THE INTEGRATION OF COMPUTER METHODS INTO URBAN PLANNING EDUCATIONAL CURRICULUMS: AN ANALYSIS AND APPRAISAL OF ONE STRATEGY

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ABSTRACT

THE INTEGRATION OF COMPUTER METHODS INTO URBAN PLANNING EDUCATIONAL CURRICULUMS: AN ANALYSIS AND APPRAISAL OF ONE STRATEGY

by Thomas Everett Borton

Throughout the United States and a large part of the rest of the world, society is undergoing a transition which we describe as urbanization. The problems associated with urbanization are legion but the means of providing solutions for either these current problems or for future needs are less obvious.

While many disciplines are concerned with these problems, one, the field of urban planning, is explicitly concerned with urbanism and the means to deal with its concomitant problems. Since urban areas are complex compositions of physical facilities, people, interacting processes and the like, the establishing and maintaining of a firmly based understanding of these components represents an incredibly difficult objective. Yet this is precisely what the professional planner is trying to accomplish in his daily work. Therefore, he must utilize every possible means available to him in this effort to:

(A) understand existing urban structure with all of its profound implications;

(B) recognize what alternatives might be pursued for the future of this structure; and

(C) determine what are the implications of these alternatives in the larger context of metropolitan area and national problems and potentials.

The field of planning has been characterized by a continually growing and changing perspective and set working procedures to provide for the planning for and management of urban communities.

A number of new techniques and methods presently offer considerable promise for aiding the planner in his efforts in dealing with urban problems and in developing of effective means for guiding future urban growth. These include the various methods of statistical methods, simulation and modeling, urban information systems, and systems analysis. Important to the development and utilization of these techniques is the use of computers in urban planning.

The computer is occupying an increasingly important role in planning and current experience suggests that computer utilization will, in increasingly significant ways, aid the planner in accomplishing a more rational and substantive approach to dealing with urban problems.

Although computers have taken on a growing significance in the methods and procedures of planning, there has been only a minimal reflection of this impact in urban planning educational programs. This research is directed toward the need to improve the means by which computer methods education is presented within our urban planning curriculums. This can be stated in the form of an if-then proposition.

> If, computer based data processing and analysis are to be important ingredients in the procedures used by urban planners to meet the increasingly complex functions which are central to his responsibilities in the processes of urban decision making,
>
> Then, planning education must respond to the practicing planners need for understanding the essential matters of computer usage and include the relevant aspects of computer methods in the educational curriculum for planning students.

In responding to this proposition, the need is to examine the requirements which fulfill the computer usage capability levels necessary for planners and to propose a means for the inclusion of these methods in an urban planning curriculum.

The particular procedure used in the study is presented in two general phases.

(1) The first is to propose a strategy that might be used for presenting computer methods in an urban planning curriculum, including the definition of objectives and criteria for structuring such a strategy.

(2) The second phase is to outline the types of steps envisioned as necessary to carry out such an approach, with reference to a particular urban planning curriculum.

The resulting analysis and discussion indicates that, to a large extent, the urban planners educational needs regarding computer methods are to develop his abilities to: communicate effectively with systems analysts and computer specialists; to recognize the general capabilities of computers for utilization in a growing number and variety of tasks; and, be competent enough in computer methods to be able to evaluate the prospects and results of computer applications in the planning program.

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Obviously the shortcomings of the thesis, itself, are purely my own responsibility.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER I

INTRODUCTION

> During the next ten years, hundreds of planning offices throughout the United States are going to begin working with computers. Some planners will approach this experience like shy virgins, others like vinegary spinsters, and still others with soft cries of joy. None of them will ever be the same again.[1]

Throughout the United States and a large part of the rest of the world, society is undergoing a transition which we describe as urbanization. The problems associated with urbanization are legion and well documented but the means of providing solutions for either these current problems or future needs are less obvious. We are participants in this urbanization phenomenon yet we find it difficult to comprehend all of its complex dimensions.

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[1] Britton Harris, "How to Succeed with Computers without Really Trying," Journal of the American Institute of Planners, XXXIII, No. 1 (January, 1967), p. 11.

While many disciplines are concerned with these problems, one, the field of urban planning, is explicitly concerned with urbanism and the means to deal with its concomitant problems. The development of the field of urban planning has paralleled the evolution of urbanism. This emergence has been characterized by a continually growing and changing perspective and emphasis among planners relative to the elements which are considered relevant to the planning for and management of urban communities.[1]

In recent years, this change process has been characterized by the introduction of a number of new techniques and methods which offer some particular potential for aiding in the solution of urban problems and the maintaining of effective means for guiding future growth. These include the various methods of statistical analysis, simulation and modeling, urban information

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[1] There is a large body of literature which discusses this matter. For example: Donald N. Michael, et. al., "Process Planning: Symposium on Programming and the New Urban Planning," Journal of the American Institute of Planners, XXXI, No. 4 (November, 1965), pp. 282-338. Also see: J. W. Dyckman, "Introduction to Readings in the Theory of Planning: The State of Planning Theory in America," Department of City Planning, University of Pennsylvania (no date), (mimeographed); and William L. C. Wheaton, "Operations Research for Metropolitan Planning," Journal of the American Institute of Planners, XXIX, No. 4 (November, 1963), pp. 250-259.

systems, and systems analysis. Basic to the development and utilization of these techniques has been the introduction of the use of computers in urban planning.

There is little question that computers are having a growing impact in urban planning. The prominent status which they have occupied in planning during recent years is, however, likely to be surpassed in the next ten years by far more impressive computer innovations in the planning and management of our urban areas.

While the rapidity and extent of these new innovations leave many planning professionals reeling, similar alterations have been experienced in other fields and disciplines. The problems of adjusting to the impact of computers are not unique to planning. Just as in other areas of impact, planners need to face up to certain adjustments in their modus operandi if they are to effectively exploit the capabilities of these computer systems.

This research is directed toward improving the means by which we may provide computer methods education within urban planning curriculums. The essence of the need to solve this problem lies in the much larger issues of urban growth and the changing structure and characteristics of our urban areas and how we can effectively deal with them in urban planning.

Since urban areas are complex compositions of physical facilities, people, interacting processes and the like, the establishing and maintaining of a firmly based understanding of these components represents an incredibly difficult objective. Yet this is precisely what the professional planner is trying to accomplish in his daily work. Therefore, he must utilize every possible means available to him in this effort to:

(1) understand existing urban structure with all of its profound implications;

(2) recognize what alternatives might be pursued for the future of this structure; and

(3) determine what are the implications of these alternatives in the larger context of metropolitan area and national problems and potentials.

The growing range of experience continues to suggest that computers are going to operate in an increasingly significant capacity to aid the planner in accomplishing a more rational and substantive approach to dealing with the three aforesaid points. Usage of computers in data handling and analysis of urban data on a large scale has opened a new level of capability for understanding what is already existent in our major urban centers and what we may expect if we follow any of the obvious alternative courses of action.

Although computers have taken on a growing significance in the methods and procedures of planning, there has been only a minimal reflection of this impact in urban planning educational programs. Educators and planning professionals have not had the definitive discussions which would lead to clearly stated objectives for teaching relevant aspects of computer methods in urban planning educational curriculums. It seems that such exchanges of ideas and objectives are essential for effective representation of computer methods in these curriculums.

Without proper guidelines for the content and the structural needs for the introduction of computer methods in urban planning curriculums, there is a likelihood of insufficient or ineffective program design at best, with no inclusion at all being the even less desirable situation. We need to define these guidelines. Desired objectives may be accomplished by accident, but that's a rather slim hope.

The primary purpose of this thesis can, then, be stated in the form of an if-then proposition.

> If, computer based data processing and analysis are to be important ingredients in the procedures used by urban planners to meet the increasingly complex functions which are central to his responsibilities in the processes of urban decision making,

> Then, planning education must respond to the practicing planners need for understanding the essential matters of computer usage and include the relevant aspects of computer methods in the educational curriculum for planning students.

In responding to this proposition, the need is to examine the requirements which fulfill the computer usage capability levels necessary for planners and to propose a means for the inclusion of these methods in an urban planning curriculum.

It is with such a need in mind that this research has been undertaken. It is likely that others will disagree with proposals made as a result of this particular study but this does not in any way lessen the importance of making explicit the requirements for properly incorporating the study of various aspects of computers and their usage within the academic program for planning students.

STUDY APPROACH

The particular procedure used in the study is presented in two general phases.

(1) The first is to propose a strategy that might be used for presenting computer methods in an urban planning curriculum, including the definition of objectives and criteria for structuring such a strategy.

(2) The second phase is to outline the types of steps envisioned as necessary to carry out such an approach, with reference to a particular urban planning curriculum. This case example will be the Michigan State University curriculum in urban planning leading to the professional masters' degree (MUP).

There are a number of means by which a study of this nature might be pursued. It was decided, however, that the most effective method would be to direct the research effort toward the analysis of a case example which could aid in focusing the study in several ways. First, the present structure of a planning educational curriculum provides a reference set of objectives and courses which have been devised to prepare students for recognized professional requirements. This specific course sequence serves as a useful set of guidelines for any discussion of curriculum adjustments. Second, any educational program adjustment proposals must be correlated with the tangible elements of actual curriculum characteristics. It is all to easy to carry an educational program critique into unattainable speculation.

The definition of computer methods, as used in this study, is limited to computer programming, computer operational characteristics, and the developing of the individual's skills for recognizing and exploiting

opportunities for effective utilization of the computers capabilities. Note that this excludes the range of operations research and systems analysis techniques which have been closely identified with the introduction of the computer in urban planning. While these are closely related, the primary effort here is to represent the computer methods as a curriculum inclusion. References to the various operations research and systems analysis techniques will indicate the association implied in the proposed curriculum strategy although no attempt to defend these techniques inclusions will be made.

The study can only provide a brief glimpse at some aspects of this curriculum development strategy. The entire task of interpreting such a strategy and implementing it is a complex and difficult task. Yet, the universities need to experiment with such approaches in urban planning curriculums. In his 1957 published "Education for Planning", Harvey Perloff wrote:

> Usually professional education has been pushed into the universities by outside leaders of the profession, and the practitioners themselves have provided much of the instruction and set the orientation of the training curriculum. Only some time later - in some cases - generations later - have the university scholars taken the reins and developed an educational program for the profession which reflects the ideals and resources of the universities, as well as the evolving - rather than the past and current - needs of the profession . . .
>
> The overall educational picture is one of gradual assimulation of social science, regional aspects, and research into planning curricula - but always

> with a considerable lag. In general, it has been long after the practitioners found themselves ill equipped to undertake tasks thrust upon them - tasks such as population and migration analysis, regional economic surveys, and the development of programming and capital budgeting techniques - that the universities responded with changes in their existing training programs or initiated new planning programs. On the whole, planning education has tended to follow somewhat haltingly after the march of practical events, rather than to anticipate needs and to develop new knowledge and methods.[1]

The aim of this research is to contribute to the development of this type of effort through the limited exploration of one particular curriculum sequence. Hopefully it at least provides some fresh insights.

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[1] Harvey S. Perloff, Education for Planning: City State, and Regional (Baltimore: Johns Hopkins Press, 1957), pp. 5, 9.

CHAPTER II

BACKGROUND

INTRODUCTION

The rise to the present level of computer orientation in planning has been a part of a rapidly changing framework of planning involvement at all levels and in all types of government. Yet, the extent of the rapid growth of the involvement of the computers in planning, even in this general growth context, has some particularly significant dimensions.

The intent of this chapter is to provide some background information describing present types of computer involvements and some dimensions of the extent of the growing role which computers and computer methods occupy in urban planning.

SOME DIMENSIONS OF THE IMPACT OF COMPUTERS IN PLANNING

What level of impact has the use of computers had in urban planning? Several examples serve to illustrate the rapid pace and extent of growth that this phase of urban planning has experienced.

Ten years ago, Harvey Perloff's book "Education for Planning: City, State, and Regional" was published, representing, at that time, the most intensive look at the requirements for educational programs for urban planning which had ever been assembled.[1] The ideas in that book expressed the pioneering approach for planning education utilized by the University of Chicago during the early 1950's and this philosophy and experience certainly represents the most innovative of ideas at that time. Yet, conspicuously missing is any mention of computers, systems analysis or the like. The startling fact remains that the full effect of computers on urban planning has come since that book was written.

During the intervening ten years, planners have been inundated with announcements of professional development short courses and conferences on electronic data processing, information systems, computer mapping, modeling, and other related materials. By 1965, the data

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[1] Perloff, op. cit.

processing section of the Municipal Year Book listed 58 planning departments in cities over 25,000 population which at that time were using, or within five years would be using, electronic data processing.

A recent study reported on twenty six planning agencies which were surveyed concerning computer usage.[1] These include sixteen metropolitan or regional planning agencies, six city planning agencies, two state agencies, one federal agency, and one consulting firm. All twenty six agencies indicate either current or planned use of data processing and computers in their agency's operations. Twenty of these are presently involved in data processing. The other six agencies are planning or developing data processing capability.

This list is admittedly limited and is only indicative of the present range of agencies involved in these programs. For example, known agency efforts in such places as Louisville, Kentucky; Kansas City, Missouri; Alexandria, Virginia; Little Rock, Arkansas; Orlando, Florida; Tulsa, Oklahoma; Santa Clara County, California; Flint, Michigan, and Lansing, Michigan, just to name a few, are not included in that study's list.

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[1] George C. Hemmens, "Survey of Planning Agency Experience with Urban Development Models, Data Processing, and Computers" Paper presented to the Conference on Urban Development Models, Highway Research Board, Dartmouth College, June, 1967.

Still another dimension to indicate the nature of this growth of activity can be illustrated by the increased number of professional planning positions available which stipulate computer based data processing and analysis as a job involvement. For example, in the annual planning job market listings of the American Society of Planning Officials for 1963, a total number of 274 jobs were listed with six of these mentioning EDP and computer applications. The corresponding job market listing for 1967 lists a total of 505 jobs with twenty nine indicating EDP and computer involvement. Figure 1 indicates that this has been part of a trend in these job listings for that five year period.

FIGURE 1

JOB LISTINGS IN THE ASPO ANNUAL JOB MARKET WITH A SPECIFIC MENTION OF EDP INVOLVEMENT 1963-1967

YEAR	1963	1964	1965	1966	1967
Number of Jobs with EDP Mentioned	6	7	18	30	29
Total Number of Jobs Listed	274	300	376	631	505
Percent of Total with EDP Mentioned	2.2%	2.3%	4.8%	4.8%	5.7%

Source: ASPO Annual Conference Job Market Issue of "Jobs in Planning" (1963-1967)

In the 1967 job listing, a number of additional positions imply the involvement with computers without specifically stating this (i.e. stating that "position involves working with advanced planning research methods"). In tabulating, however, these jobs were not included, therefore, the tabulation above is a conservative estimate of the actual number of jobs of this type that were available.

As these examples indicate, computer based data processing has become an activity in many types of planning agencies throughout the country and the development of these activities has occurred during a short span of time, less than ten years. Such activities are growing at a prodigious rate and now constitute a major activity in many planning programs.

TYPES OF USE OF COMPUTERS IN PLANNING

Since the advent of computer usage in planning, they have been incorporated in a growing number of ways. There has been a continuing high degree of dependence upon computer analysis in transportation planning.[1] Data banks have been

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[1] Roger L. Creighton, "Have We Learned Anything from Transportation Studies", Planning - 1963, American Society of Planning Officials Conference Papers, Chicago, 1963, pp. 181-186.

another of these computer related activities that have had expanding interest.[1] Although some of the early, overly-exuberant, claims for data banks have not been substantiated in the first experiences, the concepts of such information support programs remain important. More standard and subtle data processing adaptations have grown substantially during this period with the combined land use-transportation studies that are currently being conducted in many metropolitan areas and the computer based data processing which has been an integral part of many community renewal programs.[2]

There has also been increasing interest by planning researchers in the development and verification of a substantive body of theory concerning urban phenomena.[3] Prior to the availability and usage of the computer in

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[1] Richard McGinty, "Metropolitan Data Systems: A Review of Significant Developments and Suggested Principles for the Implementation of a System" (Unpublished Masters Thesis, School of Urban Planning, Michigan State University, 1965), p. 13.

[2] David Grossman, "The Community Renewal Program: Policy Development, Progress, and Problems," Journal of the American Institute of Planners, XXIX, No. 4 (November, 1963), pp. 264-265.

[3] Britton Harris, "The Uses of Theory in the Simulation of Urban Phenomena," Journal of the American Institute of Planners, XXXII, No. 5 (September, 1966), p. 272.

planning, the feasibility of conducting the experimentation and manipulation of the large volumes of data necessary to support this type of research effort was extremely limited. The data being made available by the large scale, computer based, studies is now contributing to this theoretical development and verification and the utilization of the computer to conduct analysis on the large data files enables more detailed and extensive examination of this data than would be possible without the computer (or alternatively an army of statisticians).

The prospects for utilization of computers in planning has also stimulated thoughts about the nature of the planning function, itself, in urban government and the developing urban areas. For example, John Gifford noted:

> The introduction of this new technology, with the revolutionary resource which it offers for the manipulation and processing of data, appears to require a re-examination of the planning function, its constituent operations, and ultimately, a re-evaluation of its role in relation to the functioning of the city.[1]

The sequence of activities typically referred to as the "planning process" (i.e. Inventory, Analysis, Projection, Plan Formulation, Testing, Selection of the Plan, Implementation) offers numerous opportunities to incorporate

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[1] John V. Gifford, "The Systems Requirements for an Urban Planning Information System" Paper presented to the Conference on Information Systems and Programs for Urban Planning, University of Southern California, Los Angeles, June, 1963.

computer utilization. Inventory and analysis phases involve large scale data files with their concomitant quantity and quality problems. In introducing the May, 1965 issue of the Journal of the American Institute of Planners on "Urban Development Models", Britton Harris referred to the role of the computer in these phases:

> Most of the problems of comprehensive metropolitan planning involve in the first instance very large amounts of detailed information regarding land, buildings, public services, and activities. This information must be handled and processed quickly, accurately and consistently. It is no longer possible to do this by conventional means using tabular pads, desk calculators, maps, and charts exclusively. The problems of volumes of work and of quality control over a large clerical staff become overwhelming. Even more serious is the second characteristic of the working problem. In any realistic and total view of a large city or metropolis, the number of interrelationships among activities and between these activities and the space which they occupy becomes astronomical. While planners are becoming more and more sophisticated at specifying the nature of these relationships, no means but a computer is available for exploring them in any fair degree of detail.[1]

Use of computer based routines for projections and growth analysis appears to be one of the most universally accepted applications of computer usage among planners. Availability of a number of clearly defined, procedurally based techniques for this type of analysis by planners makes

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[1] Britton Harris, "Introduction-New Tools for Planning," Journal of the American Institute of Planners, XXXI, No. 2 (May, 1965), p. 91.

this a more comfortable area of application than some other less clearly defined processes. For example, use of the computer in plan testing, outside of the transportation studies, remains an area of hopeful speculation more than proven usage. Still these and other areas of planning involvement seem certain application targets for the computer based analysis processes.

Finally, it appears that the extent of computer usage in various types of planning applications is a function of two particular factors: (1) is there a computer facility readily available to the agency such as the computer used in government accounting and billing for a city, and (2) if the agency begins to use the computer for one function, the extension to other functions is quite likely. In the Hemmens study, the results are reported that:

> (. . .) most agencies which use computers for models also use them for other agency operations. The extent of such usage appears to be somewhat dependent on whether or not a computer facility is on-site or readily accessible through another public agency. But to a larger degree this probably reflects the concomitance of computer based preparation and analysis of data with the use of models. The existence of a data processing operation within the agency then leads to further use of data processing for other operations.
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> Most agencies reporting the use of models thus also use data processing for preparation of data (cleaning, sorting, etc); for maintenance of such basic files as land use inventories, travel data, and population; for tabular reports and statistical analyses of these files; and for preparation of model inputs. Other uses of data processing mentioned by several agencies include: administration (cost accounting, inventory, personnel), work

> planning (PERT, CPM), and pre-field and field control operations for local surveys (sampling, addressing survey forms, data editing and checking).
>
> There is one exception to this general pattern of computer based models coupled with more extensive use of data processing in agency operations. Several of the city planning agencies report the use of data processing for planning operations, principally data file handling and tabular and statistical reports on these files, but no use of models. In these cases the planning agency has access to a city operated computer facility.[1]

If availability is such a primary factor, the growth in the number of computers used in urban governmental administration would seem to indicate the likelihood of a considerable expansion of activity in computer activities in planning, particularly medium size cities where small computer systems are rapidly becoming commonplace.

In general, computer applications in planning have significantly increased in both number of different agencies using computers and in the variety of types of applications in which computers have been utilized.

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[1] Hemmens, op. cit., p. 11.

THE PLANNERS NEEDS FOR COMPUTER METHODS CAPABILITIES

In view of the broadening use of computers in planning, what particular computer methods skills are required for professional urban planners? The planner can obviously be neither computer expert-programmer nor can he be a completely uninformed bystander. What guidelines can be established to aid in clarifying the needs which the planner's educational preparation should fulfill in this regard?

First, it is important to note the obvious but still important point that the computer is, for the planner, a tool for use in whatever way it can be of help. It is not an object of primary attention in and of itself. A puzzling problem often arises associated with such innovations in educational materials. On the one hand, there is resistance by both teachers and students to something untraditional, and, on the other hand, there is a "placebo" type effect from the hope and enthusiasm developed by something new and promising.[1] Care must be taken to avoid either distortion.

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[1] See, for example, the discussion in Ernest R. Hilgard and Gordon H. Bower, Theories of Learning, Third Edition (New York: Appleton-Century-Crofts, 1966), p. 578.

Broadly speaking, the planner's computer methods educational needs are to develop his capabilities to cope with the operational environment in which he will deal with computer applications. Planners are, for example, being called upon to be participants on interdisciplinary teams where they must be able to work effectively with systems analysts and computer specialists along with all the other social and physical scientists to assure a proper representation of the urban planning viewpoint in the interdisciplinary study efforts.

Specifically this requires that the planner: (1) be able to communicate effectively with these systems analysis specialists and computer programmers; (2) be able to recognize the general capabilities of computer configurations for utilization in a growing number and variety of tasks; and (3) be competent enough in computer methods to be able to evaluate the prospects and results of computer applications in the planning program.

All of these points, in essence, deal with the problem associated with the first point, the communication problem.

There have been a number of critics who have addressed themselves to this problem. For example, Robert Boguslaw has written:

> [broad educational] programs should be addressed not only to the problem of making people more at ease with the concept of computers and computer programming, but also more fundamentally toward helping them become perceptive about the implications that contemporary large scale system design has for each one of us.[1]

Britton Harris has stated it specifically in context for the planner writing:

> (. . .)national interest is focusing on new directions in urban metropolitan development, and the planning profession is ill prepared to meet the implied change. In this situation there is a grave danger that aero-space and operations research practitioners will usurp the position of the city planner with, however, inadequate substantive knowledge and grossly oversimplified techniques.[2]

Specific evidence to support the validity of these points is found in the results of the Hemmens report. In discussing the responses of the agencies surveyed to the question of what their major problems were the second most often mentioned problem was the difficulty of communications between the planning staff and the programmers and other EDP personnel. The most often mentioned problem was closely related to this, that being the finding and keeping of qualified programmers and other data processing personnel. The Hemmens report states:

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[1] Robert Boguslaw, The New Utopians - A Study of System Design and Social Change (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1965), p. 27.

[2] Britton Harris, Unpublished Memorandum to the Research Council, Graduate School of Fine Arts and the Faculty, Department of City and Regional Planning, University of Pennsylvania, March 8, 1966.

> One agency summarized the problem as establishing meaningful communications "between the staff who have a knowledge of machine capabilities and the staff who wish to make use of these machine capabilities." This problem is, of course, related to the programmer personnel problem. The concern for program quality control and dissatisfaction with available programming staff appears, from the statements of several agencies, to result in part from communications difficulty. The program prepared by the programmer often does not produce the output desired by the planning analyst. Agencies' comments suggest that this is equally due to inability of the planning analyst to describe precisely to the programmer what he wants, and to the inability of the programmer to understand how the substance of the planning analyst's problem may be affected by the choice of data manipulation and computer operations.
>
> (. . .). Few agencies hazarded an opinion on how to deal with this problem other than a general suggestion of improved education on the other's point-of-view for all parties involved. The few who expressed an opinion on a particular strategy for this education agreed that the most promising and efficient approach is to stress education of the planning analyst in the mysteries of computers and programming rather than the reverse. One agency summarized their experience and suggestion this way: "It is easier to train someone familiar with the (planning) application in data processing than it is to train someone familiar with data processing in the application."[1] (underlining added)

There are other substantially similiar discussions of this problem which direct attention to the communication problem as a critical matter in the planning agency utilization of computers.[2] These points, though

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[1] Hemmens, op. cit., pp. 16-17.

[2] See, for example, Britton Harris, "How to Succeed with Computers without Really Trying," Journal of the American Institute of Planners, XXXIII, No. 1 (January, 1967), pp. 15-16.

not original, do substantiate the basis for the designation of the primary needs in computer methods capability for the urban planner.

The educational problem is, then, how to most effectively provide the "sense" of computer usage and the familiarity with the methods which will facilitate the planners communication abilities. As the agency statement quoted in the Hemmens report put it, "It is easier to train someone familiar with the (planning) application in data processing than it is to train someone familiar with data processing in the application."[1]

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[1] Hemmens, op. cit., p. 17.

CHAPTER III

SELECTION AND DESIGN OF A STRATEGY FOR TEACHING COMPUTER METHODS IN AN URBAN PLANNING EDUCATIONAL CURRICULUM

INTRODUCTION

Before entering into particular program design efforts it is necessary to design a strategy for incorporating computer methods teaching as a part of the urban planning curriculum. This chapter proposes the guidelines and structure for this strategy. First the basis for selecting the general type of strategy is presented. Then the principles for the program design under this selected strategy are proposed and discussed. Finally the structural needs for implementing the strategy (timing and sequencing) are presented and discussed.

GUIDELINES FOR PROGRAM PLANS

The first stage of the development of the strategy has been to evolve a set of propositions which would provide the essential guidelines for the program plans. These include:

(1) It seems desirable for every planner to have a general understanding of the characteristics and usage of computers and computer methods and, for those who enter into research oriented endeavors, it is essential to develop a considerable sophistication with these techniques.

(2) It is important to present the computer methods in a manner that will demonstrate a proper balance of importance with all the other aspects of data handling and research.

(3) That computers be presented to the student as (a) a processor of data; (b) a problem solving facility; and (c) as an educational resource.

(4) That foremost in the process of establishing the program strategy is the need to assess the available resources of the particular institution in order to insure the feasibility of implementing the designed strategy (both in terms of equipment and faculty).

STRATEGY ALTERNATIVES

There are three primary types of strategies which might be pursued to achieve student exposure to the desired computer methods materials. One route is through the selection of elective courses which would deal with these techniques. The

second means is the development of the teaching of these methods as an integral part of the curriculum. Third is the reliance upon the student's own interests and abilities in a self taught type of process.

(1) Elective Courses Strategy - This is probably the closest of the three strategies to what is currently being done in those urban planning curriculums where some concern with computer oriented methods is presently evident. It entails providing the student with the opportunity to select a set of elective courses in computer methods as an alternative among the total range of electives which he will choose during his educational program. Experience with this type of approach has usually been to have these courses selected from departments other than urban planning, but this need not be the case. The drawback to the out-of-department course selection is the usual problem associated with any such selection--the assurance that the type of material presented in that course(s) will be suitable for the objectives of the planning curriculum.

Lack of coordination and timing of the materials attained through this means, with the educational program of the urban planning department, is also a severe limitation to the successful adaptation of this strategy.

Countering these difficulties is, of course, the conflict in the demand for the teaching resources of the urban planning staff. If a planning staff member commits

efforts to teaching computer methods material these resources are less available for other curriculum matters.

(2) Integrated Sequence Strategy - From the standpoint of curriculum development this strategy is, by a wide margin, the most difficult to implement and maintain. It implies a general commitment of effort in various phases of the sequence of curriculum segments by the planning staff. First, there must be a specific determination of what and how the computer methods should be presented. Second, these materials must be properly integrated into the sequence of course materials which compose the entire urban planning curriculum. This requires some capabilities by a number of the staff members for utilizing computer methods so that these may be integrated into their courses and for an overall effort for coordination (in terms of relevant sequencing) of course material inclusions and utilization of the computer methods.

The benefits of accomplishing such an integral program are considerable, particularly in light of the comments in the various studies and articles which have discussed the problems of and needs for planners usage of computer methods.[1] It must be recognized, however, that the

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[1] Hemmens, op. cit., pp. 15-17 and Britton Harris, "How to Succeed with Computers without Really Trying," Journal of the American Institute of Planners, XXXIII, No. 1 (January, 1967), pp. 15-16.

implementation of such a program is a more complex process than for the other methods.

(3) Self-Teaching Strategy - Although, as the title implies, this is to some extent a "hands off" type of strategy, even this approach can incorporate some positive elements of student development in computer methods. As in the elective courses strategy the availability of courses in other departments is always present. Another possibility is the encouragement of the development of computer skills through means such as programmed instructional techniques and/or special teaching institutes and seminars.

In addition to each of these, the students could be encouraged to use the techniques at their option in any of the various course requirements in the planning curriculum. Under such a limited commitment program, the faculty requirements are limited but the feasibility of accomplishing successful portrayals of the methods of computer usage will be just as limited.

STRATEGY SELECTION

Of the three strategy routes outlined, the second of these, the integration strategy, offers a more substantial presentation of the computer methods, however, with an apparent heavy cost in terms of staff resource requirements and curriculum coordination. The elective courses strategy

offers a relatively straightforward potential and has some precedence in some planning educational programs at the present time. It still lacks in the substantive potential for insuring certain basic capabilities in computer methods for all planning students since little control over the type of materials presented can be exerted and not all students select these elective courses.

In the third strategy, the self-teaching strategy, the weaknesses are obvious, although such means can be useful to support approaches such as those represented in the other two strategies.

Although either the elective courses or the integrative strategies might be effective, it seems that the latter of these offers both the most potential for successful educational attainment and the most challenge for program design and implementation. The requirements for the integrative strategy also appear less standard and clear cut. With these factors in mind the integrated curriculum strategy was chosen for intensive examination and program design structuring in this thesis. Many of the resulting observations should be relevant for the elective course strategy as well.

PROGRAM ELEMENTS FOR THE INTEGRATION STRATEGY

The elements necessary for structuring the integrative strategy can best be identified by expanding upon the four primary propositions presented in the examination of the alternative strategy routes.

(1) Level of Skill Attainment of Planners - There is more than one level of computer methods skill attainment which should be structured into the integrated planning curriculum. It is not expected that all planners need to have extensive knowledge in computer methods, however, some minimum level should be the basic objective. This should involve the development of basic programming techniques and a staged sequence of course work which builds experience in utilizing these skills in planning type applications. The planning student does not need to become a full-fledged programmer but he should have some basic experience in programming. Through such basic experience the student should become familiar with the general problems of computer hardware and software variations that typically hamper or enhance usage.

In gaining this basic experience, the student needs to develop an understanding of the needs, problems, and means for communicating job requirements to programming technicians with whom he will deal in professional planning applications. As was pointed out earlier in the "needs"

section, the most general expression of concern by planning agency personnel who work with computers is related to the difficulty in communicating with these technicians and to assure that work being prepared by them is properly directed toward sought objectives.

Additional opportunities must be available for those who seek to achieve more advanced capabilities with the computer. These opportunities would likely be related to a curriculum option oriented toward advanced methods for urban planning research.

(2) Balanced Presentation-Computer Methods vis-a-vis Other Urban Planning Curriculum Materials - The primary objective of the integrative strategy is to present computer methods in the urban planning curriculum in a perspective which would guide students toward achieving a sense of using computers and computer methods while attaining a proper balance in the presentation of these methods with all the other curriculum areas important for urban planning. This perspective is important to the utilization of the potentials of the computer methods and the recognition of the inherent limitations which such methods have for some types of usage.

To accomplish these objectives, the effort should be to present the computer methods concepts in the most relevant contexts possible. For example, terminology, problem

subject matter, and processing methods presented in the program should deal with familiar urban planning situations and procedures.

In relation to the maintaining of a proper perspective for computer methods in the curriculum, the effort should be to minimize, as possible, the time and cost requirements necessary to develop an effective level of computer utilization skills so as to lessen the resource infringements on other program elements. This might, for instance, require that those staff persons with computer methods capabilities work with other staff members in arranging and sequencing, into a variety of courses, opportunities for the utilization of these methods by the students.

(3) Computer Methods Curriculum Inclusions - The student should have the opportunity to understand the utilization of the computer as a processor of data and as a problem solving facility.

Each of these items is relatively straightforward. A range of techniques, strategies and analysis procedures are associated with the use of computer methods in data processing and problem solving. In each of these, the importance of clearly delineating precise steps for proceeding through a task are basic and of importance in a more general sense than just computer application. The computer methods focus serves as a forcing function to

require development of clear and logical thinking and definite plans of staged processing or analysis.

Britton Harris establishes a case for the transition of planning office personnel through five stages of computer methods indoctrination.[1] This program would progress systematically through techniques for data acquisition, data processing, data display, analysis, and simulation.

A systematically defined progression should likewise be derived for the urban planning curriculum under the integrative strategy. The specific relevent computer techniques can then be structured into the curriculum pattern.

(4) Program Resources - It is essential to assess the available resources of the particular educational institution in order to determine the feasibility of implementing the designed strategy. At the present time, the limited availability of both good computer facilities and computer methods trained urban planning staff represents a considerable limitation to the implementation of any ambitious program at most universities.

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[1] Britton Harris, "How to Succeed with Computers without Really Trying," Journal of the American Institute of Planners, XXXIII, No. 1 (January, 1967), pp. 15-16.

Yet, a number of requirements are necessary for an effective program. First, the resources must be available to permit the student the opportunity to explore the potentials for computer methods usage in at least one studio or research problem context. The facilities available should permit the student the conduct individual experimentation and analysis and he must have staff guidance and counseling opportunities available at all phases of the progressively more complex level of skill development and utilization. This is likely to require a staff member (possibly a graduate assistant or junior faculty member) who would be available to aid students in gaining skill in their interfacing with the computer and to help in solving problems that arise in this process.

The limited resources, particularly staff trained in computer methods, probably represents the single most difficult problem to overcome in achieving the integrated computer methods curriculum objective. Some aspects of this problem may, however, be alleviated through the utilization of the computer itself as an educational resource.

This has several potentially useful and interesting dimensions. First, the potentials are great for computer aided instruction as a valuable asset to aid in teaching programmable educational materials. This is of particular relevance in situations where there are limited staff resources for teaching. Utilization of the computer in this

context, both for the teaching of urban planning subject materials through a computer aided programmed instructional arrangement and for the teaching of computer materials, serves the dual objectives of educational materials presentation and computer usage accustomization.

Second, the use of computers as support mechanisms brings into the realm of feasible the development and utilization of a range of teaching techniques, such as gaming simulation, to diversify and enhance the methods of course material presentation and the opportunities for the student to develop a better sense of urban planning and management "judgment".[1]

STRUCTURING THE INTEGRATION STRATEGY

Based upon the program elements discussed above, the structuring of a program sequence can be undertaken. This sequence is developed in three general phases which might be viewed as typical in a student's evolving educational experience. These are:

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[1] Richard L. Meier and Richard D. Duke, "Gaming Simulation for Urban Planning," Journal of the American Institute of Planners, **XXXII**, No. 1 (January, 1966) pp. 3-16.

(1) Basic course work presenting essential fundamentals which will be used in a variety of ways as the foundation of an individual's abilities.

(2) Specifically directed substance course work (tool materials such as demographic analysis methods or economic projection techniques, etc.).

(3) Synthesis course work, problems, and research where the techniques of using the elements of the first two phases are utilized to approach and deal with a sphere of "real world" type problems.

Figure 2 elaborates upon these three phases in terms of a further definition of the particular types of inclusions under the general headings. In the first phase the initial foundation is established including definition and explanation of terminology, acquaintances with the capabilities of computer systems and allied facilities, the requirements for utilizing such facilities, and an introduction to the ideas of data attributes and the varying requirements of particular job types. This phase should include the introduction to a programming language and would require the preparation of certain simple programs aimed at learning the fundamentals of programming and gaining

ACCESSORY ELEMENTS

GENERAL ELEMENTS

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a sense of the systematic nature of problem formulations explicit in the utilization of the computer in solution procedures.

The second phase entails the inclusion of computer usage as a part of the "technique" development course work. During this phase the student is developing an understanding of the working techniques and study methods used in planning practice and research. The computer exposure serves as an added capability for utilizing these techniques and the student, through the exposure to and use of pre-packaged routines, can utilize the computer as a part of the familiarization process for these techniques. The programming skills required here are concentrated in input-output data handling rather than the technical main program writing capability, yet it gives the student an opportunity to observe the types of programming procedures utilized to work on different forms of problems. In the latter stages of this phase the student can begin to work on the preparation of more complex programs of his own to deal with scientific computations and data processing problems.

The third phase corresponds to the synthesis course work (i.e. a comprehensive planning course) which is typically included in the culminative stages of most urban planning curriculums. By this time the student should have an adequate grasp of both programming technique and the "sense" of applying this to a range of problem situations.

He should be, to some extent, able to utilize the computer to aid him, where feasible, to work on class problems, studio exercises, and thesis research. Those students who are particularly oriented toward research can proceed from this point with elective pursuits to expand their computer utilization sophistication. Others, who do not wish to pursue this further, have gained a considerable depth in computer usage capability that will fulfill their initial needs for a general planning career.

An associated matter that is important to the proper development of the students research capabilities is the need to generate and store urban data in conjunction with such a computer teaching program. In Figure 2, a research laboratory, which would maintain data on real and simulated urban communities, is indicated as a parallel and complimentary requirement of this type of educational program. A number of specific benefits are derived from such a computer compatible urban data resource. The student is provided with an opportunity to experience the richness of computer processed data exploration without leaving the laboratory. A known quality control level can be maintained for data in the laboratory file. Laboratory files can be maintained in formats which can ease the student's initial problems in extracting and manipulating data, particularly in the early

phases when he is just beginning to experience the difficulties of maneuvering large data files for processing and analysis purposes.

SUMMARY

This is, then, the format of the strategy which is being used in this program design research. These matters are, of course, only the beginnings of dealing with these problems. The difficult matters of specific program design are still to be dealt with in the next chapter.

CHAPTER IV

CURRICULUM DESIGN CASE EXAMPLE
THE MASTER IN URBAN PLANNING DEGREE
MICHIGAN STATE UNIVERSITY

INTRODUCTION

The development of the structure of the integration strategy in the previous chapter now provides the basis for specific proposals for a curriculum design. The graduate curriculum in urban planning at Michigan State University is used as the object of the example design.

DESCRIPTION OF THE GRADUATE CURRICULUM

(1) Background of the Michigan State University Graduate Curriculum - The graduate study program in urban planning at Michigan State University was established in 1949. It's introduction was one of a sequence of stages of development of the total urban planning program at MSU. Courses were first introduced

in urban planning in 1939 to supplement the landscape architecture teaching program and to provide service courses for other departments of the university.

An undergraduate program in urban planning was established in 1946 and formulation of the graduate program followed in 1949, establishing the curriculum leading to the degree of Master in Urban Planning (MUP). Since the inception of the program, approximately 70 graduates have received the master's degree. Present enrollment in the graduate program ranges between 30 and 40 students.

(2) Objectives of the Curriculum - The objectives of the MSU urban planning graduate curriculum are stated in the program prospectus as follows:

> General Objectives[1]
>
> A. To provide the student with the fullest opportunities to acquire substance in general knowledge of himself, of mankind and his institutions, and of his creative works.
>
> B. To so prepare the individual that he may, upon graduation, be able to assume his responsibilities as a citizen of a democratic society.
>
> C. To impart to the student an understanding of the nature of his environment and all its implications in the highly complex, cultural technology of today and the future.

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[1] Summary Information Concerning Significant Features of the School of Urban Planning and Landscape Architecture, The College of Social Science, Michigan State University (no date), p. 7.

D. To achieve a balance in learning between philosophy and theory of the individual disciplines and the actual, workable utilization of such concepts.

E. To select those learning experiences that can be the most meaningful in the limited period devoted to formal education.

F. To develop those personal abilities which will enable the graduate to communicate coherently and forcefully in written, graphic, and oral media with citizens, officials, and other professionals.

G. To create an understanding and awareness of the potential contributions available from other fields of knowledge which can achieve optimum policies and programs in environmental development.

Graduate Program Objectives[1]

A. To make available to the student those learning opportunities which will enable him to develop, over and beyond the technical skills, those intellectual qualities necessary for meeting, with poise and effectiveness, the broad and varying range of problems associated with urban development of the present and over the next 40 years. Specifically, this program aims to develop professionally qualified people who:

1) Can administer to the accumulated deficiencies of urban and metropolitan areas.

2) Can formulate workable policies and programs for corrective treatment and action.

3) Can direct and administer such programs.

4) Can draft comprehensive policies for the sound and orderly development of anticipated growth.

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[1] Ibid., pp. 8-9.

5) Can provide essential leadership in conceiving and effectuating new concepts and procedures for achieving the optimum living environment in future urban and regional patterns.

B. To encourage research interest and productivity by graduate students and faculty.

C. To serve as a fundamental curriculum for training high-level technicians, planning administrators, or, as a step in building toward a future doctoral program in regional planning.

(3) Curriculum Elements of the Master Degree - The curriculum in urban planning presently consists of a requirement of 90 term credits for graduation, 60 credits of which are taught within the School of Urban Planning. These are divided into 45 credits of course work and 15 credits for thesis research. Elective courses make up the remaining 30 credits required. The courses which make up the urban planning core sequence are listed below.

801 - City and Regional Design

801A - Urban Design

801B - Metropolitan Regions

801C - Urban Renewal and Development

810 - Planning Theory

810A - Area and Functional Design Problems

810B - Comprehensive Urban Designs

812 - Application of Social Sciences in Urban Planning

820 - Research Mechanics

821 - Housing and Urban Renewal

822 - Urban Circulation

830 - Legal Bases for Planning

831 - Zoning and Land Subdivision Regulations

832 - Planning Administration and Professional Practice

899 - Research (Thesis)

A catalogue description listing of these courses is provided in Appendix A of this thesis.

Lists of suggested electives are provided the student in counseling with his advisor, however, these are not considered to be exhaustive of those available to the student for his required program.

The structure of the MSU curriculum has been designed to fulfill the particular requirements of urban planning professional education. This format is typical of graduate curriculums in planning at schools throughout the country. This is the case because of a relatively well defined set of basic subject areas of concern that have been part of the professional orientation. For example, these include housing, urban renewal, zoning, transportation, economic base, employment, population, retail trade market analysis, land use, and community capital facilities. These are universally recognized areas of concern in the practice of planning. Although in any given curriculum,

precise course titles vary in their detail, the general characteristics of the courses are similar among the different schools.

The functional organization of the courses in the curriculums are established to meet three general requirements; theory, methods, and synthesis or application. A closer look at the details of the curriculums will identify the components of each of these three functions. In the MSU curriculum there are distinct provisions for each of these three aspects. Clear distinctions are made for: a set of theory courses, 810A and 810B; planning methods, 820; and applications, 801A, 801B, 801C. Other courses are not so clearly designated, however, all but one of these are seminars which correspond to specific subject areas such as those mentioned above. These represent some combination of the three functional categories although a particular faculty member may orient any of these toward one of the three categories.

The sequencing and functional categories of the courses are important to the proposals in this study for curriculum inclusions of computer methods. The role of the computer methods element in these courses will be different depending on the functional category of that course. For example, an important distinction is necessary

between a methods course such as 820 and the 801 studio series which are applications courses. In 820 the study of planning methods is structured around examining all of the different subject area methods (i.e. economic base, population, etc.) for examining and analyzing the characteristics of that subject area (i.e. how to conduct economic base analysis). The studio series focuses upon utilizing the whole range of planning procedures and methods, as appropriate, to deal with a problem situation. Still another type of course distinction arises when we examine the characteristic needs of a basic course in computer methods. This focuses on a different methods orientation than 820.

What is important to this discussion is the recognition of the already defined categories of the courses presently included in the urban planning curriculum. This functional identity will be maintained in the subsequent proposals for computer methods inclusions and the computer methods inclusions will differ both in style and emphasis in the different functional categories of courses.

THE PAST ROLE OF ELECTRONIC DATA PROCESSING AND COMPUTER METHODS IN THE URBAN PLANNING CURRICULUM

There is a considerable amount of precedence for the developing of the computer methods integrative strategy in the Michigan State University urban planning curriculum. A number of efforts have been made to introduce EDP and computer methods in school programs and courses.

As early as the spring term of 1959 a seminar series in automatic data processing was initiated by Professor Richard Duke and presented by the School of Urban Planning with the aid of a grant from the Sears, Roebuck Foundation. Local and visiting speakers presented materials ranging from the essentials of ADP machines and methods to the use of these techniques in economics, transportation, and urban planning. This seminar was not a formal part of the planning curriculum but it was directed to the urban planning faculty and students and these were the major participants. A publication was produced which presented the remarks of the seminar speakers. In introducing this publication the chairman of the School, Professor Myles Boylan, set forth a clear commitment for the inclusion of EDP methods in the planners educational preparation. He noted:

Undeniably, the hesitation of the planner to acquire a working knowledge of automatic data processing stems both from fear of an entirely new and complicated medium and from the prejudices imprinted during his formal education; for the principal roots of planning practice, and even of planning education, are still deep in the traditional approach of the physical designer and the legalist. It is difficult to develop confidence, suddenly, in the sensing of a robot, particularly when it is necessary to re-order a large part of one's thinking processes.

Ideally, the planner should become facile with appropriate research tools while he is learning the fundamentals of his profession, and since the university is now the source of most urban planning recruits, manifestly, the secrets of automatic data processing should be revealed as part of a planning curriculum. Today, it is the rare university that does not boast of electronic equipment for data processing. . .the means and opportunities for the student are generally at hand; all that is needed is motivation and deliberate instruction. Perhaps the first task is to instruct the teachers so that every university curriculum in urban planning can include learning experiences that require the use of these new tools.

It is the intention of my Department to utilize the volume as a basic text for research assignments to both graduate and undergraduate students in Urban Planning--assignments that will involve the use of automatic data processing. It is also the hope of the department to expand upon this nucleus of instructional material in the ultimate development of a reasonably complete introductory text on the subject. It is hoped that the necessary financial means and energy can be found to permit a repetition of the seminar approach to instruction in automatic data processing, whereby further substance may be added to the material herein.[1]

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[1] Myles Boylan, "Introduction," in Richard D. Duke (ed.), Automatic Data Processing--Its Application to Urban Planning (East Lansing, Mich.: Michigan State University, Institute for Community Development, 1959), pp. 6-7.

During the 1959-60 school year, one group of students in the undergraduate master planning course, under the direction of Professors Duke and Marquis, conducted their studies and developed a master plan for the city of Sault Ste. Marie, Michigan, using land use and building data recorded on punched cards for their analysis. While no computer usage was involved, the students gained considerable familiarity with the use of punched cards and the tabulating and utility equipment used in preparing and manipulating these punched card records.

Throughout the ensuing seven years, a series of independent inclusions of EDP and computer methods has taken place in an unsystematic manner such as a class lecture on the general aspects of computer characteristics and the inclusion in a course of one, or several problem(s) using some type of EDP or computer methods in recording and analyzing the problem data.

In the graduate curriculum, the research mechanics seminar has been the locus of most of this lecture-problem usage activity. The extent of the involvement has varied widely, depending on the particular faculty member teaching the course. The most intensive computer methods exposure was attained during the fall term of 1965 in this research course. Professor Duke and visiting lecturer Dr. Barton Burkhalter developed a series of EDP oriented problems which

exposed students to the usage of these techniques in simple data file manipulation, some basic statistical analysis, and the design of a municipal data system. The inherent problems of presenting computer methods in a single course exposure basis was vividly demonstrated in this experiment. Since students had no prior exposure to computers or computer programming a good deal of time was necessary to expose them to these basics. It was necessary to make a rapid progression through the basics, the use of these in "canned" or pre-programmed computer routine applications, and the application of the principles in the design of the data system. Some of the objectives were met regarding the general exposure of students to these methods but no longer term experience to expand upon this rapid exposure was possible.

During the period from 1960 to 1967, several students, on an individual basis, pursued the development of more extensive computer methods capabilities through the selection of elective courses in these methods. Typically these students used these techniques in the development and preparation of their thesis research.

In reviewing the experience with computer methods in the MSU urban planning curriculum, several observations can be made.

(1) There have been efforts to incorporate, on an ad hoc basis, various aspects of computer methods in the urban planning graduate curriculum, with individual faculty members using their own initiative to include these methods;

(2) It has remained the intention of the faculty to provide effective presentation of these methods, although limited teaching resources and the conflict of pressing matters in other curriculum aspects has prevented this until now;

(3) No precise objectives concerning the means of teaching computer methods and what should be included in this teaching, has been jointly agreed upon by the faculty; and

(4) The lack of convenient access to computer facilities has provided a barrier to any ready exposure of students to such facilities.

While there has not been a coordinated, structured presentation of computer methods in the Michigan State graduate planning program, there has been some exposure to these methods. In this sense, this program has provided more than many other planning schools. The objective of a more complete exposure is recognized by stated positions of faculty members, although it remains to be fulfilled.

ASSESSMENT OF AVAILABLE RESOURCES FOR TEACHING COMPUTER METHODS

Before proceeding with the design of the program elements which will be proposed to fulfill the requirements of the integrated strategy, there must be an assessment of the related resources available for use. The Michigan State University School of Urban Planning has a number of computer method related resources which are available for the computer methods teaching program. These can be classified into two general groups: (1) those of the University at-large, and (2) those specifically available to the School of Urban Planning.

(1) University At-Large Resources - The primary University resource is the Computer Center with the main computing facilities and the peripheral equipment available for preparation and handling of input material for the computer. These facilities presently include a large scale, batch process type digital computer, the CDC 3600, and its supporting peripheral devices. A completely equipped data preparation room is available in the Center which is available for all University users at no charge. A new time-sharing computer is planned in the immediate future. This is an important feature for the planning program since there should be a major difference in access between such a new

computer and the present batch processing machine. The present machine arrangement requires that all jobs be submitted at the computing center, which is not convenient to the School of Urban Planning. Plans for the time-sharing computer are to locate a console for data input and output to the new facility in the School of Urban Planning Building, thus greatly increasing the convenience of usage. In addition to hardware facilities, the Computer Center provides some consulting services to aid users in finding and correcting programming errors.

Other University wide resources include the Computer Institute for Social Science Research which consists of an interdisciplinary team of computer oriented social scientists who concentrate on the research and development of applications of computer methods to many phases of social science interests.

The computer science program in the College of Engineering offers courses in computer programming and several other programs such as systems science offer courses relevant to planning which include in them the use of computer methods ("Systems Analysis for Social Scientists").

(2) Specific School of Urban Planning Resources - A recent addition to the School of Urban Planning has been the Urban-Regional Research Institute (URRI). The Institute's efforts are to a large extent directed toward the development and utilization of computer techniques in

urban planning and urban management. Staff members of URRI are trained and experienced with computer methods although they represent the disciplines of urban planning, sociology, statistics, and communications science. Other staff members will be added to this staff representing other disciplines as well.

The Urban-Regional Research Institute facilities include a small scale computer and peripheral equipment (punched card reader, line printer, character printer and typewriter) as well as an analogue to digital converter (digitizer) and an incremental drum plotter. Data preparation equipment are available as well. The URRI offices are located in the School of Urban Planning and several staff members, including the Director, are or will be members of the urban planning faculty.

ESTABLISHMENT OF THE PROGRAM DESIGN FOR COMPUTER METHODS UNDER THE INTEGRATION STRATEGY

Framework for Establishing the Design

With these matters as background, the curriculum integration structure can now be established. The procedure will be to detail the guidelines for the computer methods integration, referring to the particular curriculum elements

of the present MSU program and using the strategy elements established in Chapter III as the basis for this detailing. Two assumptions are integral to the discussion that follows.

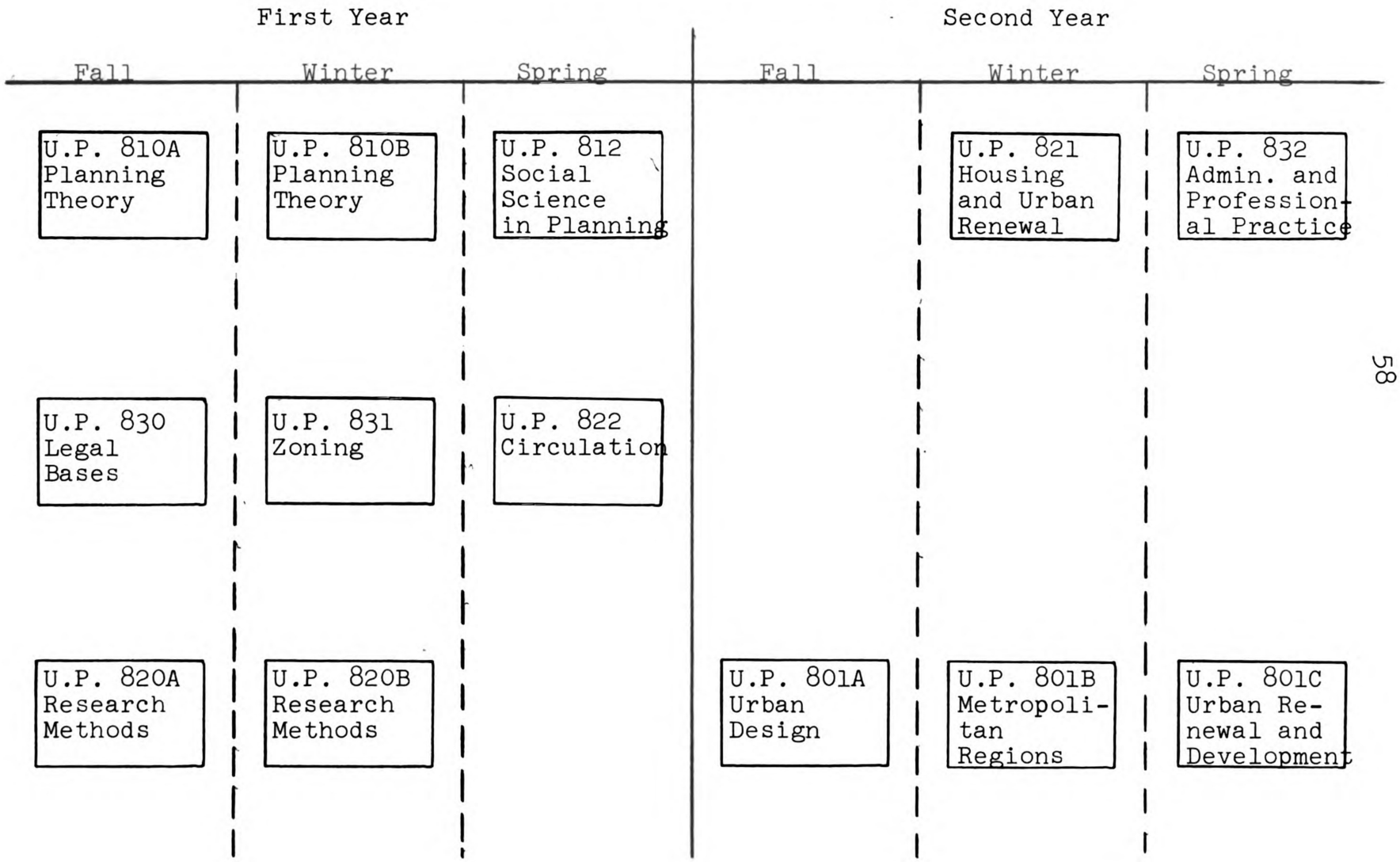
Assumption 1 - Proposals made in this discussion pertain to the present urban planning masters degree curriculum and it is not necessary to consider potential curriculum reorganizations in order to demonstrate the elements of the integrated computer methods strategy.

Assumption 2 - A reasonable amount of additional teaching and program resources can be made available to support additional curriculum elements necessary for the incorporation of the strategy.

Course Sequencing and Organization in the Present Curriculum

The courses which presently make up the urban planning masters degree core curriculum have been listed in the curriculum description section and Appendix A. These courses provide the primary framework for formulating the computer methods course organization proposals. In Figure 3, these courses are schematically diagrammed according to what might be a typical sequence which a student would pass through in completing the curriculum requirements. Elective courses are not included and, for the purposes of this study, are not necessary.

FIGURE 3 - Typical Course Sequence



Additions and Alterations Proposed for Courses

Limited adjustments and additions to this present core curriculum are proposed to provide for the integrative strategy requirements. These are similar to course alterations that might be made for parallel, but different objectives, such as the development of a quantitative methods emphasis in the curriculum. These proposals alter and expand upon the current research mechanics course (820) by extending the single course into three courses. Two of these courses, proposed as 820A and 820B, are a required research methods sequence. The third course is proposed as an elective course in advanced analytic methods which has 820A and 821B as prerequisites.

Two of these three courses, then, become keystone elements of the proposed design. The third course provides the opportunity for further extending the capabilities with non-computer as well as computer oriented analytic methods. A sequence will be structured around these three and those other courses in the curriculum which are viewed as directly related to the implementation of the integrated steps of the three strategy phases.

The Characteristics of the First Keystone Course - U.P. 820A

In this resulting sequence, the initial course (820A) is designed to accomplish the objectives of the first phase of the integration strategy as outlined in Chapter III. The course materials included in 820A are: the use of urban data

and considerations in its selection, assembly, analysis and interpretation; introduction to the terminology and use of computers in city planning; and the introduction to programming.

This course is the most computer specific of all of the courses included in the program. The prime purpose is to develop the basic skills needed in computer usage. For example, a sequence of course material for the ten week term might be:

Week 1 - Lectures and reading on background materials; equipment characteristics demonstration; terminology familiarization; demonstration examples of urban planning applications of these techniques and procedures, including discussion of types of client groups (i.e. transportation studies, CRP's) who are particular users of these.

Week 2 - Begin learning a programming language (FORTRAN).

Week 3 - Continue programming instruction and writing of first simple programs (i.e. use samples of a land use or population data manipulation) staying with basic operations; begin discussion of data and its attributes; methodological considerations in the selection, assembly, analysis and interpretation of empirical data.

Week 4 - Continue programming with problems of increasing complexity and larger problems of data file manipulation; introduction to data sources common for planning; continue discussion on data attributes, etc.

Week 5 & 6 - Continue programming and pattern of week 4; introduction to ideas of standard types of computer processing tasks typical for planning (land use, population, employment, and other such files and their maintenance, etc.); examples of an actual systems that they can review.

Week 7 - Continue programming as in weeks 4, 5 and 6; introduction to urban information systems.

Week 8 - Assignment of a term problem using programming on a standard set of data; continue discussion of urban information systems.

Week 9 - Continue term problem assignment; introduction to data mapping (SYMAP).

Week 10 - Continue term problem assignment; introduction to incremental plotting.

Final - Turn in term problem and have summary discussion of computer usage and problems in planning.

The intent of the course inclusions is to aim primarily at attaining a basic working competence with computer programming and to have a conversational ability with the

terminology of computers and their usage. Along with this, however, a series of topics concerned with the planning uses of computers and data are intertwined with the gradually increasing complexity of the programming. A term problem is used to provide a first experience with a multiple stage task of data preparation, compilation, and manipulation for a planning oriented objective.

The Characteristics of the Second Keystone Course - U.P. 820B

The following course, 820B, is intended to provide the introduction to the study procedures and techniques for urban planning research, similar to the structure of the present course 820, research mechanics. This course is presumed to proceed through the techniques which are basically important to planning including population analysis, economic base analysis, market analysis, etc. The significant addition to this course, in terms of computer methods sequencing, is the inclusion of pre-packaged (canned) computer program demonstrations and applications to problems which relate to the urban planning research study techniques that are the substance of this course. Particular efforts should be made in this course to illustrate the different problems, advantages, flexibilities, time savings, etc., that might be significant between using standard methods for a particular technique application and using a computer oriented version of carrying out the same analysis.

The requirements for data (i.e. time series, spatial series, etc.) should be introduced and compared and the differential costs of utilizing the different techniques should be emphasized.

The exposure to the variety of packaged programs included should be useful in several ways. First, the direct benefit is that of familiarization with utilizing the computer technique in a variety of basic planning oriented research procedures. Second, by reviewing other programs which have been prepared, most of which at a rather sophisticated level, the student can gain insights on some of the "styles" of program design. Third, the rigor of data requirements for such programs (and typically these programs will have rigorous data requirements) should force the student to give thought to the character of data problems at a level which he probably would not have delved if it had not been for the prodding of the familiarization process with these computer routines.

The Characteristics of the Third Course - 820C

Third in this series of courses is 820C which would be an elective course selected only by those who choose to pursue the advanced analytic techniques and along with these, a more advanced capability in utilizing the computer. This course is directed more toward the advanced analytic techniques which are being developed and utilized in planning research. The inclusions would be topics selected from matrix algebra;

statistics (regression analysis and analysis of variance); component and factor analysis; linear, non-linear, and dynamic programming; or other appropriate analytic procedures. Computer techniques would be used in working with these topics. Students would spend a considerable amount of the course (approximately one-third) with an individual problem appropriate to the analysis topics covered and in which individual problem design, data preparation and computer based analysis procedures would be required.

Not all students would elect this course and it is not established as a requirement for any other course in the program sequence although competence with techniques garnered in this course would be advantageous for subsequent use in other courses where computer usage is encouraged as would be the case with the studio courses and/or the thesis research.

Course Sequencing and Organization in the Proposed Computer Methods Integrated Program Structure

The computer methods integrated sequence of courses is proposed to include the previously identified "keystone" courses, the advanced analytic methods course, plus the seminars in circulation, housing and urban renewal, administration and professional practice, the three studio courses, and the thesis research. These have been categorized

by phase according to the characteristics listed for each phase in Chapter III. Each course is sequenced according to both time and phases and linked according to this.

In order to further define the linkage of the courses in the curriculum with the sequence of the computer methods integration strategy, Figure 4 is presented.[1] This delineates the time sequence of the various curriculum components as did the earlier figure, but it also illustrates the pattern of functional linkages of these courses according to the three phases defined in Chapter III.

The codes which are noted in Figure 4 refer to a particular link of two curriculum elements. This code is used below to identify that link and some examples are given to define the nature of the computer methods elements which are relevant to that linkage. These are:

(1) Research methods 820A provides the basic data processing and programming skills which will be utilized in all the other computer methods applications. In this linkage, these basics are prerequisite to the second research methods course, 820B, which, as already described, utilizes these basic techniques in such planning

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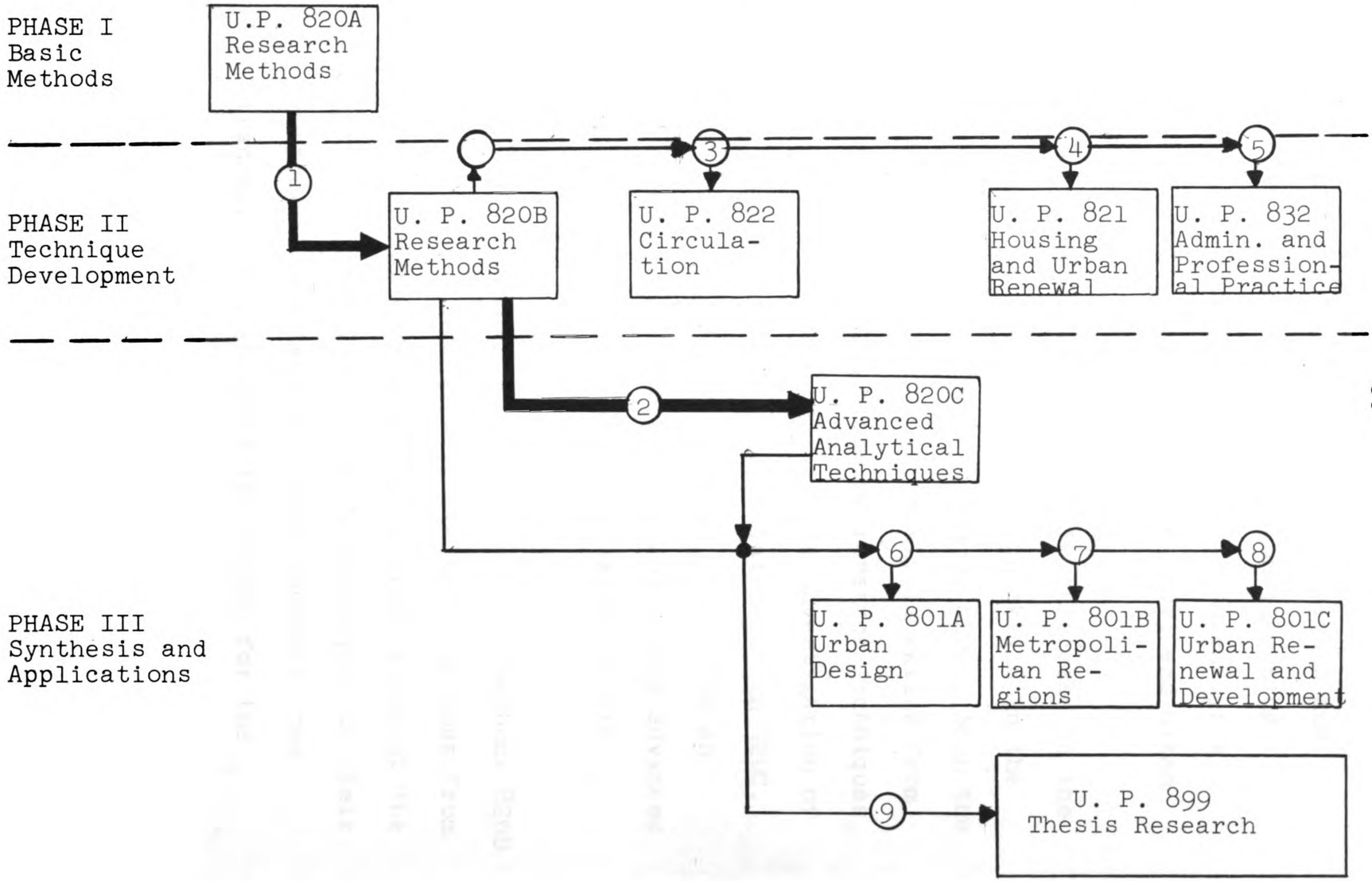
[1] Linkage is used here in the sense of a connection between a pair of courses, sequenced through time and through the defined strategy phases, in such a manner that the computer methods capability accumulated in courses up to and including the first of the pair can be utilized in the second of the pair.

FIGURE 4 - Computer Methods Integrated Sequence of Courses



research topics as population analysis and projection; economic projections; housing market analysis; retail trade area analysis; basic transportation study methods; and urban information system design.

(2) Research methods 820B leads in this case to the further development of research skills in the advanced analytic methods course 820C. Both the basic data processing and analysis skills from 820A and the urban planning research techniques skills of 820B will add to the investigation of more sophisticated research materials in 820C. Some part of 820C is intended to involve an independent research paper effort using advanced analytic and computer method skills in its preparation.

(3), (4), (5) In each of these, Research Methods 820B provides the link between the basic methods from 820A and the demonstration or application of the various urban planning study techniques in their respective substantive course context: the transportation analysis techniques for the circulation seminar; the housing analysis techniques for the housing and urban renewal seminar; and the data processing (i.e. file maintenance), network

analysis techniques (PERT and CPM), and other administrative type applications which would be relevant for the administration and professional practice seminar.

(6), (7), (8) These link the two primary research methods courses, and the third advanced methods course (if applicable), with the studio courses 801A, B, C. The methods can be used in various ways in the studios as aids in problem solving, data processing, data display, etc. At this, the synthesis level, the students challenge is different than in the other phases. This challenge is to determine, as he sees fit, where and how to utilize the techniques. Some guidance in the usage is likely from the instructor, however, the student in such problem solving situations, must rely substantially on his accumulated skill and wisdom for using the techniques. At this stage the student should be able to work with computer programmed models for his analysis and testing, and be able to map and chart data (i.e. SYMAP, and plotter routines) and conduct data handling and analysis with reasonable skill, including the design of his own basic programs.

(9) This linkage replicates the character of the previous three except that, to even a greater extent, the individuals judgment and skill governs his utilization of these methods. It is, of course, not expected that all students would use computer methods in thesis research.

This sequence of courses forms the proposed curriculum structure to satisfy the course needs for the integrated computer methods strategy. Implicit in such a structure are, however, a number of additional elements which require consideration.

Additional Program Elements

(1) Readily Available Facilities - In all of the computer utilization cases, it is presumed that both the Urban-Regional Research Institute computer facilities and the facilities of the University Computer Center would be available for use, depanding on the needs of the particular type of problem involved. It is anticipated that most applications would be feasible on the URRI facilities.

(2) Staff Resource Person - Another important component of a successful computer methods educational program of this type is the need to make available a staff person for consultation and direction of computer oriented research by students. This need could be satisfied by providing the time of either a junior faculty member or a graduate assistant with computer methods skills to carry out this function.

The availability of such an advisor would provide an invaluable aid for the students as they are gaining increased competence and confidence in their interface with the computer. Aid could be provided on program writing, data problems, locating of already programmed analysis routines, and help in assuring the proper usage of the various facilities. The incorporation of an effective resource person in this context could be a prime ingredient for assuring proper guidance and the development of the proper perspective for the student in his use of the computer.

(3) Faculty Development Program - In order to properly implement the integrative strategy throughout the variety of courses in the curriculum, some level of computer method skill is desirable for all the staff members. There should be adequate opportunity to carry on a faculty seminar program in which the necessary component inclusions in the various courses could be discussed and arrangements made to implement these into the course structure. It is probably desirable to utilize the staff members who possess computer methods skills as aids and advisors on problems within the various courses. For example, the current availability of URRI personnel for participation in this manner would appear to make it a logical step to use them to staff members in preparing ideas for such project inclusions.

(4) The Laboratory Community and Research Laboratory - In order to fully realize the benefits of the computer oriented course materials in the integrated program, it appears that it would be useful to develop a supportive research laboratory which, as described in Chapter III, would maintain data files on real and simulated urban communities. The availability of this rich data resource can provide unique research opportunities without the student having to leave the laboratory. The laboratory community might be viewed in a similar manner as the cadaver for the medical student. The data describing a functioning community is at hand for the student to dissect by effectively using combinations of his planning research technique and the growing adeptness he is gaining with the computer methods.

(5) Computer Aided Instruction - The last of these additional program elements is the development and use of computer aided instructional techniques to enhance the teaching program itself. This matter has implications for much more than just computer methods teaching. An example of the use of this in one case, the proposed 820B course in planning research methods, can serve to demonstrate this.

Computer aided instruction(CAI) utilizes the computer as an instructional resource by building upon the information processing and recall capabilities of the equipment. Two general forms of CAI are important to the educational require-

ments in the 820B course. The first of these is machine administered recitation and drill. The second is the Ersatz, or substitute, laboratory.

In the urban planning research methods course, emphasis is placed upon presenting the study techniques and procedures that are used for each of the specific task areas with which the planner deals. Inevitably there is not enough class time to teach the fundamentals of the techniques, to discuss problems which are tied to the use of these, and to discuss the cautions which such problems suggest. The form of these techniques are usually such that the teaching of their structural characteristics can be portrayed through programmed instructional procedures. For example, economic base analysis consists of a series of specific steps of data collection, manipulation and analysis. This series of steps could be portrayed in a programmed instructional package, prepared for the computer, and available to the student for use in gaining an understanding of the basic procedures used in economic base analysis. This would be prepared in the form of a tutorial type conversational mode of interaction between the student and the computer. The objective is, of course, to provide a means to transmit basic mechanics of these research materials in such a way that the time in the classroom is reserved for more adequate delving into the why's of using the techniques and the problems and cautions inherent to the application of any such analysis techniques.

The second aspect of CAI is the Ersatz, or substitute, laboratory. In the intense schedule teaching the planning techniques to the student in the present 820 course, there is little opportunity to gain actual experience with using a particular technique in an applied way. Any problem applications are, at best, very hurried and limited examples. One means to improve this exposure to the use of the technique would be to establish a tie in with the previously discussed research laboratory and, using "canned" programs which carry out the mechanics of the technique, provide the student with the opportunity to manipulate the use of the technique to see what types of results occur under different sets of conditions (i.e. manipulate parameters in residential similation model in order to check its sensitivity to different types of forces). This type of exposure can provide a far more rewarding experience to the student than just wading through one sample application of the technique in the necessarily limited types of problem examples that are possible in the overloaded schedule of the traditional research methods course form. For example, in the residential simulation case, the student can begin to sense the power (or weakness) of the theory implicit in the model by this type of active exposure to its operating characteristics.

These two types of potentials for computer aided instruction in planning are very promising, although a large volume of effort will necessarily be involved in the initial organization and undoubtedly it will be accomplished only at a relatively high cost.

CONCLUSIONS

This, then is the broad framework of one proposal to accomplish the integration of computer methods into an urban planning educational curriculum. The conclusions which can be reached from this discussion must be couched in the speculation on the substantive and technological promise of using computers in these manners, and, the cautions which have been stimulated as a result of struggling with the particulars of establishing such a strategy and designing a suggested means for including it in an educational curriculum. As is so often the case, the researcher emerges from the research effort with additional and more vexing questions than were recognized at the start.

The conclusions and observations which have been the result of this study are as follows:

(1) In the face of the increasing amount of concern with and use of computers and computer related analysis and

management techniques in the field of urban planning, there is a need to devise explicit curriculum development efforts to provide planning students with those aspects of computer methods which are necessary to enable them, to the fullest extent possible, to utilize the potentials of these techniques.

(2) It is important to achieve a proper perspective for the computer in planning education (that being as a tool for problem solving, as a processor of data, and as an educational resource for instruction) and to seek to provide students with an adequate familiarization with these techniques. A strategy which seeks to integrate the development of computer methods skills within the context of the other aspects of the professional education curriculum appears to best meet these objectives.

(3) Computer methods teaching in the urban planning curriculum have more general benefits than just the development of the capability to use computers. Inherent in the computer methods is the need to develop a capability for breaking down a problem into well defined components and to be able to clearly state the sequence and relationships of the aspects of that problem. The strength of this logical capability is relevant to problem solving in general and provides the planner with the developing of an essential capability for any type of problem with which he deals.

(4) There are numerous problems involved in the structuring of the integrative type of strategy for planning educational curriculum.

(A) There is always a heavy demand on resources available in the planning program and it must be decided which and how much of these can be committed to any program element.

(B) The strategy implies a more rigidly structured course sequencing and a more coordinated arrangement and continuity to course content, than is presently found in most curriculums. This is a difficult objective to accomplish in any curriculum and requires an agreed upon commitment by the faculty to pursue such objectives.

(C) Since the same objectives are not applicable for all students in a curriculum, provision should be made for alternative routes through the curriculum sequence to enable students to achieve different levels of computer methods capabilities.

(5) Another type of concern which is extremely important to resolve in the curriculum design is the need to provide proper correspondences in the curriculum between the essential bases for planning thought and theory and the

research methods and analysis techniques of the computer methods sequence. Without proper correspondences, the essence of the usefulness of the computer methods as a tool to aid in expanding and exploring theory is diminished and the rationale for including computer methods in the curriculum is distorted.

(6) Within the research methods sequence of courses (i.e. as in these curriculum proposals) it is important to maintain the recognition of both non-computer and computer aspects of data, analysis, and synthesis.

(7) There is a need to examine a number of aspects of the implementation phases of this type of computer methods program. Faculty and facility needs must be assessed and procedures must be provided to aid faculty in the developing of their own computer methods skills. There are a variety of promising aspects of using the computer as an educational resource. These include the development of computer aided instruction and the research laboratory (laboratory community) as instructional support elements for theory and methods segments of the curriculum.

While the requirements vary in their detail from university to university, there is a need to evolve a more explicit role for computer methods in urban planning education. This thesis provides only rudimentary steps toward the

evaluations that are necessary. The need remains to clearly determine the role of the computer in the various "task" areas central to planning and to design specific curriculum positions for the teaching of these within the integrated course strategy.

APPENDIX A

URBAN PLANNING MASTERS DEGREE TERMINAL STUDY CORE COURSES

800 . Special Problems
Fall, Winter, Spring. Variable credit - 15 credits maximum. Non-majors with School approval.

Individual research in subjects of significance to Urban Planning that are acceptable to the School.

801 . City and Regional Design
Fall, Winter, Spring. Variable credit - A student may enroll until a total of 18 credits of "design" have been completed. UP 412.

Practical application of city and regional planning theory and principles to specific and representative case studies. Work will include field research, design analysis, and presentation of workable recommendations as to appropriate objectives and action for solutions.

801A. Urban Design
Fall

Design projects for functions relation to selected community activities. Commercial, industrial, residential, institutional, and transportation land uses will be utilized for design study in appropriate dimensions.

801B. Metropolitan Regions
Winter

Selected problems of metropolitan functions of present and future significance. Intra- and inter-regional relationships of primary functional importance, such as, open spaces, economic development, community patterns, transportation, and associated land uses.

801C. Urban Renewal and Development
Spring

Measurement of urban obsolescence and deterioration and accompanying analysis of symptoms and causes for a selected community. A comprehensive plan for urban renewal and development objectives will be developed and one or more project areas will be studied and processed in accordance with most effective techniques and administrative procedures. Emphasis to be placed on the objective of unified, revitalized community development.

810 . Planning Theory
Fall, Winter. 3 credits. May be repeated for a maximum total of 6 credits.

810A. Area and Functional Design Problems
Fall

Study of applications of advanced urban planning methodology and techniques to typical city and regional situations. Collateral reading, written reports and seminar discussion.

810B. Comprehensive Urban Designs
Winter

Analysis of selected theories dealing with the design of complete communities and their intrinsic physical patterns. Existing cities will be selected for comparisons to theory. Collateral reading, written reports, and seminar discussion.

812 . Application of the Social Sciences in Urban Planning
Spring. 3(3-0)

Evaluation of social science concepts, methods and knowledge on the basis of their implications and applications in community planning and development. Participation by faculty and graduate students from appropriate social science and from urban planning.

820 . Research Mechanics
Fall. 3(3-0) UP 302 or acceptable equivalent.

Examination of research methods proven useful in application to such components of urbanization as population, land use, housing, business facilities, industrial development, traffic, recreation, and other critical aspects of community structure.

821 . Housing and Urban Renewal
Winter. 3(3-0) UP 405 or acceptable equivalent.

Regulation, stimulation, salvage, and replacement of housing through public policy and administrative procedures. Increasing role of private initiative as partner to public action through conservation, rehabilitation, and redevelopment practices. Evaluation of trends and needs; analysis of case studies.

822 . Urban Circulation
Spring. 3(3-0) UP 317 or acceptable equivalent.

Functional requirements and inter-relationships of all means for the movement of people and goods in urban areas as they affect the physical pattern of the community.

830 . Legal Bases for Planning
Fall. 3(3-0) UP 320 or acceptable equivalent.

Analysis of legislation pertinent to planning with emphasis upon enabling legislation for city and regional planning bodies and the creation of special authorities with general planning responsibilities.

831 . Zoning and Land Subdivision Regulation
Winter. 3(3-0)

Critical study of ordinance structure and planning theory as expressed in texts of ordinances. Study of selected court cases.

832 . Planning Administration and Professional Practice
Spring. 3(3-0)

Expanding scope of urban planning and implications for administration, organizations for administration; relationship to governmental operation, to other professions, to public. Staff functions and responsibilities; administrative instruments; practice of the consultant; professional ethics.

899 . Research
Variable credit - 15 credits maximum.

Individual student research on a topic of critical importance to urban planning that will demonstrate student's competence and make a contribution to the knowledge of the field.

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