had access to the computer are active users both within and outside required coursework. Moreover, the UCLA Computing Services Department anticipated a 42 percent increase in users in Fall, 1983. (**Management**, 1983:9)

Not only are business students using computers but most have the opportunity to take a full management information system program of study. MBA students at UCLA can take courses on managerial computing (required), managerial statistics, and managerial model building. Computing is also integrated into other parts of the curriculum such as finance, economics, and marketing courses which use computerized databases extensively.

THE CASE FOR PUBLIC SECTOR MIS

The integral role of computers in leading business programs contrasts sharply with the minimal role of computers in public management programs. A valid question that arises is: Is it practical to send our public management students to the business school to take MIS courses? Several public management schools are currently doing this and it appeard to be a good interim way to conserve tight resources. However, the authors believe that public management programs must eventually develop their own curricula in computers and information systems. The rationales for this position lie in the differences between public and private sector management generally, public and private sector MIS specifically, and in the dramatic changes occurring at the undergraduate and secondary levels of education.

At the most general level, the authors agree with those scholars and managers who argue that business and public management are "at least as different as they are similar, and that the differences are more important than the similarities." [2] These important differences relate directly to public sector MIS in three ways.

First, it is apparent that business courses on MIS offer some topics that would not be relevant for public management students, such as MIS in marketing and manufacturing. Conversely, business classes might not include topics that are especially relevant and important for public management students, such as government information systems, national information systems, the social impacts of information systems, and public policy issues concerning computers and information systems in society (e.g., their use in business competition, the vulnerability of large networks such as air traffic control systems, privacy and confidentiality).

Secondly, the business MIS curriculum stresses techniques built upon four key knowledge areas: 1) knowledge of computer hardware and software; 2) knowledge of data structures and the management of data; 3) knowledge of programming and systems analysis for system design; and 4) knowledge of techniques for project planning and control. Design is, in short, the **sine qua non** of MIS professional education in business at this time, in much the same way as the construction of elegant mathematical models and simulations is the **sine qua non** of management science. Other fundamental aspects of MIS, such as management use of computing and management of computing use, are only superficially covered in business schools but are important to future public managers. Thus, public management programs have an opportunity to cover many computer topics relevant for public managers which are not available in business schools and to develop a niche in the educational market.

Thirdly, computing needs to be integrated into the public management curriculum, which means it needs to be taught by public management faculty. Computing needs to be part of courses in finance, personnel, accounting, quantitative methods, and policy analysis. This kind of integration cannot be achieved

if we turn to business school faculty for computing instruction.

In addition to these considerations for public sector MIS, the option of sending graduate-level public management students to business schools for some MIS courses is becoming untenable because our graduate students do not have a computer background whereas business students do. Sixty percent of undergraduate business schools currently have a special MIS program and 22 percent are planning to implement one by 1985. (Aulgur, 1982) Thus, many business students come to their graduate work with a foundation and at least some coursework totally dedicated to computer topics. This trend is only going to increase. It is clear that very soon our students will be unable to compete unless we first ensure that they have "basic" computer literacy. Therefore, it is imperative that undergraduate public administration schools also plan to implement courses in computing.

Furthermore, even the limited training now required of public management college students under NASPAA guidelines is rapidly becoming outmoded in comparison to pre-college student preparation. Right now, 86 percent of all high schools, 77 percent of all junior highs, and 61 percent of all grade schools have at least one computer course. (**Time**, 1983:64) Well over a third of 1983 college freshmen had written a computer program in the past year. (**Chronicle of Higher Education**, 1984:12) In just a few years, students entering public management schools will already have a basic knowledge of computers and it will not be enough to offer a few hours working with statistical packages. They will expect to broaden their knowledge of computers, as related to public management tasks, or they will turn to other institutions for their college education.

In summary, computers are being utilized in more and more areas of public management and at every level of government. The curricula of most schools of public management have been unresponsive to this change in the current professional work environment of their students. In contrast, business schools consider computers an integral part of their programs. The option of sending public management students over to the business school for MIS courses is becoming untenable because our current students do not have a computer background and

our future students will enter college-level training with a level of computer knowledge beyond that currently offered. Moreover, business schools do not cover topics uniquely relevant to public sector employees. Clearly it is time for public management schools to design curricula that take computer-based tools into account if they are to respond adequately to changes being wrought by the pervasive use of computers in government, by the growing knowledge about computers and information systems in all organizations, and by our increasingly information-dependent society.

KNOWLEDGE ABOUT COMPUTERS AND INFORMATION SYSTEMS

The above arguments lead the authors to recommend a more extensive and coherent integration of computer courses in public management curricula. Yet, such a recommendation assumes that the subject of computers and information systems is a highly developed area of knowledge and thus can be taught systematically. This would have been a false assumption ten years ago but today information systems is a mature academic field. There are over 100 textbooks dealing with information systems and numerous books of readings. (Dickson and Sprague, 1980:17) Between 1973 and 1980, 430 dissertations were written in the information systems field. (Davis, 1982:10-11) Major centers for information systems research now exist at the Universities of Arizona, California (Irvine), Minnesota, Pennsylvania, and the Massachusetts Institute of Technology.

There are also many academic and practitioner journals directly concerned with information systems such as **MIS Quarterly**, **Systems, Solutions**, **Decision Science**, **Management Science**, and **Communications of the ACM**. The leading management journals, **Harvard Business Review** and **Public Administration Review**, consistently devote attention to computers and information systems.

There is also an annual Conference on Information Systems which brings together leading researchers, teachers, and doctoral students in the field. Finally, within the government

sector, there are three major professional associations, each dealing with a specific governmental level: the Urban and Regional Information Systems Association, the National Association for State Information Systems, and the Federal ADP Users Group.

Consequently, since information systems has become a mature academic field, public management programs have a wealth of information available for supplementing their existing curricula to give greater attention to the subject of computers and information systems.

GENERAL STRUCTURE FOR COMPUTER CURRICULA IN PUBLIC MANAGEMENT

Public management programs need to experiment with developing curricula and computing environments that will bring current and future public managers even with advances in information technologies. It is unlikely that a single approach will suffice, given the programmatic variety and differential resources of public management systems. Therefore, the authors suggest a general structure for curricula that recognizes different levels of computing literacy.

Arthur Luehrmann argues that, rather than being something new, computer literacy is actually a very classical form of literacy. Like reading, writing, and mathematics, it is a fundamental intellectual resource which provides tools for thinking and expressing ideas and solving problems. The test of literacy in computing as well as in other areas is being able to produce as well as to receive. For example, scientific literacy means being able to "do" science as well as to read it. The person who can read science has ordinary literacy but not scientific literacy. Similarly, computer literacy means knowing how to tell a computer what you want it to do as well as knowing how it works.

Luehermann's (1981) and other's distinctions [3] suggest that "computer literacy" is a term that has several possible meanings, ranging from:

- appreciating what computers are, their parts, how they

work, and how they relate to work
- using them in work in the sense of using preprogrammed packages
- controlling their deployment and use by others in the sense of directing where and how they are used
- producing and creating with them by writing one's own procedures or programs for doing work.

For some, such as Luehrmann, computing literacy means only the highest of these literacies, involving production and creation with computers and is comparable to what is classically meant by literacy in languages and mathematics. In more common usage, computing literacy often refers to computer appreciation or computer consciousness. The authors believe that all four levels of computer literacy are useful and they use these levels to develop a general structure for computer curricula in public management as shown in Table 1. Briefly, these four levels are:

1. Computing Consciousness--which involves an introduction to computers and computing for the **uninitiated**
2. Management Use of Computing--which encompasses the skills and knowledge required for **managers** to apply computing capabilities productively within existing organizational environments
3. Management of Computing Use--which involves knowledge of those policies and procedures employed by **managers** to provide and control computing capabilities and services
4. Management Information Systems--which involves understanding the tools and techniques required by **information systems specialists** for designing and implementing information systems.

There are several presumptions underlying this general structure. The first is that public management programs should follow the general structure of information systems curricula recommended by the two ACM Curriculum Committees on computers and information systems education for management and, wherever possible, should follow similar course content. To do less would be to accept a lower standard for public manage-

TABLE 1
GENERAL STRUCTURE OF COURSES FOR COMPUTERS IN PUBLIC MANAGEMENT

Level of Literacy	Area of Curricula	Courses	Laboratory Requirements
Appreci-ation	Introduction to Computing	Computer Consciousness	None
Use	Management Use of Computing	Managerial Computing Managerial Modeling Managerial Analysis	Mainframe or mini with terminals, or micro-computers for all courses
Control	Management of Computing Use	Management of Computing Resources and Services Management Projects	None neces-sary, but would be advanta-geous for both courses
Design	Management Information Systems	MIS Curricula in ACM Curriculum Committee Reports	Mainframe or mini with terminals, or micro-computers for most courses

ment. The standard for MIS education has been set by the reports of these two ACM curriculum committees, the first of which reported its curriculm recommendations in 1972 and the latest in 1982. (Ashenhurst, 1972; Nunamaker, Couger, and Davis, 1983) The ACM Committee recommendations aiming at developing "computer literacy" is comparable to "general literacy" in the English language and mathematics. Thus computer literacy means not only the ability to converse about computers, to appreciate what they can do or even to use them for preprogrammed tasks, but the ability to use procedural languages to solve problems in one's work. Still, the Committee recommendations recognize other levels of literacy and prescribe courses of study related thereto.

The second presumption underlying this general structure is that courses for the various levels of computing literacy should be constructed so that they build towards the standard. Courses offered at the lower levels of computing literacy should dovetail with those at the higher levels to facilitate student matriculation. In this way, students who have been exposed to one level of computing literacy should be able to matriculate towards MIS at another institution with minimum loss of past effort.

The third presumption is that not all public management programs should offer full-fledged MIS programs. Indeed, most will not. But a few schools should do so in order to produce teachers for the field and produce researchers who will develop a better understanding of the all-important differences in MIS between the public and private sectors.

The authors will next describe each of the levels of computing literacy more fully.

1. Computing Consciousness

We must first make our students conscious of computing topics. Specifically, all graduate students in public management should be required to take a prerequisite course on computer consciousness or computer appreciation. (Covvey and McAlister, 1982) This course would be meant to serve as an introduction to computing. Students should learn the different terms associated with the computer world and be made aware of the uses of and

problems associated with computers. The authors view this course as a lecture class, covering such topics as hardware, software, purpose and nature of programming languages, uses of computers in government and society, and social impacts such as privacy. This class would serve as a prerequisite for the more advanced classes on computing.

2. Management Use of Computing

Management use of computing has not been effectively addressed in public management curricula because, to a considerable extent, computing developments have taken place outside such programs in American universities. As a result, few well-educated public managers are equipped today for their role as users of the key managerial assets of the information revolution--computers, computer-based decision aids, and computer-based information. Not only should courses be offered in this area but the courses should offer environments such as computer laboratories and information centers for students that will approximate the environments in which they will work as future government managers. These environments will need to involve a moderately intelligent terminal (or microcomputer) at each individual's desk, access to a larger computer system with suitable databases, and communications capabilities with others in the organization and possibly with the external computing environment.

The authors envisage three possible courses in the management use of computing area: managerial computing, managerial modeling, and managerial analysis. The Managerial Computing course would be a laboratory course, providing hands-on use of a microcomputer or terminal for word processing, spreadsheet analysis, project scheduling, statistical analysis, graphics, electronic mail, database management, and communications. The course would provide students with both conceptual understanding and working knowledge of these managerial tools. Extensive laboratory experience is necessary because, as one consulting firm estimates, it takes "a minimum of 80-120 hours of keyboard time to learn facility with a personal computer." (Fortune, 1983)

The two other courses in the management use of computing area, Managerial Analysis and Managerial Modeling, would be important additions to a public management curriculum although the topics could also be integrated into existing finance, decision-making, and methods courses. [4] Managerial Analysis would involve laboratory use of the computer for teaching statistics, analyzing client surveys, conducting policy analysis, performing program evaluations, or assessing environmental and social impacts.

Managerial Modeling would involve lab experience with computer models in the area of operations research, operations management, finance, decision analysis, and group decision-making. [5] This course would probably cover some of the content of research and statistics courses now taught in public management programs where use is made of the computer and SPSS. Given that Managerial Analysis and Modeling would be integrated with other standard courses in the curriculum, the authors foresee the Management of Computing area representing only about two quarter courses in the curriculum.

3. Management of Computing Use

Courses in the management of computing area would address the policy issues in providing and controlling computing resources and services within governmental environments. A lecture course in the Management of Computing would be offered covering policy issues related to the management of computing resources and services. It would include such policy issues as centralization versus decentralization, changing policy, user involvement, technology transfer, sources of computing services, assessing the organizational impact of computing (e.g., shifts in decision-making power), and assessing the broad social and econonic effects of computing and computer-based information systems.

In addition, a Management of Computing Projects course that involves group participation in a project experience would be an important addition to the curriculum in this area. Such a project would focus on the design and implementation of an information system and would involve hands-on use of managerial tools to

solve case problems in, for example, two of the topics covered in the Management of Computing course.

4. Management Information Systems

This last level of computer literacy, MIS, is more or less equivalent to that offered in business school curricula. And it might be a wise use of resources for some public management programs to allow their students to take the business school course in MIS instead of attempting to develop their own course offerings. The authors say this despite their previous arguments for public sector MIS because they know that business school offerings may be the only feasible option for some public management programs. But at least some public management programs should develop an MIS curriculum that is specifically oriented towards government in order to represent public sector issues and to ensure an adequate supply of teachers and researchers for the field and for developing a better understanding of public sector MIS.

GUIDELINES FOR MIS COURSES

As indicated above, the authors believe that public sector MIS courses should follow the ACM curriculum guidelines and should further fit within the general structure outlined thus far. The public sector MIS courses must also relate to the NASPAA common body of knowledge requirements.

The ACM Curriculum Recommendations

The ACM Curriculum for business schools is oriented towards preparing people to be systems designers and information analysts--jobs they might hold to mid-career. It recommends a total of ten courses for the systems designer (the MIS major) and four courses for the information analyst (the MIS minor) in addition to one full year of work covering organization functions and management specified by the AACSB common body of knowledge. The structure of ACM courses has two major components--technology and process--with five courses in each:

Information Systems Technology

Computer concepts and software systems
Program, data and file structures
Data communication systems and networks
Modeling and decision systems

Information Systems Process

Information systems in organizations
Information analysis
Systems design process
Information systems policy
Information systems projects.

The authors recommend these two components for public sector MIS. Courses in the technology component would be similar to those offered in business MIS or in computer science. Indeed, these courses could be taken from such units because they are relatively "context free." However, courses in the process component would need to give great attention to the public sector "context" and generally should be offered by the public management program.

What differentiates the public sector MIS curriculum from the others in the general structure (Table 1) is its orientation towards preparing **information systems specialists** who will become systems designers and information analysts rather than general managers. **Systems designers** would be MIS majors, more or less equivalent to those in business schools, taking the eight courses shown in Table 2. **Information analysts** would be MIS minors, again more or less equivalent to the information analysts in business schools, taking the four courses shown in Table 2, and preparing to become the managers of departmental information systems and liaison between the user department and the information systems department. The authors would propose that public sector MIS cover the same topics as those in the ACM curriculum recommendations but cover some less fully because the topics do overlap and are more technically oriented than necessary. Plus, ten years ago the Curriculum Committee

TABLE 2
GENERAL STRUCTURE OF COURSES FOR COMPUTERS IN PUBLIC MANAGEMENT

Components of the Curriculum			
[A] Technology**	[B] Process**	[C] Use	[D] NASPAA Common Body of Knowledge
Computer concepts	Information systems concepts	Managerial Computing	Full time study for for one year in NASPAA-defined common body of knowledge
Program and data structures	Information systems analysis and design	Managerial modeling	
Data management and communications	Management of computing resources and services	Managerial analysis	
Modeling decision systems	Management of computer projects		

Future job:

/ Information Analysts = [B + D] /

/ Managers = [C + D] /

/ Systems Designers = [A + B + D] /

** The content of these courses would be similar to that in the 1982 report of the ACM Curriculum Committee on Information Systems, except that [B] courses would emphasize the public sector content.

had only eight courses for a complete curriculum. The authors also believe that public management should start with a smaller number of courses and let our experience with that curriculum shape future directions.

NASPAA Common Body of Knowledge

The NASPAA standards require that public management degree programs cover specific topical knowledge without specifying the depth of coverage. Independent of the knowledge requirements, the standards specify that degree programs require one and one-half years of study for a full time student. The authors estimate that the common body of knowledge requirements can be met in one year of full-time study, leaving one-half year available for specialization in MIS or other areas.

The specific structure and content of courses might vary from that indicated in Table 2 but generally one-half year of full-time study (approximately 8 quarter courses) beyond the NASPAA common body of knowledge requirements would be needed for systems designers. One-quarter year of full-time study (approximately 4 quarter courses) would be needed for information analysts. In contrast, the authors expect that at least one-half quarter (approximately 2 quarter courses) would be needed for all public management students to prepare them for their role as future managers in computer-oriented environments.

IMPLEMENTATION AND RESOURCE IMPLICATIONS OF THE PROPOSAL

As suggested by this article's subtitle, "A Curricula Proposal for the Next Ten Years," the authors expect that it will require ten years to implement all four levels of computer literacy at even a few schools. The first two levels can probably be achieved in the next few years but public sector MIS may be achieved by only one or two places in the next five to ten years. Then, as with the ACM curriculum that have preceded us, we will need to take stock of our curriculum once again.

The proposed general structure of computing courses in

public management programs would, for many programs, involve new costs for hardware and personnel. The magnitude of these costs will depend a great deal upon the degree of integration that can be achieved with (a) programs in business MIS or computer science at a particular college or university or (b) with other public sector MIS programs in a metropolitan region. As mentioned above, the entire technology component of the public sector MIS curriculum could be taken in business MIS or in computer science. Moreover, public management programs that tailor the process component to public sector MIS could offer these courses to business MIS, computer science, and other students as well as their own. Thus, the degree of integration both ways with other campus resources and with regional resources will influence implementation feasibility for each public management program.

Even with integration, public management programs will require computing equipment and teaching personnel. Many universities have at least one mainframe computer accessible by public management programs for statistical analysis. However, microcomputer laboratories are uncommon and management-oriented computer packages on mainframes or microcomputers are also uncommon. The prerequisite course on Computer Consciousness could be easily added to present public management curricula because the authors envision the course without hands-on computer experience. Moreover, elements of courses or even one full course in Management Use of Computing and Management of Computing Use could be implemented without a computer laboratory.

However, the authors believe that public management programs should immediately begin looking for funding to develop computer laboratories and/or plan with their respective universities for access to centralized computing resources presently owned or soon to be purchased by the university. The authors have established that, if our intentions are to prepare future managers for the work environment they will confront in a governmental setting, greater personal experience with computing is necessary. At present, that experience appears to necessarily include microcomputers and a micro-to-mainframe connection.

Public management programs will also require new faculty and/or expect to retrain existing faculty. Obtaining new faculty in public sector MIS will be very difficult even if public management programs decide to allocate faculty positions to the area. Recent AACSB statistics indicate that "19.1 faculty openings in MIS exist during the current academic year for every new doctorate produced by business schools in the field during 1982-83." (**AACBS Newsline**, 1984:5) Getting faculty who are knowledgeable about public sector MIS is even more problematic since there is not a single public management school in the United States with MIS as a doctoral field of study.

For the most part, faculty will have to be recruited from business schools (a difficult proposition given salary differences) and reoriented for public management; or, existing public management faculty will have to be retrained for MIS. The AACSB has run such a faculty retraining program for two years through the University of Minnesota's Management Information Systems Research Center in the Business School. The program has been held for six weeks each summer with faculty from a half-dozen or more MIS programs doing the teaching. The public management community may be wise to create a similar vehicle to help solve the current shortage of Ph.D.s in MIS.

CONCLUSION

The design of curricula for computers and information systems in public management is as much a matter of social process as it is of substantive knowledge and prior experience in the field. The authors view this article as a first step in the social process--an attempt to stimulate discussion leading towards a curricula design that will gain acceptance. The general structure proposed here is oriented toward graduate professional programs in public management rather than toward undergraduate programs or continuing education, although these programs also need to be addressed.

This general structure for computer education in public management is ambitious in proposing that so much of the public management curricula be devoted to MIS. But not all

public management programs need aspire to the standards proposed; indeed, the authors expect that most will not attain the level of a formal public sector MIS curriculum. However, in order to provide our students with the opportunity to reach the limits of their educational experience and to maintain credibility with our business colleagues and the professional information systems community, at least some programs must aspire to the highest level of attainment and make the resource investments necessary to achieve it.

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NOTES

1. Throughout this article the authors use "computers" and "computing" as more or less synonymous with "computers (or computing) and information systems."
2. Wallace Sayre, who spent some years helping plan Cornell's new School of Business and Public Administration, reportedly left for Columbia University with the aphorism that "public and private management are fundamentally alike in all unimportant respects." In a more recent consideration of the issue, Graham Allison concludes similarly. Allison, Graham T., Jr. (1983). "Public and Private Management: Are They Fundamentally Alike in All Unimportant Respects," in James L. Perry and Kenneth L. Kraemer (eds.). *Public Management: Public and Private Perspectives*. Palo Alto, Cal.: Mayfield Publishing Company.
3. The most articulate discussion of computer literacy is provided in Luehrmann (1981) (1972). In contrast to this discussion, see Johnson, David C., Ronald E. Anderson, Thomas P. Hansen, and Daniel L. Klassen (1980). "Computer Literacy--What Is It?" *Mathematics Teacher* 73; Minnesota Educational Computing Consortium (1979). *Minnesota Computer Literacy and Awareness Assessment*. St. Paul: MECC.
4. The Maxwell School has developed such modules for existing courses on financial management (covering spreadsheet analysis) and R&D management (decision support models) in addition to a new prerequisite course concerned with basic computer literacy (computer consciousness in our terms) and a new full course on computers covering "concepts of algorithms, structures programming, data management, display of data, and data base." See Bretschneider (1983). "Teaching Computer Technology for Information Management in Schools of Public Affairs and Administration." Syracuse: The Maxwell School, Syracuse University.
4. The use of computers as aids to group decision-making is illustrated by the work of Rohrbaugh and Quinn at the Decision Techtronics Laboratory, SUNY, Buffalo. Rohrbaugh, John (1979). "Improving the Quality of Group Judgment: Social Judgment Analysis and the Delphi Technique." *Organizational Behavior and Human Performance* 24 (August):73-92; Rohrbaugh, John (1981). "Improving the Quality of Group Judgment: Social Judgment Analysis and the Nominal Group Technique." *Organizational Behavior and Human Performance* 28 (October): 272-288; Quinn, Robert E. and John Rohrbaugh (1983). "How to Improve Organizational Decision Making: A Report on Automated Decision Conferencing." Albany: Rockefeller College of Public Affairs and Policy, SUNY, Albany, Working Paper (December 13).

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