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ABSTRACT

During the past decade, the scope of information science has been evolving into a broader but better defined area of specialization. In this paper several of the definitions of information science which have been suggested by various professional groups are discussed. The educational objectives of information science are identified, and the curricula necessary to achieve these objectives are outlined. The paper discusses the changing nature of the library's role in information science and the impact of computers on the field of information science in general. A list of references is appended. (JY)

PATTERNS FOR DEVELOPMENT OF EDUCATION IN INFORMATION SCIENCE

by Jack Belzer*

INTRODUCTION

The world has moved from the industrial revolution to mass production to the development of the computer and is now undergoing an information revolution. Our society is becoming more dependent on information each day. Industry and commerce in our competitive society is information dependent. Management, as Jay Forrester (1) defines it, is the process of converting information into action. The conversion process is defined as decision making, and the success or failure of a management decision is a function of the pertinency of information selected for that decision, out of a large number of sources or a large file. Research and development is built on the work of and in cooperation with others and is possible only when unrestricted communication among colleagues and peers exists. This implies selection of information out of a large volume of current publications where progress and results of research and development are reported by or for each scientist engaged in such activities. To keep scientists informed of peripheral activities from other disciplines which are of interest to them complicates the information problems. Command and control systems and logistics are information systems on which the military depends, and our political and socio-economic culture to be responsive to its needs is information dependent. Information today has a tendency to complicate our society because more information exists, larger volumes of information can be communicated more rapidly, and the response time to information is becoming shorter. Information science as a discipline is an outgrowth of this.

During the past decade, the scope of information science has been evolving into a broader but better defined area of specialization. The profession of information science deals with many aspects of information.

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It deals with its properties, origination, organization, manipulation, structure, control and use of information. It is concerned with information systems, their designs, operation, evaluation and with the systems components. It cuts across such disciplines as logic, behavioral sciences, cybernetics, communication theory, languages (both natural and artificial), machine translation and pure and applied mathematics. It interacts strongly with the development in the new technologies of computers, automation, microimaging, storage and retrieval, and communication, transmission and displays of information. The professional practice concerned with information has been placing new demands on the personnel dealing with the problems of information.

INFORMATION SCIENCE ENVIRONMENT

The term information science means different things to different people; and rather than giving a formal definition of "information science", it would be more useful to present several points to view. Curriculum 68[2], the report of the ACM Curriculum Committee on Computer Science, points out that there was sentiment among their members to call their discipline "information science". This point of view would make the total information science program strongly numerical analysis and computer oriented. Another school of thought is information science oriented in the pure sense. It is concerned primarily with the theoretical aspects of information and with the methodology for dealing with it. Mathematics and logic are the basis on which the science is built, but it has also information engineering aspects. It is also concerned with the design and performance of information systems, both operational and experimental. There are schools whose information science programs are oriented in this direction either with or without the emphasis on the literature or library problems. Many of the academic programs in information science are subject oriented, such as Biomedical, Management information systems, and Library and Information Retrieval systems.[3] The last named has been receiving the greatest impetus, with the posible exception of "computer science" programs. "Library and Information Science" schools have been the most active in providing academic training in information science. Computer science programs train students in all aspects of computer science and technology, and occasionally an individual expands his horizons to the information field. Where many computer science programs offer undergraduate curricula to provide students with tools for dealing with problems in other disciplines, the library and information science programs are professional in scope and offer graduate programs only. The emphasis is on dealing with recorded

knowledge closely akin to the library problem.

The major educational programs in information science today are library oriented, and most of them are either part of a library school or reside side by side with one. At the same time, one of the major problems in our cultural, scientific, and economic society which requires attention is the library and information problem. The proliferation of published materials, the storage, retrieval, dissemination and communication of recorded knowledge can retard our cultural progress, curtail scientific advancement, and drive us to economic disaster. Industry, government, and academic and research institutions are faced with this problem, and professionally trained people in information science who can deal with these problems are in great demand. The library schools in updating their own programs to meet the new demands placed on them and responding to the new technology have been forced to move in the direction of information science. To expand their programs to information science, it became necessary for these schools to define and perhaps isolate that knowledge competence which would be needed for professional practice in information science.

SEVERAL CONFERENCES ON EDUCATION

There are many factors which contributed to the development of education in information science. As the field was evolving several conferences were held on education in information science. A brief review of a few of these will shed light on the progress made in the education field for information science.

The first significant conferences relating to education in information science were held at Georgia Institute of Technology, Oct. 12-13, 1961 and April 12-13, 1962.[4] One of the outcomes of these conferences was a definition of "information science," and whether one agrees with this definition or not, it created a starting point, a foundation to build on, or a point of departure.

> The science that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. The processes include the origination, dissemination, collection, organization, storage, retrieval, interpretation, and use of information. The field is derived from or related to mathematics, logic, linguistics, psychology, computer technology, operations research, the graphic arts, communications, library science, management, and some other fields.

Another contribution resulting from these conferences was the creation of the School of Information Science at Georgia Tech, the host institution, and the Division of the Information Sciences at Lehigh University, neither of which has a library school.

During September 7-10, 1965, The American Documentation Institute, under the sponsorship of the Office of Education held a conference at Airlie House at Warrenton, Virginia, on Education for Information Science.[5] Of 55 attendees less than one third were **academicians** They were less concerned with education of **documentalists and** information scientists than they were with the effort of defining the field. This was true of the many excellent formal papers presented as well as the discussions which

took place between the presentation of papers. Several recommendations concerning educational aspects of information science resulted from this conference. Among these were:

1. The need exists to acquaint librarians with message processing by computers and its mathematical base, and computer experts should be acquainted with the human being as an information processor.

2. Many diversified information science programs are taking shape. They have difficulty in defining educational requirements especially for those who handle information at the least complicated level and the programs lacks a "core" of subjects.

3. PhD programs were described and discussed which indicated a lack of planning adequate curricula for these programs.

4. The concepts of the content and the elements that comprise them should be well defined for the fields of documentation, information science and computer science. Education in these fields must prepare its professionals to define problems in a precise algorithmic and machine tractable terms.

5. Students should be taught to apply available technology to existing problems rather than wait for the ultimate systems to be developed.

The conference chairman L. B. Heilprin summarized the conference's accomplishments as follows:

1. The field of information science consists of theory, as a pure science, and it also consists of the application of the science to the solution of the information problems.

2. Information science is concerned with stored or recorded messages, their creation, propagation and use; the user is a component of the system which constrain it as a result of his physical, psychological and psychophysical limitations.

3. Clarification with regard to contributions made by schools of library science and computer science towards his education.

The International Conference on Education for Scientific Information Work, sponsored by the International Federation for Documentation, (FID)[6] was held at the Queen Elizabeth College, London, April 3-7, 1967. It was a most comprehensive program of its kind. Thirty three papers were presented at the conference and with a very few exceptions they all related to the library oriented information field. Most papers related to the author's ongoing programs in his own institution where some goals for the future were discussed. V. Slamecka and P Zunde from Georgia Tech[7] presented a generalized model for developing educational programs.

The program $P = f(G,L,E,S,R)$

Where P = structure of an educational program

G = a set of educational goals

L = characteristics of a set of learners

E = a given educational system

S = a subject of knowledge relevant to P

R = environmental factors

The intent of this model is to indicate a vigorous approach to the design of educational programs. The available financial resources both private and public are aimed at the goals which relate to the educational system and the educational program. These are aimed at a learner which produces professional and intellectual resources. The learners interact with the program and the resultant resources interact with the goals as well as the original resources which support these programs financially. This in a way closes the loop and the feedback process keeps the program dynamic. The model was applied to Georgia Tech's own program by means of which it was possible to identify the substantive knowledge required for information science. It is composed

of three areas, namely, the theoretical which consists of modern algebra, mathematical logic, structural linguistics, general systems theory, and communication theory. The engineering area consists of techniques of information control, bionics (including control and man-machine systems) information systems design, computer systems design, and operations research. The third area consists of electives which enriches the program in computer techniques and applications, optimization theory, etc. or management or industrial engineering.

The one significant feature of this conference was that the diversity of views and the spectrum of what constituted the field was great indeed. The professionals in this field were referred to or identified as "information scientists", "documentalists", "information engineers", "scientific librarians", "industrial librarians", "scientific information specialists" etc. In many instances reference was made to them as literature searchers, literature advisors, research workers, special librarians and so on. Another inconsistency existed because no distinction was made between short courses and courses offered for academic credit. The distinction to be made here, is between training and education.

During September 25-28, 1968, the Curriculum Committee of the American Society for Information Science (ASIS) met at the University of Pittsburgh for the purpose of developing methodology and/or guidelines for structuring and evaluating curricula and information science. In attendance were nineteen members nine of whom were deans or directors of library and information science schools or centers in all representing seventeen institutions with major programs in information science. Represented on this committee were all of the points of view discussed later on under "Educational Objectives". Although a report of this conference has not yet been issued, a preview of its major accomplishment

would serve well here.

After considerable deliberation by the total group with diversified points of view and a spectrum of interests it was rewarding to find that a substantial amount of agreement and understanding was reached among the members in terms of what constitutes the field of information science and in terms of goals and objectives of information science programs. Two factors account for the agreement that was possible at the conference. One is that before any attempt was made to identify programs and/or curricula, career opportunities were examined. This led to the identification of the professional practice in the field. As soon as understanding was reached on this score it was possible to visualize graduates in information science assuming positions in our society. Once it was possible to identify the types of positions these graduates would fill, it was also possible to define the existing knowledge required for each. The second factor is a reflection of the maturity of the field itself. The discipline of information science and the function it performs in our economic structure is better understood. This kind of understanding brings several points of view closer together thus minimizing their differences. It was obvious however that the special interests and the environment of the individual institutions represented were sufficiently different in nature that to meet the objectives of each, different levels of courses were needed. To accomplish this, the committee broke up into three naturally forming groups, the library schools, the library and information science schools and the information science schools. The individual members joined that group to which they had the greatest affinity.

The Library Schools were concerned primarily with revising some of their traditional courses making them information science oriented, and introducing several new courses to provide an integrated library and

information science curriculum. Under the basic assumptions that their concern is with recorded information and with handling documents, information and data, their core curriculum included:

1. Information Resources
2. Organization of Information for Use - Theory and Implementation
3. Communication Media
4. Management of Libraries and Information Organization
5. Technical Processes - Manual and Mechanized (including acquisitions, circulation, serial records, and cataloging.)

The next level of courses recommended by this group were:

1. Information Technology
2. Computer Application in Information Systems
3. Information Storage and Retrieval
4. Systems Analysis and Design
5. Information Systems Administration

The program would provide traditional library specialization in school, public, academic, special libraries, and information science.

The Information Science Schools were concerned mainly with the theoretical aspects of information and with the methodology for dealing with it. It saw graduates of its programs, primarily as PhD's, practicing the profession in academic pursuits and conducting research. The educational goals were defined on this basis, and its recommendations for the substantive knowledge required were segmented essentially into four areas: 1) Methodology, which included all basic science such as mathematics, statistics, operations research, logic, etc.; 2) Behavioral, which deals with topics in human information processing and cognitive theory; 3) Technology, which is concerned with information presentation and transmission and computer aspects of information; and 4) Engineering, with systems analysis, linguistics, operational analysis, etc.

A curriculum in information science responsible to this group's programs falls into three levels, that of beginning graduate, graduate, and advanced graduate courses. A sample of courses at each level follows realizing that variations from school to school exist.

Beginning Graduate Level

1. Algorithmic languages
2. Data processing
3. Introduction to programming
4. Introduction to information theory
5. Introductory linguistics (philosophy of languages)
6. Numberical analysis
7. Statistical computations

Graduate Level

1. Computer design and organization
2. Computer systems
3. Information storage and retrieval
4. Processing of natural and artificial languages
5. Programming language design
6. Simulation Techniques
7. (Statistical computations)
8. Systems analysis

Advanced Graduate Level

1. Advanced numerical analysis
2. Automata theory and finite-state machines
3. Computational linguistics
4. Graph theory
5. Man-machine communication
6. Research methods in information science
7. Theoretical foundations of information science

The three levels of courses relate to theory, application and systems.

The Library and Information Science Schools related their concern to input, output, and use of information. Input deals with acquisitions, analysis, control of vocabulary, recording results of analysis, and storage of information. Output or dissemination is concerned with identification and analysis of requirements, processing, and delivery of information materials. Use relates to the application of the service in a specialized situation unrelated to the service. Rather than enumerating the specific course content in its curriculum, this group developed a model to serve as a methodology for the evaluation and development of curricula in information

science. The concern of maintaining a proper balance between library and information science and a balance between theoretical and practical content prompted this approach. The model considers four levels for curriculum evaluation, 1) context, 2) types of position for which the program is intended, 3) exit knowledge or substantive competence, and 4) courses and course content. By context is meant the formal institution for communication of recorded data. The variables are kind of institution, media of recording, environment (government, industry, university, etc.) and scope. Types of position fall into three categories, the academic and research, the integrative position bridging the gap between traditional approaches to information handling and the new technology including systems design, and the administrative and operational or functional positions. Exit knowledge or substantive competence defines general areas in which competence is either useful or required.

Evaluation of course content or substantive competence in specific areas as they relate to the types of position is possible by developing a scale which is a measure of the relatedness. A scale of 0 to 3 was suggested as follows:

0 = completely unrelated

1 = peripherally useful; for background information

2 = useful; knowledge of subject matter is important

3 = important to the practice of profession; in depth knowledge is required.

This model has not been tested and it is conceivable that it will have to go through several modifications before it will be accepted as the mechanism for the evaluation and development of curricula in information science. The methodology, however, appears to be sound and it was adopted for this purpose by the American Society for Information Science (ASIS) Curriculum Committee. The Curriculum Committee for ASIS has as its

task for 1968-69, the evaluation and analysis of existing curricula or individual courses on some comparative basis. Hopefully several subject areas within the scope of information science will be identified and courses with syllabi within each suggested.

EDUCATIONAL OBJECTIVES

The educational objectives of a graduate program are to prepare students for professional practice in the application of information science and for research in the field. A practitioner must acquire certain skills for the practice of his profession, but he must also possess a foundation with a strong theoretical base to enable him to adapt himself to the environment of a dynamic and ever-changing new technology applicable to the solution of problems of information. The educational objectives in information science should therefore focus on three broad but major areas: (1) theory concerning information, its environment and its relationship to information systems; (2) information systems, design testing and evaluation; and (3) information services.

Theory concerning information should be the basis for explaining the environment for information systems and the analysis of problems relating to them. It would deal with the methodology for developing models and simulation techniques for testing and evaluation of alternative approaches to systems design. It should contribute to the understanding of the principles and methods for processing of information. Properties of systems, properties of arrays and symbols which come from their organizational structural properites, and properties of information should be its concern.

Information systems deals with the design and testing of systems for a specific purpose of usage in handling information. The collection, reduction, organization, storage, transmission and dissemination are components to be dealt with and must be integrated into a system. It is concerned with man-machine interaction and examines information processing systems, management information system, information storage and retrieval systems, and computer systems.

Information service is concerned with providing service to many users of information centers. The understanding of the various service functions and the environment in which they can be provided is most essential. The knowledge and understanding of administration of information centers focussing on information resources, the cultural attitudes towards information and education of the user group and the influence of technological development.

It is of interest that these three areas to which academic programs should address themselves are also job oriented. Career opportunities in information science exist on all three levels. The first category is aimed at individuals who are pursuing PhD programs and whose major career interests are geared toward an academe and/or research. The second is engineering oriented, whose on the job responsibilities are to design, implement, maintain, and update information systems. The third category is for people whose career interests lie in the direction of management and administration of information centers. Obviously, no matter what career one wishes to pursue, his education and training must be a composite for all three areas with a variation in emphasis for each.

CURRICULUM DEVELOPMENT

Schools which offer programs in information science also have a tendency to fall into three categories similar to those described under Educational Objectives. One of these is the library school which finds that its program must meet the new challenges of the present day technology. The type of professional services which are needed today, especially in areas where research and development activity is being pursued, have been undergoing dynamic changes, and library school graduates must be trained for these careers. Library school curricula are being expanded to meet the new demands and this in turn begins to give them the flavor of information science.

Another category consists of the Library and Information Science Schools which recognized this problem several years ago and are now established to provide an education which more adequately meets the new challenge. These schools generally see a continuum in the library and information science and as a result of their experiences have developed strong programs where the relation of the new technology of micro-imaging, computer science, and systems, are integrated into the total program of information transfer. The third group developed its program in information science in an engineering or pure science environment and treats the field from a somewhat different point of view. It too is concerned with the problem of recorded knowledge but views transfer of knowledge as an important application in the field. In all programs substantive knowledge in mathematics and statistics, computer science, linguistics, economics and cost analysis, system design and engineering, behavioral science, and librarianship are recognized. The emphasis and the depth with which they are pursued at the various institutions are the variables which differentiate one program from another.

In developing curricula in information science, the Library School normally provides an introductory course which introduces the student to

the new technology and its impact on information services. A sample introductory survey course of this kind would discuss the functions of information systems, as they relate to mechanization or automation. Beginning with acquisitions, to analysis, indexing and vocabulary control, recording of information, storage and retrieval, display, evaluation, and dissemination and/or transmission of information, each of these functions are related to the new technology. The student here becomes acquainted with marginal-hole cards, unit record punched card methods, optical conicidence or peekaboo systems, microimaging, and general computer methods. The intellectual transformation from classical librarianship to the so called documentation methods begin to take place in this classroom. It must therefore introduce such topics as developing search strategies relating to various types of files, coding techniques, and search methodology and discusses measures and criteria for the evaluation of user satisfaction. The school would do well if it required this knowledge of the student for admission to the graduate program.

Beyond this in subsequent course work such topics as "Information Systems Organization and Design"; "Introduction to Computers", and their relationship to peripherals and methods for programming; "Computer Applications" usually relating to problems of information retrieval, dissemination of information, automatic indexing, production of surrogates, and automation of library functions; "Special Tools" microforms, audio visual facilities, duplicating and copying. As a general rule, these courses are on an introductory level either offered toward a MLS degree or imbedded in an MLS program. Much of this knowledge could also be acquired on an undergraduate level.

The Library and Information Science Schools at present dominate the library oriented field in information science. Although, in most instances, they took an empirical approach in developing their programs

they have integrated program which fills a very important need in our society. Their experience over the last several years gave these schools an opportunity to develop a competent faculty both within their own school or department as well as drawing upon existing talent elsewhere within the University. These programs have acquired the sophistication which exist in other disciplines in that they provide several levels of competency in each cognate area within the program. For example, they can take several courses in computer science each being a prerequisite for the proceeding one, or they can take them in systems analysis, statistics or linguistics depending on the students interest. This type of depth is non-existent in the library schools discussed earlier. Schools in this category have been building upon their master's program and several now have advanced degree programs leading towards a PhD. The advanced program demanded curricula in depth training in specific areas. Similarly building a curriculum where substantive competence in specific areas was possible paved the way for the advanced programs leading toward the PhD programs in information science. Most of the schools in this category still offer degrees in library science in spite of their substantive curricula in information science. A very few offer degrees in information science. One library school, for example, offers a MLS degree where electives in information science are possible, however the school also offers a MS degree in information science. The tendency to offer MS degrees in information science along side of MLS degrees will probably grow because a demand for information scientists exists now and will continue to grow. In a masters program a student is limited to the number of credits he can take if he wishes to complete his education in a reasonable time. If the degree is in library science he is usually required to take a specified set of courses in a traditional library science curriculum which continute the core. This obviously limits the

strength which one can acquire in information science. The assumption is that if the degree is an MS in information science then the student is not obligated to take the total core program in traditional librarianship. He can therefore concentrate his efforts in his major field of interest to a greater depth. As a rule, the schools in this category offer courses in each of the several general headings which can be identified as information retrieval and documentation theory and systems, computer operation, mathematics of a special kind and statistics, and linguistics. No single school offers enough courses in depth in all of these areas for a student to develop proficiency on a professional level in a masters degree program. Those schools which have a PhD program in information science rely heavily on cognate areas in conjunction with other schools or departments at their Universities and thereby manage to fill this need. An alternative to offering an MS degree in place of the MLS, is to revise the curriculum in the core program in such a way as to include the new science and technology into the traditional courses.

In the third category are schools or departments in information science completely independent of library schools. From this group are excluded the computer science and/or computer and information science departments whose programs are strongly computer science oriented. Although a great deal of commonality in the two programs exist it is the difference that distinguish these two fields. Even where the commonality in the two fields exist the emphasis in each is different. The materials which constitute the major thrust in information science are often considered peripheral to computer science. The schools which fall into this third category generally interpret information science as a discipline of a scientific nature in which mathematics and logic are the theoretical arm, and design and operation of information systems are its applied arm. They attempt to develop curricula to meet these two objectives. However different schools accomplish these objectives differently. It is reasonable to assume

that the environment in which these programs or departments were developed influence their orientation. The environment is a function of such variables as the research interests of the faculty, conflict of interest or overlap with programs in other departments, and goals they are trying to achieve in complementing other programs at the institution. Sometimes these variables tend to influence the program in the direction of theoretical aspects of information and sometimes in the direction of professional training for the design and evaluation of information systems. In schools where the program encompasses both aspects, electives in the curriculum exist whereby the student can develop an option which represents his personal interests and desires. These programs are well structured and the student is required to take a specified set of courses as his core with additional courses which develop the required competency in his selected option. The areas in which substantive knowledge encompass these programs are:

1. Mathematics, statistics and symbolic logic.
2. Theory of information and systems which cover topics in computer systems, management information and information storage and retrieval systems, and man-machine interaction.
3. Simulation and modeling including topics in self organizing systems, Turing machines and theory of automata, artificial intelligence and pattern recognition, and compatability and unsolvability.
4. Mathematical linguistics, theory of grammers, artificial languages, and machine translation.

To offer courses in all of these areas and to provide in depth competency in each would require a faculty of a size and scope which few departments in information science could afford. It is much easier to provide introductory courses in each where the enrollment is substantial in size. It is not so when courses at all levels have to be

made available. For this reason these courses are not necessarily offered by the department of information science. They may exist in other departments and cross-listing of courses among departments in a mechanism used to make the most out of the talent existing at an institution.

One area to which little attention has been given here is the computer science or computer and information science as some departments call themselves. Because computers have made one of the major contributions to the field of information science many regard it as the information science discipline. There are aspects of computer science which relate directly to information science and no information science program is complete without it. But the major concern and the emphasis placed on the various aspects in computer science differ drastically from that of information science. A prime consideration must be given to the fact that computers as such are now a part of our every day life and one can hardly mention an area where application of computers does not exist, and the limits are almost boundless. Computer science curricula therefore must train students in the use of computers in order for them to be able to utilize computers in the solution of problems in other disciplines. To provide students with this tool, undergraduate computer science programs are taken for granted in many institutions and they are the main stay of their computer science programs. Graduate programs are being structured upon the undergraduate curriculum, and this too is important because frontiers in the computer field are being extended, and further extensions are of the essence. Time sharing, real time problems, communications with computers both in transmission and linguistics, newer and better monitors and executives for automatic communication with users are the variables which influence the rate at which frontiers in the field can be extended. The Curriculum Committee on Computer Science for the Assoication for

Computing Machinery (ACM)[2] has subdivided computer science into three major divisions: "information structures and processes," "information processing systems," and "methodologies." This structure in its format is similar to that of information science, however the course content in each varies substantially. Both sciences consider the mathematical, and the physical and engineering sciences as related areas, but the emphasis in each varies significantly. For example computer design, organization, and structure, and computer operating systems are vital to the computer science programs; so is numerical analysis. These are of interest to the information science discipline but they relate to it peripherally only. On the other hand information retrieval systems including indexing and classification, statistical techniques, automatic indexing, and search strategies are essential to information science but relate minimally to computer science.

AVAILABILITY OF EDUCATIONAL PROGRAMS IN INFORMATION SCIENCE

In schools where Information Science is offered not as a seperate discipline, but as a part of another curriculum, most of them occur as part of the Library Science department or school. Other departments involved, in individual cases, are Computer Sciences, Electrical Engineering, Psychology, Business Administration, Public Administration and Liberal Arts.

The accreditation of library schools is made by the American Library Association (ALA) and a list of the accredited schools with the courses they offer appears in Journal of Education for Librarianship.(8) The analysis of the course content in these programs which are information science oriented is the task of the Curriculum Committee of the ASIS for 1968-1969 and therefore is not now available. Among the non Library School educational programs in Information Science, there appears to be no firmly established opinion of exactly where Information Science belongs within a University framework. For this reason an additional list of schools with such programs is available in a report of the Biological Sciences Communications Project of George Washington University(3).

CONCLUSION

What is the relation of curricula in information science to instructional technology? The technology relevant to information science consists of computers in general, computers in a time-sharing environment, real time systems and telecommunication networks for remote access to the system. Conversational type languages and CRT displays establish the proper man-machine communication. The important extension of this technology is to provide a common framework for remote access, and to establish a system whereby each participant has an immediate personal contact with the network. Several regional networks are in existence now, and with time they will provide the experience necessary for the larger systems. Triangle Universities Computation Center, (TUCC), is a network tying in the University of North Carolina, Duke, and North Carolina State. They share the costs in order to share their resources through the computer network. The North Carolina network has been extended to include other institutions in the state. The North Carolina Computer Center Orientation Project, (NCCOP), is associated with TUCC and buys remote computer service from the Center which is made available through dial-up teletype.

The library's traditional role in the educational process has not been diminished. The new demands which are being placed on the profession have become so great that it no longer was able to meet them in a traditional manner. At the same time the technology for processing information is being advanced at a rapid rate. The marriage between the two made it possible to provide educators with materials they need for research in the educational process. This marriage did not come easily. The adaptation of the new technology required the development of new concepts and information storage and retrieval was one of the major by-products. The integration of the new technology

into the framework of meeting the new demands for information services required talents from many disciplines. Information science was the culmination of this interdisciplinary effort. However other by-products of this effort resulted in important contributions to the instructional technology. For example, in a time-sharing environment, in order to permit users of information direct access to files for seeking the literature relevant to their special needs, tutorials are being developed to aid them. There tutorials exist, users at a console are required to identify themselves and state their business. From thereon the tutorials take over and lead the users to the final conclusion of their search needs. Not only is this a new approach to teaching methodology in the documentation and information science discipline, but it exerts an influence on teaching methodology in other areas. Computer aided instruction (CAI) which is being developed aside from this, shares in the advances made by research and experimentation in the information science area. The proposed Educational Information Network (EIN) which is being designed by a task force of EDUCOM will permit an exchange of computational resources on a national scale. The Practice Oriented Information System Experiment (POISE) has been set up by EDUCOM to provide a base of knowledge, techniques, and experience to be applied to the development and construction of computer-based information systems. The initial endeavor will be towards providing direct access to bibliographic information from a number of diverse data bases to users at remote locations. This has the potential for creating banks of the most expertly prepared educational materials which can be shared by schools everywhere.

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