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By-Piele, Philip

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This literature review examines 16 selected documents processed by the ERIC Clearinghouse on Educational Administration that deal with the application of several kinds of planning systems to educational programs. Particular attention is given to planning-programming-budgeting systems (PPBS), program evaluation review techniques (PERT), and various types of planning models. (HW)

ERIC/CEA Research Review

Planning Systems in Education

by Philip Piele, Associate Director

The systems approach to planning is best viewed as a rational process of reducing complex problems to a simple, functional model which can be used in the decision making process. By performing many of the conceptual chores of problem solving, the systems approach enables the school administrator to get a broad view of a particular program, rather than limiting him to narrow, often trivial considerations.

The purpose of this review is to examine a select number of documents received and processed at this Clearinghouse dealing with the application of several kinds of planning systems to educational programs, with particular attention given to planning-programming-budgeting systems (PPBS), program evaluation review techniques (PERT), and various types of planning models. All but one of the documents reviewed are available from the ERIC Document Reproduction Service. Complete instructions for ordering these documents are given at the end of the review.

Planning-Programming-Budgeting System (PPBS)

A planning-programming-budgeting system (PPBS) is designed to aid the school administrator in identifying objectives, defining programs to achieve objectives, analyzing systematically the alternatives available, allocating resources to programs over an extended period of time, and measuring the effectiveness of programs. The basic purpose of PPBS is to permit educational decision makers to determine policies in an effective manner by providing a rational choice among alternative courses of action with full knowledge of the implications of each. The system is designed (1) to make available to decision makers more concrete and specific data relevant to broad decisions, (2) to spell out more concretely the objectives of school programs, (3) to analyze systematically and present for school board review possible alternative programs to meet these objectives, (4) to evaluate thoroughly and compare the benefits and costs of programs, (5) to produce total rather than partial cost estimates of programs, (6) to present on a multi-year basis the prospective costs and accomplishments of programs, and (7) to review objectives and conduct program analysis on a continuing year-round basis instead of on a crowded schedule to meet budget deadlines.

When applied to the university decision-making processes, a program budget, according to Harry Williams,[1] is essentially a policy planning tool whose goal is to define program elements. Williams concludes that (1) the application of program budget methods to university budget making would not prevent the use of most existing university structures, (2) the resources used by a university in teaching, research, and public services could be explained to top administrators, (3) an annual budget could be derived in the context of extended-year programs, which in turn could be developed and evolved in the context of a university-wide, longe-range plan, (4) procedures are needed for periodically appraising each element in the planning and programming process, (5) an analytical staff would be necessary to study the establishment and definition of programs and to appraise their operations, (6) the annual budget derived from PPBS should permit intra-university comparison, (7) there would likely be non-homogeneous activities occurring in a university which would be difficult either to collect into major programs or to allocate to define program elements, and (8) present university budgets meet very well the requirements for legal and fiduciary accounting for funds received and expended by the university.

Lester S. Smith[2] recommends the adoption of PPBS in higher education because it represents a more systematic approach to the allocation of financial resources and allows the decision maker to further identify the spectrum of choices among possible resources. Smith also describes briefly the systems simulation approach to the application of computer technology in improving the allocation of resources in institutions of higher education.

Werner Z. Hirsch[3] recommends the application of program budgeting to education and presents a national-level program budgeting example with suggestions for obtaining more effective management of education. Further research and development in program budgeting is suggested to include (1) explicit delineation of goals, (2) better identification, measuring, and packaging of costs and benefits, (3) development of backup administrative organizations, and (4) more attention to future environments.

PERT Techniques in Education

Created by the Navy Department in 1958 and applied with spectacular results to development of the Polaris Missile, program evaluation review techniques (PERT) is a system for planning and controlling a wide variety of complex activities.

Over the past few years the major contributor to the application of PERT techniques to education has been Desmond L. Cook. Cook[4] sees several benefits resulting from the application of PERT to the planning function associated with educational research: (1) PERT often results in a clear statement of project objectives and goals, (2) PERT requires that those involved with the project make explicit the means by which they plan to reach its objectives, (3) the use of PERT results in clear definition of each task to be done, (4) the use of PERT enables the project manager to identify at an early stage the potential trouble spots in the project planned, (5) the use of PERT lets a project manager know where to replan in the event that the original plan is inappropriate, and (6) the use of network techniques facilitates communication since plans are portrayed in a graphic manner.

In a monograph intended to acquaint the educational community with the basic concepts and principles of PERT, Cook[5] sets forth the essential elements of the PERT technique as follows: work breakdown structure, network development, activity time estimation, network time calculation, scheduling, probability aspects of PERT, replanning the project, and introduction to PERT-cost. Several models are presented to illustrate areas in which PERT can be applied to educational research and development.

The combined application of systems analysis and management techniques is described by Cook[6] as an effective means of achieving optimum results in the planning and execution of educational programs. The application of systems analysis to project planning includes its disassembly into components and its reassembly through synthesis based on a linear flow chart approach incorporating time, cost, and performance variables.

Robert L. McKee and Kathryn Ridley[7] discuss how PERT was used to establish a college in 100 days. Through the aid of PERT, it was determined that there were nine major lines of activities and about 300 events to be accomplished to open the college. The administration used the team approach whereby the three main admini-

strators would focus attention on a major activity, plan and start its evolution, assign it to a staff member for completion, and then initiate the next activity. A college was built and established in 84 working days after the first staff member reported, and opened on schedule with 700 students. The standard PERT system was not used because the college had to be ready in such a short period of time. Instead a simplified chart taken from the master chart was used. Many of the activities and events had to be accomplished out of sequence and accelerated due to the lack of time to continually update such a complicated system. The PERT system is a valuable aid to the planning of logical steps which can be followed; it enables a constant project check to be made and graphically demonstrates bottlenecks or time lags in the schedule.

Planning Models

J. Cogswell[8] describes the characteristics and construction of a computer simulation model for duplicating the behavior of students and staff in a high school. This model incorporates systems analysis and computer simulation techniques in an attempt to recommend designs for more pervasive changes throughout the schools. The model was constructed so that a high school could be described in terms of school and student characteristics that apply to the instructional plan of the school.

Frank A. Yett[9] reports on a simulation model which is being developed by Systems Development Corporation for application to any school configuration. The model is composed of two major parts: (1) the activity processor and (2) the resource allocation processor. Yett includes flow charts of the resource allocation processor in his report.

William G. Savard[10] suggests a planning model for the State Department of Education in Hawaii so that changes in the system and the program can be more effectively accomplished for the realization of long-range aims, intermediate goals, and immediate objectives. A vital part of the model is a comprehensive information system composed of six major sub-systems: pupil personnel, staff personnel, material, curriculum and instructional programs, physical activities, and budget and finance. A framework of relationships is proposed, outlining a taxonomy of programs — those that are operational, those that are supportive, and those whose plans and budgets are on the state level and on the level of the individual school.

Richard J. O'Brien and Jerolyn R. Lyle[11] present a nontechnical discussion of an urban education model. The essential function of this analytic, symbolic model is to plan the location and enrollment size of urban elementary and secondary schools. Four sub-models compose the general urban education model: (1) the urban sub-model determines the attendance boundaries by assigning pupils to schools to achieve given objectives, (2) the school sub-model estimates space and staff requirements per school, (3) the cost sub-model estimates the cost implications of attendance area boundaries and space-staff requirements, and (4) the effectiveness sub-model assures that a prediction of achievement levels on an aggregated school plan basis may be made based on variables defined in other sub-models. The model does not yield a "solution" but does provide an array of measures of potential use to the school administrator.

Roger L. Sisson[12] has designed a computer program which simulates the gross operational features of large urban school districts and allows school district policy variables to be predicted on a year-to-year basis. The model explores the consequences of various district parameters such as student population, staff, computer equipment, numbers and sizes of school buildings, salary, and overhead cost and inflation effects. Past and present values of these parameters are used to calculate future trends. Administrative data which limit the model are student per staff member, space per student, and computer equipment per student. Community-established limits are the operational budget, capital budget, and computer budget. The simulated program can be used to determine the official policy to be adopted in terms of the foregoing parameter limits.

The school sub-model developed by Richard J. O'Brien[13] is concerned with the definition of the basic input data representing educational policy on facilities, staff, and programs. O'Brien discusses the specification of these inputs, their interrelationships and the presentation of the data in a form necessary for later evaluation of cost and effectiveness. Four types of information are generated from the model for use in educational decision making: (1) facility requirements in terms of total school plant size and functional space allocation, (2) staffing requirements by number and occupational categories, (3) special program requirements in terms of staff and space, and (4) staff and space implications for scheduling modifications.

Edward K. Zabrowski, John T. Hydman, Tetsuo Okada, and Judith R. Zinter[14] developed a computerized Markovian-type flow model called DYNAMOD II to provide estimates of the educational population of students and teachers over selected intervals of time. The authors describe the methodology used in DYNAMOD II, compare DYNAMOD II student and teacher projections with those of the Office of Education, and make special analyses of birth variations, student and teacher retention rate variations, and student-teacher ratios. DYNAMOD II is useful for exploring the effects of changes in the birth and death rates in the educational population and for examining the impact of policies designed to keep more students in school.

Bibliographies

Desmond L. Cook[15] prepared a listing of 109 related addresses, articles, books, microfilms, monographs, reports, and other items published between 1959 and 1968. The bibliography includes 39 items on network planning, 48 items on research management, 13 items on project selection, and nine items on program management.

Howard L. Vincent[16] compiled a selected bibliography of books and journal articles on the application of economic analysis and operations research to problems in educational planning.

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Abstracts of the following documents can be located in *Research in Education*, ERIC's monthly index and abstract journal. (A subscription to *RIE* can be ordered from the U.S. Government Printing Office, Washington, D.C. 20402, for $21 a year.) The complete texts are available from the ERIC Document Reproduction Service (EDRS), commercial channels, or both. To order from EDRS, indicate the "ED" number of each document and the type of reproduction desired—hard copy (HC) or microfiche (MF). Payment must accompany orders totaling less than $5 and must include a handling charge of $.50 on orders totaling less than $3. Also add applicable sales tax or submit tax exemption certificate when ordering from any state having a sales tax. A 25 percent service charge must accompany orders from outside the United States, its territories, and possessions. *Address requests* to EDRS, The National Cash Register Company, 4936 Fairmont Avenue, Bethesda, Maryland 20014.

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Joanne M. Kitchel
CASEA Editor

Stuart C. Smith
ERIC/CEA Editor

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