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ABSTRACT

A survey investigated the use of seven computerized decision-science techniques in public school systems. A stratified random sample of 128 12-grade school districts of varying sizes was drawn; a questionnaire was sent to the respective superintendents asking them to report the current and potential applications of the following techniques in their districts: 1) program evaluation and review technique (PERT); 2) planning, programing, budgeting system (PPBS); 3) simulation; 4) linear programing; 5) projection; 6) management information systems; and 7) cost-benefit analysis. Results showed that projection techniques were the most widely used, averaging three applications per district, followed by management information systems and cost-benefit analysis (each more than two applications per district), PPBS and simulation (two applications each per district) and linear programing and PERT (one per district). While the number of applications was higher than expected, it was still evident that successful methods were not being employed to an optimum extent. Since school administrators realize their needs in these areas, it is incumbent upon training programs to provide educators with the skills required to utilize these techniques. (PB)

COMPUTER APPLICATIONS IN DECISION-MAKING IN EDUCATIONAL ADMINISTRATION*

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INTRODUCTION

For most of American history the organization and management of schools has been a function of laymen and not of professional administrators. School administration did not evolve as a field study until the twentieth century when the work of administrative scientists such as Taylor, Fayol, Barnard, and Simon were applied to Educational Administration. This early emphasis on administrative science helped educational administrators to meet the challenges of their task by providing concepts with which to view their situation. But, the day of using after-the-fact data for after-the-fact decision-making is past. Dated administrative practices, which reflect the state of knowledge and technical achievement of 20 to 60 years ago, have created schools which cannot cope with the demands of society. The continual-change environment of public school education has been created by the demands of a knowledge-based society. To function effectively in this environment, the educational administrator must know and use alternatives which promote greater efficiency in educational management. Knezevich (17) asked the question, "If the present-day technology can benefit business and commerce why can it not be adapted to benefit administration?"

DECISION SCIENCE TECHNIQUES

For the purposes of this paper, seven decision-science techniques are of interest: PERT (program evaluation and review technique), PPBS (planning, programming, budgeting system), simulation, linear programming (LP), projection techniques, management information systems (MIS), and cost-benefit analysis. A review of the literature showed that in many cases, the techniques are only beginning to be applied to school settings. Andrew and Moir (2) traced the development of decision-science models and their significance for educational decision-making. Van Dusseldorp (32) analyzed educational decision-making by focusing on and utilizing the methodology and tools generated by the use of quantifiable data. Following are selected application of decision-science techniques to educational decision-making.

PERT

PERT has wide application in the scheduling and sequencing of complex projects such as the construction of school plants (17). Cook (10)

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applied PERT to a curriculum development project and to the development of a taxonomy of teacher-classroom behavior. Dippel (12) described the use of PERT to place supplies and personnel in a newly opened school. Taylor and McIsaac (34) discussed the value of PERT in cutting unnecessary school construction costs.

PPBS

PPBS projects are currently in use or planned for implementation in at least fifty public school districts (15), and their number is rapidly increasing. PPBS is not restricted to the larger school districts. Significant work has been done (28) in developing a model for using PPBS in school districts of fewer than twenty-five thousand students. The California State Department of Education (7) has developed a conceptual design for school districts changing to the PPBS technique. In the area of instructional supervision, Williams (33) and Mansergh (21) suggested applications of PPBS to improve the institutional program and to measure student achievement. A training program for educators in implementing PPBS has been designed by McGivney and Nelson (20). Two general accounts of PPBS applications in educational decision-making are given by Alioto and Jungherr (1) and Burkhead (6).

Simulation

Friederiksen (14) reports that professors of educational administration were the first to use simulation in their field of instruction as a test of administrative performance. Through a grant from the United States Office of Education, the University Council of Educational Administration (UCEA) developed a simulation package for the training of elementary school principals (31). UCEA has designed simulations to include training in the secondary principalship, assistant superintendency for business management, superintendency, community college presidency, and vocational directorship, in addition to laboratory exercises in personnel selection and professional negotiations. The simulation in professional negotiations developed by Howat (16) is one of the most advanced simulations in professional education. A less complex set of in-basket materials has been produced by Pharis, Roberts, and Wynn (26). Cruickshank and Broadbent (11) have prepared an orientation simulation for school personnel. Boardman (3) stated that the significance of simulation in education is the better educational practice caused by the rigorous investigation demanded by the use of the simulation techniques.

Linear Programming

Applications of linear programming in educational decision-making are found primarily in educational finance, personnel compensation, and evaluation of instructional programs. Bruno (4) discussed the value of linear programming in determining minimum foundation support from the state for education. He (5) also recommended the use of linear programming to develop salary schedules. An evaluation design on linear programming is suggested by Carman (8). Other aspects of the instructional program such as curriculum construction and revision and schedule-making are suited to linear programming, according to Taft and Riesman (29). Additional uses of linear programming in educational management include cafeteria menu planning (19), developing school bus routes (24), establishing school attendance zones (27), and forecasting school construction needs (13).

Projection Techniques

Projection techniques that do not depend on linear programming methods are considered as a separate decision-science technique. The need to have accurate and timely projections of school enrollments is an obvious application (18). Employing of staff, site acquisition and building programs, transportation and food service, and budgeting are key examples of the imperative need for enrollment projection.

Management Information Systems

Management information systems have extensive applications in educational decision-making. Profiles of a sample of 25 educational management information systems were presented by Mathews (22). The extent and utilization of MIS in state educational agencies was surveyed by Morphet and Jesser (23). A recent comprehensive treatment of MIS, including historical background information, is Witkin's (34) discussion of applications of management information systems in educational administration.

Cost-Benefit Analysis

Cost-benefit analysis has been applied to educational decision-making with limited success. Pearson (25) presented a model for evaluating instructional programs in terms of cost-benefit to the school, the students, and the community. Carpenter (9) pointed out that cost-effectiveness or cost-benefit can be an aid to decision-making in education, but that much work remains to be done in adapting the technique to decision-making. Woodhall (3) offered that cost-benefit analysis in education is made difficult by the noneconomic costs and benefits involved and also by the extensive time-lag that exists between educational investments and realized benefits.

THE SURVEY

In order to assess the actual and potential use of these decision-science techniques, a stratified random sample of 12-grade public school districts of varying sizes was drawn. Table 1 shows the size of the various strata, the number of school districts in each and the size and percentage of the sample in each stratum. The eight public school districts in the country that have more than 200,000 pupils were not included in the study.

A questionnaire was sent to the superintendent of schools of each of the school districts in the sample. The questionnaire asked the superintendent to report the current and potential applications of seven decision-science techniques. A list of fourteen possible application areas was also part of the questionnaire, as was a page of definitions of the decision-science techniques.

PRELIMINARY RESULTS OF THE SURVEY

The initial mailing was conducted in November of 1972 with two follow-up mailings. Eighty-three of the 128 questionnaries were returned for a 65 percent response rate. Following are some general results of the collected data.

TABLE 1

THE SAMPLING STRATIFICATION AND THE RESPONSE

Student Population	Number of Districts	Number in Sample	% of Sample	Number Returned	% Returned
100,001-200,000	21	21	100	17	81
50,001-100,000	51	20	40	16	80
25,001-50,000	104	31	30	19	61
10,000-25,000	561	56	110	31	55
TOTAL	737	128		83	65

The Decision Science Techniques

The most widely used of the seven decision-science techniques for the 14 listed educational applications were projection techniques (each school system reportedly averaged three applications), management information systems and cost/benefit analysis (more than two per system). Other techniques employed were PPBS and simulation techniques (two each per system). The least used of the seven techniques studied were linear programming and PERT (about one each per system).

On the average, each respondent listed one and a half potential applications in his school district for cost benefit analysis with almost as many potential uses for simulation, PPBS and MIS. Linear programming, projection techniques and PERT each were chosen as a potentially useful technique for one application per school district.

Projection techniques were reported to be used most frequently with "enrollment studies", "student class scheduling" and "preparation of salary schedules." Application areas that were most frequently mentioned as potential uses for projection techniques were "physical plant remodeling or expansion," "site location for physical plant additions," "inventory control" and "teacher or student assignment."

Cost/benefit analysis was most frequently mentioned as a technique that was being applied to "physical plant remodeling or expansion" and "rent/buy decisions." This last application was most often cited as a possible use for cost/benefit analysis along with "inventory control."

The responses show that MIS was most frequently used with "student records," "federal or state reporting" and "budgetary procedures or control." "Inventory control," "evaluation of staff performance" and "student records" were the most commonly reported potential uses of MIS.

It was reported that PPBS was used in 45 percent of the systems for "budgetary procedures or control." This application was also listed by 25 percent of the respondents as an MIS application of potential value.

"Physical plant remodeling or expansion" was also frequently mentioned as a potential use of PPBS.

Almost a third of the respondents claimed the use of PERT for "physical plant remodeling or expansion." The same number saw this and "Student bus scheduling" as potential applications for PERT.

Linear programming was most frequently claimed as a tool used in "student class scheduling" and was seen as valuable for use in "student bus scheduling."

The Applications

Of the 14 applications that were listed, the most frequently cited application area for which the seven decision science techniques were being used was "budgetary procedures or control," with about two citations per district. "Enrollment studies," "physical plant remodeling or expansion," "class scheduling" and "salary schedules" were mentioned on the average more than once per district.

On the average "physical plant remodeling or expansion" was listed more than once by each of the respondents as an area where one of the decision science techniques would be useful. "Site allocation," "bus scheduling," "salary schedules" and "inventory control" were mentioned almost as often.

Training

The average respondent claimed formal training in one of seven decision science techniques and would like to have training (or more training) in two of the techniques. Thirty percent of the respondents claimed formal training in PPBS and over a third of all those reporting desired training in PPBS, cost/benefit analysis and MIS. Less than ten percent of the respondents claimed formal training in cost/benefit analysis or linear programming, while at least one quarter of them desired training in each of the seven techniques.

Limitations of the Study

Granted there are validity problems with an instrument of this type. Pretesting, of course, was performed with the instrument, but no analysis of validity or reliability was conducted. In addition, the reliability of data from the school districts is challengable, since the only source of data was one respondent.

It is assumed that the respondent was the person that the superintendent felt was the most qualified to respond. The responsibility to respond was delegated in almost 20 percent of the cases.

An additional concern appears since the applications of the techniques varied in scope and sophistication, but each was counted as one application.

Another potential distortion concerns the pooling of the data from each of the strata of student population. Further analysis of the data is needed to determine differences among the various strata.

Conclusion

Although this study is contaminated with validity questions, it does provide some insights into reported usage of computer applications to decision-making in educational administration in the public schools of the United States.

A higher reported usage of these applications was found than was expected, although it is still felt that the techniques are under utilized.

More importantly, there are many applications of these tools that have been reported as being useful, but not in use. The school administrators appear to recognize the need for further implementation of these decision-science techniques in their own systems and they even express interest in further training in them.

This study indicates that school executives perceive the need for increased training and use of the computer-based decision sciences and it directs us to determine these needs more specifically and to make ourselves available to continue to fill them.

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